PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
MINISTRY OF THE ENVIRONMENT AND RENEWABLE ENERGY

National Inventory Report of Algeria
2023

Submission under the
United Nations Framework Convention on Climate Change
(UNFCCC)

October 2023

Preface

As a Non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), Algeria is required to prepare and update a national Greenhouse Gas Inventory.

- shall communicate to the COP (Conference of the Parties) a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol, as stipulated in the para 6 of the 'Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention.
- should submit updates of national GHG inventories as stipulated in para 3 of the UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention.
- is encouraged to include tables 1 and 2 (so-called NAI tables) according to the Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention.

Algeria prepared a National GHG Inventory using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 2019 Refinements to the 2006 IPCC Guidelines and a stand-alone National Inventory Report (NIR) for the period 1990 – 2020 which follows the requirements set out in the Modalities, procedures and guidelines (MPGs) for the enhanced transparency framework for action and support (ETF) referred to in Article 13 of the Paris Agreement which will be in place from 2024 onwards.

The structure of this report follows the outline and general structure of the MPGs and Guidance for operationalizing the modalities, procedures, and guidelines for the enhanced transparency framework.

Chapters 1 and 2 provide general information on the inventory preparation process and summarize the overall trends in emissions. Comprehensive information on the methodologies used for estimating emissions of Algeria's greenhouse gas inventory is presented in the sector analysis in chapters 3–8. Chapter 10 gives an overview of recalculations, including improvements made and planned.

The aim of this report is to document the methodology in order to facilitate understanding of the calculation of the Algerian GHG emissions inventory.

Data differs from last years' reported data in 1st and 2nd National Communication (NC) as some activity data have been updated or improvements in methodology have been made to enhance accuracy of the greenhouse gas inventory. Data and information presented in this report replaces the information submitted in Algeria's first and second National Communication.

Specific responsibilities of the ANCC experts for the preparation of the national GHG inventory are:

Task / Role	**Lead expert**	**Expert**	**QA Expert**
National Inventory compiler (NIC)	Khalid Belabdi	Said Kaddour	Soumeya Amroune
QA/QC representative	Meriem Bech	Hind Bougherara	Soumeya Amroune
NIR coordinator	Hind Bougherara	Meriem Bech	Hamza Merabet
Energy - Stationary combustion	Said Kaddour	Khalid Belabdi	Hamza Merabet
Energy - Mobile combustion	Said Kaddour	Khalid Belabdi	Hamza Merabet
Energy - Fugitive emissions	Said Kaddour	Khalid Belabdi	Hamza Merabet
Industrial processes and product use (IPPU)	Khalid Belabdi	Said Kaddour	Hamza Merabet
Agriculture	Soumeya Amroune	Hind Bougherara	Meriem Bech
LULUCF	Hind Bougherara	Soumeya Amroune	Hamza Merabet
Waste	Meriem Bech	Said Kaddour	Hind Bougherara
Key Category Analysis	Hind Bougherara	Khalid Belabdi	Said Kaddour
Uncertainty Analysis	Hind Bougherara	Said Kaddour	Khalid Belabdi
Data management	Khalid Belabdi	Meriem Bech	Hind Bougherara
TNC/BUR1 Project National Director Climate Change Central Director at the Ministry of Environment and Renewable Energy		Fazia DAHLAB	
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EXECUTIVE SUMMARY

ES.1. Background information on GHG inventories and climate change

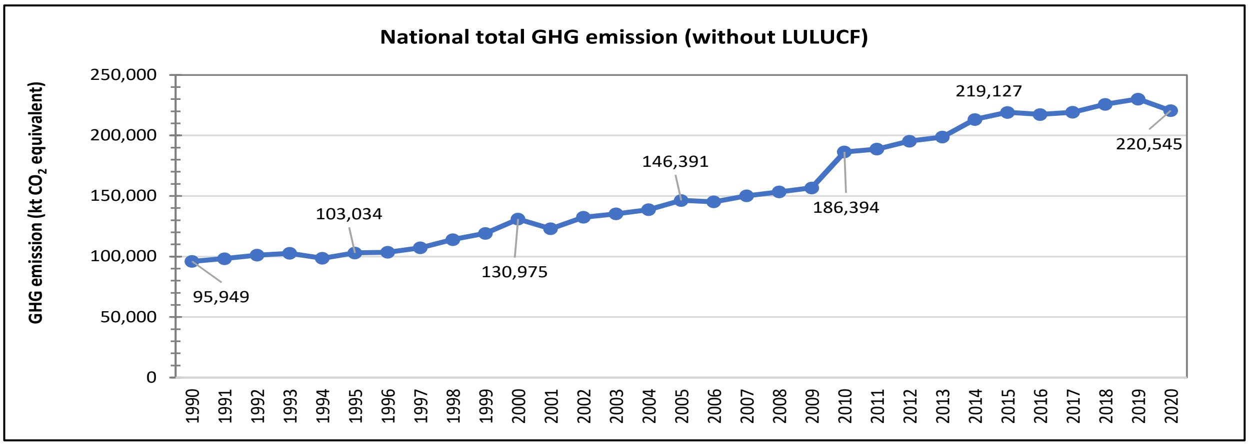
Climate as such is the totality of all atmospheric conditions at a particular location. It undergoes natural variability. Since industrialization started, mankind has been influencing the climate via the emission of greenhouse gases. In 1992, by setting up the United Nations Framework Convention on Climate Change (UNFCCC), the nations of the world meet in Conference of the Parties (COP) to start a process to prevent negative effects of climate change. Therefore, the UNFCCC obliges all Parties to report information on their greenhouse gas (GHG) emissions to the Conference of the Parties (COP) and on steps taken to implement the Convention. This is done through National Communications (NCs) and Biennial Update Report (BUR).

Algeria prepared and updated its National GHG inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol for the period 1990 – 2020 using the 'UNFCCC Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention' (Decision 17/CP.8) and 'UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention'(Decision 2/CP. 17, paragraph 40 and Annex III of decision 2/CP.17). In addition, the requirements set out in the 'Modalities, procedures and guidelines (MPGs) for the enhanced transparency framework for action and support (ETF) referred to in Article 13 of the Paris Agreement' (decision 18/CMP.1) which will be in place from 2024 onwards, are almost full implemented.

The GHG inventory for the period 1990 – 2020 has been prepared using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 2019 Refinements to the 2006 IPCC Guidelines covering the greenhouse gases (GHGs) carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFC), sulfur hexafluoride (SF_6). For the years 1994 and 2000 recalculations have been carried out to ensure comparability and consistency.

During the compilation of the inventory there were several challenges that affected the accuracy and completeness of the inventory, such as application of lower tier methods as a result of the unavailability of disaggregated activity data, lack of appropriate institutional arrangements, and absence of legal and formal procedures for the compilation of GHG emission inventories. Therefore, the focus was given to all emissions by source from the IPCC sectors Energy, Industrial processes, and Product Use (IPPU), Agriculture and Waste. It must be noted that only GHG emissions from IPCC category 4.A.1 forest land remaining forest land were estimated. It is important to clarify that for the IPCC category 4.A. Forest land, only GHG emissions from IPCC category 4.A.1 forest land remaining forest land were estimated.

ES.2. Summary of trends related to national emissions and removals.



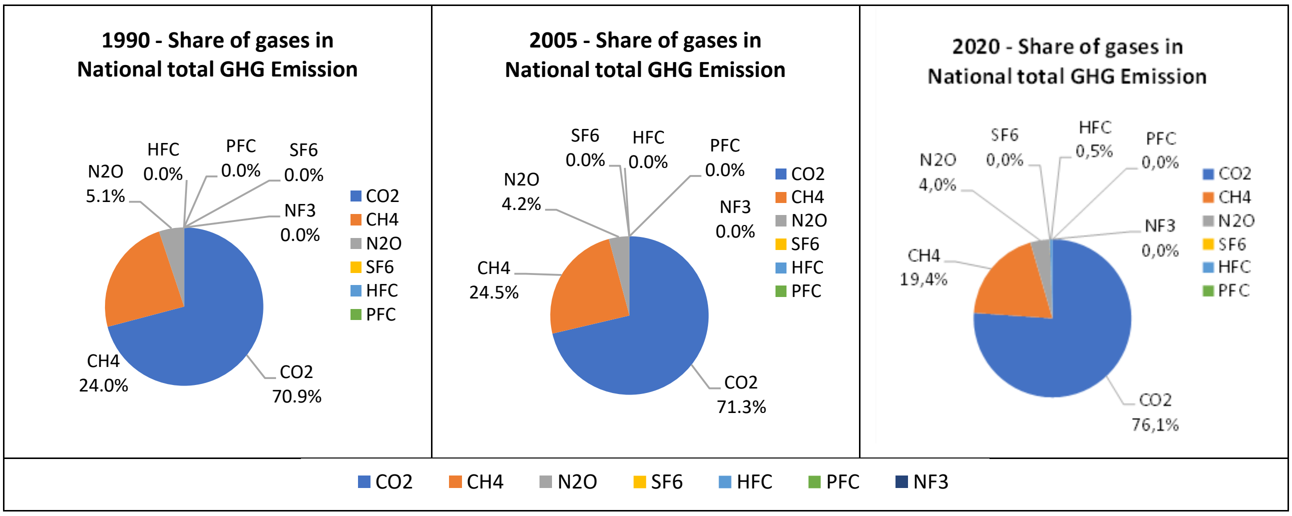
Summary-Figure 1 **National total GHG emissions (without LULUCF)**

In 2020, Algeria's greenhouse gas emissions amounted to a total of 220,544.85 kilotons (kt) calculated in CO_2 equivalents (CO_2 eq) – excluding land-use, land-use change, and forestry (LULUCF).

Carbon dioxide (CO_2) was the main source of greenhouse gases (GHG) in Algeria. This source counted for 76.1% of the total GHG emissions (excluding LULUCF). The second source of GHG was methane (CH_4) with 19.3% of the total emissions excluding LULUCF. Nitrous oxide (N_2O) was the third source with 4.0%. Fluorinated gases (F-gases), which includes hydrofluorocarbons (HFCs) and Sulphur Hexafluoride (SF_6), only accounted for 0.5% of the total GHG emissions excluding LULUCF.

In 2020, total GHG emissions increased by 129.9% compared to 1990 and by 50.7% compared to 2005. Between 2019 and 2020, the GHG emissions decreased by -4.1% due to the worldwide COVID 19 pandemic. These trends were mainly due to rapid growth of population which increased by 75.25% during this period. Indeed, the population of Algeria increased from 25,022,000 in 1990 to 43,850,000 in 2020 which directly influenced the national energy demand, particularly the electricity production and transportation fuels consumption. Also, the development of certain sectors like industry, agriculture and transport contributed to the increase of GHG emissions during the period from 1990-2020.

For the different GHG, trends over the period 1990-2020 were as follows:



Summary-Figure 2 **Share of greenhouse gases in National total GHG emissions (without LULUCF)**

Table 1 Summary of Algeria’s greenhouse gas emissions from 1990 - 2020 (without LULUCF)

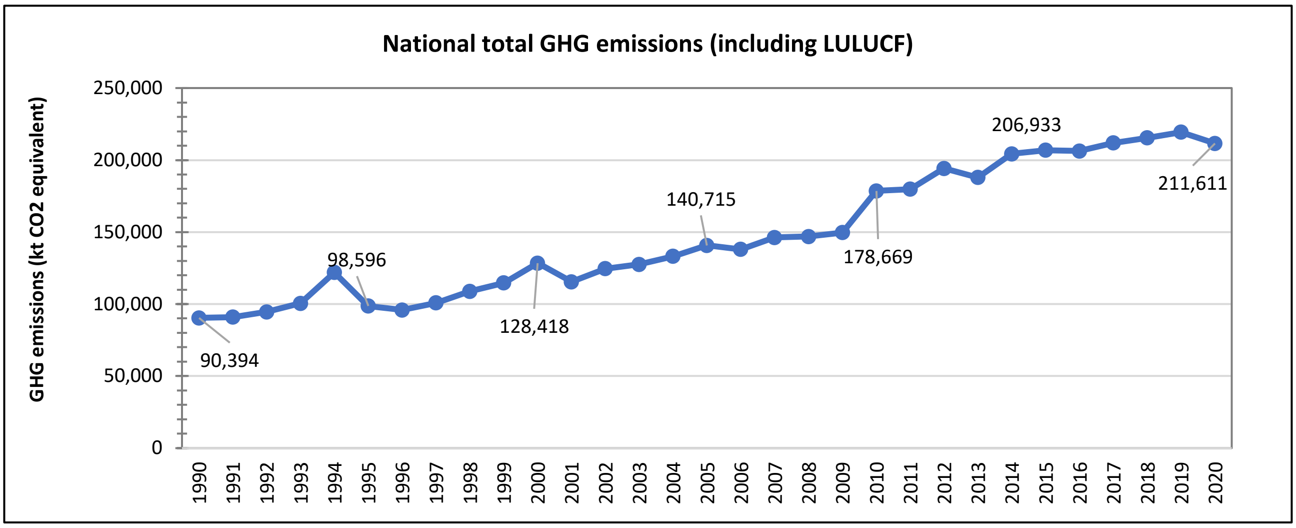
GHG	Total GHG	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
	kt CO_2 equivalent							
1990	**95,948.77**	68,065.12	22,953.10	4,930.38	NA	NA	0.16	NA
1995	**103,033.63**	71,845.64	25,845.92	5,340.54	1.22	NE	0.31	NE
2000	**130,974.80**	93,856.82	31,330.32	5,780.35	6.76	NE	0.56	NE
2005	**146,390.81**	104,501.01	35,760.48	6,099.49	28.60	NE	1.24	NE
2010	**186,394.38**	140,033.58	38,758.11	7,373.74	224.30	NE	4.26	NE
2015	**219,127.01**	167,486.76	41,572.31	8,979.01	1,076.51	NE	11.82	NE
2019	**230,093.50**	176,735.12	43,418.95	8,795.83	1,111.67	NE	29.34	NE
2020	**220,544.85**	167,832.76	42,683.12	8,784.23	1,206.05	NE	36.19	NE
Trend								
1990 - 2020	**129.9%**	146.6%	86.0%	78.2%	NA	NA	22,950%	NA
2005 - 2020	**50.7%**	60.6%	19.4%	44.0%	4118%	NA	2,827%	NA
2019 - 2020	**-4.1%**	-5.0%	-1.7%	-0.1%	8%	NA	23%	NA
Share of gas								
1990		70.9%	24.0%	5.1%	NA	*NA*	*<0.1%*	*NA*
2005		71.3%	24.5%	4.2%	<0.1%	*NA*	*<0.1%*	*NA*
2020		76.1%	19.4%	4.0%	0.5%	*NA*	*<0.1%*	*NA*
Note: Global warming potentials (GWPs) according to the **4th Assessment Report** (IPCC 2007) (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; Sulphur Hexafluoride (SF_6) = 22,800; nitrogen trifluoride (NF3) = 17,200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.								
Notation Keys: NO: not occurring; NA: not applicable; NE: not estimated; IE: included elsewhere								

In 2020, the most important gas in the Algerian GHG inventory is carbon dioxide (CO_2) with a share of 76.1% of total GHG emissions (without LULUCF). CO_2 emissions primarily result from combustion activities but also as process-related emissions from mineral industry, chemical industry, and iron & steel industry. The emissions increased by 147.4% in the period 1990-2020 mainly as significant increased activities in energy industries, manufacturing industries and construction, and transport sector.

Methane emissions (CH4) account for 19.4% of total emissions in 2020. The major sources of methane include Oil and natural gas systems with 51.6%, enteric fermentation associated with domestic livestock with 25.8 % and decomposition of wastes in landfills which contributes with 15.2% to the national total GHG emission in 2020.

Nitrous oxide (N_2O) contributes 4.0% to total national GHG emission (2020). Agricultural soil management, wastewater treatment, stationary sources of fuel combustion, and manure management were the major sources of N2O emissions and arising mainly from chemical industry, manure management and agricultural soils.

The remaining 0.5% are emissions of fluorinated compounds, which are emitted on the one hand from use of SF_6 in electrical equipment for electricity transmission and distribution, and other the other from the use of HFC as substitutes for ozone depleting substances (ODS) in refrigeration equipment and air conditioning units.



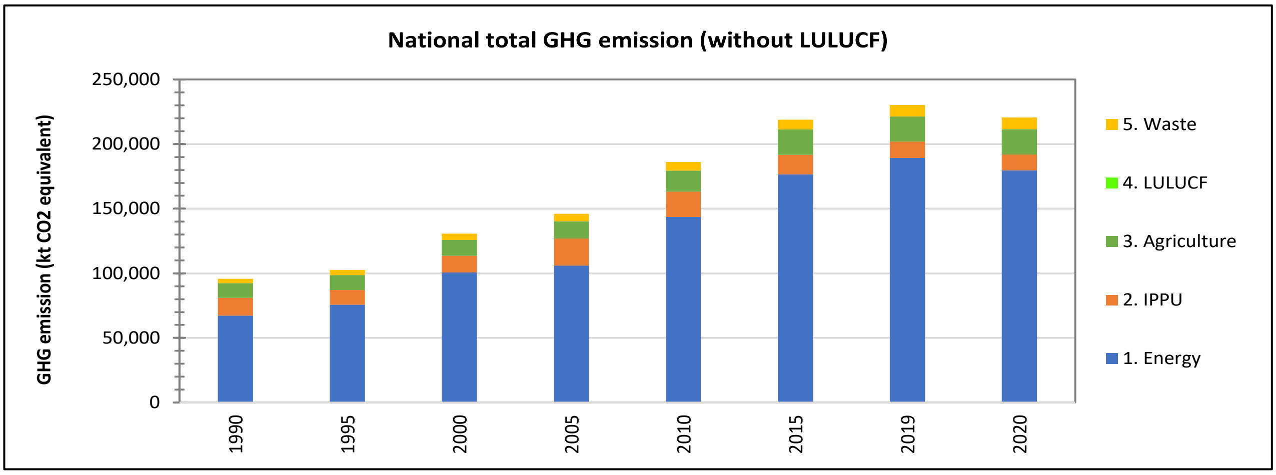
Summary-Figure 3 **National total GHG emissions (including LULUCF)**

In 2020, Algeria's greenhouse gas emissions amounted to a total of 211,611.44 kilotons (kt) calculated in CO_2 equivalents (CO_2 eq) – including land-use, land-use change, and forestry (LULUCF).

Table 2 Summary of Algeria's greenhouse gas emissions from 1990 - 2020 (including LULUCF)

GHG	Total GHG incl. LULUCF	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
	kt CO_2 equivalent							
1990	**90,394.27**	62,432.83	22,999.98	4,961.29	NA	NA	0.16	NA
1995	**67,290.34**	66,960.49	25,916.63	5,387.17	1.22	NE	0.31	NE
2000	**128,418.37**	91,113.69	31,442.83	5,854.54	6.76	NE	0.56	NE
2005	**140,715.29**	98,737.37	35,813.59	6,134.51	28.60	NE	1.24	NE
2010	**178,668.51**	132,239.96	38,798.94	7,400.67	224.30	NE	4.26	NE
2015	**206,932.67**	155,277.80	41,581.13	8,984.82	1.076.51	NE	11.82	NE
2019	**219,386.16**	165,988.04	43,442.90	8,811.63	1.111.67	NE	29.34	NE
2020	**211,611.44**	158,786.85	42,750.91	8,828.93	1.206.05	NE	36.19	NE
Trend								
1990 - 2020	134.1%	154.3%	85.9%	78.0%	NA	NA	22950%	*NA*
2005 - 2020	50.4%	60.8%	19.4%	43.9%	4118%	NA	2827%	*NA*
2019 - 2020	-3.5%	-4.3%	-1.6%	0.2%	8%	NA	23%	*NA*
Share of gas								
1990		69.0%	25.5%	5.5%	NA	*NA*	*<0.1%*	*NA*
2005		70.1%	25.5%	4.4%	<0.1%	*NA*	*<0.1%*	*NA*
2020		75.1%	20.2%	4.2%	0.6%	*NA*	*<0.1%*	*NA*
Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; sulphur hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.								
Notation Keys: NO: not occurring; NA: not applicable; NE, not estimated; IE: included elsewhere								

ES.3. Overview of source and sink category emission estimates and trends



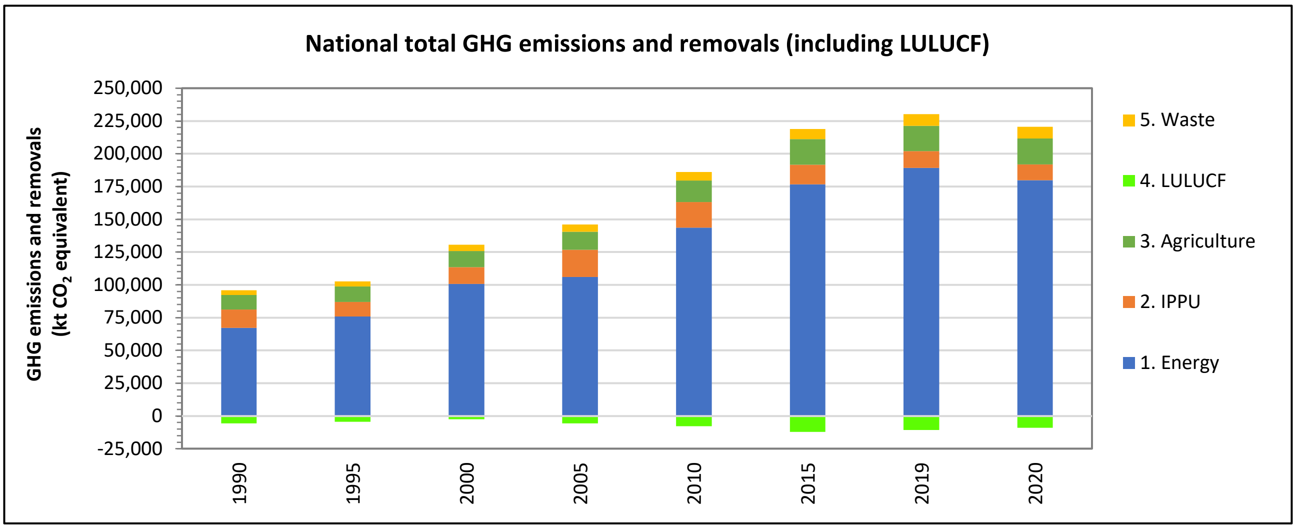
Summary-Figure 4 National total GHG emission (without LULUCF) per sector for pillar years

By far, the dominant sector regarding GHG emissions in Algeria is the IPCC sector 1 *Energy* (fuel combustion activities and Fugitive emissions from fuels), causing 70.3% of total national GHG emissions in 1990 and 81.5% of total national GHG emissions in 2020. The IPCC sector 2 *Industrial Processes and Other Product Use (IPPU)* was responsible for 14.4% of total national GHG emissions in 1990 and 5.5% of total national GHG emissions in 2020. The IPCC sector 3 *Agriculture* represent 11.7% of total national GHG emissions in 1990 and 8.9% of total GHG emissions in 2020. The IPCC sector 5 *Waste* account for 3.6% of total national GHG emissions in 1990 and 4.1% of total national GHG emissions in 2020.

For the different GHG, trends over the period 1990-2020 were as follows:

Table 3 Summary of Algeria's greenhouse gas emissions from 1990 - 2020 (without LULUCF) by category

GHG	Total GHG excluding LULUCF	1 Energy	2 IPPU	3 Agriculture	5 Waste	6 Other
	kt CO_2 equivalent					
1990	**95,948.77**	67,471.69	13,791.41	11,230.85	3,454.82	NO
1995	**103,033.63**	76,091.77	11,281.45	11 627,16	4,033.24	NO
2000	**130,974.80**	101,081.04	12,866.49	12 288,63	4,738.64	NO
2005	**146,390.81**	106,279.03	20,845.39	13 558,66	5,707.73	NO
2010	**186,394.38**	143,726.69	19,695.67	16 327,75	6,644.27	NO
2015	**219,127.01**	176,823.98	14,945.97	19 610,96	7,746.10	NO
2019	**230,093.50**	189,154.71	12,836.82	19 241,69	8,860.28	NO
2020	**220,544.85**	179,671.10	12,166.30	19 575,24	9,132.21	NO
Trend						
1990 - 2020	**129.9%**	166.3%	-11.8%	74,3%	164.3%	NA
2005 - 2020	**50.7%**	69.1%	-41.6%	44,4%	60.0%	NA
2019 - 2020	**-4.1%**	-5.0%	-5.2%	1,7%	3.1%	NA
Share in National total						
1990		70.3%	14.4%	11.7%	3.6%	NA
2005		72.5%	14.3%	9.3%	3.9%	NA
2020		81.5%	5.5%	8.9%	4.1%	NA
Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; sulphur hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.						
Notation Keys: NO: not occurring; NA: not applicable; NE, not estimated; IE: included elsewhere						



Summary-Figure 5 **National total GHG emission (with LULUCF) per sector for pillar years**

For the different GHGs, trends over the period 1990-2020 were as follows:

Table 4 Summary of Algeria’s greenhouse gas emissions from 1990 - 2020 (with LULUCF) by category

	Total GHG including LULUCF	1	2	3	4	5	6
		Energy	IPPU	Agriculture	LULUCF	Waste	Other
	kt CO_2 equivalent						
1990	**90,394.27**	67,471.69	13,791.41	11,230.85	-5,554.50	3,454.82	NO
1995	**98,595.66**	76,091.77	11,281.45	11,627.16	-4,437.96	4,033.24	NO
2000	**128,418.37**	101,081.04	12,866.49	12,288.63	-2,556.43	4,738.64	NO
2005	**140,715.29**	106,279.03	20,845.39	13,558.66	-5,675.52	5,707.73	NO
2010	**178,668.51**	143,726.69	19,695.67	16,327.75	-7,725.87	6,644.27	NO
2015	**206,932.67**	176,823.98	14,945.97	19,610.96	-12,194.33	7,746.10	NO
2019	**219,386.16**	189,154.71	12,836.82	19,241.69	-10,707.34	8,860.28	NO
2020	**211,611.44**	179,671.10	12,166.30	19,648.19	-8,933.41	9,132.21	NO
Trend							
1990 - 2020	**134.1%**	166.3%	-11.8%	74.3%	60.8%	164.3%	NA
2005 - 2020	**50.4%**	69.1%	-41.6%	44.4%	57.4%	60.0%	NA
2019 - 2020	**-3.5%**	-5.0%	-5.2%	1.7%	-16.6%	3.1%	NA

ES.4. Other information (indirect GHGs, precursor gases)

The estimation of indirect carbon dioxide and nitrous oxide emissions was not performed in this inventory cycle due to lack of resources. However, a short qualitative description is provided. See here chapter 9.

ES.5. Key category analysis (KCA)

The key categories without LULUCF (determined by Tier 1 methodology) comprise 211,313.75 kt CO_2eq in the year 2020, which corresponds to 95.3% of the total greenhouse gas emissions (without LULUCF) of Algeria.

Out of the 34 identified key categories, 21 of them were sources of CO_2 emissions and contributed most to the key category emissions: 19 sources of CO_2 emissions from IPCC sector Energy and 2 sources of CO_2 emissions from IPCC sector Industrial Processes and Product Use (IPPU). 8 of the identified key categories were sources of CH_4 emissions: 2 sources of CH_4 emissions from IPCC sector Energy, 4 sources of CH_4 emissions from IPCC sector Agriculture and 2 sources of CH_4 emissions from IPCC sector Waste. 4 of the identified key categories were sources of N_2O emissions, all from IPCC sector Agriculture. one of the identified key categories were sources of HFC emissions, all from IPCC sector IPPU.

In 2020, the following nine IPCC categories contribute already 73.3% to the national total GHG emissions (level assessment): CO_2 from gaseous fuel from 1.A.1.a Public Electricity and Heat Production, CO_2 from Gas/Diesel oil and gasoline from 1.A3.b Road transportation, CH_4 from 1.B.2.b Fugitive emission from segment natural gas and 1.B.2.c Venting and flaring (oil and natural gas), CO_2 from liquid fuels from 1.A.1.c.ii Oil and gas extraction (fuel combustion activities), 1.4.b from gaseous fuels from Residential, and CO_2 from Cement production (combustion of gaseous fuels in 1.A.2.f Non-metallic minerals and process -related emissions in 2.A.1).

The key categories with LULUCF are determined by Tier 1 methodolog. Out of the 34 identified key categories, 22 of them were sources of CO_2 emissions and contributed most to the key category emissions: 19 sources of CO_2 emissions from IPCC sector Energy and 2 sources of CO_2 emissions from IPCC sector Industrial Processes and Product Use (IPPU), one from IPCC sector LULUCF. 8 of the identified key categories were sources of CH_4 emissions: 2 sources of CH_4 emissions from IPCC sector Energy, 4 sources of CH_4 emissions from IPCC sector Agriculture and 2 sources of CH_4 emissions from IPCC sector Waste. 3 of the identified key categories were sources of N_2O emissions, three from IPCC sector Agriculture and one from IPCC sector IPPU. One key category is for HFC and IPCC category 2.F. sector.

ES.6. Improvements introduced.

The main improvement was the introduction and implementation of the methodology of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 2019 Refinements to the 2006 IPCC Guidelines covering the greenhouse gases (GHGs) carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFC), sulfur hexafluoride (SF_6). GHG emissions are estimated for IPCC sectors Energy, Industrial Processes and Product Use (IPPU), Agriculture and Waste for the period 1990 – 2020.

The second important improvement was the development of :

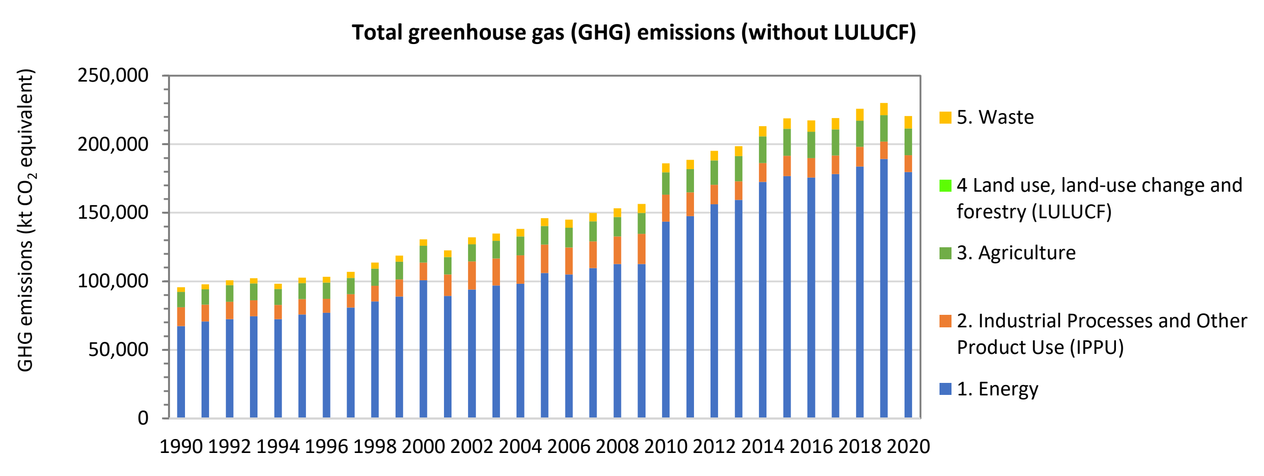
- A tier 1 methodology is applied in IPCC category 1.A Fuel combustion for CO_2 for gaseous fuel;
- A country specific emission factor for CH_4 for 3.A.a Enteric fermentation - dairy cattle. Thus, CH_4 emission emissions were estimated using TIER 2 and Option B (mature dairy cattle, other mature cattle, growing cattle) was used for reporting. Detailed livestock data were available for dairy cattle (Bovin Laitier Moderne (BLM), Bovin Laitier Local (BLL) and Bovin laitier Amélioré (BLA)), milk production, life weight as well as detailed information related to non-dairy cattle (female/male, age, life weight).

Another important improvement is the estimating of GHG emission from IPCC category 1.B *Fugitive emissions from fuels* on a disaggregated level using the guidance provided by the 2019 Refinements to the 2006 IPCC Guidelines.

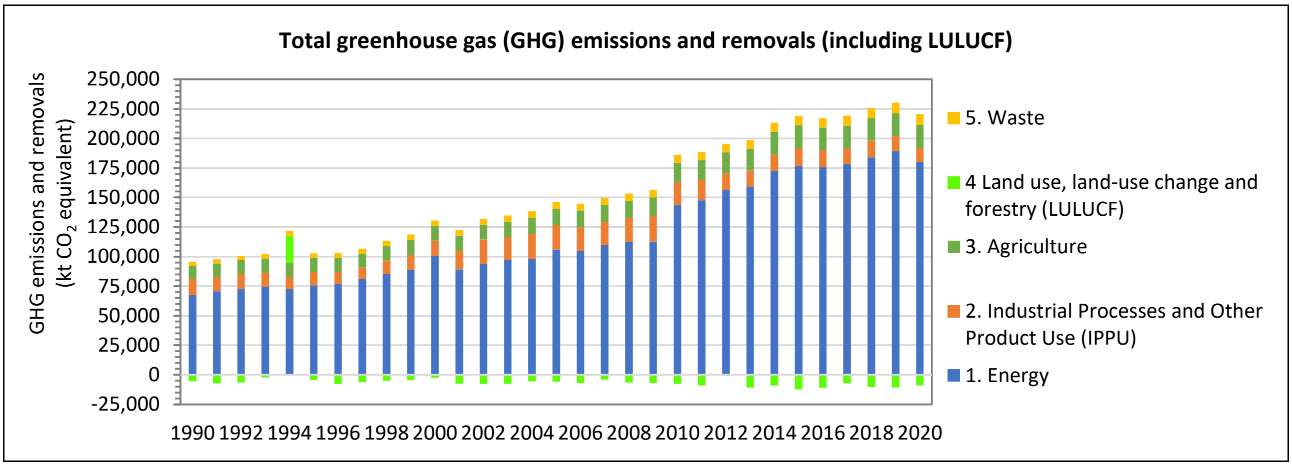
Furthermore, CH_4 Emissions from landfills have been calculated using the First Order Decay (FOD) method, the IPCC Tier 1 method given in the 2006 IPCC Guidelines. Here, the activity data 'Waste generated and deposited' for the period 1950 - 2020 could be prepared using official data but also national studies.

Finally, in many cases the improvements were achieved through availability of plant-specific and country-specific data and information.

ES.7. Summary-Figure and Tables



Summary-Figure 6 National total GHG emission (without LULUCF) by sector



Summary-Figure 7 National total GHG emission (with LULUCF) by sector

Table 5 Summary of Algeria’s greenhouse gas emissions from 1990 - 2020 (without LULUCF)

GHG	Total GHG	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
	kt CO_2 equivalent							
1990	**95,948.77**	68,065.12	22,953.10	4,930.38	NA	NA	0.16	NA
1991	**98,198.31**	69,682.72	23,179.37	5,336.03	NA	NA	0.18	NA
1992	**101,103.08**	72,303.28	23,184.82	5,614.78	NA	NA	0.21	NA
1993	**102,632.88**	73,034.00	23,864.24	5,734.40	NA	NA	0.24	NA
1994	**98,615.39**	70,092.64	23,060.99	5,460.80	0.69	NE	0.27	NE
1995	**103,033.63**	71,845.64	25,845.92	5,340.54	1.22	NE	0.31	NE
1996	**103,534.03**	70,914.46	27,215.48	5,401.63	2.12	NE	0.34	NE
1997	**107,195.86**	72,695.22	29,018.96	5,478.21	3.09	NE	0.39	NE
1998	**113,970.03**	77,195.09	30,952.16	5,818.15	4.20	NE	0.43	NE
1999	**119,181.74**	80,696.02	32,496.42	5,983.10	5.71	NE	0.49	NE
2000	**130,974.80**	93,856.82	31,330.32	5,780.35	6.76	NE	0.56	NE
2001	**122,948.72**	86,070.47	31,035.97	5,833.98	7.68	NE	0.63	NE
2002	**132,470.24**	94,647.76	31,984.37	5,826.78	10.65	NE	0.70	NE
2003	**135,246.20**	96,632.26	32,654.54	5,944.26	14.38	NE	0.77	NE
2004	**138,658.40**	99,312.81	32,874.95	6,450.02	19.79	NE	0.84	NE
2005	**146,390.81**	104,501.01	35,760.48	6,099.49	28.60	NE	1.24	NE
2006	**145,151.09**	103,408.05	35,101.46	6,601.18	38.72	NE	1.70	NE
2007	**150,115.15**	107,895.73	35,441.40	6,725.18	50.63	NE	2.23	NE
2008	**153,404.60**	111,353.32	35,432.06	6,556.55	59.90	NE	2.82	NE
2009	**156,741.89**	114,122.10	35,500.88	7,043.25	71.72	NE	3.49	NE
2010	**186,394.38**	140,033.58	38,758.11	7,373.74	224.30	NE	4.26	NE
2011	**188,751.90**	142,577.80	38,200.99	7,675.81	291.73	NE	5.17	NE
2012	**195,342.99**	147,340.44	39,439.13	8,143.19	413.40	NE	6.29	NE
2013	**198,762.99**	150,130.63	39,626.05	8,469.48	528.56	NE	7.73	NE
2014	**213,313.05**	162,421.37	41,405.60	8,821.22	654.74	NE	9.53	NE
2015	**219,127.01**	167,486.76	41,572.31	8,979.01	1.076.51	NE	11.82	NE
2016	**217,402.50**	163,683.52	43,650.24	8,886.02	1.167.40	NE	14.83	NE
2017	**219,233.34**	165,344.37	44,142.03	8,687.60	1.040.16	NE	18.70	NE
2018	**225,828.61**	171,505.43	44,287.11	8,819.34	1.191.00	NE	23.52	NE
2019	**230,093.50**	176,735.12	43,418.95	8,795.83	1.111.67	NE	29.34	NE
2020	**220,544.85**	167,832.76	42,683.12	8,784.23	1.206.05	NE	36.19	NE
				Trend				
1990 - 2020	**129.9%**	146.6%	86.0%	78.2%	*NA*	NA	22950%	*NA*
2005 - 2020	**50.7%**	60.6%	19.4%	44.0%	*4118%*	NA	2827%	*NA*
2019 - 2020	**-4.1%**	-5.0%	-1.7%	-0.1%	*8%*	NA	23%	*NA*
Share of gas								
1990		70.9%	24.0%	5.1%	NA	NA	<0.1%	NA
2005		71.3%	24.5%	4.2%	<0.1%	NA	<0.1%	NA
2020		76.1%	19.3%	4.0%	0.5%	NA	<0.1%	NA

Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon):

carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; sulphur hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.

Notation Keys: NO: not occuring; NA: not applicalble; NE, not estimated; IE: included elsewhere

Table 6 Summary of Algeria's greenhouse gas emissions and removals from 1990 - 2020 (with LULUCF)

GHG	Total GHG incl. LULUCF	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
	kt CO_2 equivalent							
1990	**90,394.27**	62,432.83	22,999.98	4,961.29	NA	NA	0.16	NA
1991	**90,955.32**	62,402.96	23,201.53	5,350.65	NA	NA	0.18	NA
1992	**94,578.60**	65,715.35	23,223.05	5,639.99	NA	NA	0.21	NA
1993	**100,488.29**	70,715.47	23,969.06	5,803.52	NA	NA	0.24	NA
1994	**121,932.89**	92,470.61	23,627.18	5,834.15	0.69	NE	0.27	NE
1995	**98,595.66**	67,290.34	25,916.63	5,387.17	1.22	NE	0.31	NE
1996	**95,827.44**	63,184.47	27,229.58	5,410.93	2.12	NE	0.34	NE
1997	**100,851.04**	66,288.59	29,056.20	5,502.77	3.09	NE	0.39	NE
1998	**108,918.03**	72,048.59	31,009.11	5,855.70	4.20	NE	0.43	NE
1999	**114,641.41**	76,042.30	32,564.76	6,028.16	5.71	NE	0.49	NE
2000	**128,418.37**	91,113.69	31,442.83	5,854.54	6.76	NE	0.56	NE
2001	**115,502.04**	78,572.70	31,066.76	5,854.28	7.68	NE	0.63	NE
2002	**124,633.27**	86,770.03	32,008.93	5,842.98	10.65	NE	0.70	NE
2003	**127,563.37**	88,923.86	32,669.95	5,954.42	14.38	NE	0.77	NE
2004	**133,142.88**	93,703.93	32,931.21	6,487.12	19.79	NE	0.84	NE
2005	**140,715.29**	98,737.37	35,813.59	6,134.51	28.60	NE	1.24	NE
2006	**138,024.81**	96,236.27	35,128.87	6,619.26	38.72	NE	1.70	NE
2007	**146,217.74**	103,862.42	35,523.30	6,779.19	50.63	NE	2.23	NE
2008	**146,957.12**	104,834.44	35,475.09	6,584.92	59.90	NE	2.82	NE
2009	**149,689.43**	106,998.30	35,543.87	7,071.60	71.72	NE	3.49	NE
2010	**178,668.51**	132,239.96	38,798.94	7,400.67	224.30	NE	4.26	NE
2011	**179,827.06**	133,599.98	38,232.93	7,696.86	291.73	NE	5.17	NE
2012	**194,252.76**	145,948.92	39,620.70	8,262.91	413.40	NE	6.29	NE
2013	**187,924.63**	139,262.88	39,643.76	8,481.16	528.56	NE	7.73	NE
2014	**204,408.45**	153,416.34	41,466.12	8,861.13	654.74	NE	9.53	NE
2015	**206,932.67**	155,277.80	41,581.13	8,984.82	1.076.51	NE	11.82	NE
2016	**206,381.81**	152,615.39	43,678.83	8,904.87	1.167.40	NE	14.83	NE
2017	**211,998.62**	157,958.20	44,233.30	8,747.78	1.040.16	NE	18.70	NE
2018	**215,469.04**	161,139.58	44,290.89	8,821.83	1.191.00	NE	23.52	NE
2019	**219,386.16**	165,988.04	43,442.90	8,811.63	1.111.67	NE	29.34	NE
2020	**211,611.44**	158,786.85	42,750.91	8,828.93	1.206.05	NE	36.19	NE
Trend								
1990 - 2020	**134.1%**	154.3%	85.9%	78.0%	NA	NA	22950%	NA
2005 - 2020	**50.4%**	60.8%	19.4%	43.9%	4118%	NA	2827%	NA
2019 - 2020	**-3.5%**	-4.3%	-1.6%	0.2%	8%	NA	23%	NA
Share of gas								
1990		69.0%	25.5%	5.5%	NA	NA	<0.1%	NA
2005		70.1%	25.5%	4.4%	<0.1%	*NA*	*<0.1%*	*NA*
2020		75.1%	20.2%	4.2%	0.6%	*NA*	*<0.1%*	*NA*

Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; sulphur hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.

Notation Keys: NO: not occuring; NA: not applicalble; NE, not estimated; IE: included elsewhere

Table 7 GHG emissions by IPCC sector excluding LULUCF

GHG	Total GHG excluding LULUCF	1 Energy	2 IPPU	3 Agriculture	5 Waste	6 Other
	kt CO_2 equivalent					
1990	**95,948.77**	67, 471.69	13,791.41	11 230,85	3,454.82	NO
1991	**98,198.31**	71, 209.53	12,116.32	11 377,41	3,495.04	NO
1992	**101,103.08**	72, 811.45	12,671.39	12 002,50	3,617.75	NO
1993	**102,632.88**	74, 976.96	11,662.56	12 258,14	3,735.21	NO
1994	**98,615.39**	72, 812.40	10,238.08	11 680,50	3,884.40	NO
1995	**103,033.63**	76, 091.77	11,281.45	11 627,16	4,033.24	NO
1996	**103,534.03**	77, 381.83	10,200.17	11 777,04	4,174.98	NO
1997	**107,195.86**	81, 228.53	9,792.48	11 862,36	4,312.50	NO
1998	**113,970.03**	85, 688.52	11,315.39	12 514,68	4,451.45	NO
1999	**119,181.74**	89, 329.81	12,359.18	12 897,41	4,595.33	NO
2000	**130,974.80**	101, 081.04	12,866.49	12 288,63	4,738.64	NO
2001	**122,948.72**	89, 629.12	15,690.85	12 738,10	4,890.65	NO
2002	**132,470.24**	94, 240.60	20,576.90	12 594,68	5,058.06	NO
2003	**135,246.20**	97, 219.84	19,827.75	12 917,22	5,281.39	NO
2004	**138,658.40**	98, 562.94	20,858.68	13 773,12	5,463.65	NO
2005	**146,390.81**	106, 279.03	20,845.39	13 558,66	5,707.73	NO
2006	**145,151.09**	105, 211.76	19,713.67	14 319,76	5,905.90	NO
2007	**150,115.15**	109, 832.69	19,512.72	14 600,43	6,169.31	NO
2008	**153,404.60**	112, 689.69	20,131.36	14 300,68	6,282.86	NO
2009	**156,741.89**	112, 985.99	21,903.72	15 359,38	6,492.79	NO
2010	**186,394.38**	143, 726.69	19,695.67	16 327,75	6,644.27	NO
2011	**188,751.90**	147, 715.58	17,332.78	16 907,35	6,796.20	NO
2012	**195,342.99**	156, 558.90	14,116.12	17 696,15	6,971.82	NO
2013	**198,762.99**	159, 631.17	13,469.76	18 506,06	7,155.99	NO
2014	**213,313.05**	172, 599.85	13,838.12	19 442,91	7,432.16	NO
2015	**219,127.01**	176, 823.98	14,945.97	19 610,96	7,746.10	NO
2016	**217,402.50**	175, 740.02	14,173.09	19 437,17	8,052.22	NO
2017	**219,233.34**	178, 257.62	13,584.19	19 014,28	8,377.25	NO
2018	**225,828.61**	183, 763.48	14,405.40	19 054,22	8,605.51	NO
2019	**230,093.50**	189, 154.71	12,836.82	19 241,69	8,860.28	NO
2020	**220,544.85**	179, 671.10	12,166.30	19 575,24	9,132.21	NO
Trend						
1990 - 2020	**129.9%**	166.3%	-11.8%	74,3%	164.3%	NA
2005 - 2020	**50.7%**	69.1%	-41.6%	44,4%	60.0%	NA
2019 - 2020	**-4.1%**	-5.0%	-5.2%	1,7%	3.1%	NA
Share in National total						
1990		70.3%	14.4%	11.7%	3.6%	NA
2005		72.6%	14.3%	9.3%	3.9%	NA
2020		81.5%	5.5%	8.9%	4.1%	NA

Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon): carbon dioxide (CO2) = 1; methane (CH4) = 25; nitrous oxide (N2O) = 298; sulphur hexafluoride (SF6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.

Notation Keys: NO: not occuring; NA: not applicalble; NE, not estimated; IE: included elsewhere

Table 8 GHG emissions and removals by IPCC sector (including LULUCF).

GHG	Total GHG including LULUCF	1 Energy	2 IPPU	3 Agriculture	4 LULUCF	5 Waste	6 Other
	kt CO_2 equivalent						
1990	**90,394.27**	67,471.69	13,791.41	11 230,85	-5,554.50	3,454.82	NO
1991	**90,955.32**	71,209.53	12,116.32	11 377,41	-7,242.99	3,495.04	NO
1992	**94,578.60**	72,811.45	12,671.39	12 002,50	-6,524.49	3,617.75	NO
1993	**100,488.29**	74,976.96	11,662.56	12 258,14	-2,144.59	3,735.21	NO
1994	**121,932.89**	72,812.40	10,238.08	11 680,50	23,317.51	3,884.40	NO
1995	**98,595.66**	76,091.77	11,281.45	11 627,16	-4,437.96	4,033.24	NO
1996	**95,827.44**	77,381.83	10,200.17	11 777,04	-7,706.58	4,174.98	NO
1997	**100,851.04**	81,228.53	9,792.48	11 862,36	-6,344.83	4,312.50	NO
1998	**108,918.03**	85,688.52	11,315.39	12 514,68	-5,052.01	4,451.45	NO
1999	**114,641.41**	89,329.81	12,359.18	12 897,41	-4,540.33	4,595.33	NO
2000	**128,418.37**	101,081.04	12,866.49	12 288,63	-2,556.43	4,738.64	NO
2001	**115,502.04**	89,629.12	15,690.85	12 738,10	-7,446.68	4,890.65	NO
2002	**124,633.27**	94,240.60	20,576.90	12 594,68	-7,836.97	5,058.06	NO
2003	**127,563.37**	97,219.84	19,827.75	12 917,22	-7,682.83	5,281.39	NO
2004	**133,142.88**	98,562.94	20,858.68	13 773,12	-5,515.52	5,463.65	NO
2005	**140,715.29**	106,279.03	20,845.39	13 558,66	-5,675.52	5,707.73	NO
2006	**138,024.81**	105,211.76	19,713.67	14 319,76	-7,126.29	5,905.90	NO
2007	**146,217.74**	109,832.69	19,512.72	14 600,43	-3,897.41	6,169.31	NO
2008	**146,957.12**	112,689.69	20,131.36	14 300,68	-6,447.48	6,282.86	NO
2009	**149,689.43**	112,985.99	21,903.72	15 359,38	-7,052.46	6,492.79	NO
2010	**178,668.51**	143,726.69	19,695.67	16 327,75	-7,725.87	6,644.27	NO
2011	**179,827.06**	147,715.58	17,332.78	16 907,35	-8,924.84	6,796.20	NO
2012	**194,252.76**	156,558.90	14,116.12	17 696,15	-1,090.23	6,971.82	NO
2013	**187,924.63**	159,631.17	13,469.76	18 506,06	-10,838.35	7,155.99	NO
2014	**204,408.45**	172,599.85	13,838.12	19 442,91	-8,904.60	7,432.16	NO
2015	**206,932.67**	176,823.98	14,945.97	19 610,96	-12,194.33	7,746.10	NO
2016	**206,381.81**	175,740.02	14,173.09	19 437,17	-11,020.69	8,052.22	NO
2017	**211,998.62**	178,257.62	13,584.19	19 014,28	-7,234.71	8,377.25	NO
2018	**215,469.04**	183,763.48	14,405.40	19 054,22	-10,359.57	8,605.51	NO
2019	**219,386.16**	189,154.71	12,836.82	19 241,69	-10,707.34	8,860.28	NO
2020	**211,611.44**	179,671.10	12,166.30	19 575,24	-8,933.41	9,132.21	NO
Trend							
1990 - 2020	**134.1%**	166.3%	-11.8%	74.3%	60.8%	164.3%	NA
2005 - 2020	**50.4%**	69.1%	-41.6%	44.4%	57.4%	60.0%	NA
2019 - 2020	**-3.5%**	-5.0%	-5.2%	1.7%	-16.6%	3.1%	NA

Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years time horizon):
carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; sulphur hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.

Notation Keys: NO: not occuring; NA: not applicalble; NE, not estimated; IE: included elsewhere

1 National circumstances, institutional arrangements and cross-cutting information

1.1 Background information on greenhouse gas (GHG) inventory and climate change

1.1.1 Background information on climate change

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun’s heat and raising temperatures.

Examples of greenhouse gas emissions that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and forests can also release carbon dioxide. Landfills for garbage are a major source of methane emissions. Energy, industry, transport, buildings, agriculture, and land use are among the main emitters.[1]

Like many countries in Africa, Algeria has not been spared by the effects of extreme or unseasonal weather. Known for its arid and semi-arid climate, the region is highly vulnerable to changes in climate. Over the last 50 years, an increase in extreme weather events has been observed.

Phenomena that bear witness to this change, which are recorded in climatological studies carried out by the National Meteorological Office, include an increasing frequency in torrential rainfall, especially in the high plateaus (e.g., Ghardaia and Bechar in 2009–2010), that has caused flooding for the first time ever. By 2020, maximum daily rainfall may exceed the normal annual average in the south of the country.

Other extreme phenomena have occurred: cyclogenesis, drought, heat waves and sandstorms. Scientists have estimated that rainfall will decrease by around 20 percent in the coming years.[2]

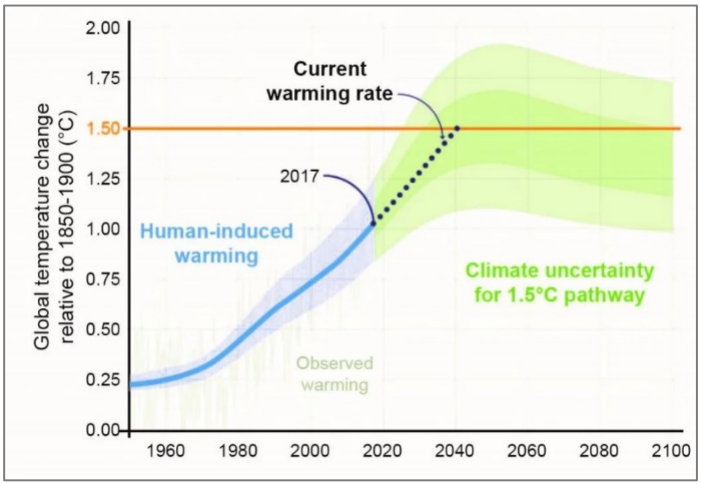


Figure 1 Human-induced warming reached approximately 1°C above pre-industrial levels in 2018.

Source: IPCC (2018): IPCC special report *Global Warming of 1.5 °C* (SR1.5).

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[1] https://www.un.org/en/climatechange/what-is-climate-change

[2] https://www.caritas.org/2011/07/climate-change-in-algeria/#:~:text=Like%20many%20countries%20in%20Africa,weather%20events%20has%20been%20observed.

1.1.1.1 Global Warming

According to the fifth assessment report of the IPCC (AR5) and stated in the IPCC special report *Global Warming of 1.5 °C* (SR1.5)[3], human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate.

As summarized in IPCC special report *Global Warming of 1.5 °C* (SR1.5) the increase of the average surface temperature of the earth will lead to

- differences in regional climate characteristics with
    - changes in climate and weather extremes, temperature extremes on land,
    - risks from droughts and precipitation deficits,
    - global mean sea level rise;
- impacts on biodiversity and ecosystems including species loss and extinction;
- increase in ocean temperature with associated increase in ocean acidity and decreases in ocean oxygen levels;
- climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth;
- needs for adaptation which also includes limited adaptive capacity for some human and natural systems.

1.1.1.2 Climate Change in Algeria

Like many African countries, Algeria has not been spared the consequences of an extreme or unseasonal climate. Known for its arid and semi-arid climate, the country is extremely exposed to climate change effects. Over the past 50 years, an increase in extreme weather events has been observed, and it is particularly affected by desertification and soil degradation. The areas of the territory receiving more than 400 mm of rainfall per year are limited to a strip of a maximum depth of 150 km from the coast. The Saharan part, covers more than 80% of Algeria's surface area, i.e, about 2 million km^2.Climate change and extreme weather events constitute serious challenges for the population, which can increase their food insecurity and slow down the socio-economic development of the country. While, the impacts of climate change are multiplying and constitute a real threat to the prosperity of the world, Algeria has adopted a voluntary approach to fight against CC and to adapt to the new climatic conditions of the country.

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[3] Available (25 May 2019) on https://www.ipcc.ch/sr15/

1.1.1.3 Convention, Kyoto Protocol and Paris Agreement

Algeria became a Party to the UN Framework Convention on Climate Change (UNFCCC) as Non-Annex I Party in 9 June 1993, accede the Kyoto Protocol also on 16 Feb 2005 and ratified the Paris Agreement on 20 Oct 2016. In the following paragraphs the key massages of the convention and Kyoto Protocol and Paris agreement are presented as on the website of UNFCCC.

- The **UN Framework Convention on Climate Change (UNFCCC) is** a “Rio Convention”, one of three adopted at the “Rio Earth Summit” in 1992. Its sister Rio Conventions are the UN Convention on Biological Diversity and the Convention to Combat Desertification. Preventing “dangerous” human interference with the climate system is the ultimate aim of the UNFCCC.[4]
- The **Kyoto Protocol** is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. Recognizing that developed countries are principally responsible for the current high levels of GHG emissions in the atmosphere as a result of more than 150 years of industrial activity, the Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities.[5]

The **Paris Agreement** builds upon the Convention and for the first time brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects, with enhanced support to assist developing countries to do so. As such, it charts a new course in the global climate effort taking into account equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.[6]

In the following tables are presented

- the Convention, Kyoto Protocol and Paris Agreement with the dates of entry into force and the current status.
- the submissions – reports and data sets – under the UN Framework Convention on Climate Change.

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[4] Link to and Text of the United Nations Framework Convention on Climate Change; available (8 January 2020) on https://unfccc.int/process/the-convention/what-is-the-convention/status-of-ratification-of-the-convention

[5] Link to and Text of the Kyoto Protocol; available (8 January 2020) on https://unfccc.int/process/the-kyoto-protocol/status-of-ratification

[6] Link to and Text of the Paris Agreement; available (8 January 2020) on https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.

Table 9 Status of signature and ratification by Algeria of the UNFCCC, Kyoto Protocol and Paris Agreement

	Entry into force	Status (05/2022)	Algeria	
			Signature	Ratification
United Nations Framework Convention on Climate Change (UNFCCC)	21 March 1994	197 Parties[7]	13 June 1992	9 June 1993
Kyoto Protocol *to the UNFCCC* (First commitment period 2008-2012)	16 February 2005	192 Parties	-	16 Feb 2005 a
Doha Amendment[8] *to the Kyoto Protocol* (Second commitment period 2013-2020)	31 December 2020	147 Parties		28 Sep 2015 A
Copenhagen Accord[9]			agreeing to the Accord[10]	
Paris Agreement *to the UNFCCC*	4 November 2016	193 Parties	22 April 2016	20 Oct 2016

Remark: Ratification, Acceptance(A), Accession(a), Approval (AA), Succession(d)

Table 10 Status of Algeria's submission of the National Communication (NC), Biennial Update Report (BUR) and Nationally Determined Contribution (NDC)

UNFCCC Reporting obligation	National Communication (NC) submission	Biennial Update Report (BUR) submission	GHG inventory (tables) as part of NC and BUR - *(Time series) based on*		GHG Inventory & National Inventory Report (NIR)	(Intended) Nationally Determined Contribution (INDC) / (NDC)
			1996 revised IPCC GL & IPCC Good Practice Guidance (GPG)	2006 IPCC Guidelines		
NC1 = INC	30 Apr 2001[11]		X (1994) UNFCCC software		30 Apr 2001[12]	
NC2	25 Nov 2010[13]		X (2000) UNFCCC software		25 Nov 2010[14]	
NC3	planned for 2023			1990-2020 Excel based	Stand-alone NIR	
1st BUR		planned for 2023				
First INDC						September 2015[15]

INC - Initial National Communication

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[7] Available (19 Mai 2022) on https://treaties.un.org/

[8] Link and Text of the Doha amendment; available (8 January 2020) on https://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf

[9] Link to and text of the Copenhagen Accord: FCCC/CP/2009/11/Add.1, 2/CP.15; available (8 January 2020) on https://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf

[10] Available (8 January 2020) on https://unfccc.int/process/conferences/pastconferences/copenhagen-climate-change-conference-december-2009/statements-and-resources/information-provided-by-parties-to-the-convention-relating-to-the-copenhagen-accord

https://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/Algeriacphaccord.pdf

[11] Available (08 March 2021) on https://unfccc.int/documents/67381; https://unfccc.int/sites/default/files/resource/Algeria%20INC_French.pdf

[12] Available (08 March 2021) on https://unfccc.int/documents/66299

[13] Available (08 March 2021) on https://unfccc.int/documents/67403; https://unfccc.int/sites/default/files/resource/Algeria_Second%20Natcom.pdf

[14] Available (08 March 2021) on https://unfccc.int/documents/66299

[15] Available (08 March 2021) on https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Algeria%20First/INDCSubmission_%20Algeria.pdf

1.1.2 Background information on greenhouse gas inventories

As a Party to the Convention and according to the Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention, section III[16], non-Annex I Parties

Para 6. shall, in accordance with Article 4, paragraph 1 (a), and Article 12, paragraph 1(a) of the Convention, communicate to the Conference of the Parties a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol, to the extent its capacities permit, following the provisions in these guidelines.

Para 7. shall estimate national GHG inventories for the year 1994 for the initial national communication (INC) or alternatively may provide data for the year 1990. For the second national communication (SNC), non-Annex I Parties shall estimate national GHG inventories for the year 2000. The least developed country Parties could estimate their national GHG inventories for years at their discretion.

Algeria submitted the Initial National communication (NC1)[17] and the GHG Inventory on the 30 April 2001 taking the 1994 year as reference year, and the second National communication (NC2)[18] and the GHG Inventory on the 25 November 2010 with 2000 year as reference year.

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[16] Available (30 January 2019) on FCCC/CP/2002/7/Add.2, section III., paragraph 6.

[17] Available (08 March 2021) on https://unfccc.int/documents/67381; https://unfccc.int/sites/default/files/resource/Algeria%20INC_French.pdf

[18] Available (08 March 2021) on https://unfccc.int/documents/67403; https://unfccc.int/sites/default/files/resource/Algeria_Second%20Natcom.pdf

1.2 A description of national circumstances and institutional arrangements

Algeria signed in 1993 the United Nations Framework Convention on Climate Change (UNFCCC), adhered to the Kyoto Protocol in 2004, and ratified the Paris Agreement in 2016.

During the preparation of the National Determined Contribution and before ratifying the Paris Agreement, a National Climate Committee has been created, including eighteen (18) ministries.

The Ministry of Environment and Renewable Energy is responsible on the technical issues related to climate change in Algeria. Several strategies and studies have been carried out by the Ministry of Environment and Renewable Energy, such as, National Climate Plan, National Adaptation Plan, and others.

1.2.1 National focal point

The UNFCCC national focal point of Algeria is the Ministry of Foreign Affairs and National Community Abroad.

This Ministry is responsible for climate change international negotiations and agreements at the international level including among others the submission of the National Communications (NC) and Biennial Updated Reports (BUR) including the National Inventory Report to the UNFCCC.

1.2.2 Overview of legal, institutional, and procedural arrangements for compiling GHG inventory

The National Inventory System (NIS) is a requirement to account for greenhouse gases emissions including the QC/QA procedures. The COP 7 (Decision 20/CP7) sets out requirements for National Inventory Systems (NIS), including the need to put in place legal, procedural, and institutional arrangements to ensure that all parties to the Protocol estimate and report overheating gases emissions in accordance with relevant decisions of the Conference of the Parties, and to facilitate UNFCCC reviews and improve the quality of its inventories.

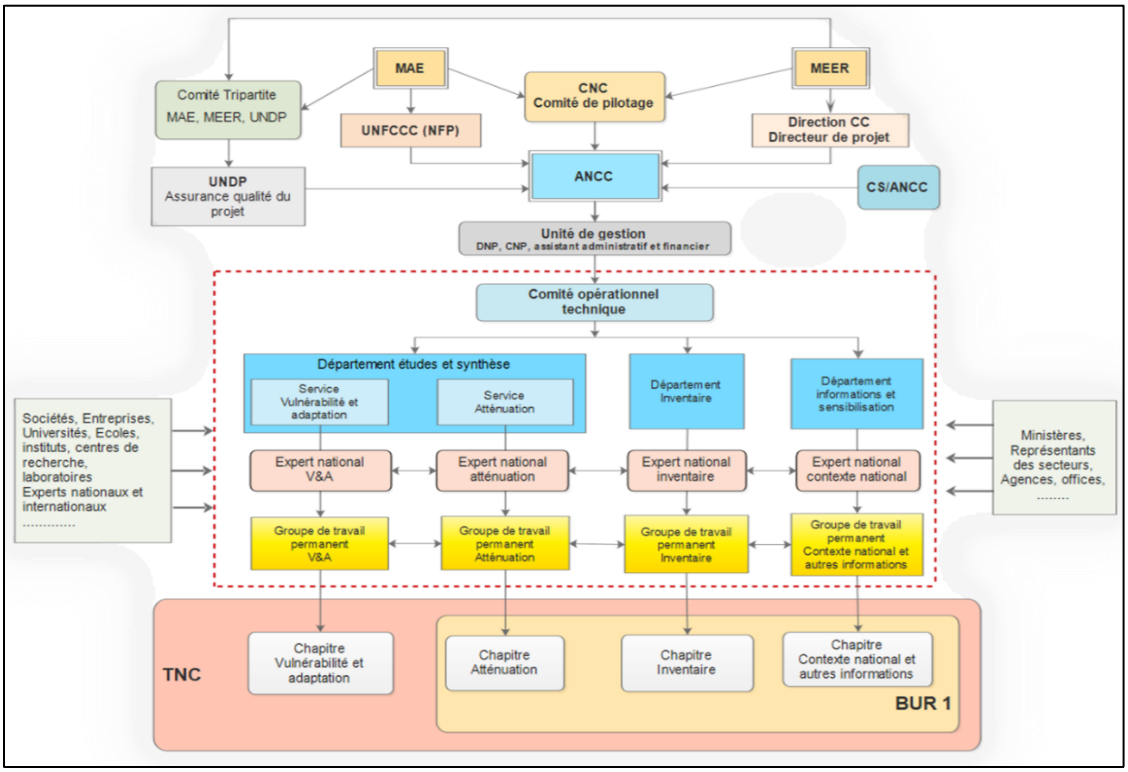

Figure 2 **Institutional arrangement for the preparation of TNC and BUR 1**[19]

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[19] Source : PRODOC du projet de préparation de TNC et BUR1 Algérie version 19- 07 -20

The figure above presents the main elements of preparation and compilation of the Third National Communication (TCN), the First Biennial Update Report (BUR1) and the National Inventory Report of Algeria. The National Climate Change Agency (ANCC) the national entity responsible for compiling the GHGs inventory and other reports relating NC, BUR and BTR in response to the Algerian engagement to the UNFCCC. Major data providers are listed in Table 11.

As for the Algerian National Inventory System (SNI), it will be developed during the next inventory cycle. Formal agreements between ANCC and major data providers (various segment and sectors) will be established.

In the following table are provided activities by objective related to the governmental project "**Implementation of the National Greenhouse Gas Inventory System and its national MRV system**"[20]. The project is financed with State budget of the Ministry of the Environment and Renewable Energy under the 2022 Finance Act[21]. This project will support the further of the MRV GHG inventory.

Table 11 Activities of the governmental project "Implementation of the National Greenhouse Gas Inventory System and its national MRV system"

Etude	Objectives	Activities
1	Institutionalisation of the national inventory system *Institutionnalisation du système national d'inventaire*	Institutional analysis study for the development of the national MRV system including the national greenhouse gas inventory system and the register of mitigation and adaptation actions with the identification and organization of structures, the development of procedures for data management, calculation, reporting, transmission, regular compilation of inventories and archiving. Etude d'analyse institutionnelle pour le développement du système national MRV incluant le système national d'inventaire des émissions de gaz à effet de serre et le registre des actions d'atténuation et d'adaptation avec l'identification et l'organisation des structures, le développement des procédures de gestion de données, de calcul, de notification, de transmission, de compilation régulière des inventaires et d'archivage.
		Analysis study of the existing legislative and regulatory framework in Algeria with development of new texts or proposal for revision of existing texts aiming at the implementation of the national MRV system of greenhouse gas emissions and mitigation and adaptation actions. Etude d'analyse du dispositif législatif et réglementaire existant en Algérie avec élaboration de nouveaux textes ou proposition de révision des textes existants visant la mise en œuvre du système national MRV des émissions de gaz à effet de serre et des actions d'atténuation et d'adaptation.
2	Design and implementation of the national MRV Emission and Action system Conception et mise en œuvre du système national MRV Emission et Actions	Design study of the national MRV Emission and Actions system with the identification of all stakeholders and their commitments, responsibilities and activities. Identification of training and capacity building needs for the implementation of the system and its sustainability. Etude de conception du système national MRV Emission et Actions avec l'identification de toutes les parties prenantes et de leurs engagements, responsabilités et activités. Identification des besoins de formation et de renforcement des capacités pour la mise en œuvre du système et sa pérennité.

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[20] Activités par objectif relatif au projet « Mise en place du Système National d'inventaire des émissions des gaz à effet de serre et de son système national MRV », financé sur budget de l'Etat du Ministère de l'Environnement dans le cadre de la loi de Finances 2022.

[21] Loi de Finances pour 2022 - JOURNAL OFFICIEL https://www.joradp.dz/FTP/jo-francais/2021/F2021100.pdf

Etude	Objectives	Activities
3	Acquisition and installation of computer equipment, ancillary hardware and IT tools (software and applications) for the operation of the national MRV system in network with all relevant sectors and institutions. Acquisition et installation des équipement informatiques, matériels accessoires et outils informatiques (logiciels et applications) pour le fonctionnement du système national MRV en réseau avec tous les secteurs et institutions concernés.	Etude de dimensionnement des installations et des équipements et des outils informatiques nécessaires au fonctionnement du réseau du système national MRV, à l'archivage et établissement de cahiers de charges par lot pour le lancement des appels d'offres. Etude de dimensionnement des installations et des équipements et des outils informatiques nécessaires au fonctionnement du réseau du système national MRV, à l'archivage et établissement de cahiers de charges par lot pour le lancement des appels d'offres.
		Appel d'offres, Acquisition et installation des équipements informatiques et des matériels nécessaires au fonctionnement du système national MRV avec tous les opérateurs et secteurs et institutions concernées. Appel d'offres, Acquisition et installation des équipements informatiques et des matériels nécessaires au fonctionnement du système national MRV avec tous les opérateurs et secteurs et institutions concernées.
4	Development of a capacity building programme for all stakeholders for the implementation of the national MRV system (greenhouse gas inventory and actions). Développement d'un programme de renforcement des capacités de toutes les parties prenantes pour la mise en œuvre du système national MRV (inventaire des gaz à effet de serre et actions).	Training of the core managers of the national MRV system and capacity building of all stakeholders for the implementation of the national GHG inventory system. Formation des cadres clés noyau du système national MRV et renforcement des capacités de toutes les parties prenantes pour la mise en œuvre du système d'inventaire national de GES.
		Conduct a cycle of specific training workshops on the national GHG inventory system and on sector-specific mitigation and adaptation actions. Réalisation d'un cycle d'ateliers de formation spécifiques sur le système national d'inventaire de GES et sur les actions d'atténuation et d'adaptation par secteur.
		Development of manuals on the procedures of the national MRV system with the GHG inventory cycle and mitigation and adaptation actions. Elaboration de manuels sur les procédures du système national MRV avec le cycle d'inventaire de GES et des actions d'atténuation et d'adaptation.
5	Training in the software and IT tools of the national MRV system for managing inventory data and the register of actions. Formation aux logiciels et outils informatiques du système national MRV de gestion des données d'inventaire et du registre des actions	Conducting a series of training workshops on the mastery of software and IT tools for the MRV system, communication and transmission platform, QA-QC, GHG inventory and action register, archiving and securing data. Réalisation d'un cycle d'atelier de formation sur la maitrise des logiciels et outils informatiques du système MRV, plateforme de communication et de transmission, de QA-QC, d'inventaire de GES et du registre des actions, archivage et sécurisation des données.

ANCC – establishing and missions.

According to Executive Decree No. 05-375 of Chaâbane 22, 1426 corresponding to September 26, 2005, establishing the ANCC, setting its missions and defining the terms of its organization and operation the National Agency for Climate Change is responsible, among other things, for listing all the activities of the various sectors to fight against climate change and for contributing to any national inventory of greenhouse gases according to the regulations in force.

Legal arrangements

The preparation of the Algeria’s third GHG inventory was undertaken under the coordination of the Ministry of Environment and Renewable Energy (MEER) and the Ministry of Foreign Affairs the National Community abroad as the focal point, and the participation of other ministries who are members in the National Climate Committee and financially supported by the Global Environment Fund, and a participation of national and international experts.

Overall Legal and Institutional arrangements

The following Presidential Decrees implement international obligations related to Climate Change at the national level:

Presidential Decree No. 16-262 of Moharram 11, 1438 corresponding to October 13, 2016, ratifying the Paris Agreement on climate change, adopted in Paris on December 12, 2015.

Presidential Decree No. 15-119 of 24 Rajab 1436 corresponding to 13 May 2015 accepting the Doha Amendment to the Kyoto Protocol to the United Nations Framework Convention on Climate Change, adopted in Doha, Qatar, on 8 December 2012.

Presidential Decree No. 04-144 of 8 Rabie El Aouel 1425 corresponding to April 28, 2004, ratifying the Kyoto Protocol to the United Nations Framework Convention on Climate Change, done in Kyoto, December 11, 1997;

Presidential Decree No. 93-99 of Chaoual 18, 1413 corresponding to April 10, 1993, ratifying the United Nations Framework Convention on Climate Change adopted by the United Nations General Assembly on May 9, 1992.

Currently, Algeria is in the process of setting up the Structure of the MRV System, which is presented by the institutional structures in charge of coordinating information on climate change and the Directorates which participate in:

1) the development of GHG inventories and mitigation measures for the four sectors (Energy, PIUP, AFOLU and Waste).
2) assessment of measures based on the impacts of climate change on the agriculture, livestock, forests, water resources, and human health sectors.
3) the management of financial resources allocated to climate change.

Further national legislation which are relevant for the preparation of the GHG Inventory is in progress.

National Statistical office (ONS) production statistics, import/export transport statistics

- Decree No. 82-489 of December 18, 1982, establishing the National Statistics Office (O.N.S.). (Page 18-41).
- Legislative decree n° 94-01 of 3 Chaâbane 1414 corresponding to January 15, 1994, relating to the STATISTICAL SYSTEM. (Page 07)

Ministry of energy and Mines, Energy balance

- Décret exécutif n° 21-239 du 19 Chaoual 1442 correspondant au 31 mai 2021 fixant les attributions du ministre de l'énergie et des mines.

  Article 05 : 2.2 La sous-direction des statistiques, bilans et synthèses, chargée :
  — de développer et de gérer la banque de données statistiques du secteur ;
  — d'établir et de diffuser les statistiques et rapports de conjoncture du secteur ;
  — d'élaborer le bilan énergétique national annuel ;

— d’élaborer le bilan annuel relatif aux activités minières ;
— de contribuer aux travaux des institutions nationales et internationales spécialisées.

- Decision No. 271 of December 27, 2012, setting the units of measurement and conversion rates used in reporting and circulation of statistical information in the energy and mining sector.

L'Agence Nationale des Déchets (AND) Landfill law, a directive, legal document

- Law n° 01-19 of December 12, 2001, relating to the management, control and elimination of waste.
- Executive Decree No. 04-410 of December 14, 2004, setting the general rules for the development and operation of waste treatment facilities and the conditions for admitting this waste to these facilities.
- Loi 01–19 du 27 Ramadhan 1422 correspondant au 12 décembre 2001, relative à la gestion, au contrôle et à l'élimination des déchets.
- Executive Decree No. 2007-205 of 15 Joumada Ethania 1428 corresponding to June 30, 2007 setting the terms and procedures for the development, publication and revision of the municipal plan for the management of household and similar waste,
- Executive Decree No. 06-138 of 16 Rabie El Aouel 1427 corresponding to April 15, 2006 regulating the emission into the atmosphere of gases, fumes, vapors, liquid or solid particles, as well as the conditions under which their control is exercised...
- Executive Decree No. 93-165 of July 10, 1993 regulating atmospheric emissions of smoke, gas, dust, odors and solid particles from fixed installations. [repealed by decree no. 06-138]

Ministère de l'Agriculture et du Développement Rural (MARD) – Agricultural statistics

- Law No. 08-16 of Aouel Chaabane 1429 corresponding to August 3, 2008 on agricultural orientation.
- Law No. 12-84 of June 14, 1984, including the general system of forests.

During the preparation of the GHG Inventory, a working group on GHG Inventory has been created. The group includes engineers and senior ministries officials in different profiles.

Several meeting and workshops have been organized with the GHG Inventory working group, under the supervision of the national and international experts on GHG Inventory, with explanations and capacity-building on IPCC 2006 guidelines and 2019 refinement to the 2006 IPCC guidelines and data collection.

The realization of the GHG inventory included the establishment of a national GHG inventory management system, which will ensure the development of future GHG inventories, National Communications and Biennial Update Reports, with, a mastery of the MRV process facilitating the development of a national MRV system.

The Ministry of the Environment and Renewable Energy also has experts in the field of GHG inventory, who are generally former managers in the sector, as well as a few engineers, who are active in particular at the level of the ANCC (National Climate Change Agency), the AND (National Waste Agency), the DCC (Climate Change Direction), which require good supervision to acquire good practices to implement in future GHG inventories and take control of the locomotive of this National GHG Inventory System in future GHG inventories.

In Algeria, the Ministry of Energy includes the company Sonatrach, which is the National Company for the Research, Production, Transport, Transformation and Marketing of Hydrocarbons. Sonatrach, an oil and gas group, has put in place a well-organized HSE policy, and a benchmark for estimating GHG emissions is being put in place, in terms of data collection and calculation of emissions, by activity and by site, across the national territory.

The forestry sector represented by the DGF (Directorate General of Forests), which is an institution under the supervision of the Ministry of Agriculture and Rural Development, also has skills in the forests sequestration. However, this does not cover the agriculture and land use change component, which requires building the capacity of officials from the Ministry of Agriculture and Rural Development as well as those from the DGF.

The Ministry of Industry, for its part, requires significant capacity building in the field of GHG emissions estimation in terms of IPPU (Industrial Processes and Products Use).

The Transports Ministry in its various forms (road, air, naval and rail) used either in the transport of people or goods is also important in the development phase of the SNGI, in particular, in the data collection phase (combustion of fuels). The sector includes, in addition to the transport directorates, the ONM (National Meteorological Office), which ensures the measurement and supply of the meteorological and modeling data necessary in the field of waste (in the GHG inventory). Capacity building for transport sector executives in the methods of collecting and compiling emission data from its activities is necessary within the framework of this project, which falls under the capacity building chapter.

The Ministry of Higher Education and Scientific Research includes some twenty research centers and research units and approximately 1,600 research laboratories, including research teams that work actively on research and development themes related to climate change such as the CDER (Center for the Development of Renewable Energies), the CRSTRA (Center for Scientific and Technical Research on Arid Regions), ENSA (National Higher School of Agronomics), …etc.

The establishments under the MESRS produce theses, scientific articles and studies as well as software that could be of great importance at the various stages of development of the GHG inventory. The CERIST (Center for Research in Scientific and Technical Information) includes a database of all defended doctoral theses.

Intense work has been done by the engineers of the National Climate Change Agency, leading to the completion of the calculations of GHG emissions and sequestration and allowing the drafting of the national GHG inventory report.

The preparation of this inventory went through a difficult period, which was characterized by the covid19 pandemic, causing a delay in the collection of data and the work of the intermenstrual working groups.

1.2.3 Inventory preparation process

The greenhouse gas inventory of Algeria for the period 1990 to 2020 was compiled according to the recommendations for inventories set out in the:

- Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention. Decision 17/CP.8 (FCCC/CP/2002/7/Add.2)[22];

  Non-Annex I Parties are required to submit their first National Communication (NC) within three years of entering the Convention, and every four years thereafter. The NCs shall be prepared in accordance with the guidelines contained in decision 17/CP.8.

  . NATIONAL GREENHOUSE GAS INVENTORY

  . Each non-Annex I Party shall, in accordance with Article 4, paragraph 1 (a), and Article 12, paragraph 1(a) of the Convention, communicate to the Conference of the Parties a national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHGs) not controlled by the Montreal Protocol, to the extent its capacities permit, following the provisions in these guidelines.

  Non-Annex I Parties shall estimate national GHG inventories for the year 1994 for the initial national communication or alternatively may provide data for the year 1990. For the second national communication, non-Annex I Parties shall estimate national GHG inventories for the year 2000. The least developed country Parties could estimate their national GHG inventories for years at their discretion.

- UNFCCC biennial update reporting guidelines for Parties not included in Annex I to the Convention (Decision 2/CP.17, FCCC/CP/2011/9/Add.1, Annex III[23])

  Non-Annex I Parties, consistent with their capabilities and the level of support provided for reporting, should submit their first Biennial Update Report (BUR) by December 2014, and every two years thereafter. The least developed country Parties and small island developing States may submit BURs at their own discretion. The BURs shall be prepared in accordance with the guidelines contained in.

  National greenhouse gas inventory

  Non-Annex I Parties should submit updates of national GHG inventories according to paragraphs 8–24 in the “Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention” (hereinafter referred to as the UNFCCC guidelines for the preparation of national communications from non-Annex I Parties) as contained in the annex to decision 17/CP.8. The scope of the updates on national GHG inventories should be consistent with capacities, time constraints, data availabilities and the level of support provided by developed countries Parties for biennial update reporting.

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[22] Available (8 January 2020) on FCCC/CP/2002/7/Add.2 https://unfccc.int/sites/default/files/17_cp.8.pdf

[23] Available (8 January 2020) on FCCC/CP/2011/9/Add.1, Annex III. https://unfccc.int/sites/default/files/resource/docs/2011/cop17/eng/09a01.pdf

The current National GHG Inventory and National Inventory Report (NIR) of Algeria for the period 1990 – 2020 has been prepared also in the light of the

- ‘Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement’[24]
- Guidance for operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement[25]
- which will be in place from 2024 onwards:
  - Application of 2006 IPCC Guidelines for National Greenhouse Gas Inventories and 2019 refinement to the 2006 IPCC guidelines;
  - Preparation of the NIR according to the principles listed in section B. Guiding principles para 3:
    - (a) Building on and enhancing the transparency arrangements under the Convention, recognizing the special circumstances of the least developed countries (LDCs) and small island developing States (SIDS), and implementing the transparency framework in a facilitative, non-intrusive, non-punitive manner, respecting national sovereignty and avoiding placing undue burden on Parties;
    - (b) The importance of facilitating improved reporting and transparency over time;
    - (c) Providing flexibility to those developing country Parties that need it in the light of their capacities;
    - (d) Promoting transparency, accuracy, completeness, consistency and comparability;
    - (e) Avoiding duplication of work and undue burden on Parties and the secretariat;
    - (f) Ensuring that Parties maintain at least the frequency and quality of reporting in accordance with their respective obligations under the Convention;
    - (g) Ensuring that double counting is avoided;
    - (h) Ensuring environmental integrity.

In the following Figure the current reporting and review obligations and the reporting and review obligations under the Paris Agreement are presented. A biennial reporting and review of the greenhouse gas inventory and National Inventory Report (NIR) will be status.

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[24] Decision 18/CMA.1, FCCC/PA/CMA/2018/3/Add.2. Available (8 January 2020) on https://unfccc.int/sites/default/files/resource/CMA2018_03a02E.pdf

[25] Decision 5/CMA.3 FCCC/PA/CMA/2021/10/Add.2. Available (20 September 2022) on https://unfccc.int/documents/460951

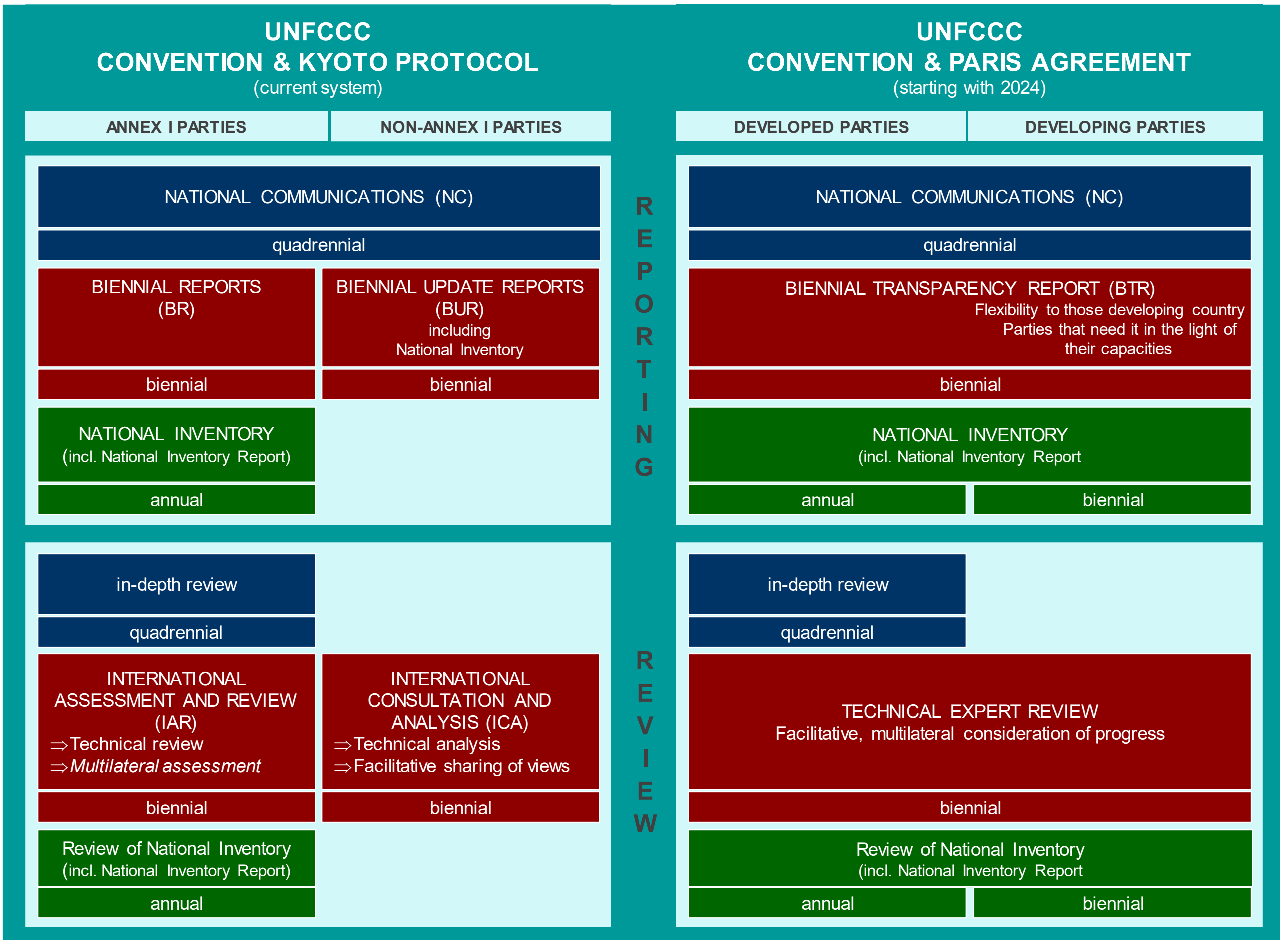

Figure 3 Comparison of the current reporting and review obligations and the reporting and review obligations under the Paris Agreement.

Source: Köther, Traute (2019): Comparison of the current reporting obligations and the reporting obligations under the Paris Agreement. Based on After WRI (2017): Designing the Enhanced Transparency Framework, Part 2: Review under the Paris Agreement.

1.2.3.1 Overview of inventory planning

The third Algeria's GHG Inventory was planned from 2019 under the supervision of the Ministry of Environment and Renewable Energy, and funded by the UNDP. The first workshop was organized on December 28th, 2019. Several workshops and meetings have been organized starting by the installation of the National System of the Inventory Management, the designation of the data provider establishments, followed by capacity building of the GHG Inventory working group on IPCC 2006 guidelines and 2019 refinement to the 2006 IPCC guidelines.

Overview of inventory preparation and management

The preparation of the inventory was characterized by two steps:

- The first step (before and during the Covid19 pandemic) was characterized by the preparation of the working groups, capacity-building of the members in terms of IPCC guidelines and date collection by the national expert and the international expert on GHG inventory.
- The second step started with the arriving of the new international expert on GHG inventory, where, there have been several meetings with sectors for completing data lacks. During this step, a hard work has been recorded between the national and international expert with the Engineers of the National Climate Change Agency and the Climate Change Direction.

1.2.3.2 GHG inventory

The third GHG inventory has been carried out using the IPCC 2006 Guidelines using Tier 1 and Tier 2 in some sub-sectors and the 2019 Refinement to the IPCC 2006 Guidelines. The calculations using Excel spreadsheet were done by the Engineers of the ANCC and the DCC under the supervision of the national and the international expert on GHG Inventory. The QA/QC were undertaken by the group of experts participating in the GHG inventory calculations.

1.2.3.3 Data collection and processing

The elaboration of the national GHG inventory requires the collaboration of the various sectors and actors to ensure the smooth running of data collection and archiving, consultation for the choice of emission factors with the compliance with QA/QC procedures and efficient and accurate compilation of emissions results using Microsoft excel.

During the installation of the National System of the Inventory Management, a list of data providers has been designated by IPCC sector as mentioned in the following table.

Table 12 List of data providers

Sigle Institution	**Institution**	**Energy**			**IPPU**	**Agri culture**	**LULUCF**	**Dechets**	
		Station-airy	**Trans-port**	**Fugitive**				**solides**	**Liquid**
MADR	Ministère de l'Agriculture et du développement rural					x	x		
DDARZASA	Direction du développement agricole et rural dans les zones arides et semi arides					x	x		
DRDPA	Direction de la régulation et du développement des productions agricoles et autres directions					x			
DGF	Direction Générale des Forêts Algérie						x		
MEM	Ministère de l'Energie et des Mines	x		x	x	x			
SONATRACH	Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures	x		x	x				
FERTIAL	Société des fertilisants d'Algérie								
SONELGAZ	Société Nationale d'electricité et du gaz	x			x				
MEER	Ministère de l'Environnement								
AND	Agence Nationale des Déchets							x	
CNTPP	Centre National des Technologies de Production Plus Propre				x				
MNS	Ministère de la Numérisation et des Statistiques								
ONS	Office National des Statistiques	x			x	x		x	x
MRE	Ministère des Ressources en Eaux							x	x
ONA	Office Nationale de l'Assainissement								x
Mi	Ministère de l'Industrie								
GICA	Groupe Industriel des Ciments en Algérie				x				
Secteur privé									
CONDOR	Condor Electronics				x				
Lafarge Algérie	Lafarge Algérie				x				

1.2.3.4 Archiving of information

The archiving of data and information is ensured at the ministerial level, at the National Statistics Office and at the Ministry of Environment and Renewable Energy, through the National Climate Change Agency.

The GHG inventory project for the first BUR and the Third National Communication for Algeria identified a need for capacity building in the area of data archiving.

1.2.3.5 Processes for official consideration and approval of inventory

The inventory has been compiled by the engineers of the National Climate Change Agency and Climate Change Direction of Ministry of Environment and Renewable Energies, under the supervision of the national and international GHG Inventory experts. After applying QA/QC procedures, the inventory has been submitted to the different Ministries and stakeholders for verifications, consideration, and approval. Once approved by all sectors (Technical approval), the National Inventory Report is submitted to the National Climate Committee for final approval. Then submitted to the UNFCCC through the National Focal Point to the UNFCCC.

1.3 Brief general description of methodologies and data sources used

The main sources for activity data are national statistics from Office National des Statistiques (ONS), Ministry of Energy and Mining, Ministry of Agriculture, and international statistics like UNSD and FAO. In order to fill gaps expert judgement based on discussion with relevant national experts is applied.

The main sources for emission factors of GHG are the

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories[26] and
- 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[27].
- Country specific emission factors

The emission factors of air pollutants were taken from the EMEP/EEA air pollutant emission inventory guidebook 2019[28].

1.3.1.1 Use of the 2006 IPCC Guidelines and Refinements to the 2006 IPCC GL

The following tables provides an overview regarding the use of the Refinements to the 2006 IPCC GL.

Table 13 Overview on the use of the Refinements to the 2006 IPCC GL

	Status	2006 IPCC GL	Refinements to the 2006 IPCC GL
IPCC sector 1 Energy			
1.A Fuel combustion	✓	x	
1.B Fugitive emissions from fuels	✓	x	x
1.B.1 Solid Fuels			
1.B.1.a Coal mining and handling	✓	x	
1.B.1.b Fuel transformation	✓	x	
1.B.2 Oil and gas	✓	x	x
1.C CO_2 Transport and storage	NO		
2 Industrial processes and product Use (IPPU)			
2.A Mineral industry	✓	x	
2.B Chemical industry	✓	x	
2.C Metal industry	✓		x
2.D Non-energy products Solvent use	✓	x	
2.E Electronics industry	NO		
2.F. Product uses as substitutes for ODS	✓		x
2.G Other product manufacture and use	✓	x	
2.H Other	NO		
3 Agriculture			
3.A Enteric fermentation			
3.A.1 Cattle (Option B: country-specific)	✓		x
3.A.2 Sheep, 3.A.3 Swine, 3.A.4 Other livestock (e.g. Camels, Goats, Horses, Mules and Asses)	✓		x
3.B Manure management	✓	x	
3.C Rice cultivation	NO		
3.D Agricultural soils			

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[26] available (18 May2022) on https://www.ipcc-nggip.iges.or.jp/public/2006gl/

[27] available (18 May2022) on https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html

[28] available (18 May2022) on https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

	Status	2006 IPCC GL	Refinements to the 2006 IPCC GL
3.D.1 Direct N_2O emissions from managed soils			
3.D.1.a Inorganic N fertilizers	✓	x	
3.D.1.b Organic N fertilizers	✓	x	
3.D.2 Indirect N_2O Emissions from managed soils	✓	x	
3.E Prescribed burning of savannahs	NO		
3.F Field burning of agricultural residues	✓		x
3.G Liming	NO		
3.H Urea application	✓	x	
3.I Other carbon-containing fertilizers	NO		
3.J Other	NO		
4 LULUCF	✓	**x**	
5 Waste			
5.A Solid waste disposal	✓		x
5.B Biological treatment of solid waste	✓	x	
5.C Incineration and open burning of waste	✓	x	
5.D Wastewater treatment and discharge	✓		x
5.E Other	NO		

1.3.1.2 Decision tree and Good Practice method

For key categories, the most accurate methods for the preparation of the greenhouse gas inventory should be used. Due to lack of data and resources, it was not possible to estimate all emissions according to the sectoral decision trees. Where the methodological choice is not in line with the sectoral decision tree, actions are defined and listed in the inventory improvement plan.

The following table briefly presents the activity data (AD) sources, the types of emission factors (EF) used, and the methods applied for estimating GHG emissions reported in this NIR. Detailed information on applied methodology, used activity data (AD) and emission factors (EF) are presented in the relevant sectoral chapters.

The preparation of the inventory starts always with identification of the key categories of the previous inventory followed by the selection of the appropriate identify the appropriate method for estimation for each category according to the **decision tree** of each source presented in Volume 2 – 5 of the 2006 IPCC guidelines. In the following Figure the general Decision Tree to choose a **Good Practice method** is presented.

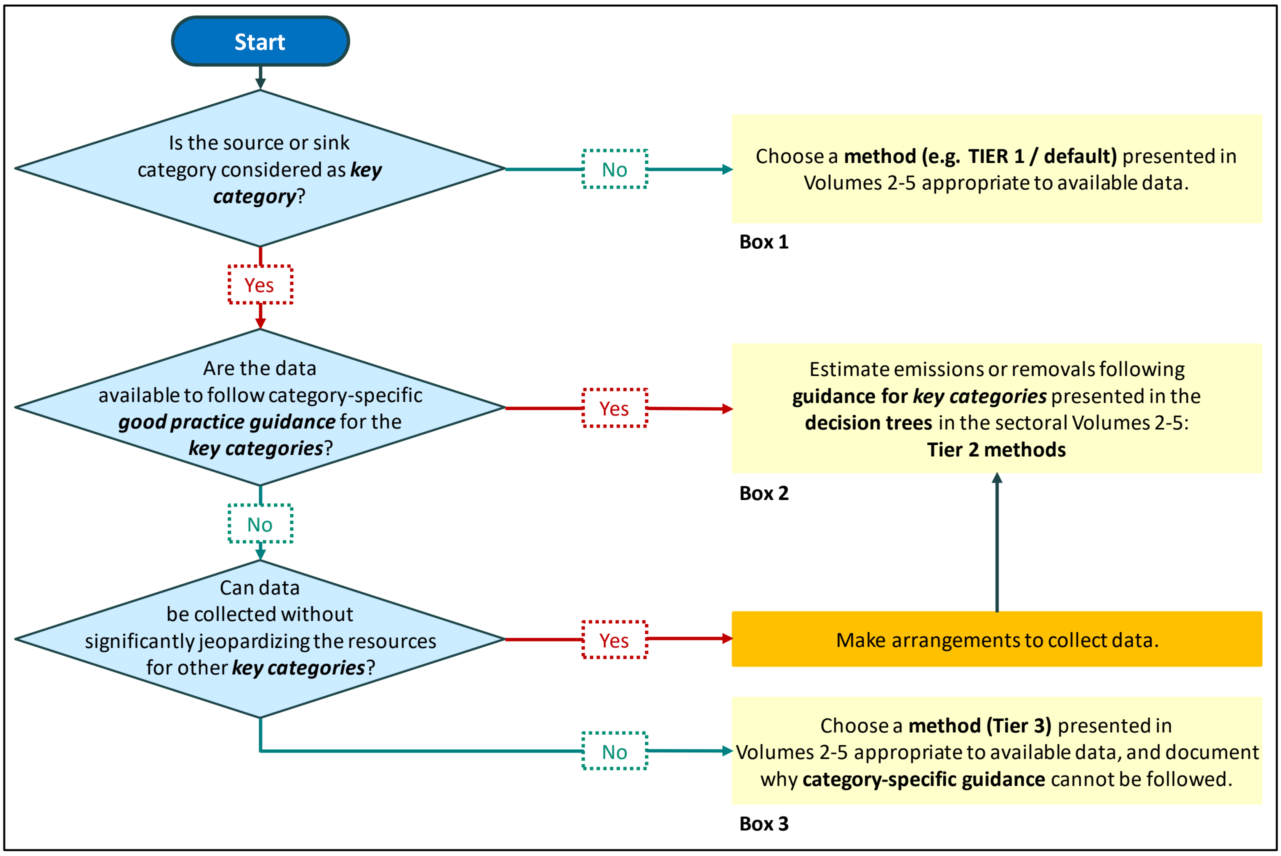

Figure 4 **Decision Tree to choose a Good Practice method.**

Source: 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, sub-chap. 4.1.2 Purpose of the key category analysis, Figure 4.1, p. 4.6.

In the following table, an overview is provided for.

- Notation keys (in general)
- Notation keys to specify the method applied
- Notation keys to specify the emission factor used
- Notation keys to specify the activity data used

Table 14 Notation keys used to specify the method applied, emission factor used report and activity data used

Notation keys to specify completeness		**Notation keys to specify the method applied**			
NA	Not applicable	**D**	IPCC default	**CS**	Country Specific
NO	Not occurring	**T1**	IPCC Tier 1	**CR**	CORINAIR
NE	Not estimated	**T1a, T1b, T1c**	IPCC Tier 1a, Tier 1b and Tier 1c, respectively	**RA**	Reference Approach
IE	Included elsewhere	**T2**	IPCC Tier 2	**OTH**	Other
C	Confidential	**T3**	IPCC Tier 3	**M**	Model

Notation keys to specify the emission factor used		**Notation keys to specify the activity data used**			
D	IPCC default	**Q**	Specific Questionnaire	**PS**	Plant specific
CS	Country specific	**MEM**	Ministry of Energy and Mines	**EJ**	Expert Judgement
PS	Plant specific	**ONS**	Statistical Office of Algeria	**BAT**	Best Available Techniques
OTH	Other	**UNSD**	United Nations Statistics Division	**GDL**	Global Data Lab
M	Model	**FAO**	FAO Statistics Division (FAOSTAT)	**WPP**	United Nations World Population Prospects
		USGS	US Geological Survey	**DESA**	United Nations Department of Economic and Social Affairs
		ONA	National Sanitation Office		

Table 15 Summary report for methods and emission factors used and source of activity data in IPCC sector 1 Energy.

IPCC sector 1	**CO_2**			**CH_4**			**N_2O**		
Energy	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
1.A Fuel combustion									
1.A.1 Energy industries									
1.A.1.a Public electricity and heat production	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD /Sonatrach/ Sonelgaz
1.A.1.b Petroleum refining	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD /Sonatrach/ Sonelgaz
1.A.1.c Manufacture solid fuels Other energy industries	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD/ Sonatrach/ Sonelgaz	T1	D	MEM/UNSD /Sonatrach/ Sonelgaz
1.A.2 Manufacturing industries Construction									
1.A.2.a Iron and steel	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.b Non-ferrous metals	NA	NA	IE	NA	NA	IE	NA	NA	IE
1.A.2.c Chemicals	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.d Pulp paper and print	NA	NA	IE	NA	NA	IE	NA	NA	IE
1.A.2.e Food processing beverages and tobacco	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.f Non-metallic minerals	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.g Manufacturing machinery	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.A.2.h Manufacturing transport equipment	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.A.2.i Mining excluding fuels and quarrying	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.A.2.j Wood and wood products	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.A.2.k Construction	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.l Textile and leather	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.2.g.vii Off-road vehicles Other machinery	NA	NA	IE	NA	NA	IE	NA	NA	IE
1.A.2.m Other	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.3 Transport									
1.A.3.a Domestic aviation	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.3.b Road transportation	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.3.c Railways	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.3.d Domestic Navigation	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.3.e Other transportation	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.4 Other sectors									
1.A.4.a Commercial institutional	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.4.b Residential	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.4.c Agriculture forestry fishing	T1	D	MEM/UNSD	T1	D	MEM/UNSD	T1	D	MEM/UNSD
1.A.5 Other	NE	NA	NE	NE	NA	NA	NE	NA	NE

IPCC sector 1	**CO_2**			**CH_4**			**N_2O**		
Energy	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
1.B Fugitive emissions from fuels									
1.B.1 Solid Fuels									
1.B.1.a Coal mining and handling	NO	NA	NA	NO	NA	NA	NO	NA	NA
1.B.1.b Fuel transformation	NA	NA	NA	T1	D	MEM/UNSD	NA	NA	NA
1.B.1.b.i Charcoal and biochar production	NA	NA	NA	NA	NA	NE	NE	NA	NA
1.B.1.b.ii Coke production	NA	NA	NA	T1	D	MEM/UNSD/ USBGS	NA	NA	NA
1.B.1.b.iii Coal to liquids	NO	NA	NA	NO	NA	NA	NO	NA	NA
1.B.1.b.iv Gas to liquids	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.1.b.v Other	NO	NA	MEM/ UNSD	NO	NA	NA	NO	NA	NA
1.B.1.c Other	NO	NA	NE	NO	NA	NA	NO	NA	NE
1.B.2 Oil and gas									
1.B.2.a Oil									
1.B.2.a.i Exploration	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.2.a.ii Production and upgrading	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.a.iii Transport	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.a.iv Refining storage	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.2.a.v Distribution of oil products	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.a.vi Other	NA	NA	NE	NA	NA	NE	NA	NA	NE
1.B.2.b Natural gas									
1.B.2.b.i Exploration	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.2.b.ii Production and gathering	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.2.b.iii Processing	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.b.iv Transmission and storage	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.b.v Distribution	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.b.vi Other	NA	NA	NE	NA	NA	NE	NA	NA	NE
1.B.2.c Venting and flaring									
1.B.2.c.i Venting	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	NA	NA	NA
1.B.2.c.ii Flaring	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.B.2.d Other	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.C CO_2 Transport and storage									
	NA	NA	NO	NA	NA	NA	NA	NA	NA

IPCC sector 1	**CO_2**			**CH_4**			**N_2O**		
Energy	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
1.D Memo items									
1.D.1 InterNAtioNAl bunkers - Aviation	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.D.1 InterNAtioNAl bunkers - NAvigation	T1	D	MEM/ UNSD	T1	D	MEM/ UNSD	T1	D	MEM/UNSD
1.D.2 Multilateral operations	NA	NA	NO	NA	NA	NO	NA	NA	NO
1.D.3 CO_2 emissions from biomass	T1	D	MEM/ UNSD	NA	NA	NA	NA	NA	NA
CO_2 captured	NA	NA	NO	NA	NA	NO	NA	NA	NO
Waste incineration with energy recovery included	NA	NA	NO	NA	NA	NO	NA	NA	NO

Table 16 Summary report for methods and emission factors used and source of activity data in IPCC sector 2 IPPU

IPCC sector 2	**CO_2**			**CH_4**			**N_2O**		
Industrial processes and product Use (IPPU)	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
2.A Mineral industry									
2.A.1 Cement production	T1	D	ONS, USGS, PS	NA	NA	NA	NA	NA	NA
2.A.2 Lime production	T1	D	ONS, USGS	NA	NA	NA	NA	NA	NA
2.A.3 Glass production	T1	D	ONS	NA	NA	NA	NA	NA	NA
2.A.4 Other process uses of carbonates	NA	NA	NE	NA	NA	NO	NA	NA	NO
2.B Chemical industry									
2.B.1 Ammonia production	T1	D	NC1, NC2, USGS, MEM/PS	NA	NA	NA	NA	NA	NA
2.B.2 Nitric acid production	NA	NA	NA	NA	NA	NA	T1	D	NC1, NC2, USGS, MEM/PS
2.B.3 Adipic acid production	NA	NA	NO	NA	NA	NA	NA	NA	NA
2.B.4 Caprolactam Glyoxal Glyoxylic production	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.B.5 Carbide production	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.B.6 Titanium dioxide production	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.B.7 Soda ash production	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.B.8 Petrochemical and carbon black production	T1	D	NC1, NC2, ONS	NA	NA	NA	NA	NA	NA
2.B.9 Fluorochemical production	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.B.10 Other	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.C Metal industry									
2.C.1 Iron and steel production	T1	D	ONS, Worldsteel	T1	D	ONS, Worldsteel	NA	NA	NA
2.C.2 Ferroalloys production	NA	NA	NO	NA	NA	NA	NA	NA	NA
2.C.3 Aluminium production	NA	NA	NO	NA	NA	NA	NA	NA	NA
2.C.4 Magnesium production	NA	NA	NO	NA	NA	NA	NA	NA	NA

IPCC sector 2	**CO_2**			**CH_4**			**N_2O**		
Industrial processes and product Use (IPPU)	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
2.C.5 Lead production	T1	D	ONS	NA	NA	NA	NA	NA	NA
2.C.6 Zinc production	T1	D	ONS	NA	NA	NA	NA	NA	NA
2.C.7 Other	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.D Non-energy products Solvent use									
2.D.1 Lubricant use	T1	D	MEM	NA	NA	NA	NA	NA	NA
2.D.2 Paraffin wax use	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.D.3 Other	NE	NA	NA	NA	NA	NA	NA	NA	NA
2.E Electronics industry									
2.E.1 Integrated circuit or semiconductor	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E.2 TFT flat panel display	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E.3 Photovoltaics	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E.4 Heat transfer fluid	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E.5 Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS									
2.G Other product manufacture and use									
2.G.1. Electrical equipment	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.2. SF_6 and PFCs from other product use	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.3 N_2O from product uses	NA	NA	NA	NA	NA	NA	NE	NA	NA
2.G.4 Other	NA	NA	NO	NA	NA	NA	NA	NA	NA
2.H Other	NA	NA	NO	NA	NA	NO	NA	NA	NO

Table 17 Summary report for methods and emission factors used and source of activity data in sector 2 IPPU – F-gases

IPCC sector	**HFCs**			**PFCs**			**SF_6**		
2 **Industrial processes and product Use (IPPU)**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
2.A Mineral industry	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.B Chemical industry	NA	NA	NO	NA	NA	NO	NA	NA	NA
2.C Metal industry	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.D Non-energy products Solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E Electronics industry									
2.E.1 Integrated circuit or semiconductor	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.E.2 TFT flat panel display	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.E.3 Photovoltaics	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.E.4 Heat transfer fluid	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.E.5 Other	NA	NA	NO	NA	NA	NO	NA	NA	NO
2.F. Product uses as substitutes for ODS									
2.F.1. Refrigeration and air-conditioning									

IPCC sector	**HFCs**			**PFCs**			**SF_6**		
2 Industrial processes and product Use (IPPU)	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
2.F.1.a. Commercial refrigeration	T1	D	PS	NA	NA	NE	NA	NA	NE
2.F.1.b. Domestic refrigeration	T1	D	PS, ONS	NA	NA	NE	NA	NA	NE
2.F.1.c. Industrial refrigeration	NE	NA	NA	NA	NA	NE	NA	NA	NE
2.F.1.d. Transport refrigeration	NE	NA	NA	NA	NA	NE	NA	NA	NE
2.F.1.e. Mobile air-conditioning	T1	D	ONS	NA	NA	NE	NA	NA	NE
2.F.1.f. Stationary air-conditioning	T1	D	ONS	NA	NA	NE	NA	NA	NE
2.F.2. Foam blowing agents	NA	NA	NE	NA	NA	NE	NA	NA	NE
2.F.3. Fire protection	NA	NA	NE	NA	NA	NE	NA	NA	NE
2.F.4. Aerosols	NA	NA	NE	NA	NA	NE	NA	NA	NE
2.F.5. Solvents	NA	NA	NE	NA	NA	NE	NA	NA	NE
2.F.6. Other applications	NA	NA	NE	NA	NA	NE	NA	NA	NE
2.G Other product manufacture and use									
2.G.1. Electrical equipment	NA	NA	NA	NA	NA	NE	T1	D	Sonelgaz
2.G.2. SF_6 and PFCs from other product use	NA	NA	NA	NE	NA	NE	NE	NA	NE
2.G.3 N_2O from product uses	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G.4 Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H Other	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 18 Summary report for methods and emission factors used and source of activity data in IPCC sector 3 Agriculture

IPCC sector	**CO_2**			**CH_4**			**N_2O**		
3 Agriculture	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
3.A Enteric fermentation									
3.A.1 Cattle									
Option A:									
3.B.1.a Dairy cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B.1.b Non dairy cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
Option B (country-specific)									
3.A.1.a Other									
3.A.1.a.i Mature dairy cattle	NA	NA	NA	T2	CS	MARD/FAO	NA	NA	NA
3.A.1.a.ii Other mature cattle	NA	NA	NA	T2	CS	MARD/FAO	NA	NA	NA
3.A.1.a.iii Growing cattle	NA	NA	NA	T2	CS	MARD/FAO	NA	NA	NA
3.A.1.a.iv Other	NA	NA	NA	NO	NA	NO	NA	NA	NA
3.A.2 Sheep	NA	NA	NA	T1	D	MARD/FAO	NA	NA	NA
3.A.3 Swine	NA	NA	NO	NA	NA	NO	NA	NA	NO
3.A.4 Other livestock									
3.A.4.a Buffalo	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.b Camels	NA	NA	NA	T1	D	MARD/FAO	NA	NA	NA
3.A.4.c Deer	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.d Goats	NA	NA		T1	D	MARD/FAO	NA	NA	NA

IPCC sector	CO_2			CH_4			N_2O		
3 Agriculture	Method applied	Emission factor (EF)	Activity data	Method applied	Emission factor (EF)	Activity data	Method applied	Emission factor (EF)	Activity data
3.A.4.e Horses	NA	NA	NA	T1	D	MARD/FAO	NA	NA	NA
3.A.4.f Mules and asses	NA	NA	NA	T1	D	MARD/FAO	NA	NA	NA
3.A.4.g Poultry	NA	NA	NA	NA	NA		NA	NA	NA
3.A.4.h Other									
3.A.4.h.i Rabbit	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.h.ii Reindeer	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.h.iii Ostrich	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.h.iv Fur-bearing animals	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.A.4.h.v Other	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.B Manure management									
3.B.1 Cattle									
Option A	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.1.a Dairy cattle	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.1.b Non dairy cattle	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
Option B (country-specific)									
3.B.1.a Other									
3.B.1.a.i Mature dairy cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B.1.a.ii Other mature cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B.1.a.iii Growing cattle	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B.1.a.iv Other	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.B.2 Sheep	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.3 Swine	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.B.4 Other livestock									
3.B.4.a Buffalo	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.B.4.b Camels	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.4.c Deer	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.B.4.d Goats	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.4.e Horses	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.4.f Mules and Asses	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.4.g Poultry	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.B.4.h Other	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.C Rice cultivation	NA	NA	NA	NA	NA	NO	NA	NA	NA
3.D Agricultural soils									
3.D.1 Direct N_2O emissions from managed soils									
3.D.1.a Inorganic N fertilizers	NA	NA	NA	NA	NA	NA	T1	D	MARD/FAO
3.D.1.b Organic N fertilizers									
3.D.1.b.i Animal manure applied to soils	NA	NA	NA	NA	NA	NA	T1	D	MARD/FAO
3.D.1.b.ii Sewage sludge applied to soils	NA	NA	NA	NA	NA	NA	NA	NA	NE
3.D.1.b.iii Other organic fertilizers applied to soils	NA	NA	NA	NA	NA	NA	NA	NA	NO
3.D.1.c Urine and dung deposited by grazing animals	NA	NA	NA	NA	NA	NA	T1	D	MARD/FAO

IPCC sector	CO_2			CH_4			N_2O		
3 Agriculture	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
3.D.1.d Crop residues	NA	NA	NA	NA	NA	NA	T1	D	FAO
3.D.1.e Mineralization immobilization loss-gain	NA	NA	NA	NA	NA	NA	NA	NA	NE
3.D.1.f Cultivation of organic soils histosols	NA	NA	NA	NA	NA	NA	NA	NA	NE
3.D.1.g Other	NA	NA	NA	NA	NA	NA	NA	NA	NO
3.D.2 Indirect N_2O Emissions from managed soils	NA	NA	NA	NA	NA	NA	T1	D	NE
3.E Prescribed burning of savannahs	NA	NA	NA	NA	NA	NO	NA	NA	NO
3.F Field burning of agricultural residues	NA	NA	NA	T1	D	MARD/FAO	T1	D	MARD/FAO
3.G Liming	NO	NA	NA	NA	NA	NA	NA	NA	NA
3.H Urea application	T1	D	FAO	NA	NA	NA	NA	NA	NA
3.I Other carbon-containing fertilizers	NO	NA	NA	NA	NA	NA	NA	NA	NA
3.J Other	NO	NA	NA	NA	NA	NA	NA	NA	NA

Table 19 Summary report for methods and emission factors used and source of activity data in IPCC sector 5 Waste

IPCC sector	CO_2			CH_4			N_2O		
5 Waste	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
5.A Solid waste disposal									
5.A.1 Managed waste disposal sites									
5.A.1.a Anaerobic	NA	NA	NA	T1	D	NC1,DESA, WPP, ONS, AND, UNSD	NA	NA	NA
5.A.1.b Semi-aerobic	NA	NA	NA	NO	NA	NO	NA	NA	NA
5.A.1.c Active-aeration	NA	NA	NA	NO	NA	NO	NA	NA	NA
5.A.2 Unmanaged waste disposal sites	NA	NA	NA	T1	D	NC1,DESA, WPP, ONS, AND, UNSD	NA	NA	NA
5.A.3 Uncategorized waste disposal sites	NA	NA	NA	NO	NA	NO	NA	NA	NA
5.B Biological treatment of solid waste									
5.B.1 Composting	NA	NA	NA	T1	D	NC1,DESA, WPP, ONS, AND, UNSD	T1	D	ONS, AND,
5.B.2 Anaerobic digestion at biogas facilities	NA	NA	NA	NO	NA	NO	NE	NA	NE

IPCC sector	CO_2			CH_4			N_2O		
5 Waste	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**	**Method applied**	**Emission factor (EF)**	**Activity data**
5.C Incineration and open burning of waste									
5.C.1 Waste incineration									
5.C.1.a Biogenic									
5.C.1.a.i Municipal solid waste	T1	D	ONS, AND, UNSD	T1	D	NC1,DESA, WPP, ONS, AND, UNSD	T1	D	ONS, AND, UNSD
5.C.1.a.ii Other									
5.C.1.a.ii.1 Industrial solid wastes	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.a.ii.2 Hazardous waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.a.ii.3 Clinical waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.a.ii.4 Sewage sludge	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.a.ii.5 Other	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b Non-biogenic									
5.C.1.b.i Municipal solid waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii Other									
5.C.1.b.ii.1 Industrial solid wastes	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii.2 Hazardous waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii.3 Clinical waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii.4 Sewage sludge	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii.5 Fossil liquid waste	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.1.b.ii.6 Other	NA	NA	NE	NE	NA	NE	NA	NA	NE
5.C.2 Open burning of waste									
5.C.2.a Biogenic	T1	D	ONS, AND, UNSD	T1	D	NC1, DESA, WPP, ONS, AND, UNSD	T1	D	ONS, AND, UNSD
5.C.2.b Non-biogenic	T1	D	ONS, AND, UNSD	T1	D	NC1,DESA, WPP, ONS, AND, UNSD	T1	D	ONS, AND, UNSD
5.D Wastewater treatment and discharge									
5.D.1 Domestic wastewater	NA	NA	NA	T1	D/CS	ONS, AND, UNSD, ONA	T1	D	ONS, AND, UNSD, ONA
5.D.2 Industrial wastewater	NA	NA	NA	IE	IE	IE	IE	IE	IE
5.D.3 Other	NA	NA	NA	NA	NA	NO	NA	NA	NO
5.E Other	NA	NA	NO	NA	NA	NO	NA	NA	NO

1.4 Brief description of key categories

The identification of key categories (KCA) is prepared in accordance with 2006 IPCC Guidelines[29]. It stipulates that a key category is one that is prioritized within the National System because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions or removals, the trend in emissions or removals, or both.

Key categories according to the following equation are those that, when summed together in descending order of magnitude, add up to 95% of the sum of all Lx,t or any category meeting the 95% threshold in any year of the Level Assessment (LA) or in the Trend Assessment (TA) is considered a *key category*.

The identification of key categories consists in general of six steps. However, for the current submission a KCA no qualitative considerations were included.

- Identifying categories
    - See Annex I: Key categories in the following table is provided information on the level of disaggregation.
- Level Assessment excluding LULUCF (Approach 1) for 1990 and 2020
- Trend Assessment excluding LULUCF (Approach 1) for 1990 - 2020

1.4.1 Level of disaggregation and identification of key categories

Following *good practice* in determining the appropriate level of disaggregation of categories to identify key categories:

• The analysis is performed at the level of IPCC categories/subcategories at which the IPCC methods	✓
• Each greenhouse gas emitted from each category is considered separately.	✓
• An analysis should be performed for emissions and removals separately within a given category.	Not applicable for this submission

1.4.2 Level Assessment

The 2006 IPCC Guidelines Tier 1 approach has been applied: contribution of each source or sink category to the total national inventory.

Equation 4.1: Level Assessment (2006 IPCC GL, Vol. 1, Chap. 4.3.1)

$$\boldsymbol{Key\ category\ level\ assessment} = \frac{|\boldsymbol{source\ or\ sink\ category\ estimate}|}{|\boldsymbol{total\ contribution}|} \Rightarrow \quad \boldsymbol{L_{x,t}} = \frac{|\boldsymbol{E_{x,t}}|}{\sum|\boldsymbol{E_{y,t}}|}$$

Where:

Lx,t = level assessment for source or sink x in latest inventory year (year t)

|Ex,t| = absolute value of emission or removal estimate of source or sink category x in year t

$\sum|E_{y,t}|$ = total contribution, which is the sum of the absolute values of emissions and removals in year t calculated using the aggregation level chosen by the country for key category analysis. Because both emissions and removals are entered with positive sign, the total contribution/level can be larger than a country's total emissions less removals

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[29] IPCC. (2006). *Methodological Choice and Identification of Key Categories. Volume 1 - General Guidance and Reporting, Chapter 4.*

1.4.3 Trend Assessment

The 2006 IPCC Guidelines Tier 1 approach has been applied:

- The trend assessment identifies categories whose trend is different from the trend of the total inventory, regardless whether category trend is increasing or decreasing, or is a sink or source.
- Categories whose trend diverges most from the total trend should be identified as **key**, when this difference is weighted by the level of emissions or removals of the category in the base year.

Equation 4.2: Trend assessment (2006 IPCC GL, Vol. 1, Chap. 4.3.1)

$$\boldsymbol{Key\ category\ Trend\ assessment} = \quad \boldsymbol{T_{x,0}} = \underbrace{\frac{|\boldsymbol{E_{x,0}}|}{\sum_y |\boldsymbol{E_{y,0}}|}}_{\textbf{Category Significance}} \times \left| \underbrace{\left[\frac{(\boldsymbol{E_{x,t}} - \boldsymbol{E_{x,0}})}{|\boldsymbol{E_{x,0}}|}\right]}_{\textbf{Category Trend}} - \underbrace{\frac{(\sum_y \boldsymbol{E_{y,t}} - \sum_y \boldsymbol{E_{y,0}})}{\sum_y |\boldsymbol{E_{y,0}}|}}_{\textbf{Overall Trend}} \right|$$

Where:

$T_{x,0}$ = trend assessment of source or sink category x in year t as compared to the base year (year 0)

$|Ex,0|$ = absolute value of emission or removal estimate of source or sink category x in year 0

$E_{x,t}$ and $E_{x,0}$ = real values of estimates of source or sink category x in years t and 0, respectively

$\sum_y E_{y,t}$, and $\sum_y E_{y,0}$ = total inventory estimates in years *t* and 0, respectively

1.4.4 Results of the Key Categories Analysis (KCA) without LULUCF for 1990

The key categories without LULUCF (determined by Tier 1 methodology) comprise 211,313.37 kt CO_2eq in the year 2020, which corresponds to 95.3% of the total greenhouse gas emissions (without LULUCF) of Algeria.

Out of the 34 identified key categories, 21 of them were sources of CO_2 emissions and contributed most to the key category emissions: 19 sources of CO_2 emissions from IPCC sector Energy and 2 sources of CO_2 emissions from IPCC sector Industrial Processes and Product Use (IPPU). 8 of the identified key categories were sources of CH_4 emissions: 2 sources of CH_4 emissions from IPCC sector Energy, 4 sources of CH_4 emissions from IPCC sector Agriculture and 2 sources of CH_4 emissions from IPCC sector Waste. 4 of the identified key categories were sources of N_2O emissions, all from IPCC sector Agriculture. one of the identified key categories were sources of HFC emissions, all from IPCC sector IPPU.

Table 20 Overview of Key Categories Analysis (KCA) excluding LULUCF.

	Number of key categories					
	CO_2	**CH_4**	**N_2O**	**HFC**	**SF6**	***Total***
Energy	19	2	-	-	-	**21**
IPPU	2	0	-	1	-	**3**
Agriculture	-	4	4	-	-	**8**
Waste	-	2	-	-	-	**2**
TOTAL	**21**	**8**	**4**	**1**	**-**	**34**

In 2020, the following nine IPCC categories contribute already 73.3% to the total GHG emissions excluding LULUCF (level assessment): CO_2 from gaseous fuel from 1.A.1.a Public Electricity and Heat Production, CO_2 from Gas/Diesel oil and gasoline from 1.A3.b Road transportation, CH_4 from 1.B.2.b Fugitive emission from segment natural gas and 1.B.2.c Venting and flaring (oil and natural gas), CO_2 from liquid fuels from 1.A.1.c.ii Oil and gas extraction (fuel combustion activities), 1.4.b from gaseous fuels from Residential, and CO_2 from Cement production (combustion of gaseous fuels in 1.A.2.f Non-metallic minerals and process -related emissions in 2.A.1).

The following table presents the results of the KCA Tier 1 by indicating the ranking of the different subcategories as well as emissions.

Table 21 Tier 1 - Key Categories Analysis (KCA): Ranking excluding LULUCF

IPCC Code	IPCC Category	GHG	Level Assessment		Trend Assessment	Base Year (1990) Estimate $E_{x,0}$	Latest Year (2020) Estimate Ex,t	Share Latest Year (2020)
			1990	2020	1990-2020	kt CO_2-equivalent		
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	3	1	4	9,266	36,250	16.4%
1 A 1 b gaseous	Petroleum Refining	CO2	20	25		1,139	1,402	0.6%
1 A 1 b liquid	Petroleum Refining	CO2	23	33		813	925	0.4%
1 A 1 c 2 liquid	Oil and gas extraction	CO2		5		NE	16,986	7.7%
1 A 1 c 3 gaseous	Other energy industries	CO2	2		2	9,827	1,621	0.7%
1 A 2 f gaseous	Non-metallic minerals	CO2		9		IE	7,575	3.4%
1 A 2 g 8 gaseous	Other	CO2	12	14		2,748	2,548	1.1%
1 A 2 g 8 liquid	Other	CO2	17			1,588	410	0.2%
1 A 3 a jet kerosene	Domestic aviation	CO2	29			477	1,728	0.8%
1 A 3 b diesel oil	Road transportation	CO2	4	2	6	6,956	27,456	12.4%
1 A 3 b gasoline	Road transportation	CO2	6	6		6,414	11,421	5.2%
1 A 3 b LPG	Road transportation	CO2		18		NO	1,601	0.7%
1 A 3 e gaseous	Other transportation	CO2		28		IE	1,602	0.7%
1 A 4 a gaseous	Commercial/institutional	CO2		21		IE	2,360	1.1%
1 A 4 a liquid	Commercial/institutional	CO2		15		IE	2,346	1.1%
1 A 4 b gaseous	Residential	CO2	14	3		2,455	21,219	9.6%
1 A 4 b liquid	Residential	CO2	7	13		4,993	3,910	1.8%
1 B 2 a	Oil	CH4	27			600	625	0.3%
1 B 2 b	Natural gas	CH4	1	4	5	11,106	22,813	10.3%
1 B 2 c	Venting and flaring	CH4	22	30		989	1,066	0.5%
1 B 2 c	Venting and flaring	CO2	5	8		6,594	7,106	3.2%
2 A 1	Cement production	CO2	13	7		2,636	10,056	4.5%
2 B 1	Ammonia Production	CO2	26		1	622	556	0.3%
2 C 1	Iron and Steel Production	CO2	11	24		2,965	1,407	0.6%
2 C 5	Lead Production	CO2	8			3,540	NO	NA
2 C 6	Zinc Production	CO2	9		3	3,397	879	0.4%
3 A 1	Dairy cattle	CH4	15	17		1,742	2,457	1.1%
3 A 2	Sheep	CH4	10	11		3,392	5,505	2.5%
3 A 4 d	Goats	CH4	21	20		1,112	2,209	1.0%
3 B 1	Cattle	N2O	24	32		787	1,027	0.5%
3 B 2	Sheep	N2O	16	16		1,633	2,628	1.2%
3 B 2	Sheep	CH4	25	31		664	1,077	0.5%
3 B 4 f	Mules and Asses	N2O			8	64	16	0.0%
3 D 1 b	Organic N fertilizers	N2O	28	23		495	1,781	0.8%
5 A	Solid waste disposal	CH4	19	10		1,278	5,981	2.7%
5 D	Wastewater treatment and discharge	CH4	18	26		1,459	1,441	0.6%

In the following table and figure, the results of the Key Categories Analysis (KCA) without LULUCF for 1990 and 2020 as well as the Trend assessment for the period 1990 – 2020 are provided.

Table 22 Level Assessment: Key categories without LULUCF 1990

Level Assessment - 1990		**GHG**	**Year 1990 Estimate Ex,t**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		
1 B 2 b	Natural gas	CH4	11,106.28	11.5%	11.5%
1 A 1 c 3 gaseous	Other energy industries	CO2	9,826.72	10.2%	21.7%
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	9,266.35	9.6%	31.4%
1 A 3 b diesel oil	Road transportation	CO2	6,956.41	7.2%	38.6%
1 B 2 c	Venting and flaring	CO2	6,594.03	6.8%	45.4%
1 A 3 b gasoline	Road transportation	CO2	6,413.70	6.7%	52.1%
1 A 4 b liquid	Residential	CO2	4,992.68	5.2%	57.3%
2 C 5	Lead Production	CO2	3,540.00	3.7%	60.9%
2 C 6	Zinc Production	CO2	3,397.00	3.5%	64.5%
3 A 2	Sheep	CH4	3,391.98	3.5%	68.0%
2 C 1	Iron and Steel Production	CO2	2,965.20	3.1%	71.1%
1 A 2 g 8 gaseous	Other	CO2	2,748.13	2.9%	73.9%
2 A 1	Cement production	CO2	2,636.19	2.7%	76.7%
1 A 4 b gaseous	Residential	CO2	2,454.98	2.5%	79.2%
3 A 1	Dairy cattle	CH4	1,741.79	1.8%	81.0%
3 B 2	Sheep	N2O	1,632.83	1.7%	82.7%
1 A 2 g 8 liquid	Other	CO2	1,588.49	1.6%	84.4%
5 D	Wastewater treatment and discharge	CH4	1,458.92	1.5%	85.9%
5 A	Solid waste disposal	CH4	1,278.19	1.3%	87.2%
1 A 1 b gaseous	Petroleum Refining	CO2	1,139.10	1.2%	88.4%
3 A 4 d	Goats	CH4	1,112.40	1.2%	89.5%
1 B 2 c	Venting and flaring	CH4	989.10	1.0%	90.6%
1 A 1 b liquid	Petroleum Refining	CO2	812.59	0.8%	91.4%
3 B 1	Cattle	N2O	787.11	0.8%	92.2%
3 B 2	Sheep	CH4	663.65	0.7%	92.9%
2 B 1	Ammonia Production	CO2	621.93	0.6%	93.6%
1 B 2 a	Oil	CH4	600.30	0.6%	94.2%
3 D 1 b	Organic N fertilizers	N2O	495	0.5%	94.7%
1 A 3 a jet kerosene	Domestic aviation	CO2	477	0.5%	95.2%

Figure 5 Key Categories excluding LULUCF for 1990

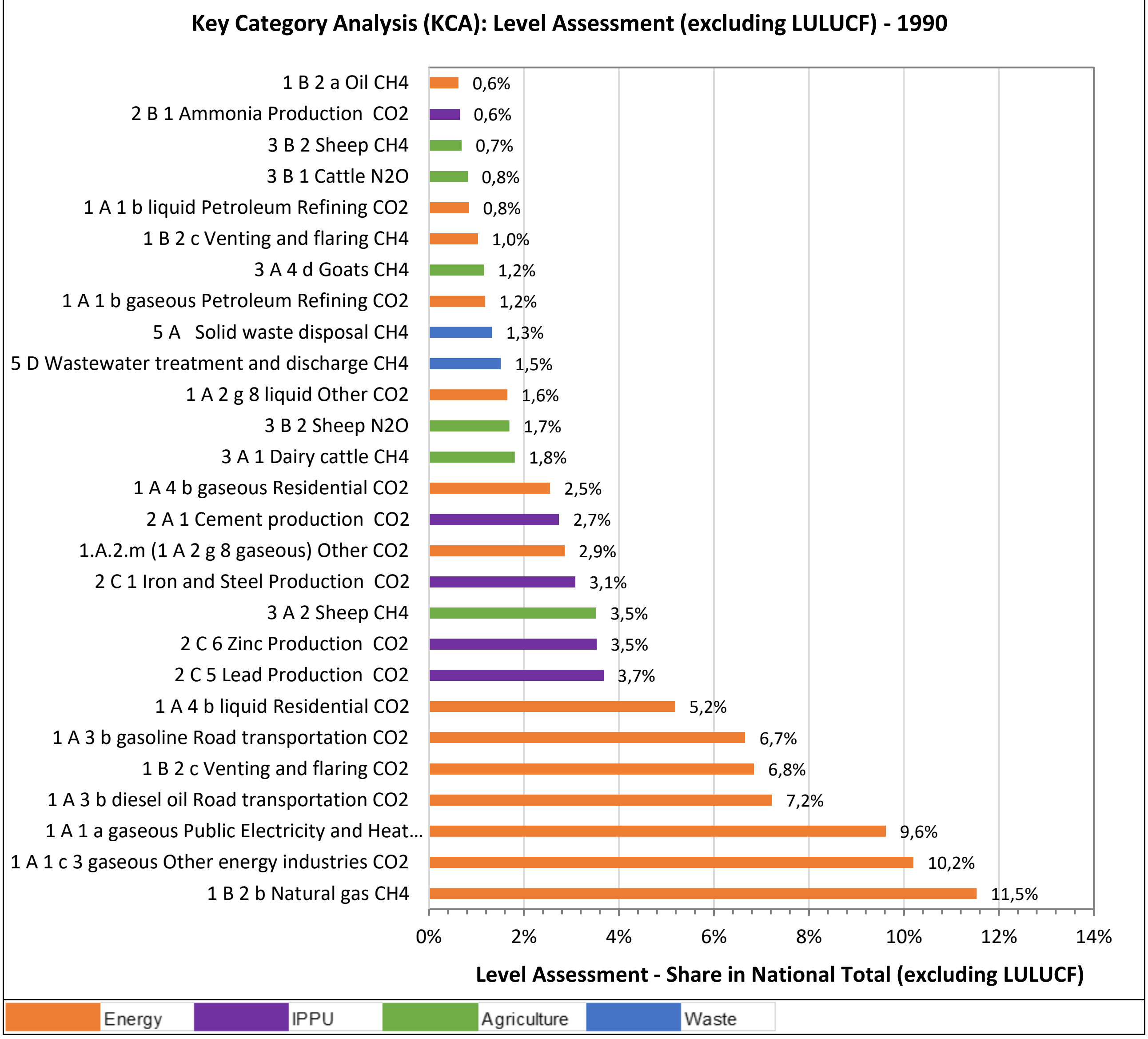


Table 23 Level Assessment: Key categories without LULUCF 2020

Level Assessment - 2020		**GHG**	**Year 2020 Estimate Ex,t**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	35,251.74	15.9%	15.9%
1 A 3 b diesel oil	Road transportation	CO2	23,749.86	10.7%	26.6%
1 A 4 b gaseous	Residential	CO2	22,060.93	10.0%	36.6%
1 B 2 b	Natural gas	CH4	20,299.44	9.2%	45.7%
1 A 1 c 2 liquid	Oil and gas extraction	CO2	15,982.03	7.2%	52.9%
1 A 3 b gasoline	Road transportation	CO2	9,795.89	4.4%	57.3%
2 A 1	Cement production	CO2	8,725.07	3.9%	61.3%
1 B 2 c	Venting and flaring	CO2	7,886.52	3.6%	64.8%
1 A 2 f gaseous	Non-metallic minerals	CO2	7,881.87	3.6%	68.4%
5 A	Solid waste disposal	CH4	6,475.52	2.9%	71.3%
3 A 2	Sheep	CH4	5,923.57	2.7%	74.0%
1 A 1 c 3 liquid	Other energy industries	CO2	5,307.35	2.4%	76.4%
1 A 4 b liquid	Residential	CO2	3,673.87	1.7%	78.0%
1 A 2 g 8 gaseous	Other	CO2	3,488.43	1.6%	79.6%
1 A 4 a liquid	Commercial/institutional	CO2	3,334.61	1.5%	81.1%
3 B 2	Sheep	N2O	2,828.26	1.3%	82.4%
3 A 1	Dairy cattle	CH4	2,365.75	1.1%	83.5%
1 A 3 b LPG	Road transportation	CO2	2,348.61	1.1%	84.5%
1 A 2 g 5 liquid	Construction	CO2	2,254.34	1.0%	85.5%
3 A 4 d	Goats	CH4	2,208.68	1.0%	86.5%
1 A 4 a gaseous	Commercial/institutional	CO2	2,201.94	1.0%	87.5%
1 A 2 a gaseous	Iron and Steel	CO2	2,047.84	0.9%	88.4%
3 D 1 b	Organic N fertilizers	N2O	1,821.48	0.8%	89.3%
2 C 1	Iron and Steel Production	CO2	1,627.08	0.7%	90.0%
1 A 1 b gaseous	Petroleum Refining	CO2	1,432.96	0.6%	90.6%
5 D	Wastewater treatment and discharge	CH4	1,428.83	0.6%	91.3%
1 A 2 e gaseous	Food processing, beverages and tobacco	CO2	1,329.80	0.6%	91.9%
1 A 3 e gaseous	Other transportation	CO2	1,229.34	0.6%	92.4%
2 F 1	Refrigeration and air conditioning	HFC	1,206.05	0.5%	93.0%
1 B 2 c	Venting and flaring	CH4	1,182.98	0.5%	93.5%
3 B 2	Sheep	CH4	1,158.96	0.5%	94.0%
3 B 1	Cattle	N2O	983.77	0.4%	94.5%
1 A 1 b liquid	Petroleum Refining	CO2	953.11	0.4%	94.9%
3 B 4 d	Goats	N2O	866.92	0.4%	95.3%

Figure 6 Key Categories excluding LULUCF for 2020

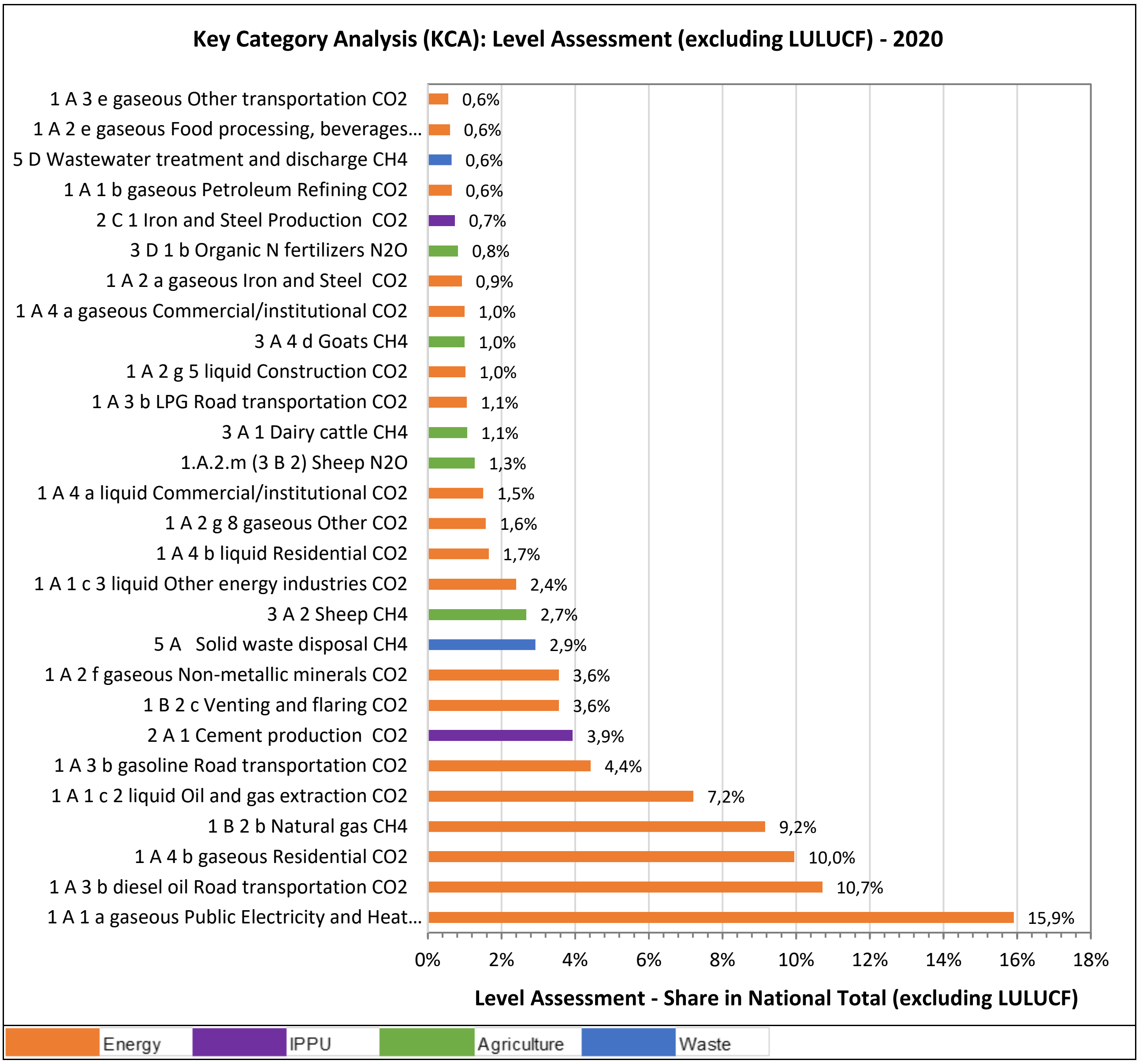
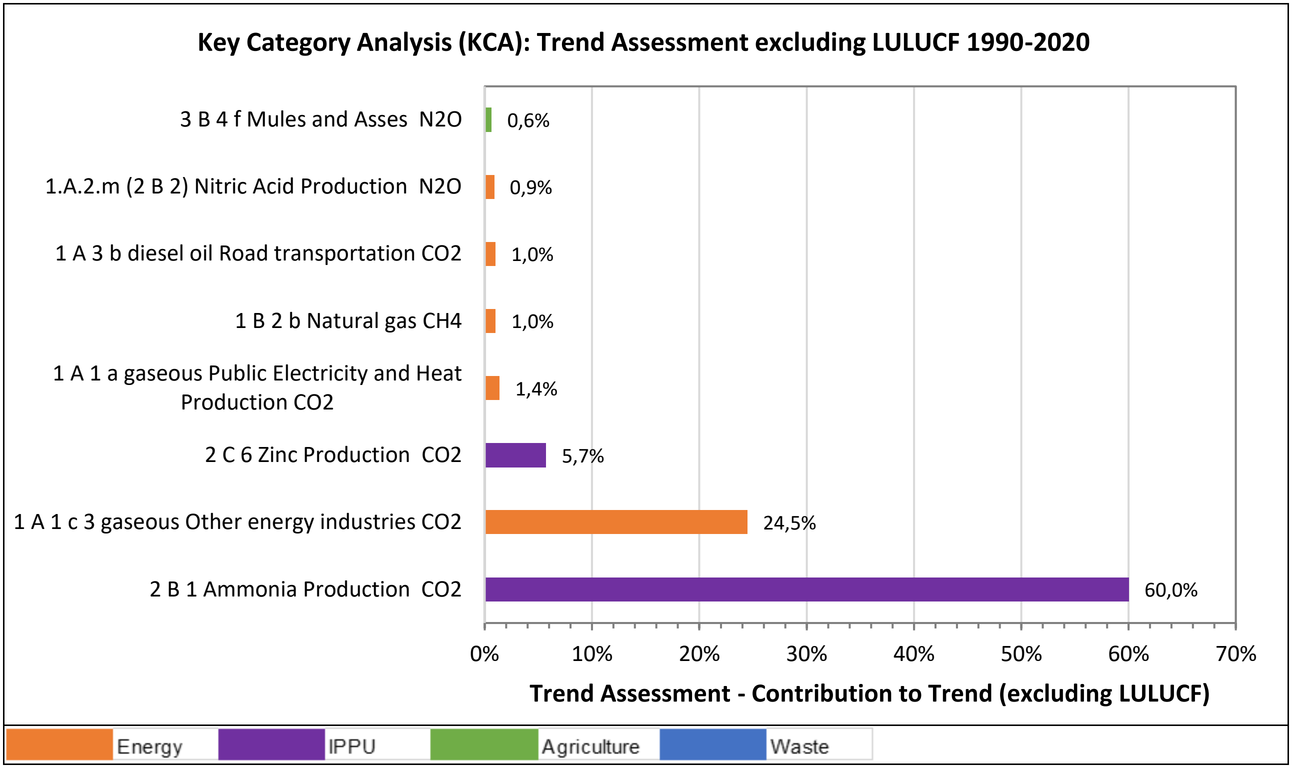


Table 24 Trend Assessment: Key categories without LULUCF 2020

Trend Assessment		**GHG**	**Base Year (1990) Estimate $E_{x,0}$**	**Latest Year (2020) Estimate $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		**$L_{x,t}$**		
2 B 1	Ammonia Production	CO2	621.93	0.00	3.085	60.0%	60.0%
1 A 1 c 3 gaseous	Other energy industries	CO2	9,826.72	738.58	1.258	24.5%	84.5%
2 C 6	Zinc Production	CO2	3,397.00	365.07	0.294	5.7%	90.2%
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	9,266.35	35,251.74	0.071	1.4%	91.6%
1 B 2 b	Natural gas	CH4	11,106.28	20,299.44	0.052	1.0%	92.6%
1 A 3 b diesel oil	Road transportation	CO2	6,956.41	23,749.86	0.051	1.0%	93.6%
2 B 2	Nitric Acid Production	N2O	427.99	39.41	0.045	0.9%	94.5%
3 B 4 f	Mules and Asses	N2O	64.08	0.00	0.033	0.6%	95.1%

Figure 7 Key Categories excluding LULUCF - Trend Assessment



1.4.5 Results of the Key Categories Analysis (KCA) including LULUCF for 2020

The key categories with LULUCF are determined by Tier 1 methodology.

Out of the 34 identified key categories, 22 of them were sources of CO_2 emissions and contributed most to the key category emissions: 19 sources of CO_2 emissions from IPCC sector Energy and 2 sources of CO_2 emissions from IPCC sector Industrial Processes and Product Use (IPPU), one from IPCC sector LULUCF. 8 of the identified key categories were sources of CH_4 emissions: 2 sources of CH_4 emissions from IPCC sector Energy, 4 sources of CH_4 emissions from IPCC sector Agriculture and 2 sources of CH_4 emissions from IPCC sector Waste. 3 of the identified key categories were sources of N_2O emissions, three from IPCC sector Agriculture and one from IPCC sector IPPU. One key category is for HFC and IPCC category 2.F. sector.

Table 25 Overview of Key Categories Analysis (KCA) including LULUCF.

	Number of key categories					
	CO_2	**CH_4**	**N_2O**	**HFC**	***SF6***	***Total***
Energy	19	2	-	-	-	***21***
IPPU	2	-	-	1	-	***3***
Agriculture	-	4	3	-	-	***7***
LULUCF	1	-	-	-	-	***1***
Waste	-	2	-	-	-	***2***
TOTAL	***22***	***8***	***3***	***1***	***-***	***34***

The following table presents the results of the KCA Tier 1 by indicating the ranking of the different subcategories as well as emissions.

Table 26 Tier 1 - Key Categories Analysis (KCA): Ranking including LULUCF.

IPCC Code	**IPCC Category**	**GHG**	**Level Assessment**		**Trend Assessment**	**Base Year (1990) Estimate $E_{x,0}$**	**Latest Year (2020) Estimate Ex, t**	**Share Latest Year (2020)**
			1990	**2020**	**1990-2020**	**kt CO_2-equivalent**		
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	3	1	4	9,266	35,252	16.6%
1 A 1 b gaseous	Petroleum Refining	CO2	21	26		1,139	1,433	0.7%
1 A 1 b liquid	Petroleum Refining	CO2	24	34		813	953	0.4%
1 A 1 c 2 liquid	Oil and gas extraction	CO2		5		NE	15,982	7.5%
1 A 1 c 3 gaseous	Other energy industries	CO2	2		2	9,827	739	0.3%
1 A 1 c 3 liquid	Other energy industries	CO2		13		NE	5,307	2.5%
1 A 2 a gaseous	Iron and Steel	CO2		23		IE	2,048	1.0%
1 A 2 e gaseous	Food processing, beverages and tobacco	CO2		28		IE	1,330	0.6%
1 A 2 f gaseous	Non-metallic minerals	CO2		10		IE	7,882	3.7%
1 A 2 g 5 liquid	Construction	CO2		20		IE	2,254	1.1%
1 A 2 g 8 gaseous	Other	CO2	13	15		2,748	3,488	1.6%
1 A 2 g 8 liquid	Other	CO2	18		9	1,588	536	0.3%
1 A 3 b diesel oil	Road transportation	CO2	4	2	6	6,956	23,750	11.2%
1 A 3 b gasoline	Road transportation	CO2	6	6		6,414	9,796	4.6%

IPCC Code	IPCC Category	GHG	Level Assessment		Trend Assessment	Base Year (1990) Estimate $E_{x,0}$	Latest Year (2020) Estimate Ex, t	Share Latest Year (2020)
			1990	2020	1990-2020	kt CO_2-equivalent		
1 A 3 b LPG	Road transportation	CO2		19		NO	2,349	1.1%
1 A 3 e gaseous	Other transportation	CO2		29		IE	1,229	0.6%
1 A 4 a gaseous	Commercial/institutional	CO2		22		IE	2,202	1.0%
1 A 4 a liquid	Commercial/institutional	CO2		16		IE	3,335	1.6%
1 A 4 b gaseous	Residential	CO2	15	3		2,455	22,061	10.4%
1 A 4 b liquid	Residential	CO2	8	14		4,993	3,674	1.7%
1 B 2 a	Oil	CH4	28			600	553	0.3%
1 B 2 b	Natural gas	CH4	1	4	5	11,106	20,299	9.6%
1 B 2 c	Venting and flaring	CH4	23	31		989	1,183	0.6%
1 B 2 c	Venting and flaring	CO2	5	9		6,594	7,887	3.7%
2 A 1	Cement production	CO2	14	8		2,636	8,725	4.1%
2 B 1	Ammonia Production	CO2	27		1	622	0	0.0%
2 B 2	Nitric Acid Production	N2O			7	428	39	0.0%
2 C 1	Iron and Steel Production	CO2	12	25		2,965	1,627	0.8%
2 C 5	Lead Production	CO2	9			3,540	NO	0.0%
2 C 6	Zinc Production	CO2	10		3	3,397	365	0.2%
2 F 1	Refrigeration and air conditioning	HFC		30		NA	1,206	0.6%
3 A 1	Dairy cattle	CH4	16	18		1,742	2,366	1.1%
3 A 2	Sheep	CH4	11	12		3,392	5,924	2.8%
3 A 4 d	Goats	CH4	22	21		1,112	2,209	1.0%
3 B 1	Cattle	N2O	25	33		787	984	0.5%
3 B 2	Sheep	N2O	17	17		1,633	2,828	1.3%
3 B 2	Sheep	CH4	26	32		664	1,159	0.5%
3 B 4 f	Mules and Asses	N2O			8	64	0	0.0%
3 D 1 b	Organic N fertilizers	N2O	29	24		495	1,821	0.9%
4A	Forest land	CO2	7	7		5,632	9,046	4.3%
5 A	Solid waste disposal	CH4	20	11		1,278	6,476	3.0%
5 D	Wastewater treatment and discharge	CH4	19	27		1,459	1,429	0.7%

In the following table and figure, the results of the Key Categories Analysis (KCA) including LULUCF for 1990 and 2020 as well as the Trend assessment for the period 1990 – 2020 are provided.

Table 27 Level Assessment: Key categories including LULUCF 1990

Level Assessment - 1990		**GHG**	**Year 1990 Estimate Ex,t**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		
1 B 2 b	Natural gas	CH4	11,106	10.9%	10.9%
1 A 1 c 3 gaseous	Other energy industries	CO2	9,827	9.6%	20.5%
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	9,266	9.1%	29.6%
1 A 3 b diesel oil	Road transportation	CO2	6,956	6.8%	36.4%
1 B 2 c	Venting and flaring	CO2	6,594	6.5%	42.9%
1 A 3 b gasoline	Road transportation	CO2	6,414	6.3%	49.2%
4A	Forest land	CO2	5,632	5.5%	54.7%
1 A 4 b liquid	Residential	CO2	4,993	4.9%	59.6%
2 C 5	Lead Production	CO2	3,540	3.5%	63.1%
2 C 6	Zinc Production	CO2	3,397	3.3%	66.4%
3 A 2	Sheep	CH4	3,392	3.3%	69.7%
2 C 1	Iron and Steel Production	CO2	2,965	2.9%	72.6%
1 A 2 g 8 gaseous	Other	CO2	2,748	2.7%	75.3%
2 A 1	Cement production	CO2	2,636	2.6%	77.9%
1 A 4 b gaseous	Residential	CO2	2,455	2.4%	80.3%
3 A 1	Dairy cattle	CH4	1,742	1.7%	82.0%
3 B 2	Sheep	N2O	1,633	1.6%	83.6%
1 A 2 g 8 liquid	Other	CO2	1,588	1.6%	85.2%
5 D	Wastewater treatment and discharge	CH4	1,459	1.4%	86.6%
5 A	Solid waste disposal	CH4	1,278	1.3%	87.8%
1 A 1 b gaseous	Petroleum Refining	CO2	1,139	1.1%	89.0%
3 A 4 d	Goats	CH4	1,112	1.1%	90.1%
1 B 2 c	Venting and flaring	CH4	989	1.0%	91.0%
1 A 1 b liquid	Petroleum Refining	CO2	813	0.8%	91.8%
3 B 1	Cattle	N2O	787	0.8%	92.6%
3 B 2	Sheep	CH4	664	0.7%	93.2%
2 B 1	Ammonia Production	CO2	622	0.6%	93.8%
1 B 2 a	Oil	CH4	600	0.6%	94.4%
3 D 1 b	Organic N fertilizers	N2O	495	0.5%	94.9%
1 A 3 a jet kerosene	Domestic aviation	CO2	477	0.5%	95.4%

Figure 8 Key Categories including LULUCF for 1990

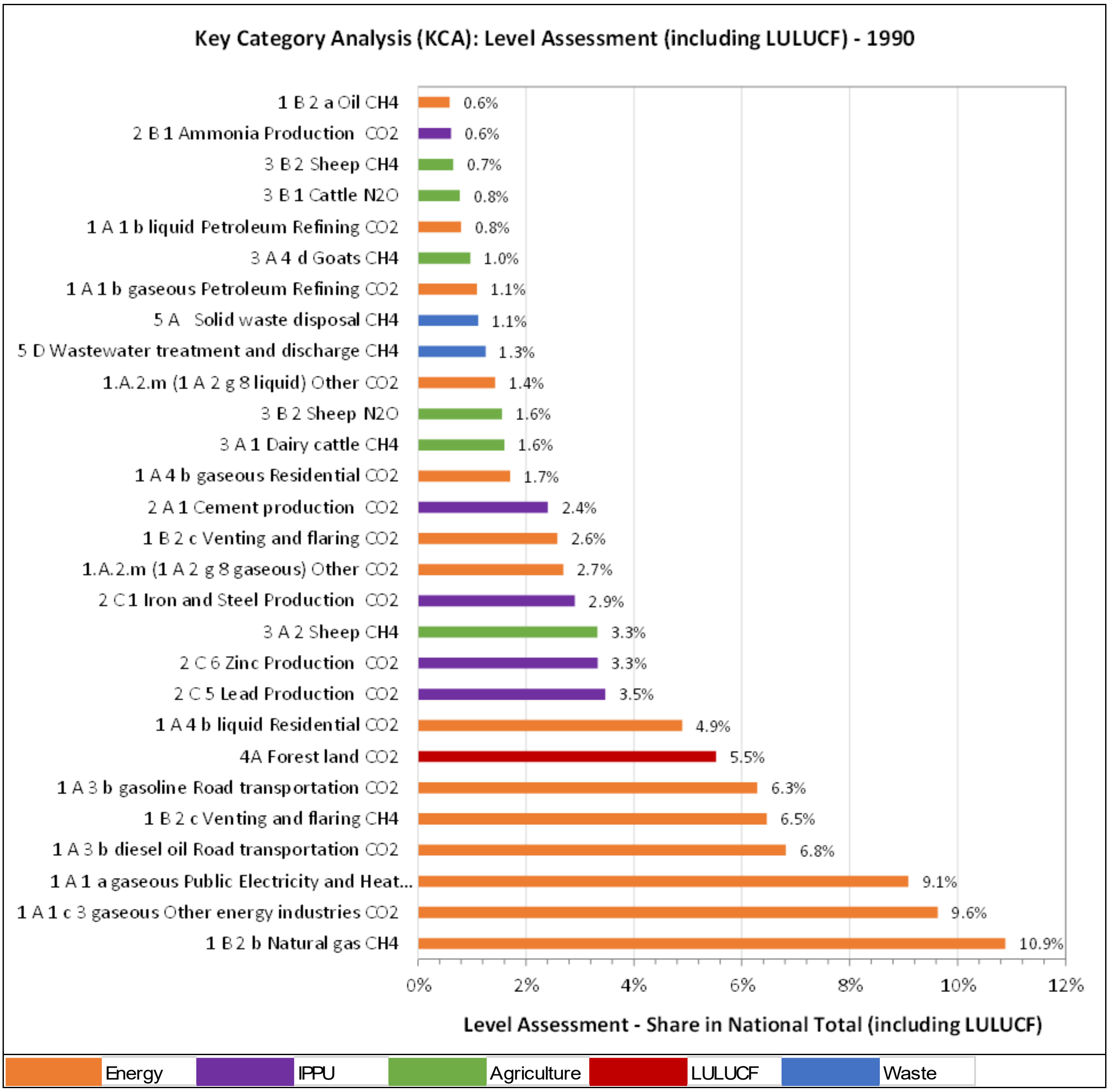


Table 28 Level Assessment: Key categories including LULUCF 2020

Level Assessment - 2020		**GHG**	**Year 2020 Estimate Ex,t**	**Level Assessment $L_{x,t}$**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	35,252	15.3%	15.3%
1 A 3 b diesel oil	Road transportation	CO2	23,750	10.3%	25.6%
1 A 4 b gaseous	Residential	CO2	22,061	9.6%	35.1%
1 B 2 b	Natural gas	CH4	20,299	8.8%	43.9%
1 A 1 c 2 liquid	Oil and gas extraction	CO2	15,982	6.9%	50.8%
1 A 3 b gasoline	Road transportation	CO2	9,796	4.2%	55.1%
4A	Forest land	CO2	9,046	3.9%	59.0%
2 A 1	Cement production	CO2	8,725	3.8%	62.8%
1 B 2 c	Venting and flaring	CO2	7,887	3.4%	66.2%
1 A 2 f gaseous	Non-metallic minerals	CO2	7,882	3.4%	69.6%
5 A	Solid waste disposal	CH4	6,476	2.8%	72.4%
3 A 2	Sheep	CH4	5,924	2.6%	75.0%
1 A 1 c 3 liquid	Other energy industries	CO2	5,307	2.3%	77.3%
1 A 4 b liquid	Residential	CO2	3,674	1.6%	78.9%
1 A 2 g 8 gaseous	Other	CO2	3,488	1.5%	80.4%
1 A 4 a liquid	Commercial/institutional	CO2	3,335	1.4%	81.8%
3 B 2	Sheep	N2O	2,828	1.2%	83.0%
3 A 1	Dairy cattle	CH4	2,366	1.0%	84.1%
1 A 3 b LPG	Road transportation	CO2	2,349	1.0%	85.1%
1 A 2 g 5 liquid	Construction	CO2	2,254	1.0%	86.1%
3 A 4 d	Goats	CH4	2,209	1.0%	87.0%
1 A 4 a gaseous	Commercial/institutional	CO2	2,202	1.0%	88.0%
1 A 2 a gaseous	Iron and Steel	CO2	2,048	0.9%	88.9%
3 D 1 b	Organic N fertilizers	N2O	1,821	0.8%	89.6%
2 C 1	Iron and Steel Production	CO2	1,627	0.7%	90.4%
1 A 1 b gaseous	Petroleum Refining	CO2	1,433	0.6%	91.0%
5 D	Wastewater treatment and discharge	CH4	1,429	0.6%	91.6%
1 A 2 e gaseous	Food processing, beverages and tobacco	CO2	1,330	0.6%	92.2%
1 A 3 e gaseous	Other transportation	CO2	1,229	0.5%	92.7%
2 F 1	Refrigeration and air conditioning	HFC	1,206	0.5%	93.2%
1 B 2 c	Venting and flaring	CH4	1,183	0.5%	93.7%
3 B 2	Sheep	CH4	1,159	0.5%	94.2%
3 B 1	Cattle	N2O	984	0.4%	94.7%
1 A 1 b liquid	Petroleum Refining	CO2	953	0.4%	95.1%

Figure 9 Key Categories including LULUCF for 2020

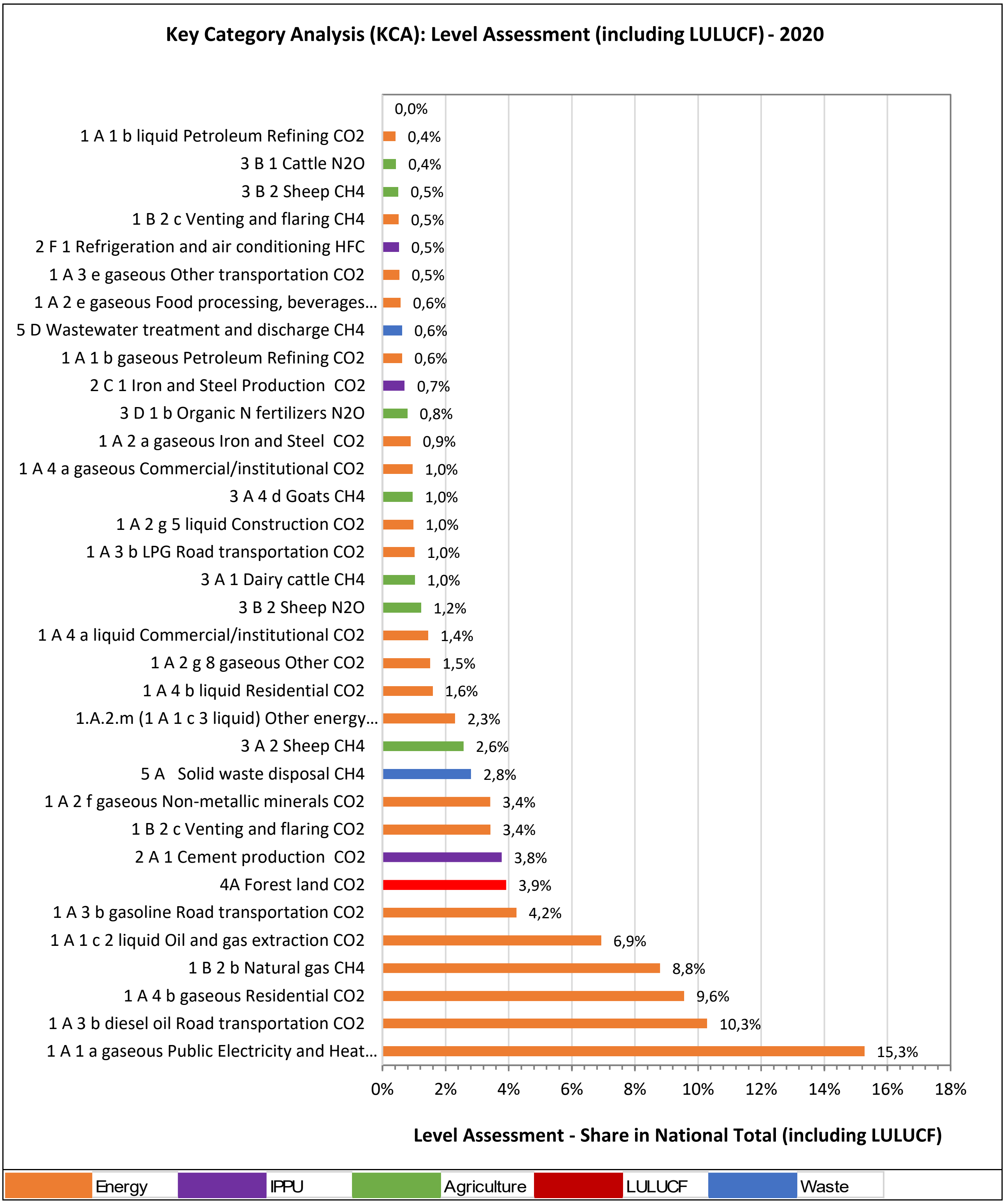
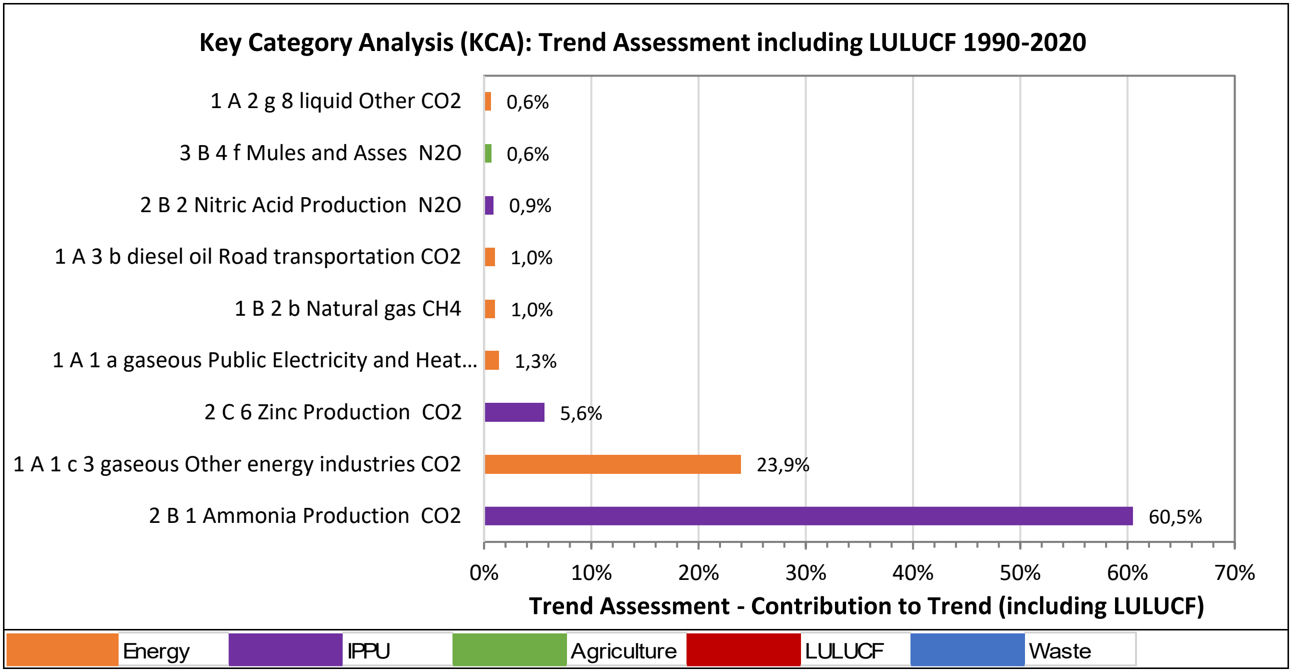


Table 29 Trend Assessment: Key categories including LULUCF 2020

Trend Assessment		**GHG**	**Base Year (1990) Estimate $E_{x,0}$**	**Latest Year (2020) Estimate $E_{x,t}$**	**Trend Assessment $L_{x,t}$**	**% Contribution to the trend**	**Cumulative Total of $L_{x,t}$**
IPCC Code	**IPCC Category**		**kt CO_2-equivalent**		**$L_{x,t}$**		
2 B 1	Ammonia Production	CO2	622	0	3.002	60.5%	60.5%
1 A 1 c 3 gaseous	Other energy industries	CO2	9,827	739	1.187	23.9%	84.4%
2 C 6	Zinc Production	CO2	3,397	365	0.277	5.6%	90.0%
1 A 1 a gaseous	Public Electricity and Heat Production	CO2	9,266	35,252	0.067	1.3%	91.4%
1 B 2 b	Natural gas	CH4	11,106	20,299	0.049	1.0%	92.4%
1 A 3 b diesel oil	Road transportation	CO2	6,956	23,750	0.048	1.0%	93.3%
2 B 2	Nitric Acid Production	N2O	428	39	0.043	0.9%	94.2%
3 B 4 f	Mules and Asses	N2O	64	0	0.032	0.6%	94.8%
1 A 2 g 8 liquid	Other	CO2	1,588	536	0.031	0.6%	95.5%

Figure 10 Key Categories including LULUCF - Trend Assessment



1.5 Brief general description of QA/QC plan and implementation

The 2006 IPCC Guidelines set out the major elements of a QA/QC system to be implemented by inventory compilers/agency:

(1) inventory agency is responsible for coordinating QA/QC activities, institutional and procedural arrangements for inventory activities and definition of roles and responsibilities.
(2) a QA/QC plan,
(3) general QC procedures (Tier 1) and source category-specific QC procedures (Tier 2)
(4) QA and review procedures, and verification activities,
(5) QA/QC system interaction with uncertainty analysis (see chapter on uncertainties),
(6) reporting, documentation, and archiving.

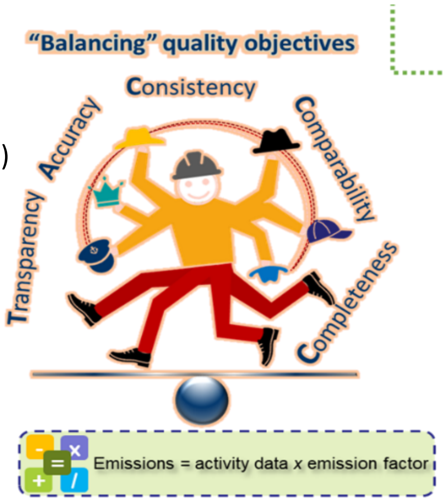
The first steps to carry out **quality assurance (QA) and quality control (QC) procedures** have already been undertaken but need further improvement. The current status and planned improvements are described in the following sub-sections.

The inventory compiler should be responsible for coordinating the institutional and procedural arrangements for inventory activities.

1.5.1 QA/QC plan

As described in the 2006 IPCC Guidelines, Chapter 6.5, a **QA/QC plan** is a **fundamental element of a QA/QC and verification system**. The QA/QC plan should, in general, outline the QA/QC and verification activities that will be implemented and the institutional arrangements and responsibilities for implementing those activities. The plan should include a scheduled time frame for the QA/QC activities that follows inventory preparation from its initial development through to final reporting in any year. The QA/QC plan is an internal document to organize and implement QA/QC and verification activities that ensure the inventory is fit for purpose and allow for improvement. Once developed, it can be referenced and used in subsequent inventory reparation, or modified as appropriate (notably, when changes in processes occur or on advice of independent reviewers). A key component of a QA/QC plan is the list of *data quality objectives*, against which an inventory can be measured in a review. Data quality objectives are concrete targets to be achieved in the inventory preparation. They should be appropriate, realistic (taking national circumstances into account) and allow for an improvement of the inventory. Where possible, data quality objectives should be measurable. Such data quality objectives may be based upon and refined from the following inventory principles:

- Timeliness
- Completeness
- Consistency (internal consistency as well as time series consistency)
- Comparability
- Accuracy
- Transparency
- Improvement



A **key component** of a QA/QC plan is the list of data **quality objectives**, against which an inventory can be measured in a review. However, a *good practice* approach is a pragmatic means of building inventories that are TACCC – and maintaining them in a manner that improves inventory quality over time. This means that the *good practice* approach reflects the national circumstances regarding financial and technical resources and capacities.

However, the GHG inventory - estimation of GHG emissions and removals including reporting elements - is subject to continuous improvement.

The QA/QC plan and the improvement of the GHG inventory follows a Plan-Do-Check-Act-Cycle (PDCA-cycle)[30], which is an accepted model for pursuing a continual improvement of a process, product, or service according to international standards and is in line within the General Guidance and Reporting of the 2006 IPCC Guidelines.

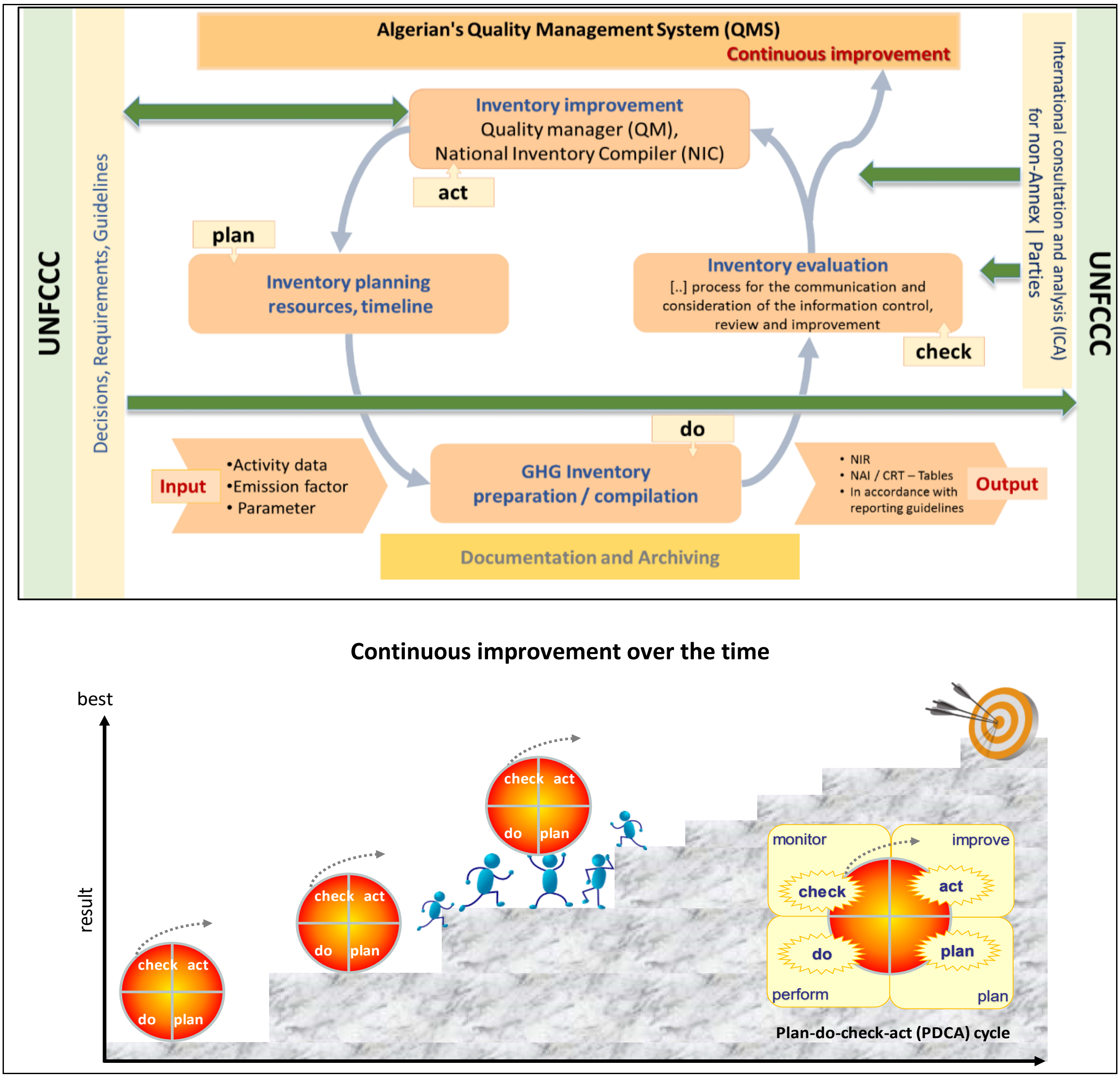


Figure 11 **Continuous improvement**

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[30] https://asq.org/quality-resources/pdca-cycle

1.5.2 Roles & responsibilities

the Expert Team *GHG Emission inventories* of ANCC is responsible for the preparation of Algeria's National Greenhouse Gas Inventory as well as for the preparation of the NIR. In the following table are the specific responsibilities for the preparation of the Algerian GHG inventory provided.

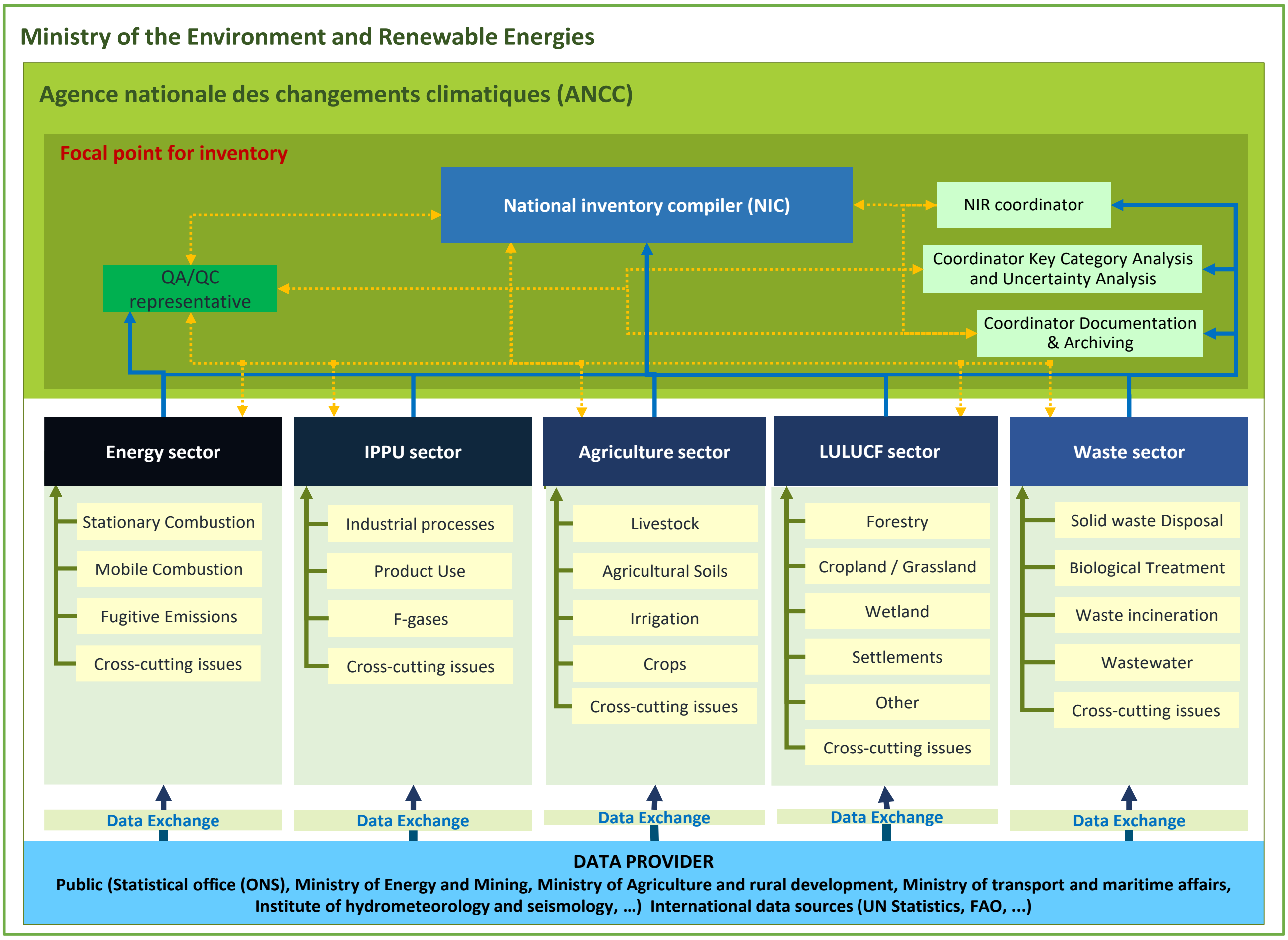

Figure 12 General data flow between roles and responsibilities

Table 30 Specific responsibilities for the preparation of the Algerian GHG inventory 1990 - 2020

Task / Role	Lead expert	Expert	QA Expert
National Inventory compiler (NIC)	Khalid Belabdi	Said Kaddour	Soumeya Amroune
QA/QC representative	Meriem Bech	Hind Bougherara	Soumeya Amroune
NIR coordinator	Hind Bougherara	Meriem Bech	Hamza Merabet
Energy - Stationary combustion	Said Kaddour	Khalid Belabdi	Hamza Merabet
Energy - Mobile combustion	Said Kaddour	Khalid Belabdi	Hamza Merabet
Energy - Fugitive emissions	Said Kaddour	Khalid Belabdi	Hamza Merabet
Industrial processes and product use (IPPU)	Khalid Belabdi	Said Kaddour	Hamza Merabet
Agriculture	Soumeya Amroune	Hind Bougherara	Meriem Bech
LULUCF	Hind Bougherara	Soumeya Amroune	Hamza Merabet
Waste	Meriem Bech	Said Kaddour	Hind Bougherara
Key Category Analysis	Hind Bougherara	Khalid Belabdi	Said Kaddour
Uncertainty Analysis	Hind Bougherara	Said Kaddour	Khalid Belabdi
Data management	Khalid Belabdi	Meriem Bech	Hind Bougherara
UNDP Project coordinator TCN & BUR1		Chérif Aoudjit	
UNDP National Expert - GHG inventory and MRV		Hamza Merabet	
International Expert - GHG inventory and MRV		Traute Köther (Austria)	

In the following table a short overview is provided about the main tasks of each role.

Table 31 Task and responsibilities within the Algerian GHG inventory 1990 - 2020

Role	Task and responsibilities
National Inventory compiler (NIC)	▪ Supervision of inventory preparation process, ▪ Compilation of reporting tables ▪ Management of 'MRV GHG inventory' ▪ implements QA/QC procedures on a national level
QA/QC representative	▪ Overall responsibility for the preparation Quality managements system (QMS) of the Algerian GHG inventory ▪ Maintaining the Quality managements system (QMS) of the Algerian GHG inventory ▪ Development and updating checklists (e.g., checklist for general QC checks) ▪ Performing quality assurance QA
NIR coordinator	▪ Overall responsibility for the preparation of the National Inventory Report (NIR) including coordination within the GHG inventory team ▪ Preparation of the final version of the NIR ▪ Responsible for chapter 1, 2 and 10, 11, 12, and 13 of the NIR ▪ Performing quality assurance and quality control (QA/QC)
Lead Expert	▪ Overall responsible for choice of methods, activity data and emission factor ▪ Collection of data and relevant parameter including exchange with data provider ▪ Estimation of the emissions of the GHG Inventory ▪ Performing recalculation if needed including time series consistency ▪ Estimation of uncertainties ▪ Provision of results (GHG emissions) to the NIC ▪ Writing the sectoral chapter of the NIR and provision of relevant information to general chapters ▪ Provision of NIR sectoral chapter to NIR coordinator ▪ Performing quality assurance and quality control (QA/QC)

Role	Task and responsibilities
	▪ Supporting in general and provision of answers to questions raised during ○ Technical Analysis of BURs as part of the international consultation and analysis (ICA) ○ Technical expert review[31] ▪ Archiving activity data, calculation sheets, and all relevant information
Sector Expert	▪ All responsibilities and tasks of the lead experts in case of his/her absence
QA Expert	▪ Performing the final QA/QC checks before final compilation of the reporting tables and NIR
Key Category Analysis	▪ Performing the Key Category Analysis ▪ Writing chapter 1.5 of the National Inventory Report
Uncertainty Analysis	▪ Performing the Uncertainty Analysis ▪ Writing chapter 1.6 of the National Inventory Report
Data management	▪ Overall responsibility of the GHG inventory folder ▪ Provision of folder structure, naming convention, etc.

Further tasks and responsibilities are outlined in the Chapter *Inventory development cycle and guidance* and table ‘National Inventory preparation schedule/guidance’.

1.5.3 Capacity building

In the following tables, the selected capacity buildings relevant to GHG inventory 1990-2020 building are provided.

Table 32 Capacity building relevant to GHG inventory 1990-2020

Date	Topic	Institution
2020-2022	• Training the Technical Analysis of Biennial Update Reports (BURs) • The 11th round of the CGE training programme for technical experts • undertaking technical analysis of biennial update reports from Parties not included in Annex I to the Convention. • The 12th round of CGE training programme for technical experts undertaking technical analysis of biennial update reports from Partied not included in Annex I to the Convention. • The 13th round of the CGE training programme for technical experts undertaking technical analysis of biennial update reports from Parties not included in Annex I to the Convention. • The 14th round of the CGE training programme for technical experts undertaking technical analysis of biennial update reports from Parties not included in Annex I to the Convention. • The 15th round of the Training programme for review experts for the technical review of biennial reports and national communications of Parties included in Annex I to the Convention	UNFCCC
2021-2022	• Training The Review of Information submitted by Annex I Parties • Training programme for the review experts for the technical review of Information reported in biennial reports and national communications by Annex I Parties.	UNFCCC
2016	Projet **APNC appui au Plan National Climat** • Les inventaires des Gaz à Effet de Serre	CITEPA

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[31] This item is not valid for reporting under the convention.

Date	Topic	Institution
2019-2022	**Renforcement de la gouvernance climatique au service de la CPDN (ClimGov)** • L’établissement des inventaires de GES dans le secteur des déchets en Algérie Formation sur le cadre de la transparence renforcée dans les changements climatiques • Méthodologies MRV des émissions de GES du secteur de l’Energie La méthodologie de développement de l’atténuation des émissions de GES du secteur de l’électricité • Méthodologies de développement de l’atténuation des émissions de GES dans le secteur du transport et de la distribution du gaz • Formation à la méthodologies IPCC 2006 d’estimations des émissions de SF_6 du secteur de l’électricité • Renforcement de capacités sur la modélisation par l’outil LEAP	GIZ
2021-2022	**Preparation of BUR 1 and TNC** GHG inventory and National Inventory preparation • Online training with international expert from Mauritius (2021) • Face-to-face training with international expert from Austria (2022)	UNDP

Table 33 Capacity building by CGE trainings and participation in trainings of review experts

						CGE trainings						Review of Information submitted by Annex I Parties																																						Technical analysis under International consultation and analysis (ICA) for non-Annex I Parties													Participation in Review of Information submitted by Annex I Parties	Participation in Review of Review of Biennial Reports (BRs) and National Communications (NCs)	Participation in Technical analysis under International consultation and analysis (ICA) for non-Annex I Parties
												Review of greenhouse gas inventories (Basic course + KP Coures)														Review of Biennial Reports (BRs) and National Communications (NCs) Overview + at least one additional focus				Technical Analysis of Biennial Update Reports (BURs)															
						2006 IPCC training						Basic course (Overview + at least one sector)									Kyoto Protocol Courses									Cluster A - reporting				Cluster B - background materials								Cluster C - REDD+			
	Institution	experience (years)	direct GHG inventory team	indirect GHG inventory team	Roster of Experts	Overview	Energy	IPPU	Agriculture	LULUCF	Waste	Overview	Energy	IPPU	Agriculture	LULUCF	Waste	Review of complex models and higher tier methods	Improving communication and facilitating consensus in expert review teams	Annual refresher seminars for experienced GHG inventory review experts	A. National Systems	B. Application of Adjustments	C. Modalities for the Accounting of Assigned Amounts under Article 7.4	D. Review of National Registries and Information on Assigned Amounts	E. Review of activities under Article 3, paragraphs 3 and 4 of the Kyoto Protocol	1. General and cross-cutting aspects	2. Targets and of policies and measures, their effects and their contribution to achieving those targets	3. Greenhouse gas emissions, emission trends, projections and the total effect of policies and measures	4. Provision of financial support, technology transfer and capacity-building	Module 1 Overview	Module 2.1 Mitigation	Module 2.2 GHG inventory	Module 2.3 Needs and support	2.1 Mitigation	2.2a GHG inventory: Energy	2.2b GHG inventory: Industrial processes	2.2c GHG inventory: Agriculture	2.2d GHG inventory: LUCF/LULUCF	2.2e GHG inventory: Waste	2.2f GHG inventory: Key differences between Revised 1996 and 2006 IPCC GI	2.3 Needs and support	REDD-plus: Guidance and Background			
1	MEER	8	x		x	x			x																					x		x	x				x			x					
2	ANCC	6	x		x																					x		x		x	x	x	x	x	x	x	x	x	x	x	x				
3	ANCC	6	x		x																					x		x		x	x	x	x	x	x	x	x	x	x	x	x				
4	ANCC	6	x																																										
5	ANCC	1																																											
6	UNDP	3	x		x																									x	x	x	x	x	x	x	x	x	x	x	x				x
7	Univ Blida	30		x	x							x		x							x	x	x	x	x					x	x	x	x	x	x	x	x	x	x	x	x		x		x
8	MEM	10		x	x	x	x														x	x	x	x	x																		x		x
9	CDER	10		x	x	x	x	x	x	x	x																			x	x	x	x	x	x	x	x	x	x	x	x				x

1.5.4 Inventory development cycle and guidance

The biennial and/or annual preparation of the GHG inventory follows in general the **inventory development cycle** presented in the following figure and described in Chapter 1 *Introduction to the 2006 Guidelines* of Volume 1: General Guidance and Reporting (GGR).

The preparation of the inventory starts always with identification of the key categories of the previous inventory followed by the selection of the appropriate identify the appropriate method for estimation for each category according to the **decision tree** of each source presented in Volume 2 – 5 of the 2006 IPCC guidelines.

The collection of activity data and relevant parameters and the estimation of emission by sources and removals by sinks should be follow the selection of the appropriate methods. As stated in the 2006 IPCC Guidelines the data collection activities should consider time series consistency and establish and maintain good verification, documentation and checking procedures (QA/QC) to minimize errors and inconsistencies in the inventory estimates.[32] Information and data on uncertainties should if possible be collected at the same time. The relevant QC Checking and documentation is done according to the QC TIER 1 & 2 Checklist which is presented in Chapter below.

The following table presents relevant inventory tasks which are based on each other. It is also indicated which documents (chapter and/or sheet) are required for the respective work steps. The relevant responsible experts involved in each step are also identified.

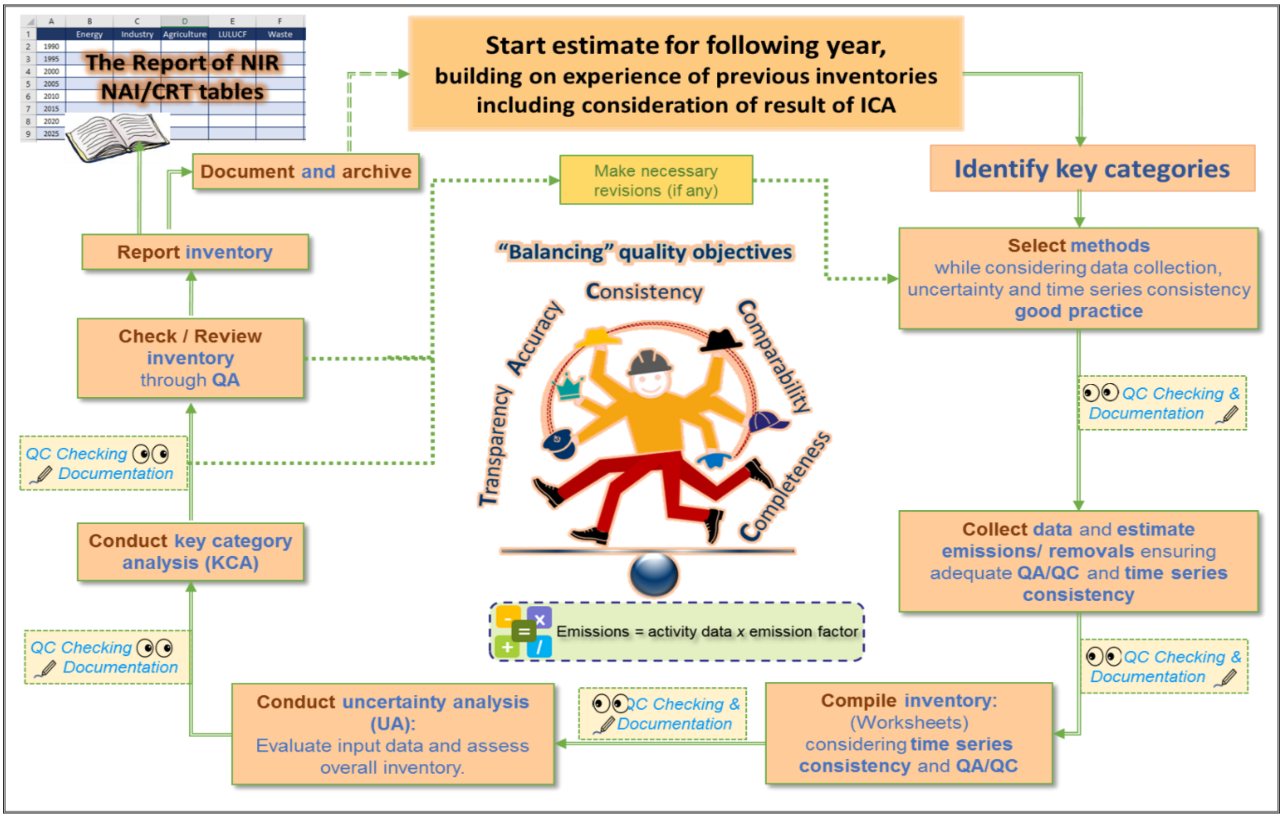

Figure 13 **Inventory development cycle**

Source : According to the 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, sub-chap. 1.5 Compiling an inventory, Figure 1.1, p. 1.9.

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[32] 2006 IPCC guidelines, Vol. 1: General Guidance and Reporting, Chap. 1: Introduction to the 2006 Guidelines, 1.5 Compiling an inventory, p. 1.9.

Table 34 National Inventory preparation schedule / guidance

	When	Task	Where / What	BUR & NC coordinator	Focal point GHG inventory	National Inventory Compiler (NIC)	QA/QC coordinator	NIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	to be determined
1.		Start estimate for following year, building on experience of previous inventories including consideration of result of ICA		🟦	🟦	🟦	🟦							
2.		Meeting of BUR & NC coordinator, Focal point GHG inventory, National Inventory Compiler (NIC) and QA/QC Coordinator: • Analyzing the QA/QC plan & Inventory improvement plan • Prioritizing the recommended improvements (including a timeline and responsibilities) • planning relevant resources.	Protocol (template) Inventory improvement plan.xlsx QA-QC improvement plan.xlsx	🟦	🟦	🟦	🟦							
3.		Kick-off meeting – GHG inventory team (News, deadlines, changes, etc.)	Protocol (template) Inventory improvement plan.xlsx QA-QC improvement plan.xlsx	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦			
4.		Conducting Capacity trainings and/or refreshing general issues, sector-specific topics, QC activities	Training plan Inventory improvement plan		🟦	🟦	🟦	🟦	🟦	🟦	🟦			
5.		Identify key categories	NIR 2020 chapter 1.5.docx KCA_2020.xlsx		🟦	🟦	🟦	🟦		🟦	🟦			
6.		Select methods while considering data collection, uncertainty and time series consistency good practice	2006 IPCC GL, Volume 2 – 5 NIR – sectoral chapters		🟦	🟦	🟦			🟦	🟦			
7.		QC Checking & Documentation, updating Inventory improvement plan	DZA_Inventory improvement plan.xlsx QC checks according to QC TIER 1 & 2 Checklist			🟦	🟦			🟦	🟦			
8.		Kick-off meeting – with data provider (with all / in groups)	Protocol (template)		🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦		
9.		Collection of activity data and relevant parameters ensuring adequate • QC Checking (completeness, transparency, accuracy) • time series consistency • documentation (if discrepancies, delay, etc.)	Data collection using data collection files (template) (source-specific) from data provider								🟦	🟦		
10.			Archiving response (letter, Email, etc.) in folder 04_Archive								🟦			
11.		Preparation/Updating of calculation sheets • adding new year • modification if higher TIER methodology will be applied • updating NIR tables templates • updating graphs	source-specific calculation sheets, e.g., 1A1a_InventoryTool_DZA.xlsx								🟦			

	When	**Task**	**Where / What**	**BUR & NC coordinator**	**Focal point GHG inventory**	**National Inventory Compiler (NIC)**	**QA/QC coordinator**	**NIR coordinator**	**Documentation & Archiving Lead**	**KCA & UA coordinator**	**Sector experts**	**Data provider**	**QA experts**	to be determined
12.		Estimate emissions/removals ensuring adequate QA/QC and time series consistency	Inserting activity data or linking data collection files with calculation files								▨			
13.		QC Checking & Documentation, updating Inventory improvement plan	• Documentation • QC checks according to part 1,2,3 and 6 of QC TIER 1 & 2 Checklist								▨			
14.		Preparation/Updating of Inventory file • adding new year • adding new calculation file, if needed • updating NIR tables templates • updating graphs	0_CRT_NationalTotal_1990-2020_DZA_v5.xlsx 1_CTR_Tables_Input.xlsx 2_CTR_Tables_Input.xlsx 3_CTR_Tables_Input.xlsx 4_CTR_Tables_Input.xlsx 5_CTR_Tables_Input.xlsx GHG_Input_CRT_Total_1990-2020_DZA.xlsx			▨								
15.		Compile inventory considering time series consistency and QA/QC: update links of all calculation sheets	0_CRT_NationalTotal_1990-2020_DZA_v5.xlsx 1_CTR_Tables_Input.xlsx, etc. GHG_Input_CRT_Total_1990-2020_DZA.xlsx QC checks according *QC TIER 1 & 2 Checklist*			▨								
16.		Sharing results with inventory team and QC check of Inventory file by sector experts and if needed revision of Inventory file	QC checks *QC TIER 1 & 2 Checklist*		▨	▨		▨			▨			
17.		Make necessary revisions (if any)				▨								
18.		Conduct uncertainty analysis (UA): Evaluation of input data: AD and EF.	"category" calculation files, sheet uncertainties							▨	▨			
19.		Conduct uncertainty analysis (UA): assessment of overall inventory uncertainty.	19R_V1_Ch03_Ad_IPCC_Tool_for_Approach_1_Uncertainty_Analysis.xlsx 19R_V1_Ch03_Ad_IPCC_Tool_Uncertainty_Analysis_DZA.xlsx Using GHG_Input_CRT_Total_1990-2020_DZA.xlsx QC checks according to *QC TIER 1 & 2 Checklist*							▨				
20.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to *QC TIER 1 & 2 Checklist*							▨	▨			

	When	Task	Where / What	BUR & NC coordinator	Focal point GHG inventory	National Inventory Compiler (NIC)	QA/QC coordinator	NIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	to be determined
21.		Sharing results with inventory team and QC check of UA file by sector experts and NIR coordinator			▨	▨	▨	▨		▨	▨			
22.		Make necessary revisions (if any)								▨				
23.		Conduct key category analysis (KCA) • Update formula for new inventory year • Update link with CRT-CommonReportingTables_DZA.xlsx	KCA_DZA_1990-2020_v3.xlsx Using GHG_Input_CRT_Total_1990-2020_DZA.xlsx							▨				
24.		QC Checking & Documentation, updating Inventory improvement plan	QC checks according to part 1 of *QC TIER 1 & 2 Checklist*							▨				
25.		Sharing results with inventory team and QC check of KCA file by sector experts and NIR coordinator	KCA_DZA_1990-2020_v3.xlsx 19R_V1_Ch03_Ad_IPCC_Tool_Uncertainty_Analysis_DZA.xlsx		▨	▨	▨	▨		▨	▨			
26.		Make necessary revisions of emission estimation if higher TIER methodology has to be applied according to decision tree of relevant source (if any)									▨			
27.		Repeat step 14. to – 25. in case of revision												
28.		QC Checking & Documentation, updating Inventory improvement plan	"category" calculation files, sheet Improvements QC checks according to *QC TIER 1 & 2 Checklist*								▨			
29.		Update NIR sectoral chapter									▨			
30.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of *QC TIER 1 & 2 Checklist*		▨			▨						
31.		Update NIR chapter 1 Introduction			▨			▨						
32.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of *QC TIER 1 & 2 Checklist*					▨		▨				
33.		Update NIR chapter 1.6 KCA						▨		▨				
34.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of *QC TIER 1 & 2 Checklist*					▨		▨				
35.		Update NIR chapter 1.7 Uncertainties						▨		▨				
36.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to part 2 and 3 of *QC TIER 4 & 5 Checklist*				▨	▨						

	When	Task	Where / What	BUR & NC coordinator	Focal point GHG inventory	National Inventory Compiler (NIC)	QA/QC coordinator	NIR coordinator	Documentation & Archiving Lead	KCA & UA coordinator	Sector experts	Data provider	QA experts	to be determined
37.		Finalization of Inventory Improvement Plan and QA-QC improvement plan Finalization of NIR Chapter 9 Recalculation and Improvement	Inventory improvement plan.xlsx QA-QC improvement plan.xlsx				▨							
38.		Update NIR chapter 1.6 QA/QC					▨	▨						
39.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to *QC TIER 1 & 2 Checklist*					▨						
40.		Update NIR chapter 2 Trend						▨						
41.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to *QC TIER 1 & 2 Checklist*					▨						
42.		Treatment of confidentiality issues	Checklist - Confidential data			▨	▨	▨			▨			
43.		Update NIR chapter # References						▨						
44.		QC Checking & Documentation, Cross-checking with Inventory improvement plan	QC checks according to *QC TIER 1 & 2 Checklist*		▨	▨	▨						▨	▨
45.		Check / Review inventory and NIR through QA	QA checks using the *QC TIER 1 & 2 Checklist*		▨	▨	▨						▨	▨
46.		Make necessary revisions of emission estimation and /or NIR based on findings and recommendations of QA (if any)									▨			
47.		Repeat step 14. to – 47. in case of revision												
48.		Finalize National GHG Inventory and National Inventory Report (NIR) for approval			▨									
49.		Reporting of National Inventory and National Inventory Report (NIR)			▨									
50.		Collection of QC documents, QA documents, Inventory Improvement Plan					▨							
51.		Archiving calculations files, Inventory files, KCA & UA file, NIR, QC documents, QA documents, Inventory Improvement Plan	05_QA-QC\04_InventoryImprovementList 06_Inventory\2018\Submission 07_NIR\2018_NIR\02_Submission_UNFCCC						▨					

1.5.5 Inventory improvement plan

The National Climate Change Agency placed under the supervision of the Minister responsible for the environment is responsible for the Inventory improvement plan.

The purpose of the agency is to promote the integration of the problem of climate change in all development plans and to contribute to the protection of the environment.

As part of the national strategy in the field of climate change, the agency is responsible for carrying out information, awareness, study and synthesis actions in areas relating to emissions and sequestration of greenhouse gases effect, adaptation to climate change, mitigation of its effects and various socio-economic impacts and to list all the activities of the various sectors to fight against climate change and to contribute to any national inventory of greenhouse gases according to the regulations in force;

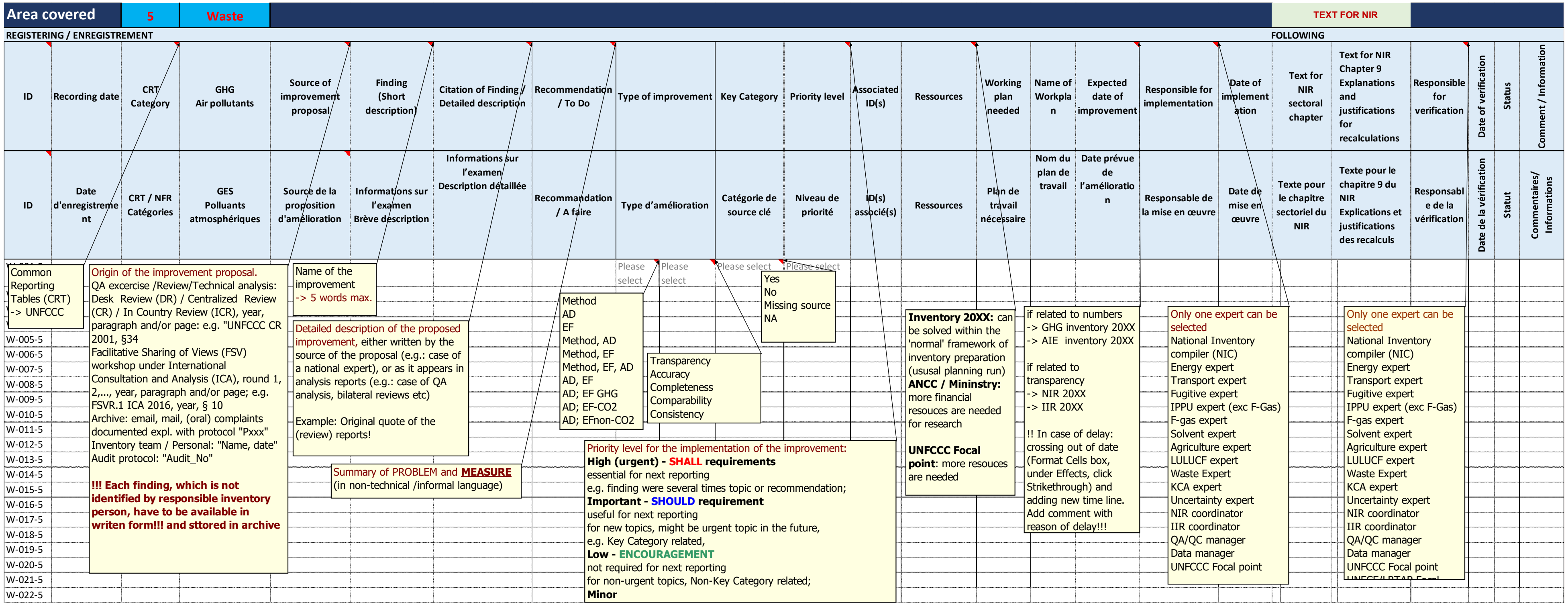
The planning of the GHG inventory preparation of each inventory cycle start with thoroughly analysis of the **QA/QC plan** and **Inventory improvement plan** in order to prioritize the tasks and available resources.

- QA/QC plan: bases on findings of internal and external audits; it also includes a training plan for sector experts;
- Inventory improvement plan: based on findings of the International Consultation and Analysis (ICA), (peer-) reviews, audits of the GHG inventory.

The results from internal/external audits, expert peer reviews and UNFCCC international consultation and analysis (ICA) are merged in the inventory improvement plan and Quality improvement plan. These plans lists the relevant sector, recommendations for improvement (reference and citation), priorities, responsibilities, deadlines and confirmation of implementation.

The following table presents the template of the inventory improvement plan which is prepared for each sector, QA/QC plan and Institutional arrangements.

Table 35 The inventory improvement plan



Area covered	5	Waste		TEXT FOR NIR	

REGISTERING / ENREGISTREMENT

FOLLOWING

ID	Recording date	CRT Category	GHG Air pollutants	Source of improvement proposal	Finding (Short description)	Citation of Finding / Detailed description	Recommendation / To Do	Type of improvement	Key Category	Priority level	Associated ID(s)	Ressources	Working plan needed	Name of Workplan	Expected date of improvement	Responsible for implementation	Date of implementation	Text for NIR sectoral chapter	Text for NIR Chapter 9 Explanations and justifications for recalculations	Responsible for verification	Date of verification	Status	Comment / Information
ID	Date d'enregistrement	CRT / NFR Catégories	GES Polluants atmosphériques	Source de la proposition d'amélioration	Informations sur l'examen Brève description	Informations sur l'examen Description détaillée	Recommandation / A faire	Type d'amélioration	Catégorie de source clé	Niveau de priorité	ID(s) associé(s)	Ressources	Plan de travail nécessaire	Nom du plan de travail	Date prévue de l'amélioration	Responsable de la mise en œuvre	Date de mise en œuvre	Texte pour le chapitre sectoriel du NIR	Texte pour le chapitre 9 du NIR Explications et justifications des recalculs	Responsable de la vérification	Date de la vérification	Statut	Commentaires/ Informations
								Please select Please select	Please select	Please select													
W-005-5																							
W-006-5																							
W-007-5																							
W-008-5																							
W-009-5																							
W-010-5																							
W-011-5																							
W-012-5																							
W-013-5																							
W-014-5																							
W-015-5																							
W-016-5																							
W-017-5																							
W-018-5																							
W-019-5																							
W-020-5																							
W-021-5																							
W-022-5																							

Common
Reporting
Tables (CRT)
-> UNFCCC

Origin of the improvement proposal.
QA excercise /Review/Technical analysis: Desk Review (DR) / Centralized Review (CR) / In Country Review (ICR), year, paragraph and/or page: e.g. "UNFCCC CR 2001, §34
Facilitative Sharing of Views (FSV) workshop under International Consultation and Analysis (ICA), round 1, 2,…, year, paragraph and/or page; e.g. FSVR.1 ICA 2016, year, § 10
Archive: email, mail, (oral) complaints documented expl. with protocol "Pxxx"
Inventory team / Personal: "Name, date"
Audit protocol: "Audit_No"

!!! Each finding, which is not identified by responsible inventory person, have to be available in writen form!!! and sttored in archive

Name of the improvement
-> 5 words max.

Detailed description of the proposed improvement, either written by the source of the proposal (e.g.: case of a national expert), or as it appears in analysis reports (e.g.: case of QA analysis, bilateral reviews etc)

Example: Original quote of the (review) reports!

Summary of PROBLEM and **MEASURE**
(in non-technical /informal language)

Method
AD
EF
Method, AD
Method, EF
Method, EF, AD
AD, EF
AD; EF GHG
AD; EF-CO2
AD; EFnon-CO2

Transparency
Accuracy
Completeness
Comparability
Consistency

Yes
No
Missing source
NA

Priority level for the implementation of the improvement:
High (urgent) - SHALL requirements
essential for next reporting
e.g. finding were several times topic or recommendation;
Important - SHOULD requirement
useful for next reporting
for new topics, might be urgent topic in the future,
e.g. Key Category related,
Low - ENCOURAGEMENT
not required for next reporting
for non-urgent topics, Non-Key Category related;
Minor

Inventory 20XX: can be solved within the 'normal' framework of inventory preparation (ususal planning run)
ANCC / Mininstry: more financial resouces are needed for research

UNFCCC Focal point: more resouces are needed

if related to numbers
-> GHG inventory 20XX
-> AIE inventory 20XX

if related to transparency
-> NIR 20XX
-> IIR 20XX

!! In case of delay: crossing out of date (Format Cells box, under Effects, click Strikethrough) and adding new time line. Add comment with reason of delay!!!

Only one expert can be selected
National Inventory compiler (NIC)
Energy expert
Transport expert
Fugitive expert
IPPU expert (exc F-Gas)
F-gas expert
Solvent expert
Agriculture expert
LULUCF expert
Waste Expert
KCA expert
Uncertainty expert
NIR coordinator
IIR coordinator
QA/QC manager
Data manager
UNFCCC Focal point

Only one expert can be selected
National Inventory compiler (NIC)
Energy expert
Transport expert
Fugitive expert
IPPU expert (exc F-Gas)
F-gas expert
Solvent expert
Agriculture expert
LULUCF expert
Waste Expert
KCA expert
Uncertainty expert
NIR coordinator
IIR coordinator
QA/QC manager
Data manager
UNFCCC Focal point

1.5.6 Quality control (QC) and Quality assurance (QA) procedures

The ANCC also represents the emission inventory control body: the Agency is organized so that each sector expert controls the sector of his colleague who is responsible for controlling another sector.

As stated in the 2006 IPCCC Guidelines, Chapter 6.6, and presented in the following figure,

- general QC procedures include generic quality checks related to calculations, data processing, completeness, and documentation that are applicable to all inventory source and sink categories.
- category-specific QC complements general inventory QC procedures and is directed at specific types of data used in the methods for individual source or sink categories. These procedures require knowledge of the specific category, the types of data available and the parameters associated with emissions or removals and are performed in addition to the general QC checks.

<table>
<tr><th>does NOT require</th><th>requires</th></tr>
<tr><th colspan="2">knowledge of the emission source category</th></tr>
<tr><th>⇩
general</th><th>⇩
source specific</th></tr>
<tr><td colspan="2">QC procedures
sector experts (1st party)
performed throughout preparation of inventory</td></tr>
<tr><td>TIER 1</td><td>TIER 2</td></tr>
<tr><td>data validation, calculation sheet
(check of formal aspects)</td><td>preparation of NIR, comparison with IPCC Guidelines
(check of applicability, comparisons)</td></tr>
<tr><td colspan="2">QA procedures
quality manager (2nd or 3rd party; staff not directly involved, preferably independent)
performed at different levels or after inventory work has finished</td></tr>
<tr><td colspan="2">TIER 1
basic, before submission</td></tr>
<tr><td></td><td>expert peer review
internal audit / expert peer review
evaluate if TIER2 QC is effectively performed
(check if methodologies are applicable)</td></tr>
<tr><td colspan="2">TIER 2
extensive</td></tr>
<tr><td>(quality management) system audit
evaluate if TIER 2 QC is effectively performed</td><td>expert peer review
International Consultation and Analysis (ICA)
• A technical analysis of BUR by a team of experts (TTE)
• A facilitative sharing of views in the form of workshop under the SBI
evaluate if TIER 2 QC is effectively performed
(check if methodologies are applicable)</td></tr>
</table>

Figure 14 General overview of QA/QC procedures

QC procedures are performed as defined in the Checklist provided in IPCC 2006 Guidelines,

- Table 6.1 General inventory QC procedures
- A1. General QC checklist
- A2. Category-specific QC checklist

For each step of the inventory cycle relevant QC checks are prepared. Furthermore, the checks are divided in content checks and formal checks. As well checks could be done for activity data, emission factor, and emission factor separately. In case of higher Tier method, not only AD and EF are used but also other parameters.

As the estimation of the GHG emissions and removal and the preparation of the reporting elements NIR and NAI tables are done at different stages of the inventory preparation cycle, the QC TIER 1 & 2 Checklist provides guidance on how and where the checks have to be done. Finally, each source has its own QC TIER 1 & 2 Checklist which can be individually refined.

1.5.6.1 Checklist for general QC checks

In the following table the Checklist for general QC checks (QC TIER 1) provided by the 20016 IPCC guidelines is provided.

Table 36 Checklist for general QC checks

Checklist for general QC checks (complete table for each category):			
Inventory Report:		**Source/Sink Category**	
Title(s) and Date(s) of Inventory Spreadsheet(s):			
Source (sink) category estimates prepared by (name/affiliation):			
Summary of results of checks and corrective actions taken			
Suggested checks to be performed in the future:			
Any residual problems after corrective actions have been taken:			

Checklist for general QC checks (complete table for each category):							
Item		**Check completed**			**Corrective action**		**Supporting documents (provide reference)**
		Date	Individual (first initial, last name)	Errors (Y/N)	Date	Individual (first initial, last name)	
DATA GATHERING, INPUT, AND HANDLING ACTIVITIES: QUALITY CHECKS							
1	Check a sample of input data for transcription errors.						
2	Review spreadsheets with computerized checks and/or quality check reports						
3	Identify spreadsheet modifications that could provide additional controls or checks on quality						
4	Other (specify):						
DATA DOCUMENTATION: QUALITY CHECKS							
5	Check project file for completeness						
6	Confirm that bibliographical data references are included (in spreadsheet) for every primary data element						
7	Check that all appropriate citations from the spreadsheets appear in the inventory document						
8	Check that all citations in spreadsheets and inventory are complete (i.e., include all relevant information)						
9	Randomly check bibliographical citations for transcription errors						
10	Check that originals of new citations are in current docket submittal						
11	Randomly check that the originals of citations						

Checklist for general QC checks (complete table for each category):							
Item		**Check completed**			**Corrective action**		**Supporting documents (provide reference)**
		Date	Individual (first initial, last name)	Errors (Y/N)	Date	Individual (first initial, last name)	
	(including Contact Reports) contain the material & content referenced						
12	Check that assumptions and criterion for selection of activity data, emission factors and other estimation parameters are documented						
13	Check that changes in data or methodology are documented						
14	Check that citations in spreadsheets and inventory document conform to acceptable style guidelines						
15	Other (specify):						
CALCULATING EMISSIONS AND CHECKING CALCULATIONS							
16	Check that all calculations are included (instead of presenting results only)						
17	Check whether units, parameters, and conversion factors are presented appropriately						
18	Check if units are properly labelled and correctly carried through from beginning to end of calculation						
19	Check that conversion factors are correct						
20	Check that temporal and spatial adjustment factors are used correctly						
21	Check the data relationships (comparability) and data processing steps (e.g., equations) in the spreadsheets						
22	Check that spreadsheet input data and calculated data are clearly differentiated						
23	Check a representative sample of calculations, by hand or electronically						
24	Check some calculations with abbreviated calculations						
25	Check the aggregation of data within a category						
26	When methods or data have changed, check consistency of time series inputs and calculations						
27	Check current year estimates against previous years (if available) and investigate unexplained departures from trend						
28	Check value of implied emission/removal factors across time series and investigate unexplained outliers						
29	Check for any unexplained or unusual trends for activity data or other calculation parameters in time series						
30	Check for consistency with IPCC inventory guidelines and good practices, particularly if changes occur						
31	Other (specify):						

1.5.6.2 Category-specific checklist

In the following table the Category-specific checklist (QC TIER 2) provided by the 20016 IPCC guidelines is provided.

Table 37 Category-specific checklist

Checklist for general QC checks (complete table for each category):			
Inventory Report:		**Source/Sink Category**	
Title(s) and Date(s) of Inventory Spreadsheet(s):			
Key category (or includes a key subcategory):	(Y / N)		
Category estimates prepared by (name/affiliation):			
Summary of results of checks and corrective actions taken			
Suggested checks to be performed in the future:			
Any residual problems after corrective actions have been taken:			

Category-specific checklist - Part A: Data gathering and selection							
		Check completed			**Corrective action**		
Item		**Date**	Individual (first initial, last name)	Errors (Y/N)	Date	Individual (first initial, last name)	Supporting documents (provide reference)
EMISSION DATA QUALITY CHECKS							
1	Emission comparisons: historical data for source, significant sub-source categories						
2	Checks against independent estimates or estimates based on alternative methods						
3	Reference calculations						
4	Completeness						
5	Other (detailed checks)						
EMISSION FACTOR QUALITY CHECK							
6	Assess representativeness of emission factors, given national circumstances and analogous emissions data						
7	Compare to alternative factors (e.g., IPCC default, cross-country, literature)						
8	Search for options for more representative data						
9	Other (detailed checks)						
ACTIVITY DATA QUALITY CHECK: NATIONAL LEVEL ACTIVITY DATA							
10	Check historical trends						
11	Compare multiple reference sources						
12	Check applicability of data						
13	Check methodology for filling in time series for data that are not available annually						
14	Other (detailed checks)						
ACTIVITY DATA QUALITY CHECK: SITE-SPECIFIC ACTIVITY DATA							
15	Check for inconsistencies across sites						
16	Compare aggregated and national data						
17	Other (detailed checks)						

Category-specific checklist - Part B: Secondary data and direct emission measurement							
		Check completed			Corrective action		
Item		**Date**	Individual (first initial, last name)	Errors (Y/N)	Date	Individual (first initial, last name)	Supporting documents (provide reference)
SECONDARY DATA: SAMPLE QUESTIONS REGARDING THE QUALITY OF INPUT DATA							
1	Are QC activities conducted during the original preparation of the data (either as reported in published literature or as indicated by personal communications) consistent with and adequate when compared against (as a minimum), general QC activities?						
2	Does the statistical agency have a QA/QC plan that covers the preparation of the data?						
3	For surveys, what sampling protocols were used and how recently were they reviewed?						
4	For site-specific activity data, are any national or international standards applicable to the measurement of the data? If so, have they been employed?						
5	Have uncertainties in the data been estimated and documented?						
6	Have any limitations of the secondary data been identified and documented, such as biases or incomplete estimates? Have errors been found?						
7	Have the secondary data undergone peer review and, if so, of what nature?						
8	Other (detailed checks)						
DIRECT EMISSION MEASUREMENT: CHECKS ON PROCEDURES TO MEASURE EMISSIONS							
9	Identify which variables rely on direct emission measurement.						
10	Check procedures used to measure emissions, including sampling procedures, equipment calibration and maintenance.						
11	Identify whether standard procedures have been used, where they exist (such as IPCC methods or ISO standards).						
12	Other (detailed checks)						

1.5.6.3 QA and review procedures, and verification activities

As stated in the 2006 IPCCC Guidelines, Chapter 6.8, and presented in Figure 14, Quality assurance (QA) comprises activities outside the actual inventory compilation. Good practice for QA procedures includes reviews and audits to

- assess the quality of the inventory,
- determine the conformity of the procedures taken and to identify areas where improvements could be made.

QA procedures may be taken at different levels (internal/external), and they are used in addition to the general and category-specific QC procedures.

Through internal/external audit and expert peer review an evaluation if TIER2 QC can be effectively performed:

- GHG inventory preparation and the GHG inventory is in line with 2006 IPCC Guidelines;
- data collection, calculation, referencing and archiving is handled according to the QA/QC plan;
- enough resources for the preparation of the GHG inventory and related reporting elements (NAI table and National Inventory Report (NIR)) are guaranteed by relevant national institutions;
- relevant activity data (e.g., energy balance, livestock data) are available and if the reliability of external data is ensured;
- QA/QC plan needs improvement;
- recommendations of UNFCCC international consultation and analysis (ICA) and previous internal/external audits and expert peer reviews have been considered and implemented;
- tailor-made / suitable trainings for the sector experts, National Inventory Compiler and other experts involved in the inventory preparation are provided.

1.5.7 Documentation and archiving

1.5.7.1 Documentation

For each sector, the documentation of the methodology and actual emission calculation (e.g., 1A1a_ElectricityTool_DZA.xlsx) includes:

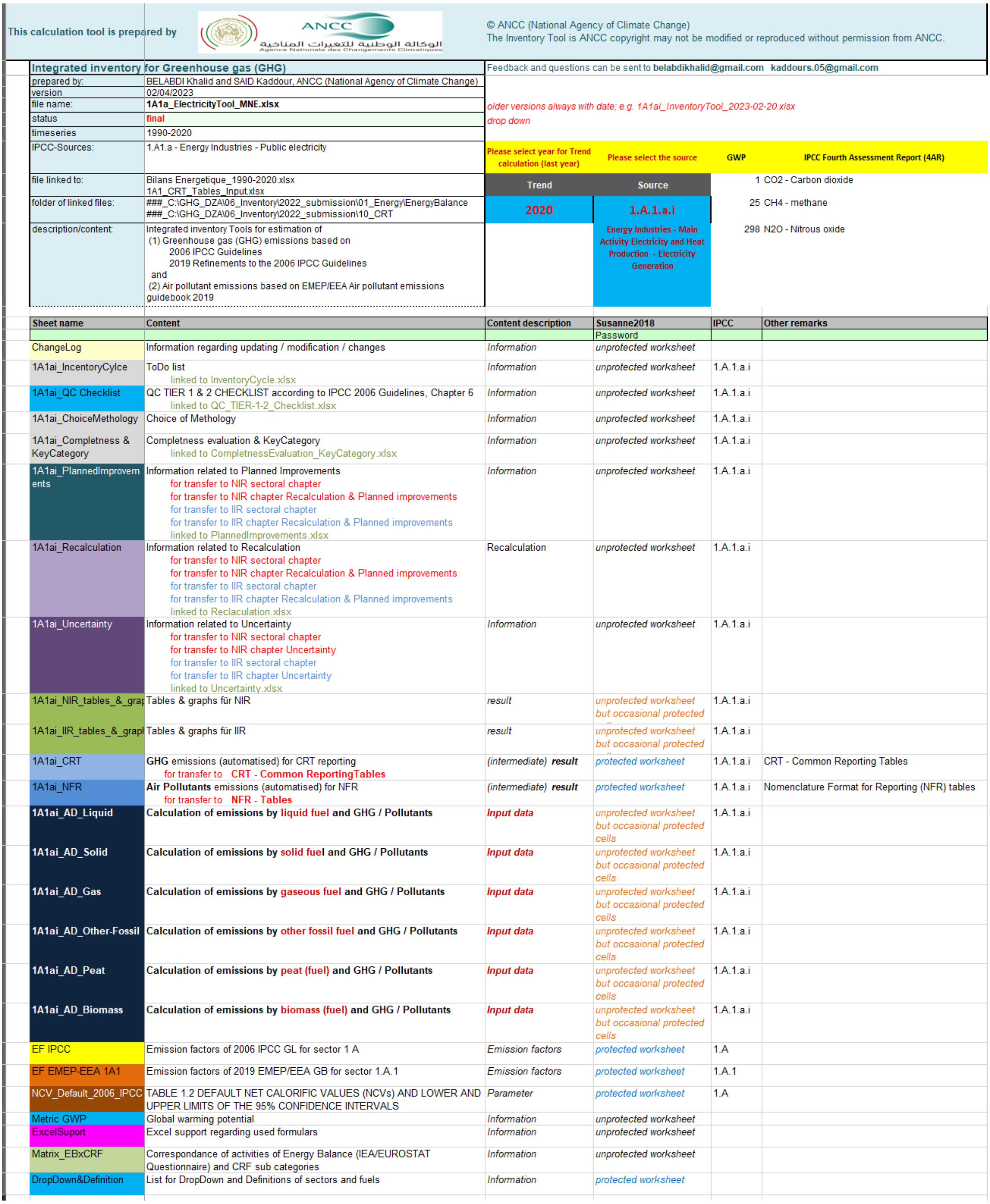
- Description (source/sink category, emissions, key source, completeness, uncertainty),
- Methodology (decision tree).
- “Logbook” (who did what and when) (see Table 34 National Inventory preparation schedule / guidance)
- References for activity data, emission factors and/or emissions, respectively,
- Documentation of assumptions, sources of data and information, expert judgements etc. to allow full reproduction and understanding of choices made,
- Recalculations,
- Planned improvements,
- QC activities.

1.5.7.2 Expert judgements

The documentation of expert judgements in line with the IPCC 2006 Guidelines should include:

- Name of the expert and institution/department,
- Date,
- Basis of judgement (references to relevant studies etc.),
- Underlying assumptions

Table 38 ReadMe of emission calculation sheets



This calculation tool is prepared by

ANCC الوكالة الوطنية للتغيرات المناخية Agence Nationale des Changements Climatiques

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Integrated inventory for Greenhouse gas (GHG)

Feedback and questions can be sent to **belabdikhalid@gmail.com** **kaddours.05@gmail.com**

prepared by:	BELABDI Khalid and SAID Kaddour, ANCC (National Agency of Climate Change)
version	02/04/2023
file name:	**1A1a_ElectricityTool_MNE.xlsx**
status	**final**
timeseries	1990-2020
IPCC-Sources:	1.A1.a - Energy Industries - Public electricity
file linked to:	Bilans Energetique_1990-2020.xlsx 1A1_CRT_Tables_Input.xlsx
folder of linked files:	###_C:\GHG_DZA\06_Inventory\2022_submission\01_Energy\EnergyBalance ###_C:\GHG_DZA\06_Inventory\2022_submission\10_CRT
description/content:	Integrated inventory Tools for estimation of (1) Greenhouse gas (GHG) emissions based on 2006 IPCC Guidelines 2019 Refinements to the 2006 IPCC Guidelines and (2) Air pollutant emissions based on EMEP/EEA Air pollutant emissions guidebook 2019

older versions always with date; e.g. 1A1ai_InventoryTool_2023-02-20.xlsx

drop down

Please select year for Trend calculation (last year)	Please select the source
Trend	**Source**
2020	**1.A.1.a.i** **Energy Industries - Main Activity Electricity and Heat Production - Electricity Generation**

GWP	IPCC Fourth Assessment Report (4AR)
1	CO2 - Carbon dioxide
25	CH4 - methane
298	N2O - Nitrous oxide

Sheet name	Content	Content description	Susanne2018	IPCC	Other remarks
			Password		
ChangeLog	Information regarding updating / modification / changes	*Information*	*unprotected worksheet*		
1A1ai_IncentoryCylce	ToDo list linked to InventoryCycle.xlsx	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_QC Checklist	QC TIER 1 & 2 CHECKLIST according to IPCC 2006 Guidelines, Chapter 6 linked to QC_TIER-1-2_Checklist.xlsx	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_ChoiceMethology	Choice of Methology	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_Completness & KeyCategory	Completness evaluation & KeyCategory linked to CompletnessEvaluation_KeyCategory.xlsx	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_PlannedImprovements	Information related to Planned Improvements for transfer to NIR sectoral chapter for transfer to NIR chapter Recalculation & Planned improvements for transfer to IIR sectoral chapter for transfer to IIR chapter Recalculation & Planned improvements linked to PlannedImprovements.xlsx	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_Recalculation	Information related to Recalculation for transfer to NIR sectoral chapter for transfer to NIR chapter Recalculation & Planned improvements for transfer to IIR sectoral chapter for transfer to IIR chapter Recalculation & Planned improvements linked to Reclaculation.xlsx	Recalculation	*unprotected worksheet*	1.A.1.a.i	
1A1ai_Uncertainty	Information related to Uncertainty for transfer to NIR sectoral chapter for transfer to NIR chapter Uncertainty for transfer to IIR sectoral chapter for transfer to IIR chapter Uncertainty linked to Uncertainty.xlsx	*Information*	*unprotected worksheet*	1.A.1.a.i	
1A1ai_NIR_tables_&_grap	Tables & graphs für NIR	*result*	*unprotected worksheet but occasional protected*	1.A.1.a.i	
1A1ai_IIR_tables_&_grapl	Tables & graphs für IIR	*result*	*unprotected worksheet but occasional protected*	1.A.1.a.i	
1A1ai_CRT	GHG emissions (automatised) for CRT reporting for transfer to **CRT - Common ReportingTables**	*(intermediate)* ***result***	*protected worksheet*	1.A.1.a.i	CRT - Common Reporting Tables
1A1ai_NFR	**Air Pollutants** emissions (automatised) for NFR for transfer to **NFR - Tables**	*(intermediate)* ***result***	*protected worksheet*	1.A.1.a.i	Nomenclature Format for Reporting (NFR) tables
1A1ai_AD_Liquid	**Calculation of emissions by liquid fuel and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
1A1ai_AD_Solid	**Calculation of emissions by solid fuel and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
1A1ai_AD_Gas	**Calculation of emissions by gaseous fuel and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
1A1ai_AD_Other-Fossil	**Calculation of emissions by other fossil fuel and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
1A1ai_AD_Peat	**Calculation of emissions by peat (fuel) and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
1A1ai_AD_Biomass	**Calculation of emissions by biomass (fuel) and GHG / Pollutants**	***Input data***	*unprotected worksheet but occasional protected cells*	1.A.1.a.i	
EF IPCC	Emission factors of 2006 IPCC GL for sector 1 A	*Emission factors*	*protected worksheet*	1.A	
EF EMEP-EEA 1A1	Emission factors of 2019 EMEP/EEA GB for sector 1.A.1	*Emission factors*	*protected worksheet*	1.A.1	
NCV_Default_2006_IPCC	TABLE 1.2 DEFAULT NET CALORIFIC VALUES (NCVs) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS	*Parameter*	*protected worksheet*	1.A	
Metric GWP	Global warming potential	*Information*	*unprotected worksheet*		
ExcelSuport	Excel support regarding used formulars	*Information*	*unprotected worksheet*		
Matrix_EBxCRF	Correspondance of activities of Energy Balance (IEA/EUROSTAT Questionnaire) and CRF sub categories	*Information*	*unprotected worksheet*		
DropDown&Definition	List for DropDown and Definitions of sectors and fuels	*Information*	*protected worksheet*		

1.5.7.3 Archiving

It is *good practice* to maintain documentation archive in such a way that every inventory estimate can be fully documented and reproduced if necessary. This includes secure archiving of complete datasets and shared databases that are used in inventory development. This is particularly important for categories that rely on the multi-step development of emissions from a large set of primary data from outside sources.

Currently there is no centralized database for data collection and management in place, but it is planned under the new MRV system.

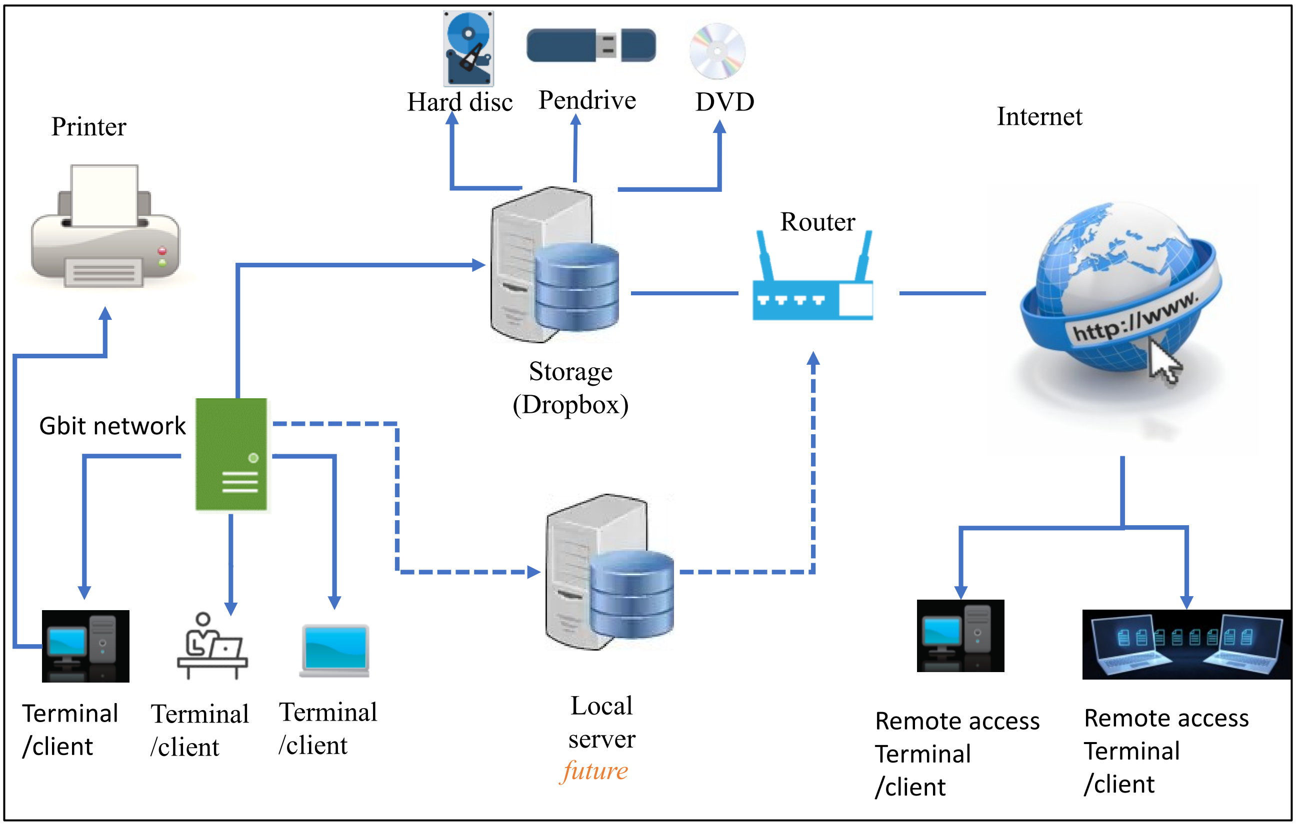

Figure 15 General overview of the data management inventory system of the Agency

1.5.8 Treatment of confidentiality issues

Information or data is declared as confidential when it could directly or indirectly identify an individual person, business, or organization. Following the Statistics Law Article, confidential data should not be published. To ensure completeness confidential data may be used to estimate GHG emissions and removal, but these emissions can be reported at a higher aggregated level so that confidentiality is no longer an issue. The checklist *Confidential data* should be used in order to ensure, that confidential data used in the inventory is not published.

1.6 General uncertainty assessment, including data pertaining to the overall uncertainty of inventory totals.

Uncertainty estimates are an essential element of a complete inventory of greenhouse gas emissions and removals and require a detailed understanding of the uncertainties of the respective input parameters. They should be derived for both the national level and the trend estimate, as well as for the component parts such as emission factors, activity data and other estimation parameters for each category.

As presented in the 2019 Refinement to the 2006 IPCC Guidelines two approaches for the estimation of combined uncertainties can be applied

- Approach 1 uses simple error propagation equations and is used to estimate uncertainty in individual categories, in the inventory as a whole, and in trends between a year of interest and a base year.
- Approach 2 uses Monte Carlo or similar techniques.

However, the GHG inventory for 1990 – 2020 is prepared mainly applying TIER 1 methodology of the 2006 IPCC guidelines and the 2019 Refinement to the 2006 IPCC Guidelines. Therefore, the default uncertainties associated with the activity data and emission factors were selected.
The application of the TIER 1 approach for estimating the uncertainties is applied.

TIER 1 should be implemented using Table 3.2 of the 2019 Refinement to the 2006 IPCC GL.

The excel based tool 19R_V1_Ch03_Ad_IPCC_Tool_for_Approach_1_Uncertainty_Analysis.xlsx provided with the 2019 Refinement to the 2006 IPCC GL was applied.

Table 39 Summary report of uncertainties analysis

Sector	**Emissions/ removals in base year**	**Emissions/ removals in year t**	**Contribution to total uncertainty by sector in year t**	**Contribution to total trend uncertainty by sector**
	kt CO_2 equivalent	**kt CO_2 equivalent**	**%**	**%**
Energy	67,471.69	179,671.10	92.7	92.7
IPPU	13,791.41	12,166.30	0.2	0.2
Agriculture	11,230.85	19,575.24	2.3	2.3
LULUCF	-5,554.50	-8,933.41	NE	NE
Waste	3,454.82	9,132.21	4.8	4.8
Other	NO	NE	NA	NA
Total	90,394.27	211,611.44	99.9	99.9
Uncertainty in total inventory			**14.7%**	**48.1%**

In Annex II of the NIR The Uncertainty assessment for the GHG inventory 1990 – 2020 is presented. Information is presented in the format and outline of the Table 3.3 of volume 1 of the 2006 IPCC Guidelines.

1.7 General assessment of the completeness

The sources and sinks not considered in the inventory but included in the IPCC 2006 Guidelines are clearly indicated, the reasons for such exclusion are explained. Notation keys - NA, NO, NE, IE - used are in accordance with the 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Chapter 8: Reporting Guidance and Tables, TABLE 8, page 8.7.

Sources and sinks	All sources and sinks included in the IPCC 2006 Guidelines are addressed. No additional sources and sinks specific to Algeria have been identified. Currently the following GHGs source and sink categories could not be estimated due to lack of data and resources:
Gases	Both direct GHGs as well as precursor gases are covered by the GHG inventory of Algeria. HFC and NF3 were not estimated due to lack of data and resources.
Geographic coverage	The geographic coverage is complete. There is no part of the Algeria’s territory not covered by the inventory.

1.8 Metric - Global warming potentials (GWP)

UNFCCC provides methods for climate change transparency such as common metrics.[33] One of the more well-known emission metric is the **Global Warming Potential (GWP)**, which has become the **default metric** for transferring emissions of different gases to a common scale.

To quantify and compare the climate impacts of various emissions, it is necessary to choose a climate parameter by which to measure the effects which are among others.

- radiative forcing,
- temperature response,
- etc.

For assessments and evaluation, one may—as an alternative to models that explicitly include physical processes resulting in forcing and responses—apply simpler measures or metrics that are based on results from complex models. **Metrics are used to quantify the contributions to climate change of emissions of different substances** and can thus act as ‘exchange rates’ in multi-component policies or comparisons of emissions from regions/countries or sources/sectors.

The GWP for a time horizon of 100 years from the IPCC was adopted as a metric to implement the multi-gas approach embedded in the UNFCCC and made operational in the Kyoto Protocol.

The metrics GWP is given in absolute terms (e.g., ton/kg) by normalizing to the reference gas CO_2. To transform the effects of different emissions to a common scale — often called ‘**CO_2 equivalent emissions**’ (**CO_2 eq**) —the emission (Ei) of component i can be multiplied with the adopted normalized metric (Mi):

$$\textbf{Emission}_i \times \textbf{GWP}_i = \textbf{CO}_2\ \textbf{eq}_i$$

The aggregated greenhouse gases (GHG in CO_2 equivalents) are prepared using the global warming potentials (GWP) provided by the IPCC Assessment Reports based on the effects of GHGs over a 100-year time horizon.

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[33] https://unfccc.int/process-and-meetings/transparency-and-reporting/methods-for-climate-change-transparency/common-metrics

Table 40 Decision on the use of the 100-year time-horizon GWP values from the Assessment Reports of the IPCC[34]

Decision	Description / Content
18/CMA.1 (2018)	The *Ad Hoc Working Group on the Paris Agreement* (APA) concluded its deliberations at CMA 1 (December 2018), and Parties agreed that Parties account for anthropogenic emissions and removals in accordance with common metrics assessed by the IPCC and in accordance with decision 18/CMA.1[35] (decision 4/CMA.1, annex II, paragraph 1(a)). Pursuant the modalities, procedures and guidelines (MPGs) for the transparency framework for action and support adopted by decision 18/CMP.1, Parties agreed to use the 100-year time-horizon GWP values from the **Fifth Assessment Report of the IPCC** (see table 8.A.1[36]), or 100-year time-horizon GWP values from a subsequent IPCC assessment report as agreed upon by the CMA, to report aggregate emissions and removals of GHGs, expressed in CO_2 eq (decision 18/CMA.1, annex, paragraph 37[37]).
4/CMP.7 (2011)	By decision **4/CMP.7**[38], Parties agreed that for the second commitment period of the Kyoto Protocol, the GWPs used to calculate the CO_2 equivalence of emissions and removals of the GHGs listed in the Annex A to the Kyoto Protocol shall be those listed in the column entitled "Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the **Fourth Assessment Report of the IPCC**, based on the effects of GHGs over a 100-year time horizon.
17/CP.8 (2002) **18/CP.8 (2002)**	In 2002 the COP by its decision **17/CP.8**[39] decided that non-Annex I Parties wishing to report on aggregated GHG emissions and removals expressed in CO_2 eq should use the "**1995 IPCC GWP Values**" **(Second assessment report of the IPCC)** based on the effects of GHGs over a 100-year time horizon. At the same time, by its decision **18/CP.8**[40], it decided that Annex I Parties should report aggregate emissions and removals of GHGs, expressed in CO_2 eq using the same "**1995 IPCC GWP Values**" **(Second assessment report of the IPCC)** based on the effects of GHGs over a 100-year time horizon.
4/CP.1 (1995)	The COP in its **decision 4/CP.1**[41] decided that Parties may use GWPs to reflect their inventories and projections in CO_2 eq terms. In such cases, the 100-year time-horizon values provided by the IPCC in its 1994 Special Report should be used. Parties may also make use of at least one of the other time-horizons provided by the IPCC.

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[34] https://unfccc.int/process-and-meetings/transparency-and-reporting/methods-for-climate-change-transparency/common-metrics

[35] FCCC/PA/CMA/2018/3/Add.1: https://unfccc.int/sites/default/files/resource/cma2018_3_add1_advance.pdf#page=12

[36] IPCC (20##) Chater 8 Anthropogenic and Natural Radiative Forcing: Appendix 8.A: Lifetimes, Radiative Efficiencies and Metric Values *(Table 8.A.1.);* https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf#page=73

[37] FCCC/PA/CMA/2018/3/Add.2: https://unfccc.int/sites/default/files/resource/cma2018_3_add2_new_advance.pdf#page=25

[38] FCCC/KP/CMP/2011/10/Add.1: https://unfccc.int/documents/7112

[39] FCCC/CP/2002/7/Add.2: Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention https://unfccc.int/documents/3217

[40] FCCC/CP/2002/7/Add.2: Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, part I: UNFCCC reporting guidelines on annual inventories https://unfccc.int/documents/3217

[41] FCCC/CP/1995/7/Add.1; https://unfccc.int/documents/1168

Table 41 Global warming potentials (GWP) provided by the IPCC Assessment Reports.

Species / gas name	**Chemical formula / Abbreviation**	**Global Warming Potential (Time Horizon) based on the effects of GHGs over a 100-year time horizon**		
		IPCC Second Assessment Report[42]	**IPCC Fourth Assessment Report[43]**	**IPCC Fift Assessment Report[44]**
Carbon dioxide	CO_2	1	1	1
Methane	CH_4	21	25	28
Nitrous oxide	N_2O	310	298	265
Sulphur hexafluoride	SF_6	23 900	22 800	23 500
Nitrogen trifluoride	NF3		17200	16 100
Hydrofluorocarbons	*HFC*	*Hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances*		
Hydrofluorocarbons	*PFC*			
HFC-23	CHF3	11 700	14 800	12 400
HFC-32	CH2F2	650	675	677
HFC-41	CH3F	150	92	116
HFC-43-10mee	CF3CHFCHFCF2CF3	1 300	1 640	1 650
HFC-125	C2HF5	2 800	3 500	3 170
HFC-134	C2H2F4	1 000	1 100	1 120
HFC-134a	CH2FCF3	1 300	1 430	1 300
HFC-152a	C2H4F2	140		138
HFC-143	C2H3F3	300	353	328
HFC-143a	CF3CH3	3 800	4 470	4 800
HFC-152	CH2FCH2F		53	16
HFC-152a	C2H4F2		124	138
HFC-161	CH3CH2F		12	4
HFC-227ea	C3HF7	2 900	3 220	3 350
HFC-236cb	CH2FCF2CF3		1 340	1 210
HFC-236ea	CHF2CHFCF3		1 370	1 330
HFC-236fa	C3H2F6	6 300	9 810	8 060
HFC-245ca	C3H3F5	560	693	710
HFC-245fa	CHF2CH2CF3		1 030	858
HFC-365mfc	CH3CF2CH2CF3		794	804
Perfluoromethane	CF4	6 500	7390	6 630
Perfluoroethane	C2F6	9 200	12 200	11 100
Perfluoropropane	C3F8	7 000	8 830	8 900

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[42] IPCC (1996): Climate Change 1995. *Table 4: Global Warming Potential referenced to the updated decay response for the Bern carbon cycle model and future CO2 atmospheric concentrations held constant at current levels.*
https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_sar_wg_I_full_report.pdf

[43] IPCC. (2007). *Climate Change 2007 - The Physical Science Basis Contribution of Working Group I to the Fourth Assessment Report of the IPCC.* ***(Table TS.2).*** Available (12 March 2021) at: https://www.ipcc.ch/site/assets/uploads/2018/05/ar4_wg1_full_report-1.pdf; https://www.ipcc.ch/site/assets/uploads/2018/05/ar4-wg1-errata.pdf

[44] IPCC (20##) Chater 8 Anthropogenic and Natural Radiative Forcing: Appendix 8.A: Lifetimes, Radiative Efficiencies and Metric Values *(Table 8.A.1.)*
https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf;
https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf#page=73

Species / gas name	Chemical formula / Abbreviation	Global Warming Potential (Time Horizon) based on the effects of GHGs over a 100-year time horizon		
		IPCC Second Assessment Report[42]	IPCC Fourth Assessment Report[43]	IPCC Fift Assessment Report[44]
Perfluorobutane	C4F10	7 000	8 860	9 200
Perfluorocyclobutane	c-C4F8	8 700	10 300	9 540
Perfluoropentane	C5F12	7 500	9 160	8 550
Perfluorohexane	C6F14	7 400	9 300	7 910
Perfluorodecalin	C10F18		7 500	7 190
Perfluorocyclopropane	c-C3F6		17340	9 200
For further species see relevant IPCC Asssessment report				
See also Chaper 2.10 Global Warming Potentials and Other Metrics for Comparing Different Emissions[45] and Table 2.14. Lifetimes, radiative efficiencies and direct (except for CH_4) GWPs relative to CO_2. For ozone-depleting substances and their replacements, data are taken from IPCC/TEAP (2005) unless otherwise indicated.				

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[45] https://www.ipcc.ch/site/assets/uploads/2018/02/ar4-wg1-chapter2-1.pdf

2 Trends in greenhouse gas emissions and removals

2.1 Description of emission and removal trends for aggregated GHG emissions and removals

Algeria’s total greenhouse gas (GHG) emissions (without LULUCF) were estimated to be
in 1990 to 95,948.77 kt CO_2 equivalents,
in 2005 to 146,390.81 kt CO_2 equivalents,
in 2020 to 220,544.85 kt CO_2 equivalents,

Total national GHG emissions without LULUCF increased by 130.4% between 1990 and 2020, by 51.0% between 2005 and 2020 and decreased by 4.1% during the period 2019-2020.

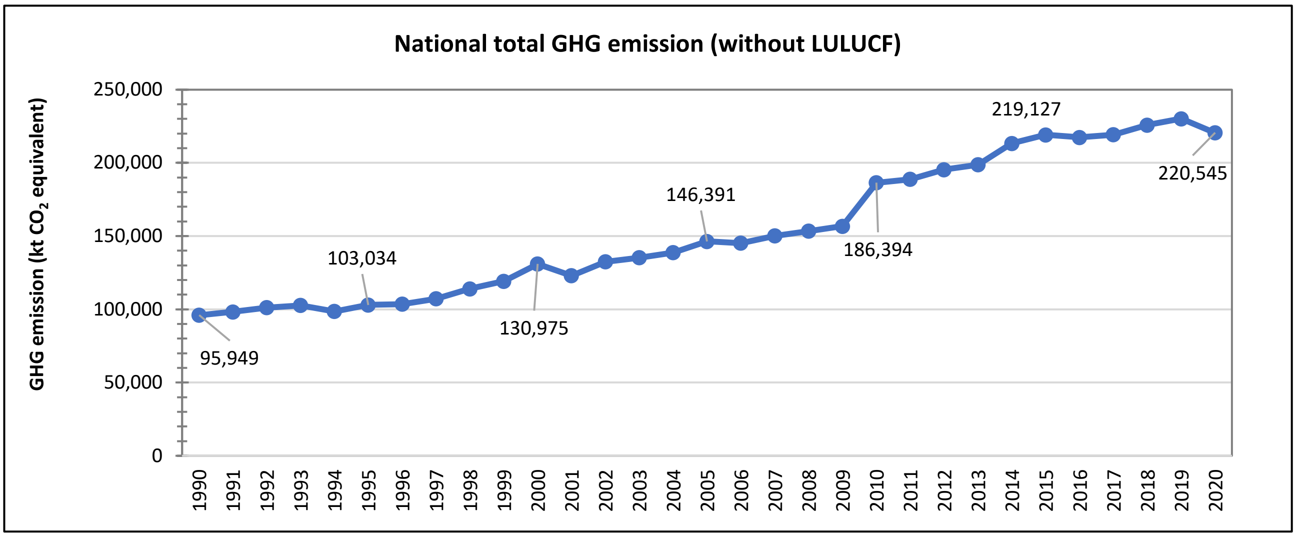


Figure 16 National total GHG emission (without LULUCF)

Trend 1990 - 2020

The increase of total GHG emissions between 1990 and 2020 were mainly due to the increase of GHG emissions from IPCC sector 1 *Energy* from 67,471.69 kt CO_2 equivalents in 1990 and to 179,671.10 kt CO_2 equivalents in 2020, which is an increase of 166.3%. The main reasons for the increase of the GHG emissions in IPCC sector 1 *Energy* were the emissions from:

- IPCC category 1.A.1 *Energy industries* (includes for e.g., electricity production, fuel combustion in refineries), which more than doubled,
- IPCC category 1.A.3 *Transport* (includes for e.g., national aviation, road transport), which have almost tripled.
- IPCC category 1.B. Fugitive emissions (includes for e.g., oil and gas exploration, production, transmission, and distribution activities), which increased by 55.0% compared to 1990.

These trends can be explained by the increase in national energy demand by the various sectors. Indeed, the residential sector is the leading energy consumer, accounting for over 46% of final energy consumption, followed by the industrial sector, which currently represents almost 27% of national energy consumption, and the transport sector, which accounts for around 15% of final energy consumption.

The *Industrial Processes and Product use* (IPPU) generated emissions of 13,791.41 kt CO_2 equivalents in 1990 and 12,166.30kt CO_2 equivalents in 2020, or 14.4% and 5.5 of total Algerian GHG emissions, respectively. During the period 1990-2020 the GHG emissions from IPPU decreased by 11.8 %. The key drivers are activities in the IPCC category 2.A. *Mineral industry* (e.g., cement industry) and IPCC category 2.B. *Chemical industry* (e.g., ammonia and related downstream processes).

The IPCC sector 3 *Agriculture* represents the second important source of GHG emissions at the national level, with GHG emissions which increased by 74.3% from 11,230.85 CO_2 equivalents to 19,575.24 CO_2 equivalents during the period from 1990 to 2020. The CH_4 emissions from IPCC category 3.A *Enteric fermentation* were the most significant source of IPCC sector 3 *Agriculture*, which increased by 68.6% from 6,523.74 kt CO_2 equivalents in 1990 and to 10,998.49 kt CO_2 equivalents in 2020. Here, the most important driving forces are the partly strongly increasing livestock numbers, increasing intensive livestock farming with high milk and meat production.

The IPCC sector 5 *Waste* was a comparable small source in Algerian GHG greenhouse gas emission. However, the GHG emissions have almost tripled during the period 1990 – 2020, from 3,454.82 Kt CO_2 equivalents in 1990 to and 9,132.21 Kt CO_2 equivalents in 2020. The increased solid waste and wastewater generation and related treatments were responsible for the increased GHG emissions. Waste management and treatment activities are sources of greenhouse gas emissions (see Figure 2). In 2020, landfills were the third-largest source of Algerian anthropogenic CH_4 emissions, generating 6 475.52 Kt CO_2 equivalent and accounting for 15.2% of total Algerian CH_4 emissions. Additionally, wastewater treatment generates emissions of 2 189.80 Kt CO_2 equivalents and accounts for 3.3% Algerian CH_4 emissions, and 8.7 % of Algerian N_2O emissions. Overall, emission sources accounted in the Waste chapter generated 9 132.21 Kt CO_2 equivalent, or 4.1% of total Algerian greenhouse gas emissions in 2020.

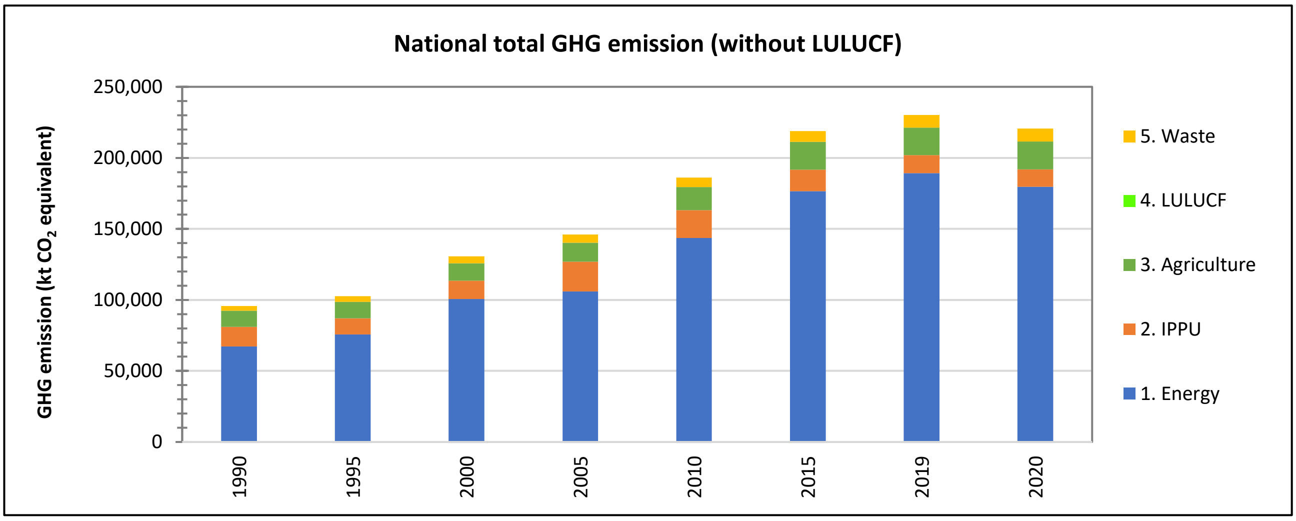


Figure 17 National total GHG emission (without LULUCF) per sector for pillar years

Share of gases in the Algeria's GHG inventory

The following figures present the share of gases in national total GHG emission (without LULUCF).

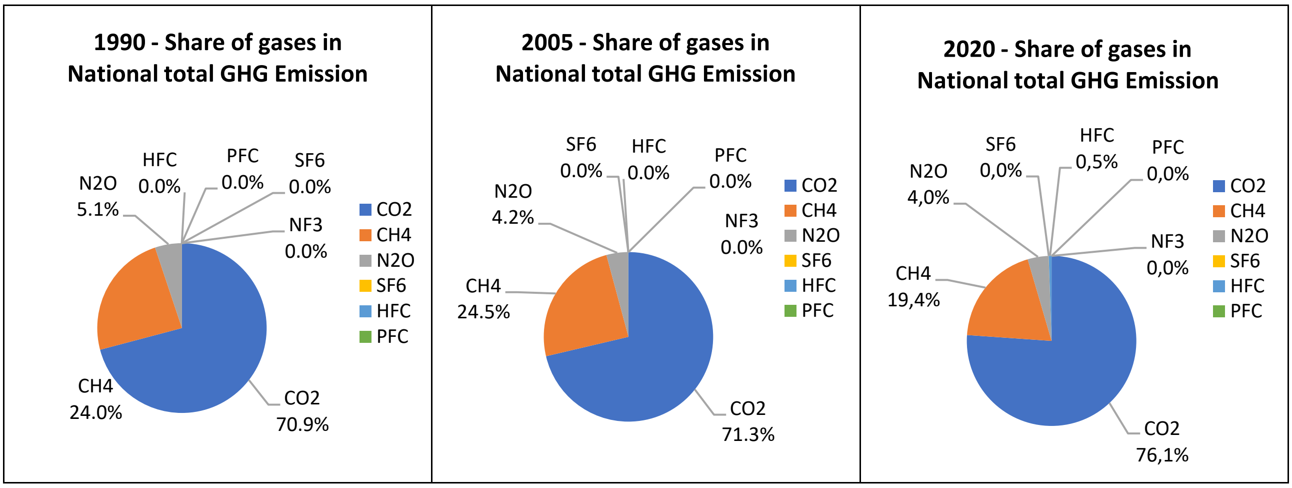
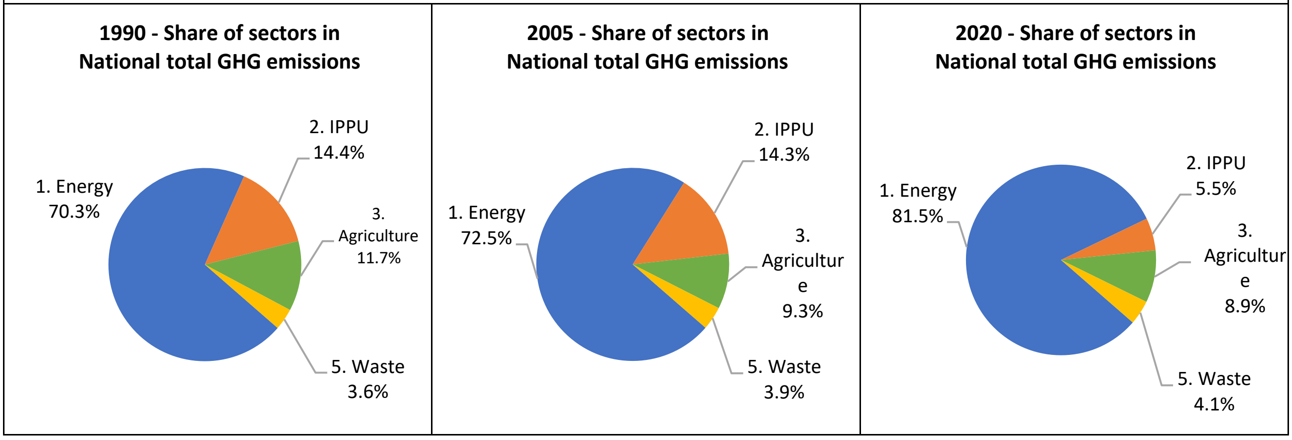


Figure 18 **Share of gases in National total GHG Emission (without LULUCF)**

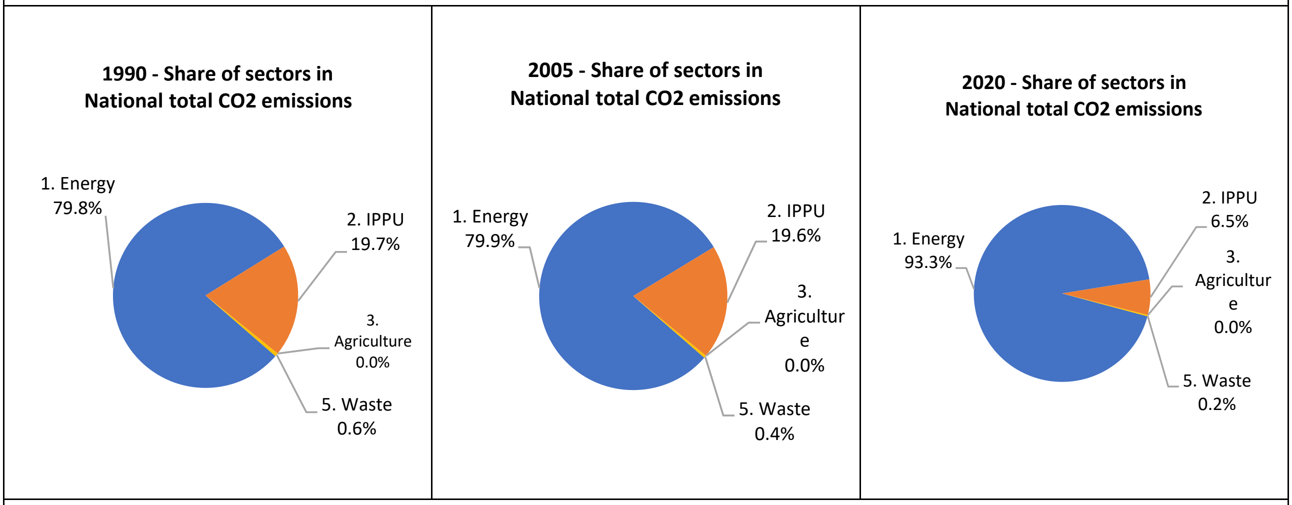
The most important gas in the Algeria's GHG inventory is carbon dioxide (CO_2) with a share of 76.1% of total emissions in 2020 (without LULUCF). CO_2 emissions result primarily from combustion activities, either in IPCC category 1.A *Fuel combustion* or as result of flaring of methane (CH_4) in IPCC category 1.B *Fugitive emissions*. Methane (CH_4) contributes 19.4% to total national GHG emissions. In Algeria, CH_4 mainly arises from IPCC category 1.B *Fugitive emissions* and IPCC category 3.A *Enteric fermentation* (livestock stock farming) and IPCC category 4.A. *Waste disposal*. Nitrous oxide (N_2O) contributes 4.2% to total national GHG emissions. In Algeria, the IPCC category 2.B *Chemical industries* (nitric acid production) and IPCC category 3.D *Agricultural soils* are the main source of N_2O. With about 0.5% the fluorinated compounds (SF_6 and HFC) contribute 0.5% to total national GHG emissions. The fluorinated compounds (F-gases) are mostly emitted from the use of these gases as substitutes for ozone depleting substances (ODS) in refrigeration equipment and in electrical equipment for electricity transmission and distribution. However, it must be noted, that emissions of fluorinated compounds (F-gases) cover currently only the gases HFCH-123, HFC-32, HFC-134a and the blend R-410 and even those emission were only estimated to a limited extent in this inventory cycle.

The following figures present the shares of IPCC sectors in National total GHG emission (without LULUCF) in 1990, 2005 and in 2020.

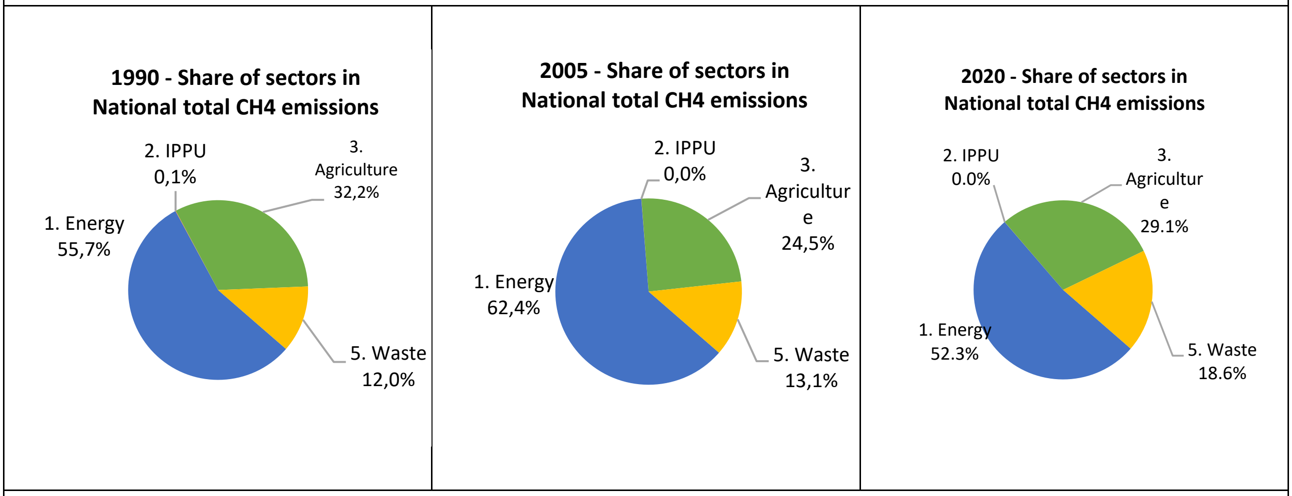
Share of IPCC sectors in National total GHG emission (without LULUCF) in 1990, 2005 and in 2020



Share of IPCC sectors in National total GHG emission (without LULUCF) in 1990, 2005 and in 2020



Share of IPCC sectors in National total GHG emission (without LULUCF) in 1990, 2005 and in 2020



Share of IPCC sectors in National total GHG emission (without LULUCF) in 1990, 2005 and in 2020

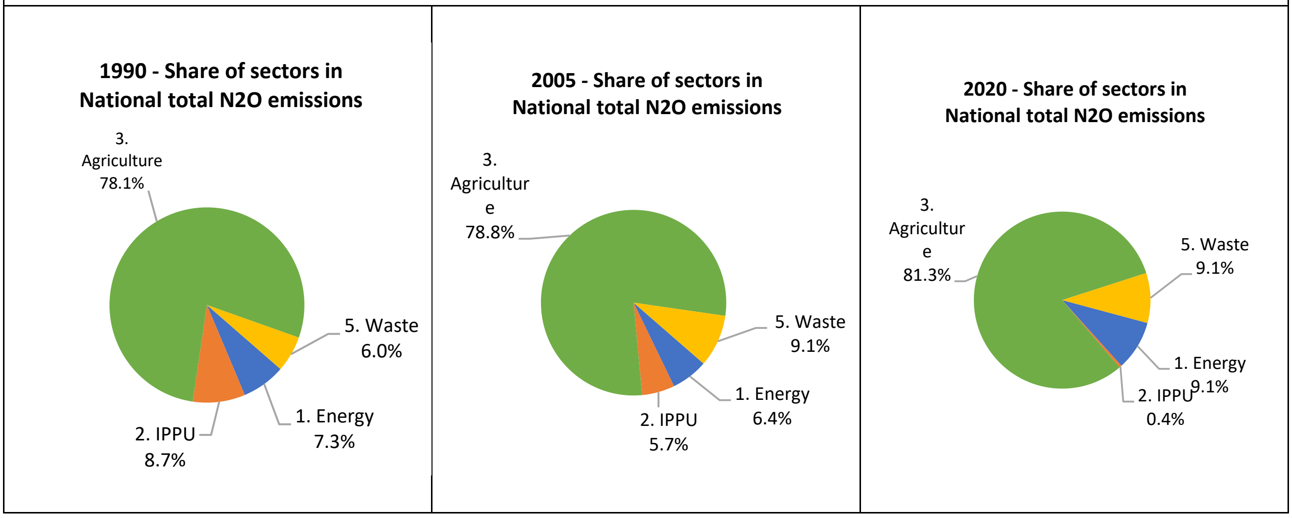


Figure 19 Share of IPCC sectors in National total emission (without LULUCF) in 1990 and in 2020

Table 42 Summary of Algeria’s greenhouse gas emissions from 1990 - 2020 (without LULUCF)

GHG	Total GHG	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
	kt CO_2 equivalent							
1990	95,948.77	68,065.12	22,953.10	4,930.38	NA	NA	0.16	NA
1991	98,198.31	69,682.72	23,179.37	5,336.03	NA	NA	0.18	NA
1992	101,103.08	72,303.28	23,184.82	5,614.78	NA	NA	0.21	NA
1993	102,632.88	73,034.00	23,864.24	5,734.40	NA	NA	0.24	NA
1994	98,615.39	70,092.64	23,060.99	5,460.80	0.69	NE	0.27	NE
1995	103,033.63	71,845.64	25,845.92	5,340.54	1.22	NE	0.31	NE
1996	103,534.03	70,914.46	27,215.48	5,401.63	2.12	NE	0.34	NE
1997	107,195.86	72,695.22	29,018.96	5,478.21	3.09	NE	0.39	NE
1998	113,970.03	77,195.09	30,952.16	5,818.15	4.20	NE	0.43	NE
1999	119,181.74	80,696.02	32,496.42	5,983.10	5.71	NE	0.49	NE
2000	130,974.80	93,856.82	31,330.32	5,780.35	6.76	NE	0.56	NE
2001	122,948.72	86,070.47	31,035.97	5,833.98	7.68	NE	0.63	NE
2002	132,470.24	94,647.76	31,984.37	5,826.78	10.65	NE	0.70	NE
2003	135,246.20	96,632.26	32,654.54	5,944.26	14.38	NE	0.77	NE
2004	138,658.40	99,312.81	32,874.95	6,450.02	19.79	NE	0.84	NE
2005	146,390.81	104,501.01	35,760.48	6,099.49	28.60	NE	1.24	NE
2006	145,151.09	103,408.05	35,101.46	6,601.18	38.72	NE	1.70	NE
2007	150,115.15	107,895.73	35,441.40	6,725.18	50.63	NE	2.23	NE
2008	153,404.60	111,353.32	35,432.06	6,556.55	59.90	NE	2.82	NE
2009	156,741.89	114,122.10	35,500.88	7,043.25	71.72	NE	3.49	NE
2010	186,394.38	140,033.58	38,758.11	7,373.74	224.30	NE	4.26	NE
2011	188,751.90	142,577.80	38,200.99	7,675.81	291.73	NE	5.17	NE
2012	195,342.99	147,340.44	39,439.13	8,143.19	413.40	NE	6.29	NE
2013	198,762.99	150,130.63	39,626.05	8,469.48	528.56	NE	7.73	NE
2014	213,313.05	162,421.37	41,405.60	8,821.22	654.74	NE	9.53	NE
2015	219,127.01	167,486.76	41,572.31	8,979.01	1.076.51	NE	11.82	NE
2016	217,402.50	163,683.52	43,650.24	8,886.02	1.167.40	NE	14.83	NE
2017	219,233.34	165,344.37	44,142.03	8,687.60	1.040.16	NE	18.70	NE
2018	225,828.61	171,505.43	44,287.11	8,819.34	1.191.00	NE	23.52	NE
2019	230,093.50	176,735.12	43,418.95	8,795.83	1.111.67	NE	29.34	NE
2020	220,544.85	167,832.76	42,683.12	8,784.23	1.206.05	NE	36.19	NE
Trend								
1990 - 2020	129.9%	146.6%	86.0%	78.2%	NA	NA	22950%	NA
2005 - 2020	50.7%	60.6%	19.4%	44.0%	4118%	NA	2827%	NA
2019 - 2020	-4.1%	-5.0%	-1.7%	-0.1%	8%	NA	23%	NA
Share of gas								
1990		70.9%	24.0%	5.1%	NA	NA	<0.1%	NA
2005		71.3%	24.5%	4.2%	<0.1%	NA	<0.1%	NA
2020		76.1%	19.4%	4.0%	0.5%	NA	<0.1%	NA
Note: Global warming potentials (GWPs) according to the 4th Assessment Report (IPCC 2007) (100 years’ time horizon): carbon dioxide (CO_2) = 1; methane (CH_4) = 25; nitrous oxide (N_2O) = 298; Sulphur Hexafluoride (SF_6) = 22 800; nitrogen trifluoride (NF3) = 17 200; hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) consist of different substances, therefore GWPs have to be calculated individually depending on the substances; see NIR chapter 1.8.								
Notation Keys: NO: not occurring; NA: not applicable; NE, not estimated; IE: included elsewhere								

In the following figure is presented the development of the trend in total GHG emissions during the period 1990–2020 by gas in index form (base year = 100). Compared to 1990, all emissions of gases have increased significantly due to population growth, rising economic and agricultural activities as well as increased transport performance.

The decreasing trend from 2019 to 2020 is a result of the worldwide COVID pandemic and the economic downturn during this period.

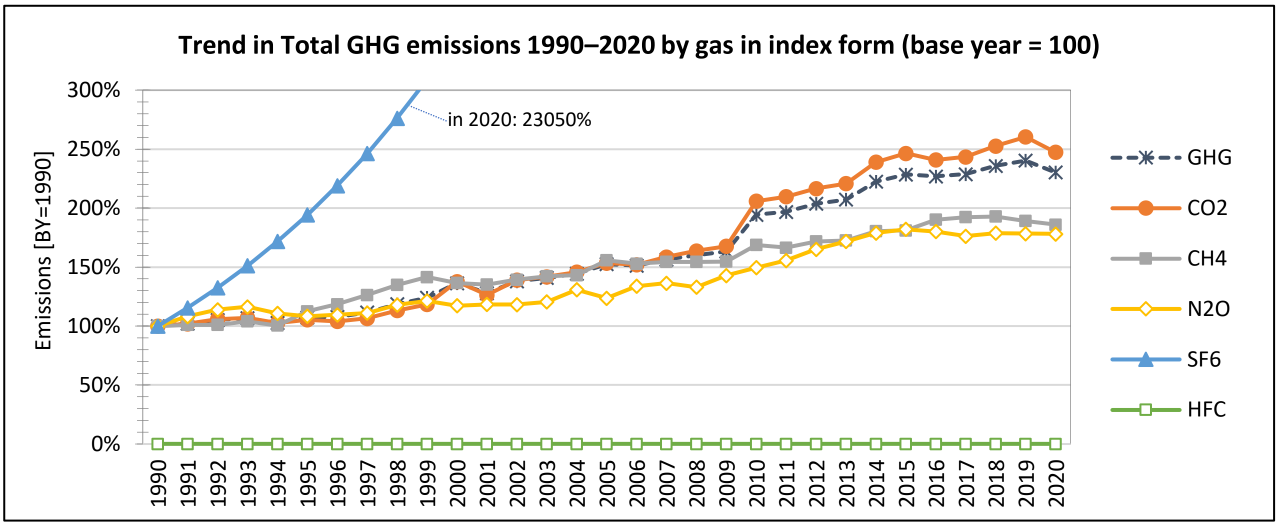


Figure 20 Trend in Total GHG emissions 1990–2020 by gas in index form (base year = 100)

2.1.1 GHG emissions

Algeria’s total GHG emissions (without LULUCF) were estimated to be 220,672.12 kt in 2020.

- Compared to 1990, where the GHG emissions amounted to 95,948.77 kt CO_2 equivalent, GHG emissions (without LULUCF) increased by 129.9%.
- Compared to 2005, where the GHG emissions were estimated to be 146,390.81kt CO_2 equivalent, GHG emissions (without LULUCF) increased by 50.7%.
- Compared to 2019, where the GHG emissions were estimated to be 230,093.50 kt CO_2 equivalent, GHG emissions (without LULUCF) decreased by 4.1%.

The following table presents Algeria’s greenhouse gas emissions by sector for the period 1990 – 2020.

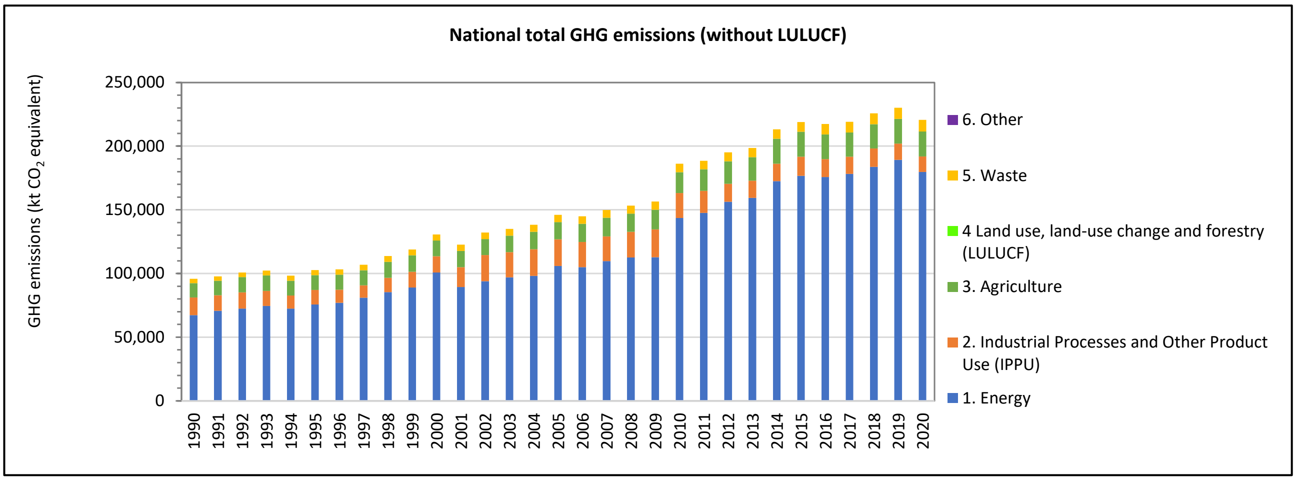


Figure 21 National total GHG emission (without LULUCF) by sector

The following figures present Trend of National Total GHG emissions by IPCC sector in index form (base year = 100).

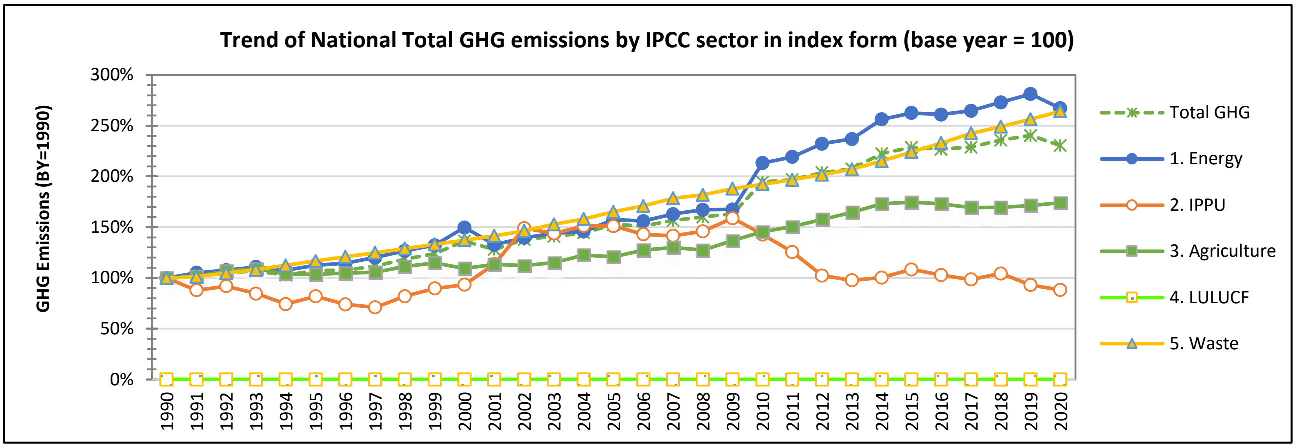


Figure 22 **Trend of National Total GHG emissions by IPCC sector in index form (base year = 100)**

Table 43 GHG emissions by IPCC sector.

GHG	Total GHG	1	2	3	4	5	6
		Energy	**IPPU**	**Agriculture**	**LULUCF**	**Waste**	**Other**
	kt CO_2 equivalent						
1990	95,948.77	67,471.69	13,791.41	11 230,85	NE	3,454.82	NO
1991	98,198.31	71,209.53	12,116.32	11 377,41	NE	3,495.04	NO
1992	101,103.08	72,811.45	12,671.39	12 002,50	NE	3,617.75	NO
1993	102,632.88	74,976.96	11,662.56	12 258,14	NE	3,735.21	NO
1994	98,615.39	72,812.40	10,238.08	11 680,50	NE	3,884.40	NO
1995	103,033.63	76,091.77	11,281.45	11 627,16	NE	4,033.24	NO
1996	103,534.03	77,381.83	10,200.17	11 777,04	NE	4,174.98	NO
1997	107,195.86	81,228.53	9,792.48	11 862,36	NE	4,312.50	NO
1998	113,970.03	85,688.52	11,315.39	12 514,68	NE	4,451.45	NO
1999	119,181.74	89,329.81	12,359.18	12 897,41	NE	4,595.33	NO
2000	130,974.80	101,081.04	12,866.49	12 288,63	NE	4,738.64	NO
2001	122,948.72	89,629.12	15,690.85	12 738,10	NE	4,890.65	NO
2002	132,470.24	94,240.60	20,576.90	12 594,68	NE	5,058.06	NO
2003	135,246.20	97,219.84	19,827.75	12 917,22	NE	5,281.39	NO
2004	138,658.40	98,562.94	20,858.68	13 773,12	NE	5,463.65	NO
2005	146,390.81	106,279.03	20,845.39	13 558,66	NE	5,707.73	NO
2006	145,151.09	105,211.76	19,713.67	14 319,76	NE	5,905.90	NO
2007	150,115.15	109,832.69	19,512.72	14 600,43	NE	6,169.31	NO
2008	153,404.60	112,689.69	20,131.36	14 300,68	NE	6,282.86	NO
2009	156,741.89	112,985.99	21,903.72	15 359,38	NE	6,492.79	NO
2010	186,394.38	143,726.69	19,695.67	16 327,75	NE	6,644.27	NO
2011	188,751.90	147,715.58	17,332.78	16 907,35	NE	6,796.20	NO
2012	195,342.99	156,558.90	14,116.12	17 696,15	NE	6,971.82	NO
2013	198,762.99	159,631.17	13,469.76	18 506,06	NE	7,155.99	NO
2014	213,313.05	172,599.85	13,838.12	19 442,91	NE	7,432.16	NO
2015	219,127.01	176,823.98	14,945.97	19 610,96	NE	7,746.10	NO
2016	217,402.50	175,740.02	14,173.09	19 437,17	NE	8,052.22	NO
2017	219,233.34	178,257.62	13,584.19	19 014,28	NE	8,377.25	NO
2018	225,828.61	183,763.48	14,405.40	19 054,22	NE	8,605.51	NO
2019	230,093.50	189,154.71	12,836.82	19 241,69	NE	8,860.28	NO
2020	220,544.85	179,671.10	12,166.30	19 575,24	NE	9,132.21	NO
Trend							
1990 - 2020	129.9%	166.3%	-11.8%	74,3%	NA	164.3%	NA
2005 - 2020	50.7%	69.1%	-41.6%	44,4%	NA	60.0%	NA
2019 - 2020	-4.1%	-5.0%	-5.2%	1,7%	NA	3.1%	NA
Share in National total							
1990		70.3%	14.4%	11.7%	NA	3.6%	NA
2005		72.5%	14.3%	9.3%	NA	3.9%	NA
2020		81.5%	5.5%	8.9%	NA	4.1%	NA

2.1.2 CO_2 emissions

Algeria's total CO_2 emissions (without LULUCF) were estimated to be 167,832.76 kt in 2020.

- Compared to 1990, where the CO_2 emissions were estimated to be 68,065.12kt, CO_2 emissions (without LULUCF) increased by 146.6%.
- Compared to 2005, where the CO_2 emissions amounted to 104,501.01 kt, CO_2 emissions (without LULUCF) increased by 60.6%.
- Compared to 2019, where the CO_2 emissions were estimated to be 176,735.12kt, CO_2 emissions (without LULUCF) decreased by 5.0%.
- The following table presents Algeria's CO_2 emissions by sector for the period 1990 – 2020.

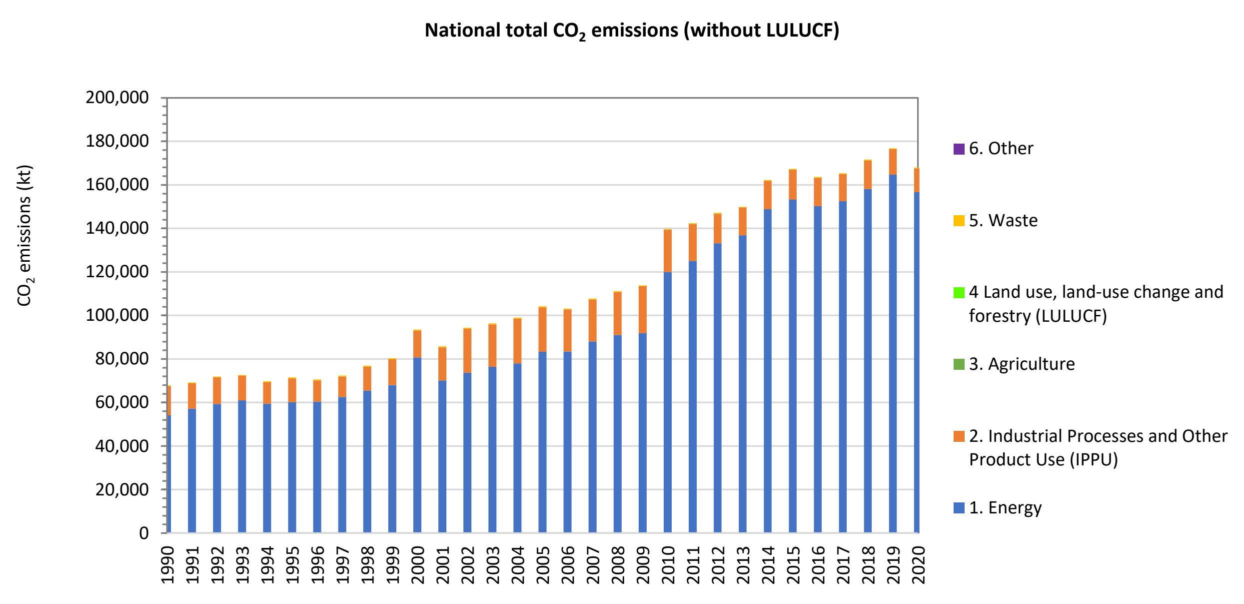


Figure 23 **National total CO_2 emissions (without LULUCF) by sector**

The following figures present Trend of National Total GHG emissions by IPCC sector in index form (base year = 100).

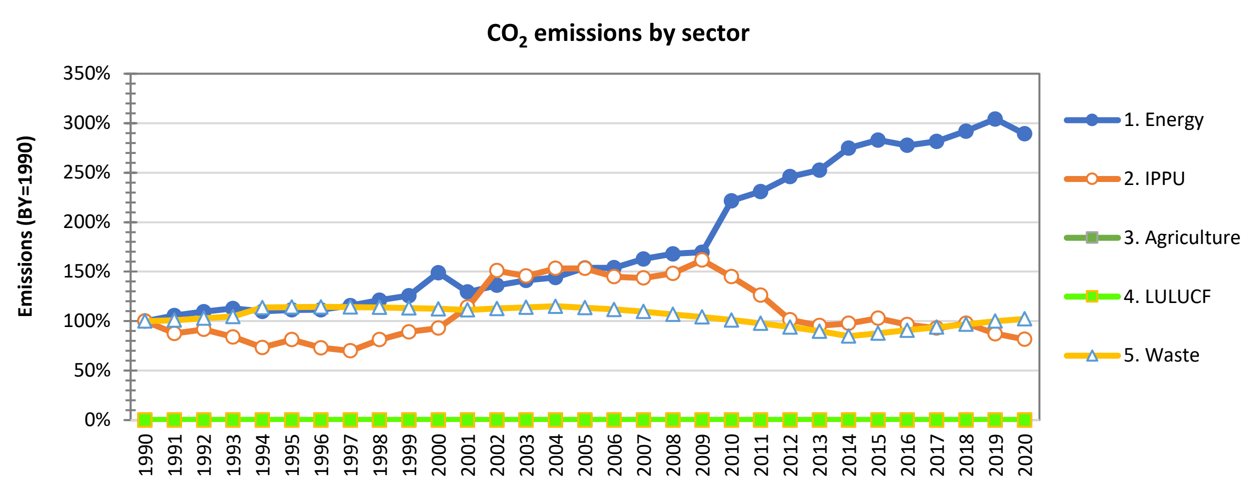


Figure 24 **Trend of National Total CO_2 emissions by IPCC sector in index form (base year = 100)**

Table 44 CO₂ emissions (in kt) (without LULUCF) by IPCC sector.

CO_2	**Total CO_2**	**1**	**2**	**3**	**4**	**5**	**6**
		Energy	**IPPU**	**Agriculture**	**LULUCF**	**Waste**	**Other**
	kt						
1990	68,065.12	54,320.56	13,344.62	NE	NE	399.95	NO
1991	69,682.72	57,608.69	11,670.20	NE	NE	403.84	NO
1992	72,303.28	59,667.32	12,224.45	NE	NE	411.51	NO
1993	73,034.00	61,399.32	11,216.19	NE	NE	418.49	NO
1994	70,092.64	59,846.73	9,791.24	NE	NE	454.66	NO
1995	71,845.64	60,559.72	10,829.04	NE	NE	456.88	NO
1996	70,914.46	60,712.46	9,744.59	NE	NE	457.41	NO
1997	72,695.22	62,906.18	9,332.27	NE	NE	456.77	NO
1998	77,195.09	65,889.87	10,850.11	NE	NE	455.11	NO
1999	80,696.02	68,356.46	11,886.94	NE	NE	452.62	NO
2000	93,856.82	81,018.02	12,389.55	NE	NE	449.25	NO
2001	86,070.47	70,389.53	15,235.69	NE	NE	445.25	NO
2002	94,647.76	74,055.36	20,141.69	NE	NE	450.71	NO
2003	96,632.26	76,766.21	19,410.43	NE	NE	455.62	NO
2004	99,312.81	78,393.29	20,459.41	NE	NE	460.11	NO
2005	104,501.01	83,586.16	20,460.79	NE	NE	454.06	NO
2006	103,408.05	83,620.35	19,340.88	NE	NE	446.82	NO
2007	107,895.73	88,306.30	19,151.00	NE	NE	438.43	NO
2008	111,353.32	91,141.48	19,784.89	NE	NE	426.95	NO
2009	114,122.10	92,094.89	21,566.21	44.53	NE	416.47	NO
2010	140,033.58	120,229.51	19,336.19	63.27	NE	404.62	NO
2011	142,577.80	125,269.15	16,858.33	59.50	NE	390.83	NO
2012	147,340.44	133,415.98	13,503.37	45.47	NE	375.63	NO
2013	150,130.63	136,989.58	12,737.87	44.00	NE	359.17	NO
2014	162,421.37	148,976.23	13,038.78	67.47	NE	338.90	NO
2015	167,486.76	153,334.50	13,733.90	67.47	NE	350.90	NO
2016	163,683.52	150,383.06	12,869.94	67.47	NE	363.06	NO
2017	165,344.37	152,577.48	12,391.61	NE	NE	375.28	NO
2018	171,505.43	158,083.69	13,034.56	NE	NE	387.18	NO
2019	176,735.12	164,692.39	11,642.71	NE	NE	400.02	NO
2020	167,832.76	156,545.57	10,878.29	NE	NE	408.90	NO
Trend							
1990 - 2020	146.6%	188.2%	-18.5%	NA	NA	2.2%	NA
2005 - 2020	60.6%	87.3%	-46.8%	NA	NA	-9.9%	NA
2019 - 2020	-5.0%	-4.9%	-6.6%	NA	NA	2.2%	NA
Share in National total							
1990		79.8%	19.7%	NA	NA	0.6%	NA
2005		79.7%	19.6%	NA	NA	0.4%	NA
2020		93.3%	6.5%	NA	NA	0.2%	NA

2.1.3 CH_4 emissions

Algeria's total CH_4 emissions were estimated to be 42,683.12 kt CO_2 equivalent in 2020.

- Compared to 1990, where the CH_4 emissions were estimated to be 22,953.10 kt CO_2 equivalent, CH_4 emissions increased by 86.0%.
- Compared to 2005, where the CH_4 emissions amounted to 35,760.48 kt CO_2 equivalent, CH_4 emissions increased by 19.4%.
- Compared to 2019, where the CH_4 emissions were estimated to be 43,418.95 kt CO_2 equivalent, CH_4 emissions decreased by 1.7%.
- The following table presents Algeria's CH_4 emissions by sector for the period 1990 – 2020.

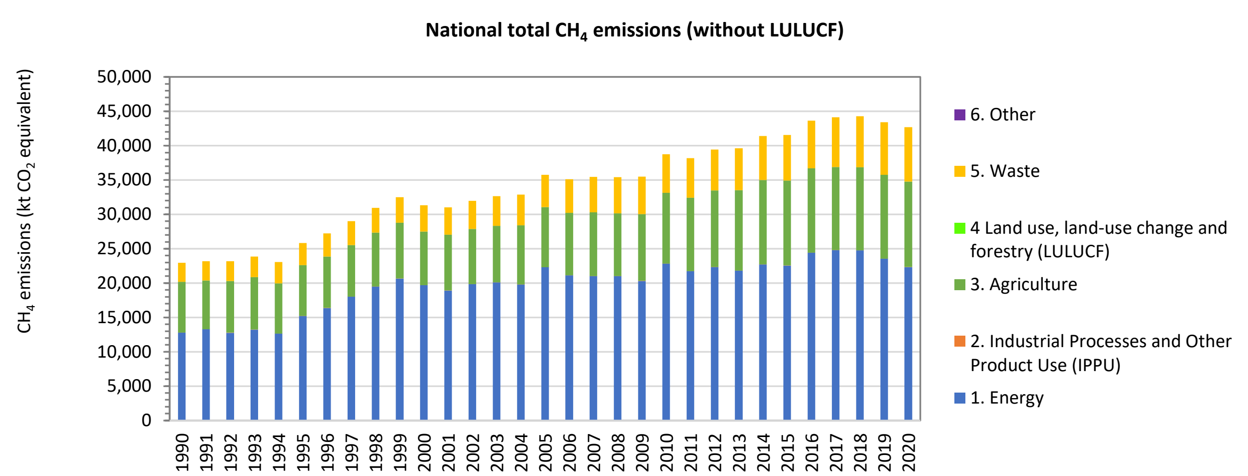


Figure 25 **National total CH_4 emission by sector**

The following figures present Trend of National Total GHG emissions by IPCC sector in index form (base year = 100).

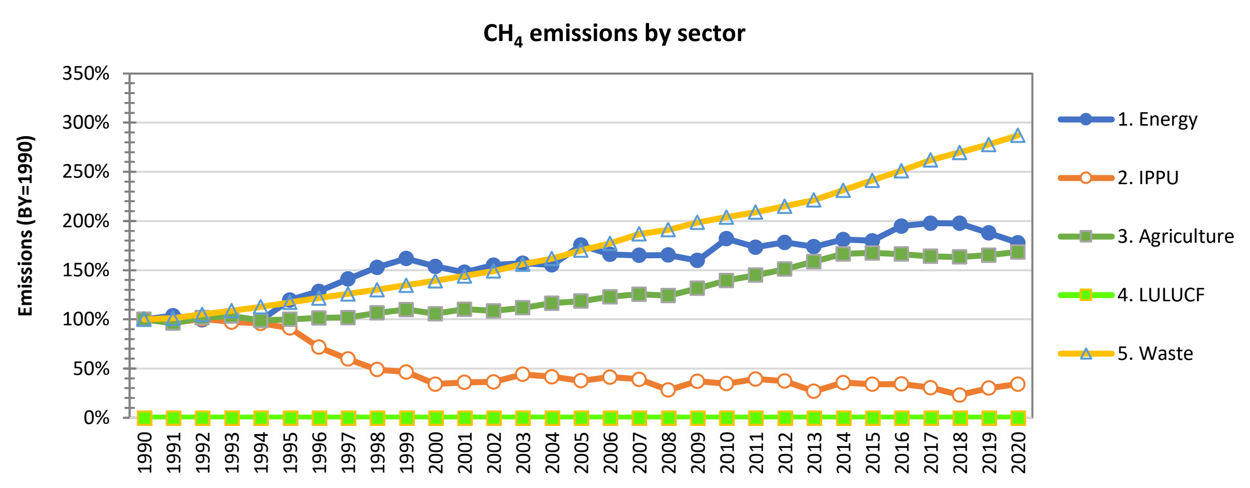


Figure 26 **Trend of National Total CH_4 emissions by IPCC sector in index form (base year = 100)**

Table 45 CH_4 emissions (in kt) by IPCC sector.

CH_4	Total CH_4	1	2	3	4	5	6
		Energy	**IPPU**	**Agriculture**	**LULUCF**	**Waste**	**Other**
	kt						
1990	918.12	511.72	0.75	295.24	NE	110.41	NO
1991	927.17	530.91	0.72	283.95	NE	111.60	NO
1992	927.39	510.31	0.75	300.40	NE	115.93	NO
1993	954.57	528.94	0.73	304.83	NE	120.08	NO
1994	922.44	505.63	0.72	291.76	NE	124.33	NO
1995	1,033.84	608.75	0.68	295.03	NE	129.38	NO
1996	1,088.62	654.50	0.53	299.38	NE	134.21	NO
1997	1,160.76	720.73	0.44	300.67	NE	138.91	NO
1998	1,238.09	779.49	0.37	314.52	NE	143.71	NO
1999	1,299.86	826.02	0.35	324.78	NE	148.71	NO
2000	1,253.21	787.20	0.26	312.04	NE	153.72	NO
2001	1,241.44	756.42	0.27	325.68	NE	159.07	NO
2002	1,279.37	793.62	0.27	320.92	NE	164.56	NO
2003	1,306.18	803.81	0.33	329.67	NE	172.37	NO
2004	1,315.00	792.14	0.31	343.92	NE	178.63	NO
2005	1,430.42	892.04	0.28	350.19	NE	187.91	NO
2006	1,404.06	845.11	0.31	362.94	NE	195.70	NO
2007	1,417.66	840.37	0.29	370.80	NE	206.20	NO
2008	1,417.28	839.96	0.21	366.11	NE	211.00	NO
2009	1,420.04	812.40	0.28	388.21	NE	219.15	NO
2010	1,550.32	913.23	0.26	411.76	NE	225.07	NO
2011	1,528.04	869.42	0.29	427.69	NE	230.63	NO
2012	1,577.57	893.69	0.28	446.20	NE	237.40	NO
2013	1,585.04	871.99	0.20	468.45	NE	244.40	NO
2014	1,656.22	909.10	0.27	491.52	NE	255.34	NO
2015	1,662.89	901.87	0.25	494.36	NE	266.40	NO
2016	1,746.01	977.54	0.26	491.01	NE	277.20	NO
2017	1,765.68	991.63	0.23	484.55	NE	289.27	NO
2018	1,771.48	991.24	0.17	482.47	NE	297.60	NO
2019	1,736.76	941.99	0.22	487.87	NE	306.67	NO
2020	1,707.32	892.83	0.25	497.35	NE	316.90	NO
Trend							
1990 - 2020	86.0%	74.5%	-65.8%	68,5%	NA	187.0%	NA
2005 - 2020	19.4%	0.1%	-8.9%	42,0%	NA	68.6%	NA
2019 - 2020	-1.7%	-5.2%	13.8%	1,9%	NA	3.3%	NA
Share in National total							
1990		55.7%	0.1%	32.2%	NA	12.0%	NA
2005		62.4%	0.0%	24.5%	NA	13.1%	NA
2020		52.3%	0.0%	29.1%	NA	18.6%	NA

Table 46 CH_4 (kt CO_2 equivalent) emissions by IPCC sector.

CH_4	Total CH_4	1	2	3	4	5	6
		Energy	**IPPU**	**Agriculture**	**LULUCF**	**Waste**	**Other**
	kt CO_2 equivalent						
1990	22,953.10	12,793.12	18.65	7,381.08	NE	2,760.26	NO
1991	23,179.37	13,272.72	17.95	7,098.79	NE	2,789.91	NO
1992	23,184.82	12,757.75	18.74	7,510.12	NE	2,898.20	NO
1993	23,864.24	13,223.44	18.15	7,620.63	NE	3,002.02	NO
1994	23,060.99	12,640.77	17.90	7,293.96	NE	3,108.36	NO
1995	25,845.92	15,218.80	17.02	7,375.67	NE	3,234.43	NO
1996	27,215.48	16,362.43	13.37	7,484.43	NE	3,355.24	NO
1997	29,018.96	18,018.28	11.12	7,516.71	NE	3,472.86	NO
1998	30,952.16	19,487.25	9.14	7,863.08	NE	3,592.69	NO
1999	32,496.42	20,650.51	8.67	8,119.40	NE	3,717.84	NO
2000	31,330.32	19,679.95	6.38	7,801.06	NE	3,842.93	NO
2001	31,035.97	18,910.57	6.69	8,141.98	NE	3,976.72	NO
2002	31,984.37	19,840.44	6.81	8,023.11	NE	4,114.01	NO
2003	32,654.54	20,095.25	8.20	8,241.74	NE	4,309.33	NO
2004	32,874.94	19,803.60	7.77	8,597.94	NE	4,465.64	NO
2005	35,760.48	22,300.94	6.99	8,754.85	NE	4,697.70	NO
2006	35,101.45	21,127.85	7.70	9,073.40	NE	4,892.51	NO
2007	35,441.39	21,009.17	7.27	9,269.88	NE	5,155.07	NO
2008	35,432.03	20,998.98	5.25	9,152.80	NE	5,275.00	NO
2009	35,501.15	20,310.14	6.90	9,705.34	NE	5,478.76	NO
2010	38,758.33	22,830.98	6.46	10,294.07	NE	5,626.83	NO
2011	38,201.24	21,735.84	7.34	10,692.33	NE	5,765.72	NO
2012	39,439.39	22,342.39	6.95	11,155.00	NE	5,935.06	NO
2013	39,626.31	21,800.11	4.99	11,711.31	NE	6,109.90	NO
2014	41,405.88	22,727.70	6.66	12,287.95	NE	6,383.56	NO
2015	41,572.60	22,547.15	6.34	12,359.07	NE	6,660.04	NO
2016	43,650.47	24,438.70	6.41	12,275.32	NE	6,930.03	NO
2017	44,142.25	24,791.04	5.72	12,113.80	NE	7,231.69	NO
2018	44,288.83	24,782.67	4.31	12,061.76	NE	7,440.09	NO
2019	43,420.98	23,551.86	5.60	12,196.71	NE	7,666.81	NO
2020	42,685.12	22,322.74	6.37	12,433.64	NE	7,922.38	NO
Trend							
1990 - 2020	86.0%	74.5%	-65.8%	68,5%	NA	187.0%	NA
2005 - 2020	19.4%	0.1%	-8.9%	42,0%	NA	68.6%	NA
2019 - 2020	-1.7%	-5.2%	13.8%	1,9%	NA	3.3%	NA
Share in National total							
1990		55.7%	0.1%	32.2%	NA	12.0%	NA
2005		62.4%	0.0%	24.5%	NA	13.1%	NA
2020		52.3%	0.0%	29.1%	NA	18.6%	NA

2.1.4 N_2O emissions

Algeria's total N_2O emissions are estimated to be 8,784.23 kt CO_2 equivalent in 2020.

- Compared to 1990, where the N_2O emissions amounted to 4,930.38 kt CO_2 equivalent, N_2O emissions increased by 78.2%.
- Compared to 2005, where the N_2O emissions are estimated to 6,099.49 kt CO_2 equivalent, N_2O emissions increased by 44.0%.
- Compared to 2019, where the N_2O emissions are estimated to be 8,795.83 kt CO_2 equivalent, N_2O emissions decreased by 0.1%.

The following table presents Algeria's N_2O emissions by sector for the period 1990 – 2020.

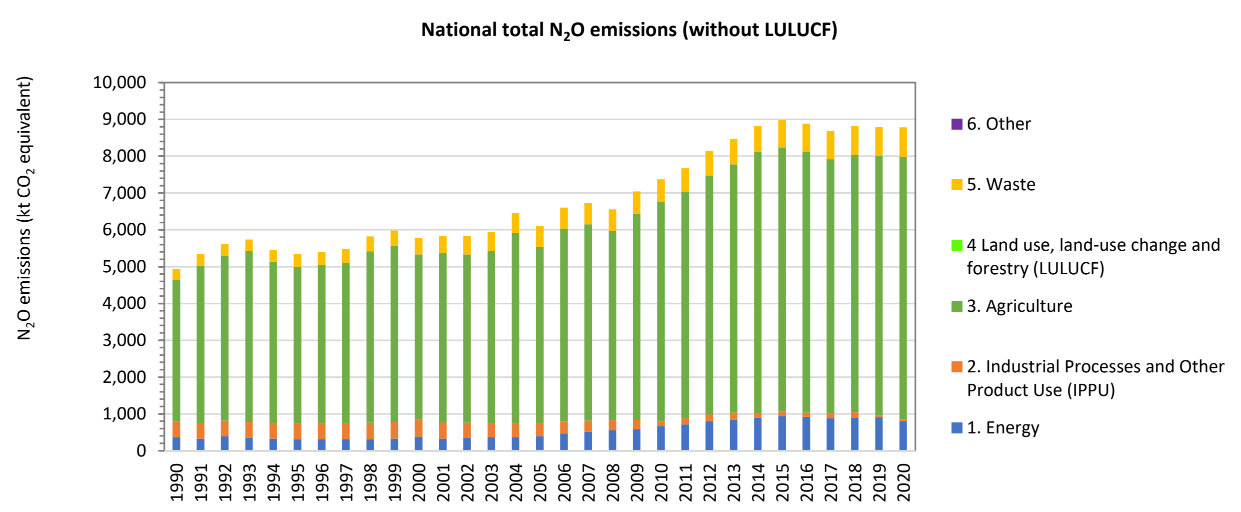


Figure 27 **National total N_2O emission by sector**

The following figures present Trend of National Total GHG emissions by IPCC sector in index form (base year = 100).

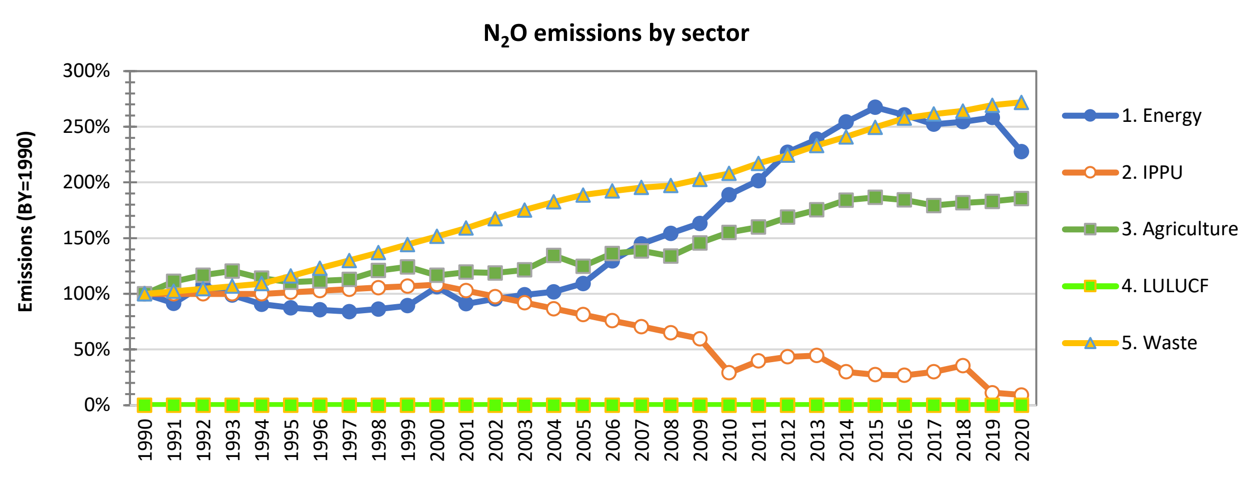


Figure 28 **Trend of National Total N_2O emissions by IPCC sector in index form (base year = 100)**

Table 47 N_2O (in kt) emissions by IPCC sector.

N_2O	Total N_2O	1	2	3	4	5	6
		Energy	IPPU	Agriculture	LULUCF	Waste	Other
	kt						
1990	16.54	1.20	1.44	12.92	NE	0.99	NO
1991	17.91	1.10	1.44	14.36	NE	1.01	NO
1992	18.84	1.30	1.44	15.08	NE	1.03	NO
1993	19.24	1.19	1.44	15.56	NE	1.06	NO
1994	18.32	1.09	1.44	14.72	NE	1.08	NO
1995	17.92	1.05	1.46	14.27	NE	1.15	NO
1996	18.13	1.03	1.48	14.40	NE	1.22	NO
1997	18.38	1.02	1.50	14,58	NE	1.28	NO
1998	19.52	1.04	1.52	15.61	NE	1.35	NO
1999	20.08	1.08	1.53	16.03	NE	1.43	NO
2000	19.40	1.29	1.55	15.06	NE	1.50	NO
2001	19.58	1.10	1.48	15.42	NE	1.57	NO
2002	19.55	1.16	1.40	15.34	NE	1.66	NO
2003	19.95	1.20	1.32	15.69	NE	1.73	NO
2004	21.64	1.23	1.24	17.37	NE	1.81	NO
2005	20.47	1.32	1.17	16.12	NE	1.87	NO
2006	22.15	1.56	1.09	17.61	NE	1.90	NO
2007	22.57	1.74	1.01	17.89	NE	1.93	NO
2008	22.00	1.84	0.93	17.27	NE	1.95	NO
2009	23.64	1.95	0.86	18.82	NE	2.01	NO
2010	24.74	2.24	0.42	20.03	NE	2.06	NO
2011	25.76	2.38	0.57	20.66	NE	2.15	NO
2012	27.33	2.69	0.62	21.80	NE	2.22	NO
2013	28.42	2.82	0.64	22.65	NE	2.31	NO
2014	29.60	3.01	0.43	23.78	NE	2.38	NO
2015	30.13	3.16	0.39	24.11	NE	2.47	NO
2016	29.82	3.08	0.38	23.81	NE	2.55	NO
2017	29.15	2.98	0.43	23.16	NE	2.58	NO
2018	29.60	3.01	0.51	23.46	NE	2.61	NO
2019	29.52	3.05	0.16	23.64	NE	2.66	NO
2020	29.48	2.69	0.13	23.97	NE	2.69	NO
Trend							
1990 - 2020	78.2%	124.1%	-90.8%	85.5%	NA	171.9%	NA
2005 - 2020	44.0%	104.7%	-88.7%	48.7%	NA	44.1%	NA
2019 - 2020	-0.1%	-11.8%	-17.0%	1.4%	NA	0.9%	NA
Share in National total							
1990		7.3%	8.7%	78.1%	NA	6.0%	NA
2005		6.4%	5.7%	78.8%	NA	9.1%	NA
2020		9.1%	0.4%	81.3%	NA	9.1%	NA

Table 48 N_2O emissions (in kt CO_2 equivalent) by IPCC sector.

N_2O	**Total N_2O**	**1**	**2**	**3**	**4**	**5**	**6**
		Energy	**IPPU**	**Agriculture**	**LULUCF**	**Waste**	**Other**
	Kt CO_2 equivalent						
1990	4,930.38	358.01	427.99	3,849.77	NE	294.61	NO
1991	5,336.03	328.13	427.99	4,278.62	NE	301.30	NO
1992	5,614.78	386.37	427.99	4,492.38	NE	308.04	NO
1993	5,734.40	354.20	427.99	4,637.51	NE	314.70	NO
1994	5,460.80	324.89	427.99	4,386.54	NE	321.38	NO
1995	5,340.54	313.25	433.86	4,251.49	NE	341.93	NO
1996	5,401.63	306.95	439.74	4,292.62	NE	362.32	NO
1997	5,478.21	304.07	445.62	4,345.66	NE	382.86	NO
1998	5,818.15	311.41	451.50	4,651.59	NE	403.65	NO
1999	5,983.10	322.83	457.38	4,778.01	NE	424.88	NO
2000	5,780.35	383.07	463.25	4,487.57	NE	446.46	NO
2001	5,833.98	329.01	440.16	4,596.13	NE	468.68	NO
2002	5,826.78	344.81	417.07	4,571.57	NE	493.34	NO
2003	5,944.26	358.38	393.97	4,675.48	NE	516.43	NO
2004	6,450.01	366.06	370.88	5,175.17	NE	537.90	NO
2005	6,099.49	391.93	347.78	4,803.81	NE	555.97	NO
2006	6,601.18	463.56	324.69	5,246.36	NE	566.57	NO
2007	6,725.17	517.22	301.59	5,330.55	NE	575.81	NO
2008	6,556.52	549.24	278.50	5,147.88	NE	580.90	NO
2009	7,043.44	580.96	255.41	5,609.51	NE	597.56	NO
2010	7,373.90	666.20	124.46	5,970.41	NE	612.83	NO
2011	7,675.97	710.59	170.21	6,155.52	NE	639.65	NO
2012	8,143.47	800.54	186.12	6,495.68	NE	661.13	NO
2013	8,469.77	841.48	190.61	6,750.75	NE	686.92	NO
2014	8,821.53	895.92	128.41	7,087.50	NE	709.71	NO
2015	8,979.32	942.33	117.40	7,184.43	NE	735.16	NO
2016	8,886.28	918.26	114.51	7,094.38	NE	759.13	NO
2017	8,687.87	889.09	128.02	6,900.48	NE	770.28	NO
2018	8,819.83	897.12	152.02	6,992.46	NE	778.24	NO
2019	8,796.39	910.46	47.50	7,044.98	NE	793.46	NO
2020	8,784.73	802.79	39.41	7,141.61	NE	800.93	NO
Trend							
1990 - 2020	78.2%	124.2%	-90.8%	85.5%	NA	171.9%	NA
2005 - 2020	44.0%	104.8%	-88.7%	48.7%	NA	44.1%	NA
2019 - 2020	-0.1%	-11.8%	-17.0%	1.4%	NA	0.9%	NA
Share in National total							
1990		7.3%	8.7%	78.1%	NA	6.0%	NA
2005		6.4%	5.7%	78.8%	NA	9.1%	NA
2020		9.1%	0.4%	81.3%	NA	9.1%	NA

2.1.5 SF_6 emissions

Algeria’s total SF_6 emissions were estimated to be 36.19 kt CO_2 equivalent in 2020.

- Compared to 1990, where the SF_6 emissions amounted to 0.16 kt CO_2 equivalent, SF_6 emissions increased by 22950%.
- Compared to 2005, where the SF_6 emissions are estimated to be 1.24 kt CO_2 equivalent, SF_6 emissions increased by 2827%.
- Compared to 2019, where the SF_6 emissions were estimated to be 29.34 kt CO_2 equivalent, SF_6 emissions increased by 23%.

The significant increase of SF6 emissions is mainly due to lack of data from compagnies and some inconsistent data provided by other national companies such as GRTE company. Activities are planned in the NIIP to collect better data from companies. Extrapolation used to complete the time series is based only on electricity production from 2010 back to 1990 which needs to be improved using the number of equipment installed and their SF6 capacities.

The increase is also due to decommissioning of electrical equipment containing SF_6 from the distribution and transmission network after about 35 years of lifetime.

2.1.6 HFC emissions

Algeria’s total HFC emissions are estimated to 1,206.05 kt CO_2 equivalent in 2020.

- Compared to 1994, where the HFC emissions were estimated to be 0.69 kt CO_2 equivalent, HFC emissions increased by 175305%.
- Compared to 2005, where the HFC emissions amounted to 28.60 kt CO_2 equivalent, HFC emissions increased by 4118%.
- Compared to 2019, where the HFC emissions were estimated to be 1,111.67 kt CO_2 equivalent, HFC emissions increased by 8%.

The significant increase of emissions is due to decommissioning of equipment / units in the refrigeration segment containing HFC after about 16 years of lifetime.

2.1.7 PFC emissions

PFC emissions are not estimated due to lack of data and resources in this inventory preparation cycle.

2.1.8 NF_3 emissions

NF_3 emissions are not estimated due to lack of data and resources in this inventory preparation cycle.

Table 49 SF_6 and HFC emissions (in kt CO_2 equivalent) by IPCC sector.

SF_6	**Total SF_6**	**Total HFC**	**Total PFC**	**Total NF3**
	kt CO_2 equivalent			
1990	0.16	NA	NE	NE
1991	0.18	NA	NE	NE
1992	0.21	NA	NE	NE
1993	0.24	NA	NE	NE
1994	0.27	0.69	NE	NE
1995	0.31	1.22	NE	NE
1996	0.34	2.12	NE	NE
1997	0.39	3.09	NE	NE
1998	0.43	4.20	NE	NE
1999	0.49	5.71	NE	NE
2000	0.56	6.76	NE	NE
2001	0.63	7.68	NE	NE
2002	0.70	10.65	NE	NE
2003	0.77	14.38	NE	NE
2004	0.84	19.79	NE	NE
2005	1.24	28.60	NE	NE
2006	1.70	38.72	NE	NE
2007	2.23	50.63	NE	NE
2008	2.82	59.90	NE	NE
2009	3.49	71.72	NE	NE
2010	4.26	224.30	NE	NE
2011	5.17	291.73	NE	NE
2012	6.29	413.40	NE	NE
2013	7.73	528.56	NE	NE
2014	9.53	654.74	NE	NE
2015	11.82	1,076.51	NE	NE
2016	14.83	1,167.40	NE	NE
2017	18.70	1,040.16	NE	NE
2018	23.52	1,191.00	NE	NE
2019	29.34	1,111.67	NE	NE
2020	36.19	1,206.05	NE	NE
Trend				
1990 - 2020	22,950.1%	NA	NA	NA
2005 - 2020	2,826.9%	4,117.6%	NA	NA
2019 - 2020	23.3%	8.5%	NA	NA
Share in National total				
1990	100% from sector 2 IPPU	100% from sector 2 IPPU		
2005				
2020				

2.2 Description of emission and removal trends by sector and by gas

2.2.1 Energy

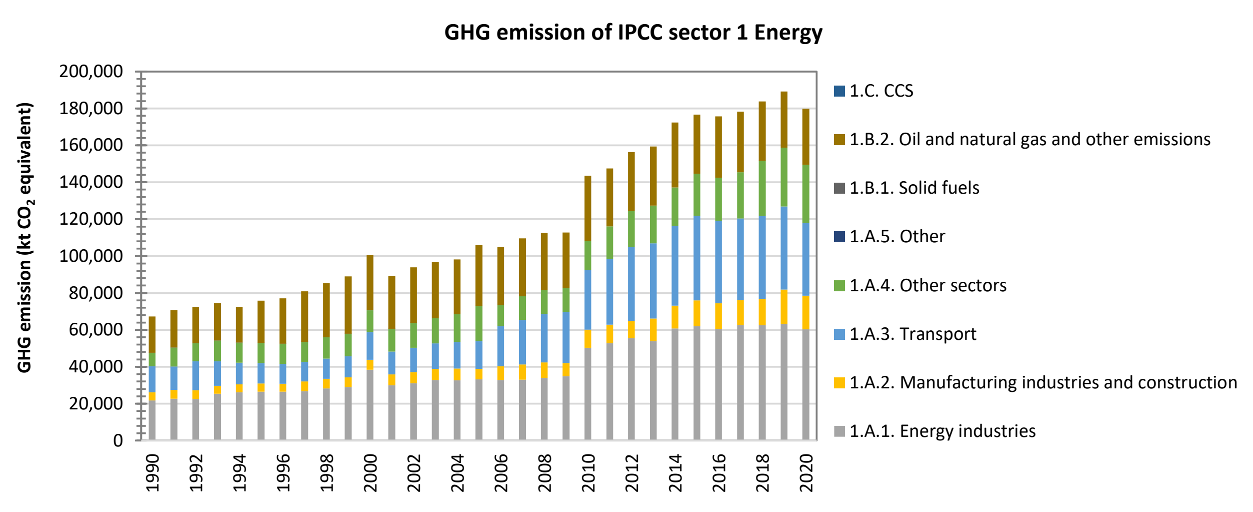


Figure 29 **GHG emission from IPCC sector 1 Energy**

Emissions from the energy sector are the main source of GHGs in Algeria, In the year 2020, about 81.5 % of national total GHGs emissions and 93.3% of national total CO_2 emissions from Algeria arose from the energy sector.

Emissions from the energy sector increased by 166.3 % from 67,471.69 kt CO_2 equivalents in 1990 to 179,671.10 kt CO_2 equivalents in 2020, which is mainly due to the increase in emissions from the energy industries with the increase in national and international energy demand (population increase, residential sector,...), while emissions from the transport sector also increased with the increase in the number of vehicles on the one hand and the high share of diesel on the other.

Total emissions from energy mainly consist of CO_2 whereas N_2O and CH_4 emissions only make up about 0.4% and 12.4%, respectively. The increase in N_2O emissions is primarily due the increasing activity of transport. The increase of CH_4 emissions is mainly due to increased natural gas and oil activities. CO_2 emissions have increased significantly during the period 1990-2020, from 47,840.14 kt to 149,246.58 kt, which is an increase of 212.0%. Between 2005 and 2020, the emissions increased by 103.8%. However, CO_2 emissions decreased by 5.9% from 2019 to 2020, emissions associated to public electricity production increased mainly due to higher power generation from gas turbine power plants. Emissions from road transport increased as a result of higher diesel and gasoline fuel sales due to 176.8%. Between 1990 and 2020. In the year 2020, emissions from households (1.A.4.b.i) increased by 1.3% due to higher heating demand (heating degree days were higher than in 2019).

The figure 29 above, illustrates the share of greenhouse gases emissions (CO_2, CH_4 and N_2O) from IPCC sector 1 Energy. In 1990, the share of CH_4 emission in total GHG emissions was 24.0%, which was mainly due to activities of natural gas exploration, processing, transmission, and distribution (1.B.2.b). In 2005, the share of CH_4 emissions increased to 24.5.0% due to increased natural gas consumption, export and the consumption of liquid fuels in 1.A.4 Other sectors (institutional/Households, agriculture). After the natural gas distribution network extension in 2006, high number of households switched to use of natural gas for heating resulting in a significant decrease of the liquid fuels consumption. In 2020, the share of CH_4 emission in total GHG emissions decreased significantly to 19.3% which is mainly a result of significant increase of CO_2 emissions from 1.A Fuel combustion (1990: 47,840.14 kt CO_2 equivalent; 2020: 149,246.58 kt CO_2 equivalent) whereas the CH_4 emissions from 1.B.2 did not increase in the same way/level during the same period (1990: 19,631.55 kt CO_2 equivalent; 2020: 30,424.51kt CO_2 equivalent).

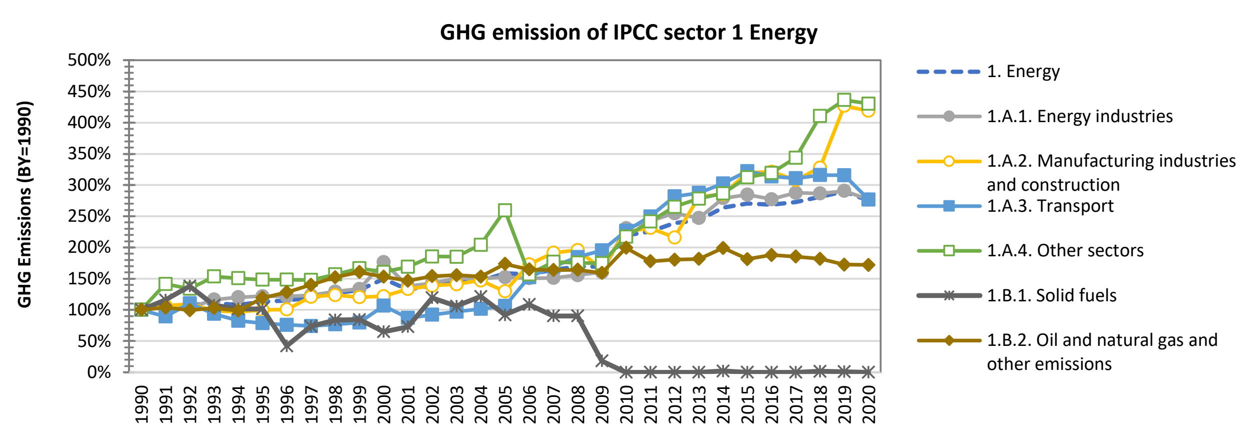


Figure 30 **Trend of GHG emissions in IPCC sector 1 Energy by IPCC category in index form (base year = 1990)**

Table 50 GHG emissions from IPCC sector 1 Energy.

	1	**1.A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	1.B.1	1.B.2	1.C
GHG	**Energy**	Fuel combustion	Energy industries	Manufacturing industries and con-struction	Transport	Other sectors	Other	Fugitive emissions	Solid fuels	Oil and natural gas and other emissions	CCS
	kt CO_2 equivalent										
1990	67,471.69	47,840.14	21,799.48	4,344.70	14,214.35	7,481.62	NE	19,631.55	0.77	19,630.79	NO
1991	71,209.53	50,885.62	22,775.04	4,628.60	12,683.30	10,798.68	NE	20,323.91	0.89	20,323.03	NO
1992	72,811.45	53,123.22	22,537.02	4,754.53	15,682.13	10,149.54	NE	19,688.23	1.06	19,687.17	NO
1993	74,976.96	54,611.20	25,409.91	4,286.99	13,306.50	11,607.80	NE	20,365.76	0.82	20,364.94	NO
1994	72,812.40	53,516.37	26,200.44	4,204.04	11,741.92	11,369.97	NE	19,296.03	0.78	19,295.25	NO
1995	76,091.77	53,276.45	26,585.69	4,338.36	11,181.53	11,170.86	NE	22,815.32	0.78	22,814.54	NO
1996	77,381.83	52,804.56	26,457.63	4,365.92	10,807.38	11,173.63	NE	24,577.28	0.32	24,576.95	NO
1997	81,228.53	53,752.06	26,852.17	5,244.64	10,521.25	11,134.02	NE	27,476.46	0.56	27,475.90	NO
1998	85,688.52	56,283.72	28,187.03	5,371.38	10,911.32	11,813.99	NE	29,404.80	0.64	29,404.16	NO
1999	89,329.81	58,184.66	29,108.34	5,210.43	11,341.41	12,524.48	NE	31,145.15	0.65	31,144.50	NO
2000	101,081.04	71,014.87	38,449.96	5,290.01	15,157.17	12,117.72	NE	30,066.17	0.50	30,065.68	NO
2001	89,629.12	60,868.31	30,059.99	5,784.82	12,353.30	12,670.20	NE	28,760.81	0.56	28,760.25	NO
2002	94,240.60	64,128.76	31,125.79	6,022.84	13,091.09	13,889.04	NE	30,111.85	0.91	30,110.93	NO
2003	97,219.84	66,574.15	32,820.70	6,114.93	13,795.47	13,843.05	NE	30,645.69	0.81	30,644.88	NO
2004	98,562.94	68,853.39	32,700.59	6,389.75	14,442.77	15,320.27	NE	29,709.55	0.93	29,708.62	NO
2005	106,279.03	73,230.10	33,202.12	5,623.14	15,111.41	19,293.43	NE	33,048.93	0.70	33,048.23	NO
2006	105,211.76	73,720.88	32,848.80	7,497.19	21,636.05	11,738.84	NE	31,490.88	0.83	31,490.05	NO
2007	109,832.69	78,426.93	32,939.22	8,284.59	24,040.37	13,162.76	NE	31,405.76	0.69	31,405.06	NO
2008	112,689.69	81,623.67	33,896.77	8,441.16	26,228.69	13,057.05	NE	31,066.02	0.69	31,065.33	NO
2009	112,985.99	82,866.92	34,932.38	7,069.85	27,725.33	13,139.35	NE	30,119.07	0.14	30,118.93	NO
2010	143,726.69	108,445.00	50,346.66	9,644.44	32,197.65	16,256.25	NE	35,281.68	NE	35,281.68	NO
2011	147,715.58	116,227.75	52,813.84	9,894.99	35,511.14	18,007.77	NE	31,487.83	NE	31,487.83	NO
2012	156,558.90	124,628.66	55,552.24	9,307.94	40,062.23	19,706.25	NE	31,930.24	NE	31,930.24	NO
2013	159,631.17	127,500.52	53,872.58	12,145.64	40,864.60	20,617.70	NE	32,130.66	NE	32,130.66	NO
2014	172,599.85	137,337.64	60,805.73	12,326.15	43,001.00	21,204.77	NE	35,262.21	0.02	35,262.19	NO

	1	1.A	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	1.B.1	1.B.2	1.C
GHG	**Energy**	Fuel combustion	Energy industries	Manufacturing industries and con-struction	Transport	Other sectors	Other	Fugitive emissions	Solid fuels	Oil and natural gas and other emissions	CCS
	kt CO_2 equivalent										
2015	176,823.98	144,716.83	62,030.64	13,799.72	45,808.43	23,078.04	NE	32,107.14	NE	32,107.14	NO
2016	175,740.02	142,483.01	60,456.12	13,871.71	44,621.24	23,533.95	NE	33,257.01	NE	33,257.01	NO
2017	178,257.62	145,478.11	62,721.73	13,284.66	44,189.71	25,282.00	NE	32,779.51	NE	32,779.51	NO
2018	183,763.48	151,590.99	62,456.90	14,128.14	44,902.00	30,103.96	NE	32,172.49	0.01	32,172.48	NO
2019	189,154.71	158,623.53	63,362.84	18,413.42	44,883.01	31,964.27	NE	30,531.18	0.01	30,531.17	NO
2020	179,671.10	149,246.58	60,336.12	18,036.67	39,353.33	31,520.46	NE	30,424.51	NE	30,424.51	NO
Trend											
1990 - 2020	166.3%	212.0%	176.8%	315.1%	176.9%	321.3%	NA	55.0%	NA	55.0%	NA
2005 - 2020	69.1%	103.8%	81.7%	220.8%	160.4%	63.4%	NA	-7.9%	NA	-7.9%	NA
2019 - 2020	-5.0%	-5.9%	-4.8%	-2.0%	-12.3%	-1.4%	NA	-0.3%	NA	-0.3%	NA
Share in National total											
1990	70.3%	49.9%	22.7%	4.5%	14.8%	7.8%	NA	20.5%	0.0%	20.5%	NA
2005	72.5%	50.0%	22.7%	3.9%	10.3%	13.2%	NA	22.6%	0.0%	22.6%	NA
2020	81.5%	67.7%	27.4%	8.2%	17.8%	14.3%	NA	13.8%	NA	13.8%	NA

2.2.2 Industrial Processes and Other Product Use (IPPU)

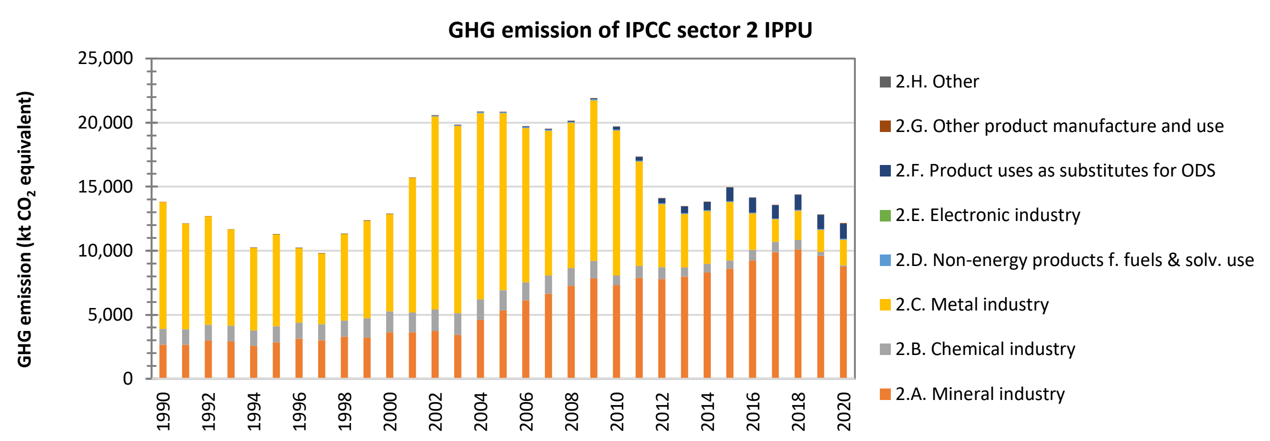


Figure 31 GHG emission from IPCC sector 2 Industrial Processes and Other Product Use (IPPU)

Emissions from the IPCC sector 2 Industrial Processes and Product Use (IPPU) decreased by 11.8% from 13,791.41 kt CO_2 equivalents in 1990 to 12,166.30 kt CO_2 equivalents in 2020, which is mainly caused by increasing emissions from mineral and metal industry, particularly cement, zinc and Iron and Steel production.

Algeria's greenhouse gas emissions from IPCC sector 2 *Industrial Processes and Product Use (IPPU)* were estimated to be 12,166.30 kt CO_2 equivalents in 2020 and 13,791.41 kt CO_2 equivalents in 1990. Compared to 1990 GHG emissions decreased by 11.8%, compared to 2005 GHG emissions decreased by 41.6%, compared to 2019 GHG emissions decreased by 5.2%.

The general trend is marked by significant dips and jumps due to the

- Increase of production after 1999
- world economic crisis (2009)
- increased production of cement and zinc
- reduction of export of e.g., zinc
- change of technology in iron & steel industry
- worldwide pandemic and the national economic downturn due to COVID19.

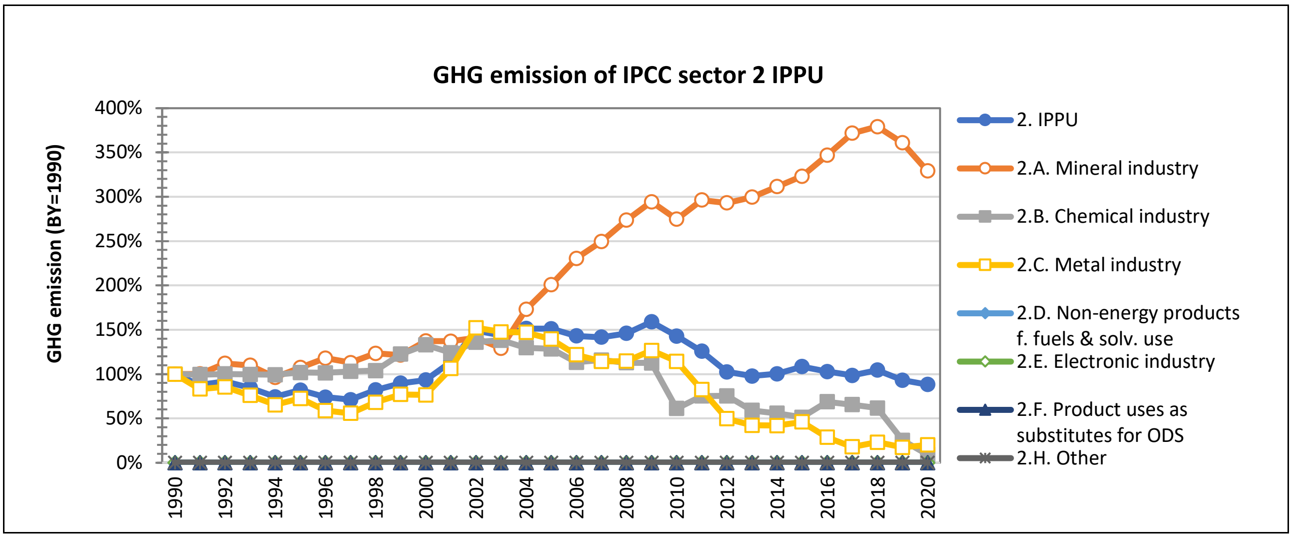


Figure 32 Trend of GHG emissions in IPCC sector 2 IPPU by IPCC category in index form (base year = 1990)

Table 51 GHG emissions from IPCC sector 2 Industrial Processes and Other Product Use (IPPU).

	2	2.A	2.B	2.C	2.D	2.E	2.F	2.G	2.H
GHG	**IPPU**	Mineral industry	Chemical industry	Metal industry	Non-energy products f. fuels & solv. use	Electronic industry	Product uses as substitutes for ODS	Other product manufacture and use	Other
	kt CO_2 equivalent								
1990	13,791.41	2,660.95	1,226.61	9,903.69	IE	NA	NA	0.16	NA
1991	12,116.32	2,661.19	1,217.88	8,237.07	IE	NA	NA	0.18	NA
1992	12,671.39	2,981.50	1,227.99	8,461.69	IE	NA	NA	0.21	NA
1993	11,662.56	2,922.80	1,220.06	7,519.46	IE	NA	NA	0.24	NA
1994	10,238.08	2,562.19	1,217.30	6,457.64	IE	NA	0.69	0.27	NA
1995	11,281.45	2,853.81	1,246.60	7,179.51	IE	NA	1.22	0.31	NA
1996	10,200.17	3,136.17	1,244.04	5,817.50	IE	NA	2.12	0.34	NA
1997	9,792.48	3,005.18	1,263.38	5,520.45	IE	NA	3.09	0.39	NA
1998	11,315.39	3,283.40	1,275.00	6,752.34	IE	NA	4.20	0.43	NA
1999	12,359.18	3,228.19	1,501.94	7,622.85	IE	NA	5.71	0.49	NA
2000	12,866.49	3,650.17	1,631.06	7,577.95	IE	NA	6.76	0.56	NA
2001	15,690.85	3,648.86	1,522.55	10,511.13	IE	NA	7.68	0.63	NA
2002	20,576.90	3,742.90	1,668.25	15,081.88	72.52	NA	10.65	0.70	NA
2003	19,827.75	3,435.86	1,694.53	14,604.80	77.41	NA	14.38	0.77	NA
2004	20,858.68	4,599.98	1,591.27	14,553.53	93.27	NA	19.79	0.84	NA
2005	20,845.39	5,346.57	1,573.96	13,811.84	83.19	NA	28.60	1.24	NA
2006	19,713.67	6,133.88	1,388.60	12,062.93	87.85	NA	38.72	1.70	NA
2007	19,512.72	6,637.72	1,421.13	11,316.71	84.31	NA	50.63	2.23	NA
2008	20,131.36	7,276.83	1,382.75	11,339.48	69.57	NA	59.90	2.82	NA
2009	21,903.72	7,832.98	1,380.76	12,534.53	80.24	NA	71.72	3.49	NA
2010	19,695.67	7,310.01	750.17	11,317.78	89.15	NA	224.30	4.26	NA
2011	17,332.78	7,884.16	922.76	8,159.81	69.16	NA	291.73	5.17	NA
2012	14,116.12	7,796.00	923.69	4,917.78	58.96	NA	413.40	6.29	NA
2013	13,469.76	7,968.03	723.32	4,178.45	63.68	NA	528.56	7.73	NA
2014	13,838.12	8,288.39	684.66	4,135.94	64.86	NA	654.74	9.53	NA
2015	14,945.97	8,598.86	628.85	4,561.54	68.39	NA	1,076.51	11.82	NA
2016	14,173.09	9,228.53	843.59	2,847.99	70.75	NA	1,167.40	14.83	NA
2017	13,584.19	9,888.20	803.72	1,776.22	57.19	NA	1,040.16	18.70	NA
2018	14,405.40	10,086.06	756.00	2,286.91	61.91	NA	1,191.00	23.52	NA
2019	12,836.82	9,601.94	309.48	1,713.05	71.34	NA	1,111.67	29.34	NA
2020	12,166.30	8,755.03	113.90	1,992.63	62.50	NA	1,206.05	36.19	NA
Trend									
1990 - 2020	-11.8%	229.0%	-90.7%	-79.9%	NA	NA	NA	22950.1%	NA
2005 - 2020	-41.6%	63.8%	-92.8%	-85.6%	-24.9%	NA	4117.6%	2826.9%	NA
2019 - 2020	-5.2%	-8.8%	-63.2%	16.3%	-12.4%	NA	8.5%	23.3%	NA
Share in National total									
1990	14.4%	2.8%	1.3%	10.3%	NA	NA	NA	0.0%	NA
2005	14.3%	3.7%	1.1%	9.5%	0.1%	NA	0.0%	0.0%	NA
2020	5.5%	4.0%	0.1%	0.9%	0.0%	NA	0.5%	0.0%	NA

2.2.3 Agriculture

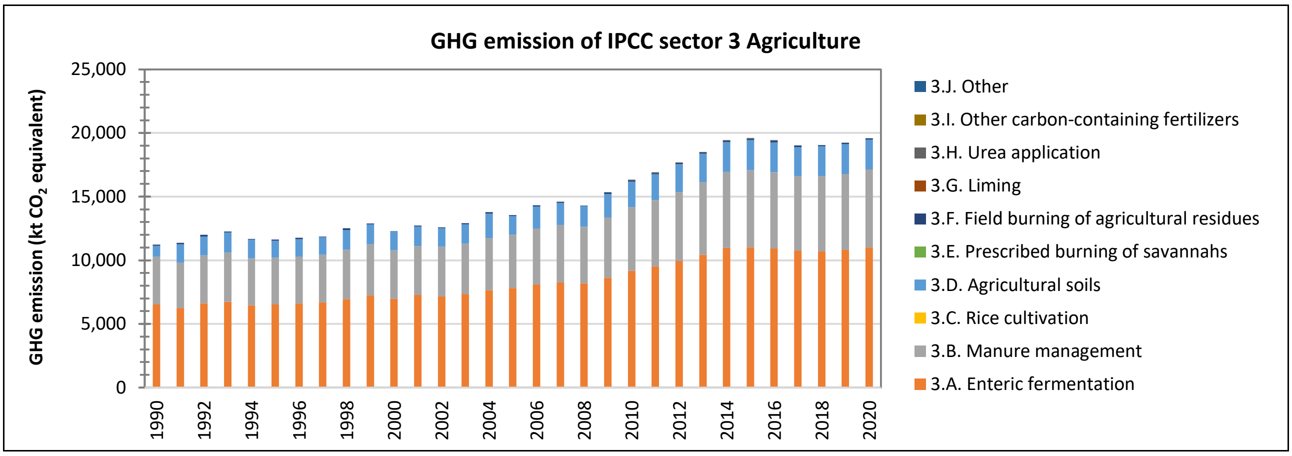


Figure 33 **GHG emission from IPCC sector 3 Agriculture**

GHG Emissions from the IPCC sector 3 *Agriculture* increased by 74.3% from 11,230.85 Kt CO_2 equivalents to 19,575.24 Kt CO_2 equivalents during the period 1990 to 2020. The CH_4 emissions from IPCC category 3.A *Enteric fermentation* were the most significant source of IPCC sector 3 *Agriculture*, which increased by 68.6% from 6,523.74 kt CO_2 equivalents in 1990 to 10,998.49 kt CO_2 equivalents in 2020. The GHG emissions from Agriculture sector are about 8.9% of total greenhouse gas emissions in Algeria in 2020 and 11.7% in 1990. In the period, 2005 to 2020 GHG emissions from the agriculture sector increased by 40.8% and in the period 2019 to 2020 GHG emissions from Agriculture sector decreased by 1.8%.

The major GHG emitted from this sector is CH_4, which represents 63.51% of all emissions from this sector in 2020, followed by N_2O with 34.48% and CO_2 with 0.34%. Here, the most important driving forces are the increasing livestock numbers imported and the increasing intensive livestock farming with high milk and meat production according to the National Strategy for improving food security and agricultural development introduced by the government.

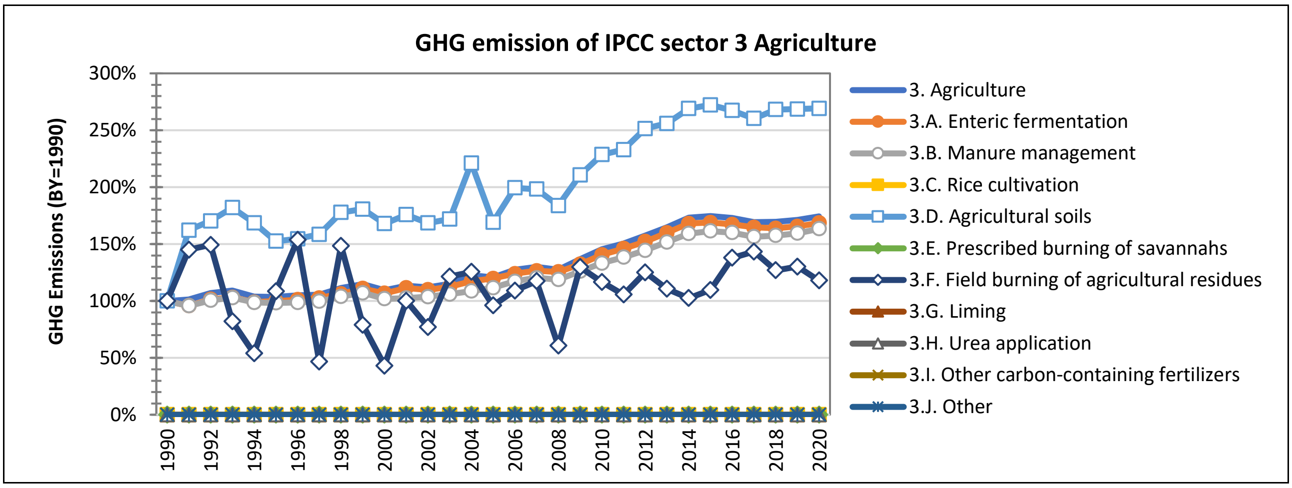


Figure 34 **Trend of GHG emissions in IPCC sector 3 Agriculture by IPCC category in index form (base year= 1990)**

Table 52 GHG emissions from IPCC sector 3 Agriculture.

	3	3.A	3.B	3.C	3.D	3.E	3.F	3.G	3.H	3.I	3.J
GHG	**Agriculture**	Enteric fermentation	Manure management	Rice cultivation	Agricultural soils	Prescribed burning of savannahs	Field burning agricultural residues	Liming	Urea application	Other carbon-containing fertilizers	Other
	kt CO_2 equivalent										
1990	**11,230.85**	6,523.74	3,747.65	NA	872.95	NA	86.50	NO	NE	NA	NA
1991	**11,377.41**	6,245.40	3,590.06	NA	1,416.49	NA	125.46	NO	NE	NA	NA
1992	**12,002.50**	6,617.61	3,768.34	NA	1,487.43	NA	129.12	NO	NE	NA	NA
1993	**12,258.14**	6,737.64	3,859.99	NA	1,589.49	NA	71.02	NO	NE	NA	NA
1994	**11,680.50**	6,458.42	3,702.41	NA	1,473.06	NA	46.62	NO	NE	NA	NA
1995	**11,627.16**	6,514.52	3,687.49	NA	1,331.41	NA	93.75	NO	NE	NA	NA
1996	**11,777.04**	6,595.88	3,698.37	NA	1,349.72	NA	133.07	NO	NE	NA	NA
1997	**11,862.36**	6,698.23	3,739.87	NA	1,383.94	NA	40.31	NO	NE	NA	NA
1998	**12,514.68**	6,935.69	3,897.75	NA	1,552.81	NA	128.43	NO	NE	NA	NA
1999	**12,897.41**	7,237.19	4,014.45	NA	1,577.37	NA	68.40	NO	NE	NA	NA
2000	**12,288.63**	6,963.58	3,821.04	NA	1,466.63	NA	37.37	NO	NE	NA	NA
2001	**12,738.10**	7,271.54	3,845.32	NA	1,534.59	NA	86.65	NO	NE	NA	NA
2002	**12,594.68**	7,167.77	3,889.16	NA	1,470.97	NA	66.77	NO	NE	NA	NA
2003	**12,917.22**	7,337.03	3,972.70	NA	1,502.45	NA	105.04	NO	NE	NA	NA
2004	**13,773.12**	7,660.08	4,073.68	NA	1,930.70	NA	108.65	NO	NE	NA	NA
2005	**13,558.66**	7,812.72	4,184.90	NA	1,477.98	NA	83.06	NO	NE	NA	NA
2006	**14,319.76**	8,089.87	4,394.16	NA	1,741.31	NA	94.42	NO	NE	NA	NA
2007	**14,600.43**	8,258.17	4,509.90	NA	1,730.81	NA	101.56	NO	NE	NA	NA
2008	**14,300.68**	8,187.72	4,454.97	NA	1,605.50	NA	52.49	NO	NE	NA	NA
2009	**15,359.38**	8,635.15	4,728.35	NA	1,839.10	NA	112.25	NO	44.53	NA	NA
2010	**16,327.75**	9,172.44	4,994.96	NA	1,996.13	NA	100.95	NO	63.27	NA	NA
2011	**16,907.35**	9,532.42	5,190.02	NA	2,034.07	NA	91.34	NO	59.50	NA	NA
2012	**17,696.15**	9,931.82	5,414.63	NA	2,196.03	NA	108.21	NO	45.47	NA	NA
2013	**18,506.06**	10,439.89	5,691.68	NA	2,234.75	NA	95.74	NO	44.00	NA	NA
2014	**19,442.91**	10,968.58	5,969.75	NA	2,348.47	NA	88.64	NO	67.47	NA	NA
2015	**19,610.96**	11,018.95	6,051.84	NA	2,377.80	NA	94.91	NO	67.47	NA	NA
2016	**19,437.17**	10,916.70	5,998.89	NA	2,334.82	NA	119.30	NO	67.47	NA	NA
2017	**19,014.28**	10,751.56	5,866.21	NA	2,272.45	NA	124.05	NO	NE	NA	NA
2018	**19,054.22**	10,697.05	5,905.53	NA	2,341.85	NA	109.79	NO	NE	NA	NA
2019	**19,241.69**	10,805.37	5,977.82	NA	2,345.90	NA	112.60	NO	NE	NA	NA
2020	**19,575.24**	10,998.49	6,124.74	NA	2,349.92	NA	102.10	NO	NE	NA	NA
Trend											
1990 - 2020	**74.3%**	68.6%	63.4%	NA	169.2%	NA	18.0%	NA	NA	NA	NA
2005 - 2020	**44.4%**	40.8%	46.4%	NA	59.0%	NA	22.9%	NA	NA	NA	NA
2019 - 2020	**1.7%**	1.8%	2.5%	NA	0.2%	NA	-9.3%	NA	NA	NA	NA
Share in National total											
1990	**12.4%**	7.2%	4.1%	NA	1.0%	NA	0.1%	NA	NA	NA	NA
2005	**9.5%**	5.5%	2.9%	NA	1.0%	NA	0.1%	NA	NA	NA	NA
2020	**8.9%**	5.0%	2.8%	NA	1.1%	NA	0.0%	NA	NA	NA	NA

2.2.4 Land use, Land use change and Forestry (LULUCF)

Total GHG emissions and removals from IPCC sector 4 LULUCF amounted to -5,554.50kt CO_2 eq in 1990, then decreased to 5,675.52kt CO_2 eq in 2005 and decreased to 8,933.41 kt CO_2 eq in 2020. Except for the year 1994, where the GHG emissions from the IPCC sector 4 LULUCF amounted to 23,317.51 kt CO_2 eq, the IPCC sector 4 LULUCF was a net sink in Algeria: the range was -12,194.33 kt CO_2 eq in 2015 to -1,090.23 kt CO_2 eq in 2012.

The fluctuation in GHG emissions and removals from IPCC sector 4 LULUCF are mainly due to losses of carbon due to forest fires.

The IPCC sector 4 LULUCF is dominated by fluxes of CO_2. Emissions of CH_4 and N_2O contribute only marginally to the overall GHG balance of the sector LULUCF.

It must be noted that only GHG emissions from IPCC category 4.A.1 Forest remaining forest were estimated.

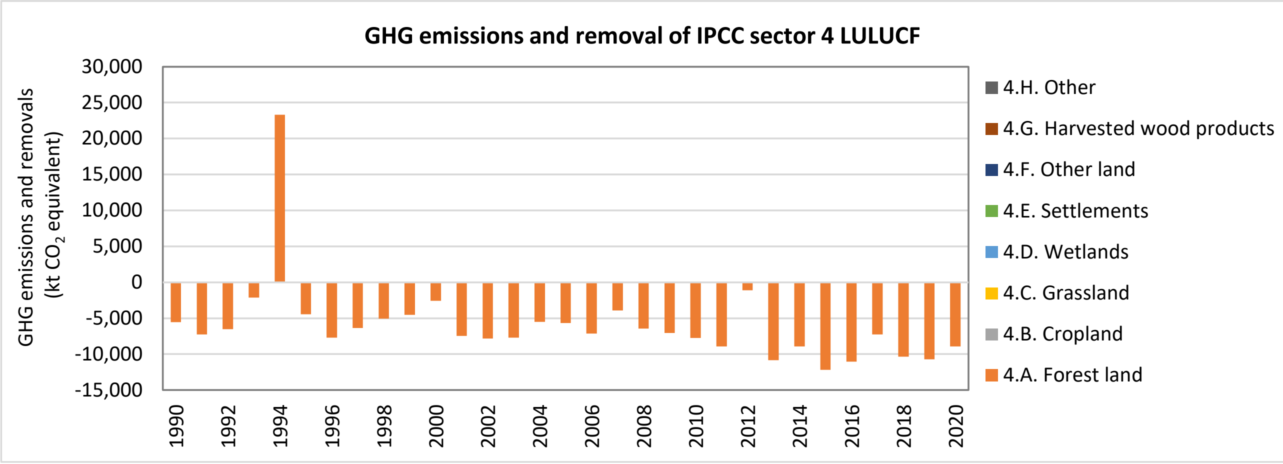


Figure 35 Total GHG emissions and removals by category of IPCC sector 4 LULUCF (1990-2020)

Table 53 GHG Emissions and removals from IPCC sector 4 LULUCF per category: 1990-2020

GHG emissions	4	4.A	4.B	4.C	4.D	4.E	4.F	4.G
	TOTLAL LULUCF	Total Forest land	Total Cropland	Total Grassland	Total Wetlands	Total Settlements	Total Other land	Harvested Wood Products (HWP)
	kt CO2 equivalent							
1990	-5,554.50	-5,554.50	NE	NE	NE	NE	NE	NE
1991	-7,242.99	-7,242.99	NE	NE	NE	NE	NE	NE
1992	-6,524.49	-6,524.49	NE	NE	NE	NE	NE	NE
1993	-2,144.59	-2,144.59	NE	NE	NE	NE	NE	NE
1994	23,317.51	23,317.51	NE	NE	NE	NE	NE	NE
1995	-4,437.96	-4,437.96	NE	NE	NE	NE	NE	NE
1996	-7,706.58	-7,706.58	NE	NE	NE	NE	NE	NE
1997	-6,344.83	-6,344.83	NE	NE	NE	NE	NE	NE
1998	-5,052.01	-5,052.01	NE	NE	NE	NE	NE	NE
1999	-4,540.33	-4,540.33	NE	NE	NE	NE	NE	NE
2000	-2,556.43	-2,556.43	NE	NE	NE	NE	NE	NE
2001	-7,446.68	-7,446.68	NE	NE	NE	NE	NE	NE
2002	-7,836.97	-7,836.97	NE	NE	NE	NE	NE	NE
2003	-7,682.83	-7,682.83	NE	NE	NE	NE	NE	NE
2004	-5,515.52	-5,515.52	NE	NE	NE	NE	NE	NE
2005	-5,675.52	-5,675.52	NE	NE	NE	NE	NE	NE
2006	-7,126.29	-7,126.29	NE	NE	NE	NE	NE	NE
2007	-3,897.41	-3,897.41	NE	NE	NE	NE	NE	NE
2008	-6,447.48	-6,447.48	NE	NE	NE	NE	NE	NE
2009	-7,052.46	-7,052.46	NE	NE	NE	NE	NE	NE
2010	-7,725.87	-7,725.87	NE	NE	NE	NE	NE	NE
2011	-8,924.84	-8,924.84	NE	NE	NE	NE	NE	NE
2012	-1,090.23	-1,090.23	NE	NE	NE	NE	NE	NE
2013	-10,838.35	-10,838.35	NE	NE	NE	NE	NE	NE
2014	-8,904.60	-8,904.60	NE	NE	NE	NE	NE	NE
2015	-12,194.33	-12,194.33	NE	NE	NE	NE	NE	NE
2016	-11,020.69	-11,020.69	NE	NE	NE	NE	NE	NE
2017	-7,234.71	-7,234.71	NE	NE	NE	NE	NE	NE
2018	-10,359.57	-10,359.57	NE	NE	NE	NE	NE	NE
2019	-10,707.34	-10,707.34	NE	NE	NE	NE	NE	NE
2020	-8,933.41	-8,933.41	NE	NE	NE	NE	NE	NE
Trend								
1990 - 2020	60.8%	60.8%	NA	NA	NA	NA	NA	NA
2005 - 2020	57.4%	57.4%	NA	NA	NA	NA	NA	NA
2019 - 2020	-16.6%	-16.6%	NA	NA	NA	NA	NA	NA

2.2.5 Waste

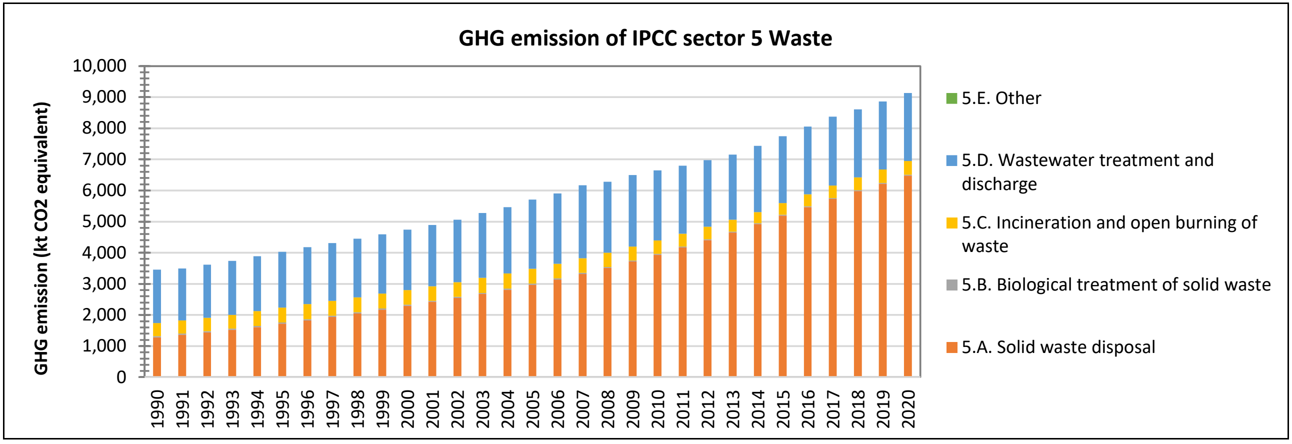


Figure 36 **GHG emission from IPCC sector 5 Waste**

Overall GHG emissions from management and treatment of solid waste and wastewater amounted to 3,454.82Kt CO_2 eq in 1990 and estimated to be 9,132.21Kt CO_2 eq in 2020. In 2020, GHG emissions from the waste sector were 164,33% above the level of 1990. The GHG emissions from waste sector are about 4.2% of total greenhouse gas emissions in Algeria in 2020 and 3.6% in 1990. In the period, 2005 to 2020 GHG emissions from the Waste sector increased by 60.0%. However, GHG emissions from the Waste sector decreased by 3.1%. over the period 2019 to 2020. The reasons for the significant increase in emissions are, on the one hand, the strong population growth and, on the other hand, the growing waste generation rate.

The major GHG emitted from this sector is CH_4, which represents 86.8% of all emissions from this sector in 2020, followed by N_2O with 8.8% and CO_2 with 4.5%.

CH_4 emissions from Waste sector amounted to 316.90 kt in 2020 which is 187.02% above the level of 1990 (110.41kt). CH_4 emissions originate from all sub-categories within this sector, but the largest source is 5.A Solid Waste Disposal, contributing 89.41% to total CH_4 emissions from this sector.

The increase of CH_4 emissions is a result of strong population growth and growing waste generation rate at the same time. The amount of landfilled waste increased significantly with still a high organic fraction within this waste. Furthermore, the high number of unmanaged landfill sites, where limited soil cover, poor waste compaction, high leachate levels, and other conditions, does not allow to control the landfill gas generation or methane recovery. The increasing number of habitants connected to septic tanks or cesspools contributed to the CH_4 emissions.

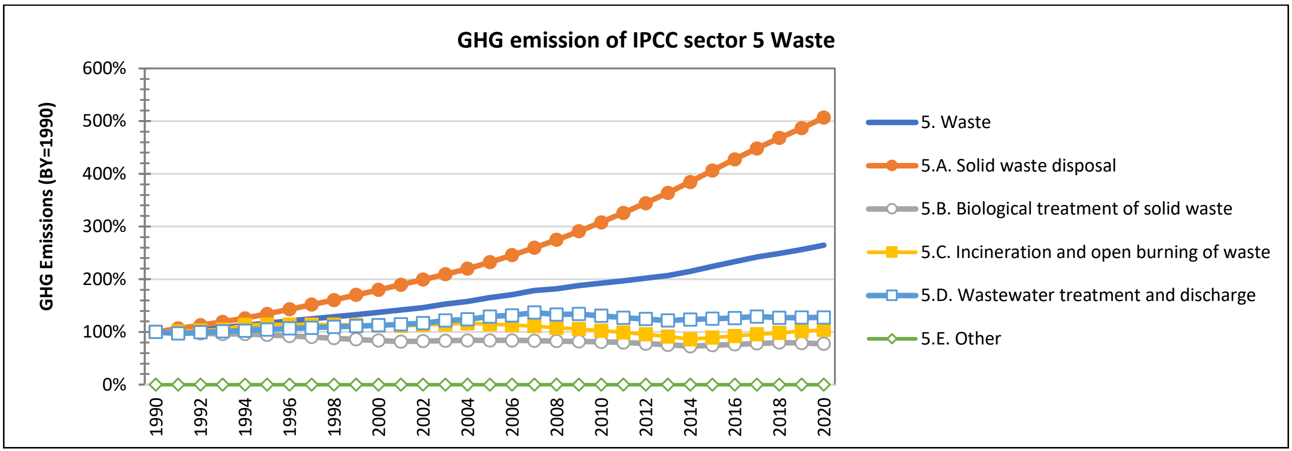


Figure 37 **Trend of GHG emissions in IPCC sector 5 Waste by IPCC category in index form (base year = 1990)**

Table 54 GHG emissions from IPCC sector 5 Waste.

	5	**5.A**	**5.B**	**5.C**	**5.D**	**5.E**
GHG	**Waste**	Solid waste disposal	Biological treatment of solid waste	Incineration and open burning of waste	Wastewater treatment and discharge	Other
	kt CO_2 equivalent					
1990	**3,454.82**	1,278.19	39.46	420.46	1,716.70	NO
1991	**3,495.04**	1,362.70	38.96	424.85	1,668.53	NO
1992	**3,617.75**	1,441.15	38.45	433.01	1,705.13	NO
1993	**3,735.21**	1,523.37	37.90	440.47	1,733.47	NO
1994	**3,884.40**	1,609.41	37.98	477.09	1,759.93	NO
1995	**4,033.24**	1,718.18	37.27	479.70	1,798.09	NO
1996	**4,174.98**	1,828.70	36.48	480.57	1,829.23	NO
1997	**4,312.50**	1,940.62	35.65	480.23	1,856.01	NO
1998	**4,451.45**	2,053.81	34.79	478.84	1,884.01	NO
1999	**4,595.33**	2,175.40	33.94	476.61	1,909.38	NO
2000	**4,738.64**	2,298.03	33.08	473.49	1,934.04	NO
2001	**4,890.65**	2,421.74	32.25	469.72	1,966.94	NO
2002	**5,058.06**	2,547.57	32.62	476.66	2,001.20	NO
2003	**5,281.39**	2,677.30	32.91	483.08	2,088.10	NO
2004	**5,463.65**	2,811.15	33.13	489.09	2,130.29	NO
2005	**5,707.73**	2,970.97	33.17	482.89	2,220.70	NO
2006	**5,905.90**	3,140.55	33.12	475.40	2,256.82	NO
2007	**6,169.31**	3,320.45	33.00	466.67	2,349.20	NO
2008	**6,282.86**	3,511.31	32.64	454.63	2,284.28	NO
2009	**6,492.79**	3,718.15	32.41	443.70	2,298.53	NO
2010	**6,644.27**	3,935.52	32.09	431.30	2,245.36	NO
2011	**6,796.20**	4,165.79	31.67	416.86	2,181.88	NO
2012	**6,971.82**	4,402.00	30.78	400.91	2,138.13	NO
2013	**7,155.99**	4,650.69	29.83	383.62	2,091.85	NO
2014	**7,432.16**	4,916.36	28.79	362.39	2,124.62	NO
2015	**7,746.10**	5,192.56	29.50	375.15	2,148.89	NO
2016	**8,052.22**	5,463.70	30.19	388.05	2,170.28	NO
2017	**8,377.25**	5,726.83	30.87	401.00	2,218.55	NO
2018	**8,605.51**	5,980.95	31.49	413.58	2,179.49	NO
2019	**8,860.28**	6,216.25	31.23	427.06	2,185.75	NO
2020	**9,132.21**	6,475.52	30.60	436.29	2,189.80	NO
Trend						
1990 - 2020	**164.3%**	406.6%	-22.5%	3.8%	27.6%	NA
2005 - 2020	**60.0%**	118.0%	-7.7%	-9.6%	-1.4%	NA
2019 - 2020	**3.1%**	4.2%	-2.0%	2.2%	0.2%	NA
Share in National total						
1990	**3.8%**	1.4%	0.0%	0.5%	1.9%	NA
2005	**4.0%**	2.1%	0.0%	0.3%	1.6%	NA
2020	**4.1%**	2.9%	0.0%	0.2%	1.0%	NA

3 Energy (IPCC sector 1)

3.1 Overview of the sector and background information

In the Energy Sector, emissions originating from fuel combustion activities in road traffic, in the energy and manufacturing industry and in the commercial, agricultural, and residential sector (Category 1.A) as well as fugitive emissions from fuels (Category 1.B) are considered.

Emissions from the energy sector are the main source of GHGs in Algeria. In the year 2020, about 81.5% of national total GHGs emissions and 93.3 % of national total CO_2 emissions from Algeria originated from the energy sector.

Emissions from the energy sector increased by 167.1% from 67,471.69 kt CO_2 equivalents in 1990 to 179,671.10 kt CO_2 equivalents in 2020, which is mainly due to the increase of national energy consumption especially residential sector resulting of the population increase. Moreover, emissions from the transport sector also increased with the increase in the vehicle fleet on the one hand and the high share of diesel and gasoline on the other.

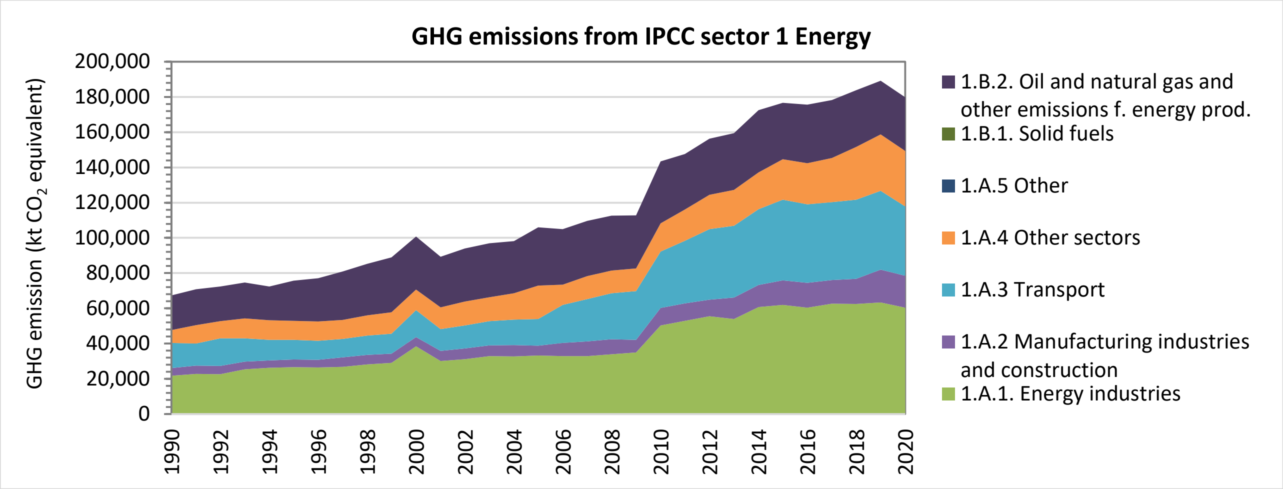


Figure 38 GHG emissions from IPCC sector 1 Energy

Total emissions from energy mainly consist of CO_2 whereas N_2O and CH_4 emissions only make up about 0.4% and 12.4%, respectively. The increase in N_2O emissions is primarily due to the increase of transport's activity. The increase of CH_4 emissions mainly occurs in the residential sector due to increased natural gas and oil activities. The strong increase in CO_2 emissions from 73,230.10 kt to 146,390.81 kt which is an increase of 103.8 % between 2005 and 2020, CO_2 emissions decreased by 5.9% from 2019 to 2020. Emissions from public electricity production increased mainly due to higher power generation from gas turbine power plants. Emissions from road transport increased as a result of higher diesel and gasoline fuel sales, which reached 176.9% between 1990 and 2020. In the year 2020, emissions from households (1.A.4.b.i) decreased by 1.4% due to higher heating demand (heating degree days were higher than in 2019).

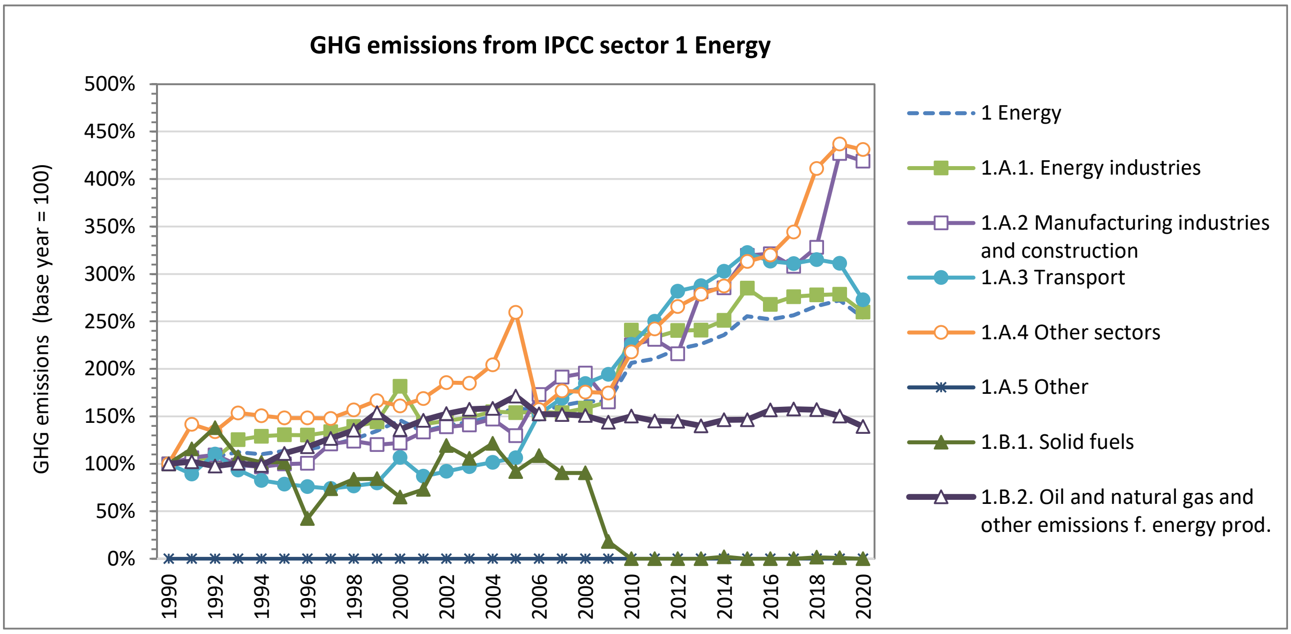


Figure 39 Trend in GHG emissions from IPCC sector 1 Energy 1990–2020 by category in index form (base year = 100)

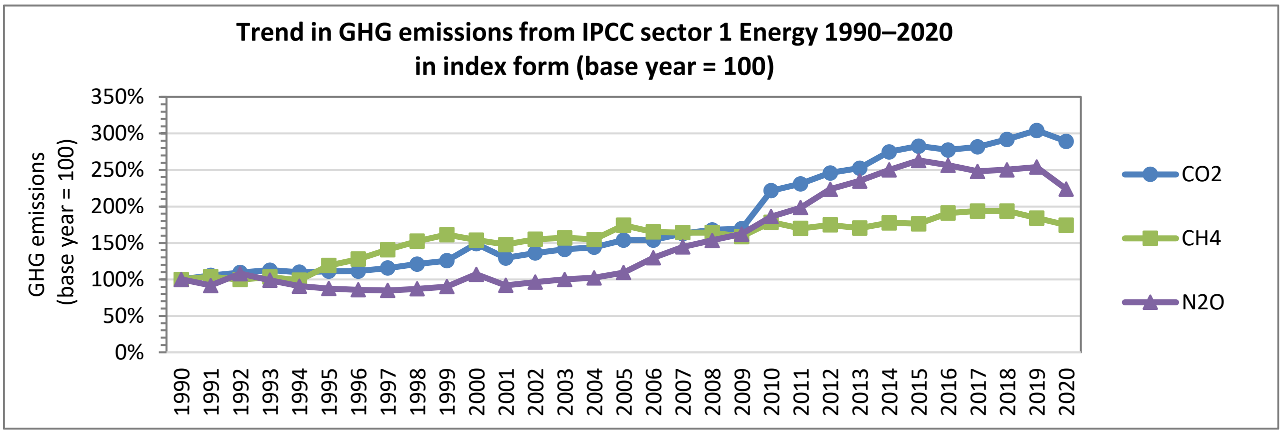


Figure 40 Trend in GHG emissions from IPCC sector 1 Energy 1990–2020 by gas in index form (base year = 100)

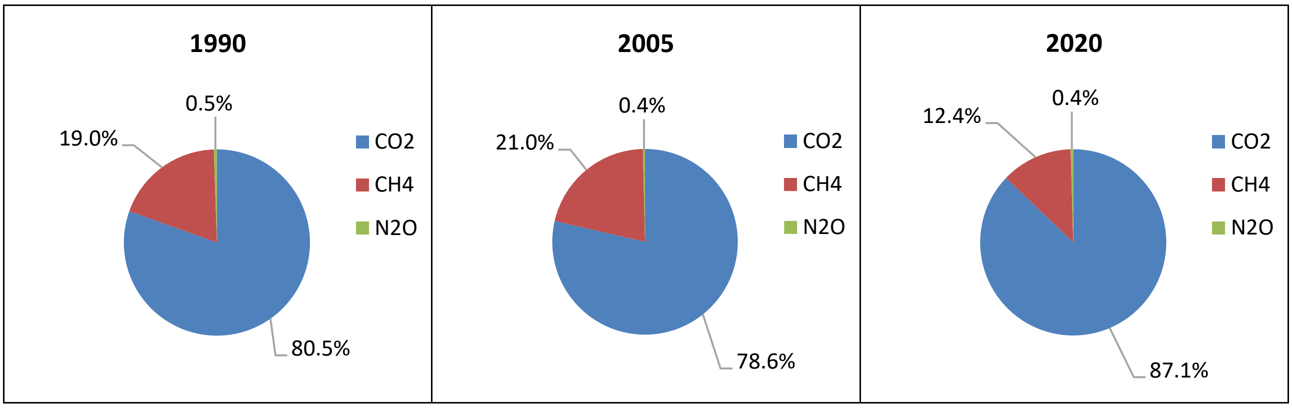


Figure 41 Share of greenhouse gases from IPCC sector 1 Energy

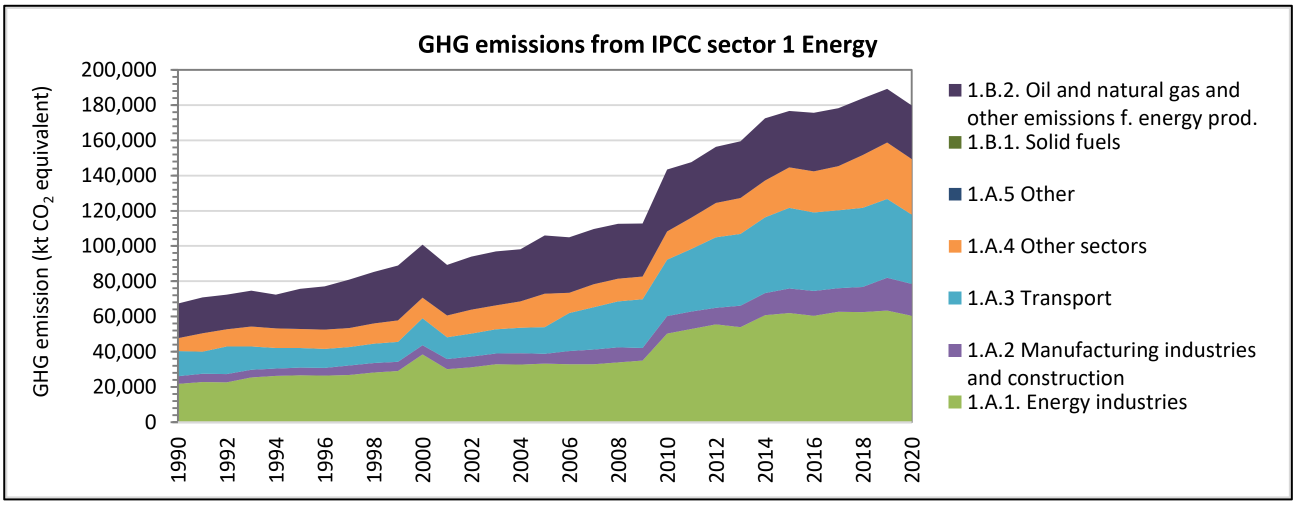


Figure 42 Share of greenhouse gases from IPCC sector 1 Energy by category.

The figure above illustrates the share of greenhouse gases (CO_2, CH_4 and N_2O) from IPCC sector 1 Energy. In 1990, the share of CH_4 emission in total GHG emissions was 19.0%, which was mainly due to activities of natural gas production, processing, transmission and distribution (1.B.2.b). In 2005 the share of CH_4 emissions in GHG emissions increased by 21.0%. The reasons are the increasing emissions from 1.B.2.b due to increased natural gas consumption and export and the increasing consumption of liquid fuels in 1.A.4 Other sectors (institutional/Households, agriculture). After connection to the national electricity network in 2006, the consumption of liquid fuels decreased significantly. In 2020, the share of CH_4 emissions in total GHG emissions decreased significantly by 12.4%, which is mainly a result of significant increase of CO_2 emissions from 1.A Fuel combustion (1990: 47,840.14 kt CO_2 equivalent; 2020: 149,246.58 kt CO_2 equivalent) whereas the CH_4 emissions from 1.B.2 did not increase in the same way/level during the same period (1990: 19,630.79 kt CO_2 equivalent; 2020: 30,424.51 kt CO_2 equivalent).

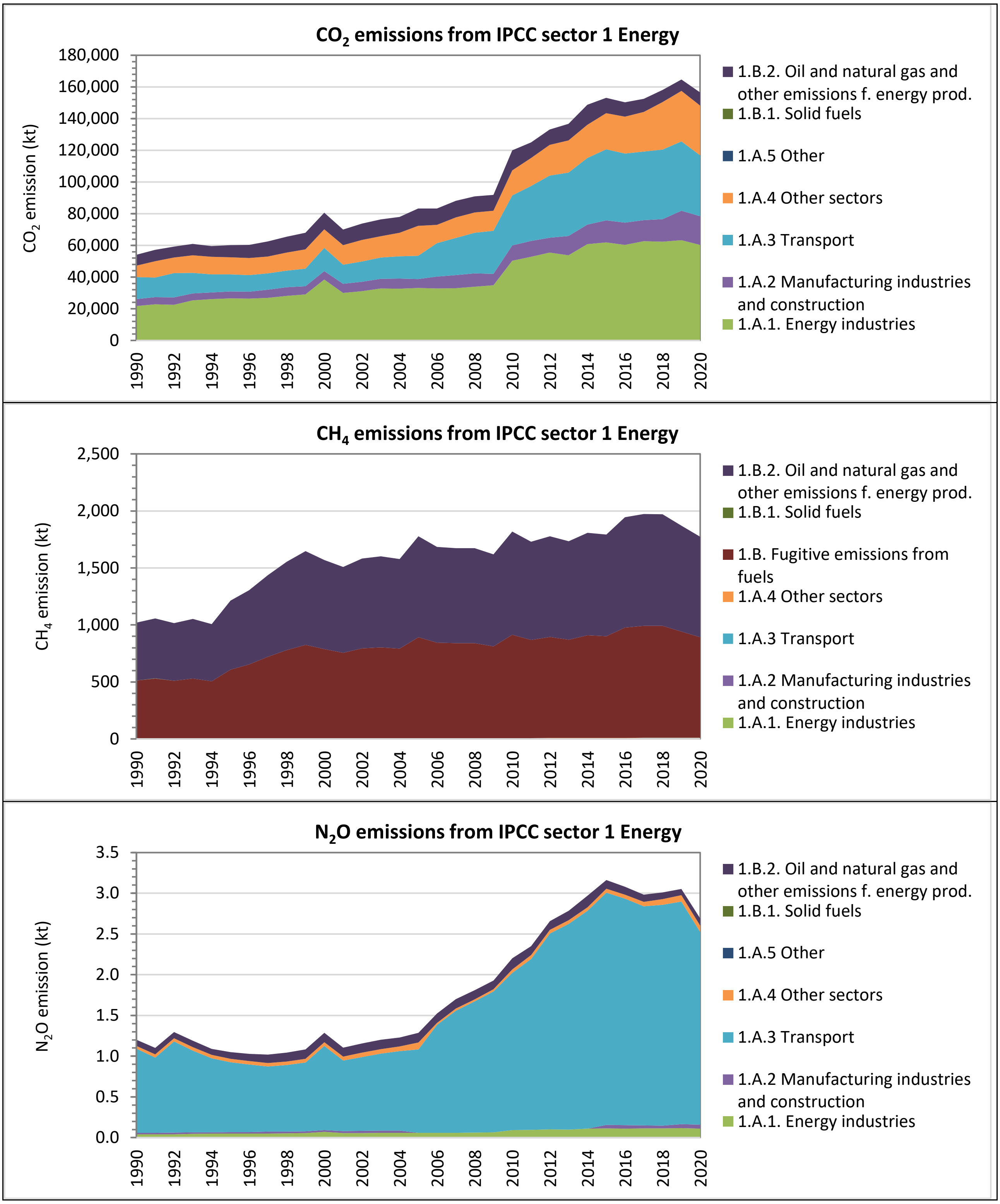


Figure 43 CO2, CH_4 and N2O Emissions from IPCC sector 1 Energy by category

Table 55 GHG emissions from IPCC sector 1 Energy

GHG emissions	**Energy**	**Fuel Combustion Activities**						**Fugitive emissions from fuels**		
	1	**1A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	**1.B.1**	**1.B.2**
	TOTAL	Fuel Combustion Activities	Energy Industries	Manufacturing Ind. & Construction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt CO_2 equivalent									
1990	**67,471.69**	47,840.14	21,799.48	4,344.70	14,214.35	7,481.62	NE	19,631.55	0.77	19,630.79
1991	**71,209.53**	50,885.62	22,775.04	4,628.60	12,683.30	10,798.68	NE	20,323.91	0.89	20,323.03
1992	**72,811.45**	53,123.22	22,537.02	4,754.53	15,682.13	10,149.54	NE	19,688.23	1.06	19,687.17
1993	**74,976.96**	54,611.20	25,409.91	4,286.99	13,306.50	11,607.80	NE	20,365.76	0.82	20,364.94
1994	**72,812.40**	53,516.37	26,200.44	4,204.04	11,741.92	11,369.97	NE	19,296.03	0.78	19,295.25
1995	**76,091.77**	53,276.45	26,585.69	4,338.36	11,181.53	11,170.86	NE	22,815.32	0.78	22,814.54
1996	**77,381.83**	52,804.56	26,457.63	4,365.92	10,807.38	11,173.63	NE	24,577.28	0.32	24,576.95
1997	**81,228.53**	53,752.06	26,852.17	5,244.64	10,521.25	11,134.02	NE	27,476.46	0.56	27,475.90
1998	**85,688.52**	56,283.72	28,187.03	5,371.38	10,911.32	11,813.99	NE	29,404.80	0.64	29,404.16
1999	**89,329.81**	58,184.66	29,108.34	5,210.43	11,341.41	12,524.48	NE	31,145.15	0.65	31,144.50
2000	**101,081.04**	71,014.87	38,449.96	5,290.01	15,157.17	12,117.72	NE	30,066.17	0.50	30,065.68
2001	**89,629.12**	60,868.31	30,059.99	5,784.82	12,353.30	12,670.20	NE	28,760.81	0.56	28,760.25
2002	**94,240.60**	64,128.76	31,125.79	6,022.84	13,091.09	13,889.04	NE	30,111.85	0.91	30,110.93
2003	**97,219.84**	66,574.15	32,820.70	6,114.93	13,795.47	13,843.05	NE	30,645.69	0.81	30,644.88
2004	**98,562.94**	68,853.39	32,700.59	6,389.75	14,442.77	15,320.27	NE	29,709.55	0.93	29,708.62
2005	**106,279.03**	73,230.10	33,202.12	5,623.14	15,111.41	19,293.43	NE	33,048.93	0.70	33,048.23
2006	**105,211.76**	73,720.88	32,848.80	7,497.19	21,636.05	11,738.84	NE	31,490.88	0.83	31,490.05
2007	**109,832.69**	78,426.93	32,939.22	8,284.59	24,040.37	13,162.76	NE	31,405.76	0.69	31,405.06
2008	**112,689.69**	81,623.67	33,896.77	8,441.16	26,228.69	13,057.05	NE	31,066.02	0.69	31,065.33
2009	**112,985.99**	82,866.92	34,932.38	7,069.85	27,725.33	13,139.35	NE	30,119.07	0.14	30,118.93
2010	**143,726.69**	108,445.00	50,346.66	9,644.44	32,197.65	16,256.25	NE	35,281.68	NE	35,281.68
2011	**147,715.58**	116,227.75	52,813.84	9,894.99	35,511.14	18,007.77	NE	31,487.83	NE	31,487.83
2012	**156,558.90**	124,628.66	55,552.24	9,307.94	40,062.23	19,706.25	NE	31,930.24	NE	31,930.24
2013	**159,631.17**	127,500.52	53,872.58	12,145.64	40,864.60	20,617.70	NE	32,130.66	NE	32,130.66
2014	**172,599.85**	137,337.64	60,805.73	12,326.15	43,001.00	21,204.77	NE	35,262.21	0.02	35,262.19
2015	**176,823.98**	144,716.83	62,030.64	13,799.72	45,808.43	23,078.04	NE	32,107.14	NE	32,107.14
2016	**175,740.02**	142,483.01	60,456.12	13,871.71	44,621.24	23,533.95	NE	33,257.01	NE	33,257.01
2017	**178,257.62**	145,478.11	62,721.73	13,284.66	44,189.71	25,282.00	NE	32,779.51	NE	32,779.51
2018	**183,763.48**	151,590.99	62,456.90	14,128.14	44,902.00	30,103.96	NE	32,172.49	0.01	32,172.48
2019	**189,154.71**	158,623.53	63,362.84	18,413.42	44,883.01	31,964.27	NE	30,531.18	0.01	30,531.17
2020	**179,671.10**	149,246.58	60,336.12	18,036.67	39,353.33	31,520.46	NE	30,424.51	NE	30,424.51
Trend										
1990 - 2020	**166.3%**	212.0%	176.8%	315.1%	176.9%	321.3%	NA	55.0%	NA	55.0%
2005 - 2020	**69.1%**	103.8%	81.7%	220.8%	160.4%	63.4%	NA	-7.9%	NA	-7.9%
2019 - 2020	**-5.0%**	-5.9%	-4.8%	-2.0%	-12.3%	-1.4%	NA	-0.3%	NA	-0.3%
Share										
1990	**100.0%**	70.9%	32.3%	6.4%	21.1%	11.1%	NA	29.2%	0.0%	29.2%
2005	**100.0%**	68.9%	31.2%	5.3%	14.2%	18.2%	NA	31.2%	0.0%	31.2%
2020	**100.0%**	83.1%	33.6%	10.0%	21.9%	17.5%	NA	16.9%	NA	16.9%

Table 56 CO_2 emissions in kt from IPCC sector 1 Energy

CO_2 emissions	**Energy**	**Fuel Combustion Activities**						**Fugitive emissions from fuels**		
	1	**1A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	**1.B.1**	**1.B.2**
	TOTAL	Fuel Combustion Activities	Energy Industries	Manu-facturing Ind. & Con-struction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt									
1990	**54,320.56**	47,408.07	21,776.31	4,336.62	13,847.43	7,447.72	NE	6,912.49	NE	6,912.49
1991	**57,608.69**	50,484.18	22,750.76	4,620.22	12,355.13	10,758.08	NE	7,124.51	NE	7,124.51
1992	**59,667.32**	52,653.71	22,512.51	4,745.94	15,285.08	10,110.18	NE	7,013.61	NE	7,013.61
1993	**61,399.32**	54,168.54	25,383.15	4,279.01	12,944.10	11,562.28	NE	7,230.78	NE	7,230.78
1994	**59,846.73**	53,106.03	26,172.81	4,196.34	11,411.84	11,325.03	NE	6,740.70	NE	6,740.70
1995	**60,559.72**	52,883.76	26,557.51	4,330.21	10,869.63	11,126.41	NE	7,675.96	NE	7,675.96
1996	**60,712.46**	52,420.43	26,430.31	4,357.68	10,503.28	11,129.17	NE	8,292.02	NE	8,292.02
1997	**62,906.18**	53,371.57	26,823.79	5,234.71	10,225.27	11,087.81	NE	9,534.61	NE	9,534.61
1998	**65,889.87**	55,894.39	28,157.41	5,361.19	10,610.28	11,765.52	NE	9,995.48	NE	9,995.48
1999	**68,356.46**	57,781.98	29,077.77	5,200.70	11,030.10	12,473.42	NE	10,574.48	NE	10,574.48
2000	**81,018.02**	70,545.16	38,410.92	5,279.79	14,786.63	12,067.82	NE	10,472.87	NE	10,472.87
2001	**70,389.53**	60,450.56	30,029.04	5,773.77	12,029.95	12,617.80	NE	9,938.98	NE	9,938.98
2002	**74,055.36**	63,686.37	31,093.27	6,011.12	12,752.91	13,829.08	NE	10,368.99	NE	10,368.99
2003	**76,766.21**	66,116.61	32,786.90	6,102.95	13,442.33	13,784.43	NE	10,649.60	NE	10,649.60
2004	**78,393.29**	68,380.09	32,666.85	6,377.36	14,078.17	15,257.72	NE	10,013.19	NE	10,013.19
2005	**83,586.16**	72,716.75	33,168.02	5,610.78	14,729.91	19,208.04	NE	10,869.41	NE	10,869.41
2006	**83,620.35**	73,156.03	32,814.67	7,482.93	21,160.25	11,698.18	NE	10,464.32	NE	10,464.32
2007	**88,306.30**	77,794.76	32,905.36	8,268.75	23,503.49	13,117.17	NE	10,511.54	NE	10,511.54
2008	**91,141.48**	80,957.20	33,861.79	8,425.42	25,654.62	13,015.37	NE	10,184.27	NE	10,184.27
2009	**92,094.89**	82,164.40	34,897.30	7,060.29	27,110.49	13,096.33	NE	9,930.49	NE	9,930.49
2010	**120,229.51**	107,641.69	50,296.86	9,629.20	31,513.30	16,202.32	NE	12,587.82	NE	12,587.82
2011	**125,269.15**	115,356.77	52,761.63	9,878.93	34,764.95	17,951.26	NE	9,912.37	NE	9,912.37
2012	**133,415.98**	123,649.77	55,497.12	9,294.45	39,210.73	19,647.47	NE	9,766.21	NE	9,766.21
2013	**136,989.58**	126,470.17	53,819.14	12,127.54	39,967.69	20,555.79	NE	10,519.41	NE	10,519.41
2014	**148,976.23**	136,250.92	60,745.14	12,308.39	42,053.61	21,143.77	NE	12,725.31	NE	12,725.31
2015	**153,334.50**	143,560.23	61,968.89	13,779.67	44,799.70	23,011.96	NE	9,774.28	NE	9,774.28
2016	**150,383.06**	141,348.15	60,396.10	13,851.21	43,634.61	23,466.23	NE	9,034.91	NE	9,034.91
2017	**152,577.48**	144,360.62	62,659.43	13,266.64	43,227.28	25,207.26	NE	8,216.86	NE	8,216.86
2018	**158,083.69**	150,439.65	62,394.86	14,110.67	43,924.07	30,010.05	NE	7,644.03	NE	7,644.03
2019	**164,692.39**	157,435.60	63,300.02	18,389.02	43,883.37	31,863.18	NE	7,256.79	NE	7,256.79
2020	**156,545.57**	148,183.35	60,276.32	18,012.05	38,474.07	31,420.91	NE	8,362.22	NE	8,362.22
Trend										
1990 - 2020	**188.2%**	212.6%	176.8%	315.3%	177.8%	321.9%	NA	21.0%	NA	21.0%
2005 - 2020	**87.3%**	103.8%	81.7%	221.0%	161.2%	63.6%	NA	-23.1%	NA	-23.1%
2019 - 2020	**-4.9%**	-5.9%	-4.8%	-2.0%	-12.3%	-1.4%	NA	15.2%	NA	15.2%
Share										
1990	**100.0%**	87.3%	40.1%	8.0%	25.5%	13.7%	NA	12.8%	NA	12.8%
2005	**100.0%**	87.0%	39.7%	6.7%	17.6%	23.0%	NA	13.0%	NA	13.0%
2020	**100.0%**	94.7%	38.5%	11.5%	24.6%	20.1%	NA	5.3%	NA	5.3%

Table 57 CH_4 emissions in kt from IPCC sector 1 Energy

CH_4 emissions	**Energy**	**Fuel Combustion Activities**						**Fugitive emissions from fuels**		
	1	**1A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	**1.B.1**	**1.B.2**
	TOTAL	Fuel Combustion Activities	Energy Industries	Manu-facturing, Ind.& Construction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt									
1990	**511.72**	3.87	0.44	0.11	2.36	0.95	NE	507.86	0.03	507.83
1991	**530.91**	3.86	0.47	0.12	2.12	1.16	NE	527.04	0.04	527.01
1992	**510.31**	4.24	0.48	0.12	2.52	1.12	NE	506.07	0.04	506.02
1993	**528.94**	4.48	0.51	0.11	2.54	1.32	NE	524.45	0.03	524.42
1994	**505.63**	4.30	0.53	0.11	2.36	1.30	NE	501.33	0.03	501.30
1995	**608.75**	4.18	0.53	0.11	2.24	1.29	NE	604.57	0.03	604.54
1996	**654.50**	4.17	0.50	0.11	2.27	1.29	NE	650.33	0.01	650.31
1997	**720.73**	4.30	0.53	0.14	2.29	1.35	NE	716.43	0.02	716.40
1998	**779.49**	4.42	0.55	0.14	2.30	1.42	NE	775.07	0.03	775.04
1999	**826.02**	4.58	0.57	0.14	2.37	1.50	NE	821.44	0.03	821.42
2000	**787.20**	4.84	0.72	0.14	2.51	1.46	NE	782.36	0.02	782.34
2001	**756.42**	4.85	0.58	0.15	2.60	1.52	NE	751.57	0.02	751.55
2002	**793.62**	5.26	0.62	0.16	2.73	1.75	NE	788.36	0.04	788.32
2003	**803.81**	5.36	0.64	0.16	2.87	1.69	NE	798.45	0.03	798.42
2004	**792.14**	5.60	0.65	0.17	2.97	1.81	NE	786.54	0.04	786.51
2005	**892.04**	6.28	0.64	0.16	3.09	2.38	NE	885.76	0.03	885.73
2006	**845.11**	5.42	0.65	0.20	3.24	1.33	NE	839.69	0.03	839.66
2007	**840.37**	5.97	0.64	0.22	3.62	1.50	NE	834.39	0.03	834.37
2008	**839.96**	6.02	0.66	0.22	3.78	1.36	NE	833.94	0.03	833.91
2009	**812.41**	6.15	0.64	0.15	3.97	1.39	NE	806.25	0.01	806.24
2010	**913.24**	7.14	0.90	0.23	4.38	1.63	NE	906.09	NE	906.09
2011	**869.43**	7.70	0.94	0.24	4.84	1.68	NE	861.72	NE	861.72
2012	**893.70**	8.40	0.99	0.20	5.41	1.79	NE	885.29	NE	885.29
2013	**872.00**	8.93	0.96	0.27	5.76	1.93	NE	863.07	NE	863.07
2014	**909.11**	9.30	1.09	0.27	6.03	1.91	NE	899.80	0.00	899.80
2015	**901.89**	9.83	1.11	0.30	6.34	2.08	NE	892.04	NE	892.04
2016	**977.55**	9.82	1.08	0.31	6.31	2.13	NE	967.72	NE	967.72
2017	**991.64**	10.18	1.12	0.28	6.45	2.33	NE	981.45	NE	981.45
2018	**991.31**	11.07	1.12	0.28	6.81	2.86	NE	980.16	0.00	980.16
2019	**942.07**	11.94	1.13	0.38	7.41	3.02	NE	930.05	0.00	930.05
2020	**892.91**	11.42	1.08	0.38	6.98	2.98	NE	881.41	NE	881.41
Trend										
1990-2020	**74.5%**	195.3%	142.8%	241.3%	195.2%	214.9%	NA	73.6%	NA	73.6%
2005-2020	**0.1%**	81.9%	67.5%	134.6%	126.2%	24.9%	NA	-0.5%	NA	-0.5%
2019-2020	**-5.2%**	-4.4%	-4.8%	-0.1%	-5.8%	-1.5%	NA	-5.2%	NA	-5.2%
Share										
1990	**100.0%**	0.8%	0.1%	0.0%	0.5%	0.2%	NA	99.2%	0.0%	99.2%
2005	**100.0%**	0.7%	0.1%	0.0%	0.3%	0.3%	NA	99.3%	0.0%	99.3%

CH_4 emissions	Energy	Fuel Combustion Activities						Fugitive emissions from fuels		
	1	**1A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	**1.B.1**	**1.B.2**
	TOTAL	Fuel Combustion Activities	Energy Industries	Manu-facturing, Ind.& Con-struction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt									
2020	**100.0%**	1.3%	0.1%	0.0%	0.8%	0.3%	NA	98.7%	NA	98.7%

Table 58 N_2O emissions in kt from IPCC sector 1 Energy

N_2O emissions	Energy	Fuel Combustion Activities						Fugitive emissions from fuels		
	1	**1A**	**1.A.1**	**1.A.2**	**1.A.3**	**1.A.4**	**1.A.5**	**1.B**	**1.B.1**	**1.B.2**
	TOTAL	Fuel Combustion Activities	Energy Industries	Manu-facturing Ind. & Con-struction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt									
1990	**1.20**	1.13	0.04	0.02	1.03	0.03	NE	0.08	NA	0.08
1991	**1.10**	1.02	0.04	0.02	0.92	0.04	NE	0.08	NA	0.08
1992	**1.30**	1.22	0.04	0.02	1.12	0.04	NE	0.08	NA	0.08
1993	**1.19**	1.11	0.05	0.02	1.00	0.04	NE	0.08	NA	0.08
1994	**1.09**	1.02	0.05	0.02	0.91	0.04	NE	0.07	NA	0.07
1995	**1.05**	0.97	0.05	0.02	0.86	0.04	NE	0.08	NA	0.08
1996	**1.03**	0.94	0.05	0.02	0.83	0.04	NE	0.09	NA	0.09
1997	**1.02**	0.92	0.05	0.02	0.80	0.04	NE	0.10	NA	0.10
1998	**1.04**	0.94	0.05	0.02	0.82	0.04	NE	0.11	NA	0.11
1999	**1.08**	0.97	0.05	0.02	0.85	0.05	NE	0.12	NA	0.12
2000	**1.29**	1.17	0.07	0.02	1.03	0.05	NE	0.12	NA	0.12
2001	**1.10**	0.99	0.06	0.02	0.87	0.05	NE	0.11	NA	0.11
2002	**1.16**	1.04	0.06	0.03	0.91	0.05	NE	0.11	NA	0.11
2003	**1.20**	1.09	0.06	0.03	0.94	0.06	NE	0.12	NA	0.12
2004	**1.23**	1.12	0.06	0.03	0.97	0.06	NE	0.11	NA	0.11
2005	**1.32**	1.20	0.06	NE	1.02	0.09	NE	0.12	NA	0.12
2006	**1.56**	1.44	0.06	NE	1.32	0.02	NE	0.11	NA	0.11
2007	**1.74**	1.62	0.06	NE	1.50	0.03	NE	0.12	NA	0.12
2008	**1.84**	1.73	0.06	NE	1.61	0.03	NE	0.11	NA	0.11
2009	**1.95**	1.84	0.06	NE	1.73	0.03	NE	0.11	NA	0.11
2010	**2.24**	2.10	0.09	NE	1.93	0.04	NE	0.14	NA	0.14
2011	**2.38**	2.28	0.10	NE	2.10	0.05	NE	0.11	NA	0.11
2012	**2.69**	2.58	0.10	NE	2.40	0.05	NE	0.11	NA	0.11
2013	**2.82**	2.71	0.10	NE	2.53	0.04	NE	0.12	NA	0.12
2014	**3.01**	2.86	0.11	NE	2.67	0.04	NE	0.14	NA	0.14
2015	**3.16**	3.05	0.11	0.04	2.85	0.05	NE	0.11	NA	0.11
2016	**3.08**	2.98	0.11	0.04	2.78	0.05	NE	0.10	NA	0.10
2017	**2.98**	2.89	0.11	0.04	2.69	0.05	NE	0.09	NA	0.09
2018	**3.01**	2.93	0.11	0.03	2.71	0.07	NE	0.08	NA	0.08
2019	**3.05**	2.98	0.12	0.05	2.73	0.08	NE	0.08	NA	0.08
2020	**2.69**	2.60	0.11	0.05	2.36	0.08	NE	0.09	NA	0.09

N_2O emissions	Energy	Fuel Combustion Activities						Fugitive emissions from fuels		
	1	1A	1.A.1	1.A.2	1.A.3	1.A.4	1.A.5	1.B	1.B.1	1.B.2
	TOTAL	Fuel Combustion Activities	Energy Industries	Manu-facturing Ind. & Con-struction	Transport	Other sectors	Non-Specified	Fugitive emissions from fuels	Solid Fuels	Oil and Natural Gas
	kt									
Trend										
1990 - 2020	**124.1%**	131.1%	172.2%	182.3%	129.0%	121.8%	NA	19.6%	NA	19.6%
2005 - 2020	**104.7%**	117.5%	82.4%	79.5%	131.6%	-11.6%	NA	-23.9%	NA	-23.9%
2019 - 2020	**-11.8%**	-12.6%	-4.8%	2.0%	-13.5%	-1.7%	NA	16.7%	NA	16.7%
Share										
1990	**100.0%**	93.7%	3.4%	1.5%	86.0%	2.9%	NA	6.3%	NA	6.3%
2005	**100.0%**	90.9%	4.6%	2.1%	77.7%	6.6%	NA	9.1%	NA	9.1%
2020	**100.0%**	96.6%	4.1%	1.9%	87.8%	2.8%	NA	3.4%	NA	3.4%

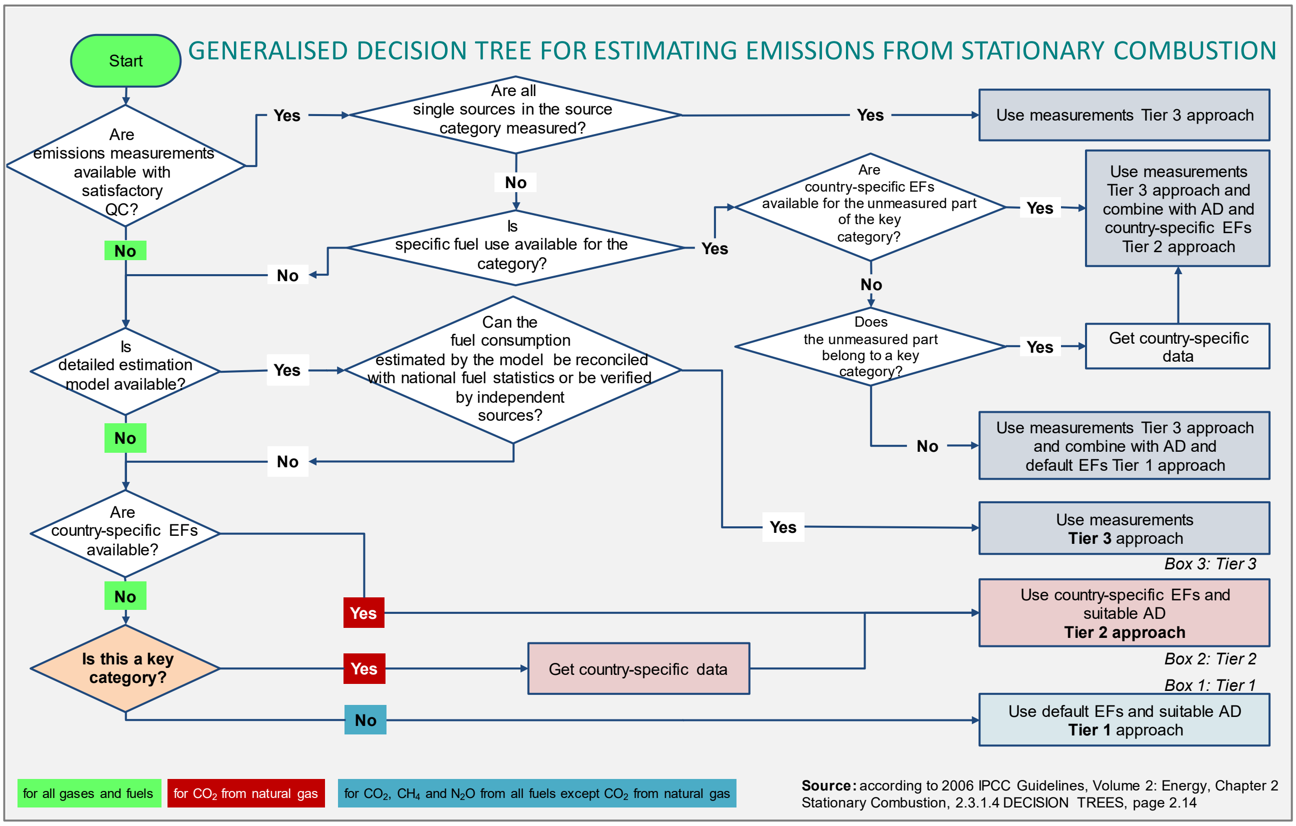
3.2 Fuel combustion (1.A)

Methodological issues

In the following figure is provided the decision tree and the decision (highlighted) for estimating CO_2, CH_4 and N_2O emissions from

- 1.A.1 Energy Industries
- 1.A.2 Manufacturing Industries and Construction
- 1.A.3 Transport
- 1.A.4 Other Sectors

Figure 44 Decision tree for estimating GHG emission from 1.A Fuel Combustion Activities



Source: according to 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2 Stationary Combustion, 2.3.1.4 DECISION TREES, page 2.14

3.2.1 Comparison of the Sectoral Approach (SA) with the Reference Approach

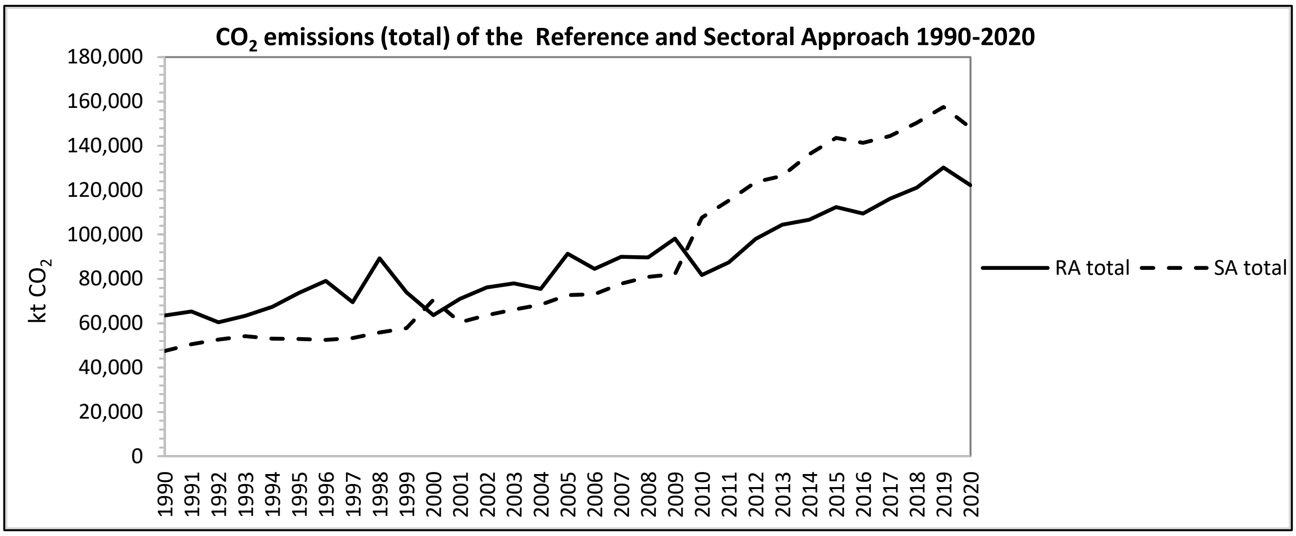


Figure 45 CO_2 emissions (Total) of the Reference and Sectoral Approach 1990 to 2020.

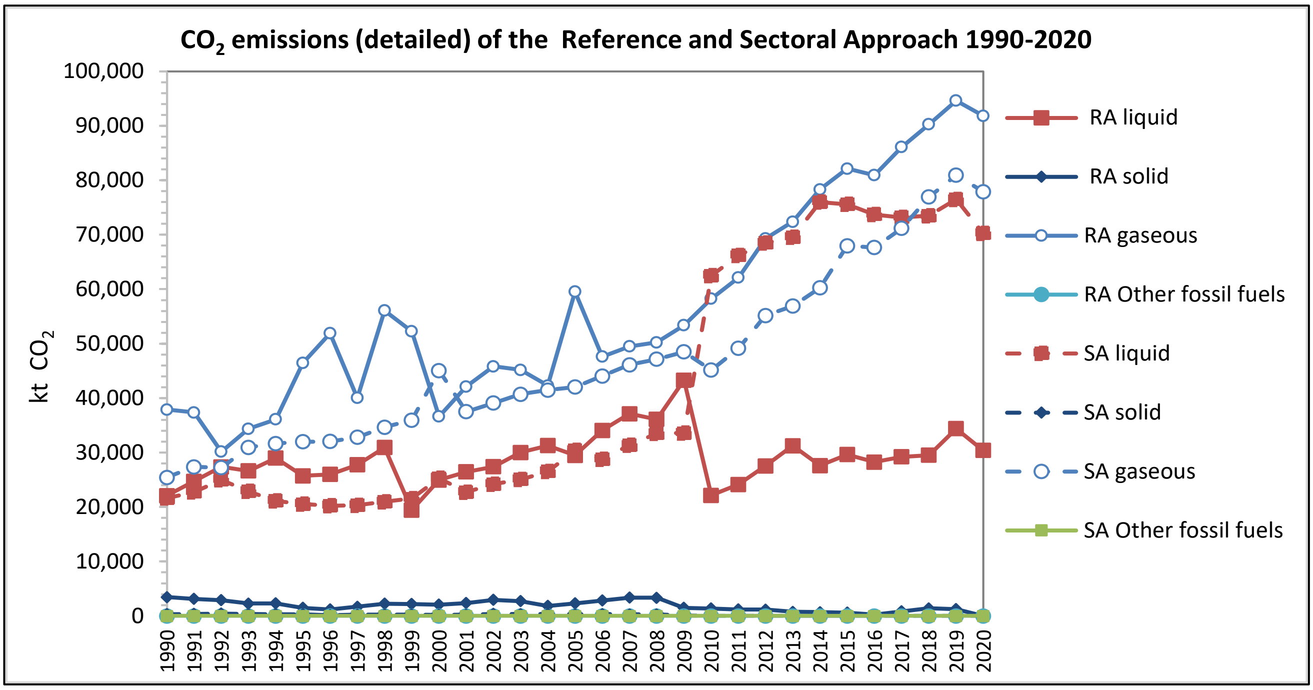


Figure 46 CO_2 emissions (detailed) of the Reference and Sectoral Approach 1990 to 2020.

Explanation of differences between reference approach and sectoral approach

- Time series data consistency: Different data sources are used to estimate CO2 emissions by the sectoral and reference approaches which makes time series incoherent mainly for the following reasons:
    - Energy balance is used to extract time series data for the reference approach for all years 1990-2020. The energy balance includes some data aggregated for the time period of 1990-2009. Data from UNDS are used to fill up the gaps of the missing data in the energy balance.
    - The methodology of energy balance development and data categories in the energy balance

changed in year 2010 with more disaggregated categories.
    - Sectoral data were missing for years 1990 – 2009, therefore data from UNSD database were used
    - All data of fuels used by the power generation are provided by the company Sonelgaz for the whole period 1990- 2020
    - The ministry of Energy provided data for the sector for the period of 2010-2020 and the gaps have been completed using data from UNSD for this period.
- Use of country specific NCV (CS NCV) which were partly significant different to default NCV provided by 2006 IPCC guidelines and UN default for natural gas (TJ / 10^6 m^3) (see table below)
- Use of different CS NCV for natural gas which are based on CS Gross Calorific Value (GCV) due to Decision No. 271 of December 27, 2012 of the Ministry of Energy and Mines setting the units of measurement and conversion rates used. Annex 3.[46]
- Gaseous fuels:
    - Use of 2006 IPCC EF for CO_2 for natural gas: 56.10 tCO_2/TJ
    - In sectoral approach the non-energy use of natural gas for ammonia, methanol and other petrochemical production is not included.
- Liquid fuels: In sectoral approach, additional data collected for refining, liquification and extraction were used; these data were not included in the Energy balance published by MEM[47].
- Solid fuels: Use of blast furnace gas and coke oven gas was provided in all years.

Many improvements are planned (see on page 165, sub-section 3.2.2.2.5) are included in the National Inventory Improvement Plan (NIIP) to reduce the differences between reference approach and sectoral approach.

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[46] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines.

[47] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

In the following table are presented the applied country specific (CS) net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC sector 1.

Table 59 Country specific (CS) Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC sector 1

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**		**Difference**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**		
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default	8.7%	3.41
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0	4.2%	1.79
	Motor Gasoline* Essence automobile	TJ / Gg	44.75 * 0.95 = 42.51	44.3	4.0%	1.79
	Residual Fuel Oil Fiouls résiduels	TJ / Gg	42.18 * 0.95 = 40.07	40.4	0.8%	0.33
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3	7.6%	3.58
	Other Kerosene Autres kérosènes	TJ / Gg	43.92 * 0.95 = 41.72	43.8	4.7%	2.08
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	-	40.2		

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[48]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines, Vol. 2, Chap. 1 (1.4.1.3), Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [49]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

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[48] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines.

[49] https://unstats.un.org/unsd/energystats/methodology/ires/

The following table provides the results of the CO_2 emissions of the reference and sectoral approaches.

Table 60 CO_2 emissions of the Reference and Sectoral Approach 1990 to 2020

	Reference Approach					Sectoral Approach 1.A Fuel Combustion				
	Total	Liquid	Solid	Gaseous	Other fossil fuels	Total	Liquid	Solid	Gaseous	Other fossil fuels
	kt CO_2 equivalent					kt CO_2 equivalent				
1990	63,431.83	22,072.22	3,466.92	37,892.69	NO	47,408.07	21,653.84	318.89	25,435.28	NO
1991	65,229.76	24,728.60	3,145.22	37,355.94	NO	50,484.18	22,754.83	369.39	27,359.92	NO
1992	60,430.04	27,362.89	2,909.68	30,157.48	NO	52,653.71	24,984.19	440.32	27,229.16	NO
1993	63,286.14	26,628.64	2,286.17	34,371.32	NO	54,168.54	22,872.29	342.72	30,953.45	NO
1994	67,371.13	28,978.03	2,300.17	36,092.93	NO	53,106.03	21,130.83	324.00	31,651.13	NO
1995	73,663.36	25,724.39	1,498.37	46,440.60	NO	52,883.76	20,566.91	324.00	31,992.78	NO
1996	79,072.70	25,985.14	1,186.76	51,900.79	NO	52,420.43	20,240.38	135.05	32,044.93	NO
1997	69,486.49	27,761.26	1,688.98	40,036.25	NO	53,371.57	20,337.01	234.91	32,799.55	NO
1998	89,254.83	30,928.76	2,244.61	56,081.46	NO	55,894.39	20,980.66	267.26	34,646.37	NO
1999	73,898.68	19,448.74	2,185.28	52,264.67	NO	57,781.98	21,561.24	268.96	35,951.67	NO
2000	63,675.16	24,960.52	2,082.58	36,632.06	NO	70,545.16	25,289.99	207.11	45,047.95	NO
2001	70,958.73	26,477.40	2,369.74	42,111.59	NO	60,450.56	22,721.33	232.64	37,496.48	NO
2002	76,212.22	27,416.69	2,965.86	45,829.67	NO	63,686.37	24,214.91	380.17	39,091.14	NO
2003	77,944.24	30,018.21	2,737.58	45,188.45	NO	66,116.61	25,063.61	337.62	40,715.27	NO
2004	75,413.53	31,273.30	1,844.51	42,295.73	NO	68,380.09	26,511.82	387.55	41,480.61	NO
2005	91,364.31	29,497.67	2,323.73	59,542.91	NO	72,716.75	30,391.51	293.36	42,031.74	NO
2006	84,537.28	34,059.39	2,847.24	47,630.65	NO	73,156.03	28,745.64	346.13	44,064.14	NO
2007	89,980.22	37,132.28	3,358.45	49,489.49	NO	77,794.76	31,381.75	288.25	46,124.63	NO
2008	89,676.89	36,102.27	3,355.70	50,218.92	NO	80,957.20	33,528.34	288.25	47,140.53	NO
2009	98,176.34	43,297.16	1,497.21	53,381.97	NO	82,164.40	33,611.82	57.88	48,494.60	NO
2010	81,777.54	22,158.29	1,377.97	58,241.27	NO	107,641.69	62,485.96	NO	45,155.67	NO
2011	87,452.74	24,133.15	1,204.69	62,114.89	NO	115,356.77	66,225.05	NO	49,131.67	NO
2012	98,008.81	27,552.70	1,157.94	69,298.18	NO	123,649.77	68,481.37	NO	55,168.37	NO
2013	104,363.98	31,240.56	742.62	72,380.80	NO	126,470.17	69,559.77	NO	56,910.36	NO
2014	106,609.75	27,605.77	697.44	78,306.54	NO	136,250.92	75,986.23	6.52	60,258.15	NO
2015	112,371.28	29,625.68	606.32	82,139.28	NO	143,560.23	75,586.41	NO	67,973.80	NO
2016	109,419.36	28,265.54	214.88	80,938.94	NO	141,348.15	73,706.55	NO	67,641.59	NO
2017	116,182.24	29,227.22	841.45	86,113.57	NO	144,360.62	73,171.40	NO	71,189.20	NO
2018	121,189.75	29,509.38	1,398.08	90,282.29	NO	150,439.65	73,494.30	4.95	76,940.34	NO
2019	130,266.74	34,384.33	1,248.67	94,633.74	NO	157,435.60	76,498.70	2.99	80,933.85	NO
2020	122,264.14	30,407.78	18.33	91,838.04	NO	148,183.35	70,266.31	NO	77,916.99	NO

The following tables provide the differences of CO_2 emissions in percent between reference and sectoral approaches.

Table 61 Differences of CO_2 emissions of the Reference and Sectoral Approaches by type of fuel in percent

	Total	Liquid	Solid	Gaseous	Other fossil fuels
1990	25.3%	1.9%	90.8%	32.9%	NA
1991	22.6%	8.0%	88.3%	26.8%	NA
1992	12.9%	8.7%	84.9%	9.7%	NA
1993	14.4%	14.1%	85.0%	9.9%	NA
1994	21.2%	27.1%	85.9%	12.3%	NA
1995	28.2%	20.0%	78.4%	31.1%	NA
1996	33.7%	22.1%	88.6%	38.3%	NA
1997	23.2%	26.7%	86.1%	18.1%	NA
1998	37.4%	32.2%	88.1%	38.2%	NA
1999	21.8%	-10.9%	87.7%	31.2%	NA
2000	-10.8%	-1.3%	90.1%	-23.0%	NA
2001	14.8%	14.2%	90.2%	11.0%	NA
2002	16.4%	11.7%	87.2%	14.7%	NA
2003	15.2%	16.5%	87.7%	9.9%	NA
2004	9.3%	15.2%	79.0%	1.9%	NA
2005	20.4%	-3.0%	87.4%	29.4%	NA
2006	13.5%	15.6%	87.8%	7.5%	NA
2007	13.5%	15.5%	91.4%	6.8%	NA
2008	9.7%	7.1%	91.4%	6.1%	NA
2009	16.3%	22.4%	96.1%	9.2%	NA
2010	-31.6%	-182.0%	NA	22.5%	NA
2011	-31.9%	-174.4%	NA	20.9%	NA
2012	-26.2%	-148.5%	NA	20.4%	NA
2013	-21.2%	-122.7%	NA	21.4%	NA
2014	-27.8%	-175.3%	99.1%	23.0%	NA
2015	-27.8%	-155.1%	NA	17.2%	NA
2016	-29.2%	-160.8%	NA	16.4%	NA
2017	-24.3%	-150.4%	NA	17.3%	NA
2018	-24.1%	-149.1%	99.6%	14.8%	NA
2019	-20.9%	-122.5%	99.8%	14.5%	NA
2020	-21.2%	-131.1%	NA	15.2%	NA

3.2.1.1 Methodology

The default methodology is applied according to 2006 IPCC Guidelines[50]. The Reference Approach methodology breaks the calculation of carbon dioxide emissions from fuel combustion into 5 steps:

Step 1: Estimate apparent fuel consumption in original units

Step 2: Convert to a common energy unit

Step 3: Multiply by carbon content to compute the total carbon

Step 4: Compute the excluded carbon

Step 5a: Correct for carbon unoxidized

Step 5b: Convert to CO_2 emissions

These steps are expressed in the following equation.

Equation 6.1: CO_2 Emissions from fuel combustion using the Reference approach (2006 IPCC GL, Vol. 2, Chap. 6.3)

$$\boldsymbol{CO_2Emissions} = \sum_{all\,fuels}\left[\left(\left(\textbf{Apparent Consumption}_{fuel} \times \textbf{ConversionFactor}_{fuel} \times \textbf{Carbon Content}_{fuel}\right) \times \mathbf{10^{-3}} - \textbf{Excluded Carbon}_{fuel}\right) \times \textbf{Fraction of carbon oxidised}_{fuel} \times \frac{\mathbf{44}}{\mathbf{12}}\right]$$

Where:

Emissions $_{CO2}$ = CO_2 emissions (Gg CO_2)

Apparent Consumption = production + imports – exports – international bunkers - stock change

Conversion Factor (ConVer) = conversion factor for the fuel to energy units (TJ) on a net calorific value basis

Carbon content (CC) = carbon content (tonne C/TJ)

Note that tonne C/TJ is identical to kg C/GJ

Excluded Carbon = carbon in feedstocks and non-energy use excluded from fuel combustion emissions (Gg C)

Fraction of carbon oxidized (COF) = fraction of carbon oxidized.

Usually the value is 1, reflecting complete oxidation. Lower values are used only to account for carbon retained indefinitely in ash or soot

44/12 = molecular weight ratio of CO_2 to C

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[50] 2006 IPCC Guidelines, Volume 2: Energy, Chapter 6: Reference Approach, sub-chapter 6.3 ALGORITHM, page 6.5

3.2.1.1.1 Activity data

3.2.1.1.2 Apparent consumption of fuels

According to 2006 IPCC Guidelines, the supply of fuels is calculated based on data for each fuel and inventory year:

- ⇨ the amounts of primary fuels **produced**[51] (production of secondary fuels and fuel products are not included);
- ⇨ the amounts of primary and secondary fuels **imported**;
- ⇨ the amounts of primary and secondary fuels **exported**;
- ⇨ the amounts of primary and secondary fuels **used in international bunkers**;
- ⇨ the net **increases or decreases** in **stocks** of primary and secondary fuels.

The production of secondary fuels should be ignored in the calculations because the carbon in these fuels is already included in the supply of primary fuels from which they were derived.

The **apparent consumption of a primary fuel** is calculated as follows:

Equation 6.2: Apparent consumption of primary fuel (2006 IPCC GL, Vol. 2, Chap. 6.3)

$$\begin{aligned}\text{Apparent Consumption}_{fuel} = \text{Production}_{fuel} \\ +\text{Imports}_{fuel} \\ -\text{Exports}_{fuel} \\ -\text{International Bunkers}_{fuel} \\ -\text{Stock Change}_{fuel}\end{aligned}$$

The **apparent consumption of a secondary fuel** is calculated as follows:

Equation 6.3: Apparent consumption of secondary fuel (2006 IPCC GL, Vol. 2, Chap. 6.3)

$$\begin{aligned}\text{Apparent Consumption}_{fuel} = \text{Imports}_{fuel} \\ -\text{Exports}_{fuel} \\ -\text{International Bunkers}_{fuel} \\ -\text{Stock Change}_{fuel}\end{aligned}$$

The activity data are taken from the national energy balance but not from the IEA Joint Questionnaire (JQ) as this was not available.

3.2.1.1.3 Conversion to energy units

***Step 2**: Convert to a common energy unit.*

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. For estimation of emissions that arise from combustion of fossil fuels, the default net caloric values (NCV) have been used according to 2006 IPCC Guidelines and presented in the following table.

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[51] Production of coal includes the quantities extracted or produced calculated after any operation for removal of inert matter.

3.2.1.1.4 Excluded carbon

***Step 4**: Compute the excluded carbon*

The amount of carbon which does not lead to fuel combustion emissions has to be excluded, as the because the aim is to provide an estimate of fuel combustion emissions (category 1A).

Carbon excluded from fuel combustion is either emitted in another sector of the inventory (for example as an industrial process emission) or is stored in a product manufactured from the fuel. In the 1996 Guidelines, carbon in the apparent consumption that does not lead to fuel combustion emissions has been referred to as “stored carbon” but, as the above definition makes clear, stored carbon is only part of the carbon to be excluded from “total carbon” in the 2006 IPCC Guidelines. The main flows of carbon concerned in the calculation of excluded carbon are those used as feedstock, reductant or as non-energy products. Table 6.1 sets out the main products in each group 3 If countries have other fossil fuel carbon products which should be excluded, they should be taken into consideration and documented.

Table 62 Fuel used as feedstock, reductant and/or non-energy products in Algeria.

	Fuel	**Fuel used as feedstock, reductant and/or non-energy products**	**Emissions are assumed to be included in**	**Not reported in Energy balance**
Feedstock	Naphtha	x	Plastics production	x
	LPG (butane/propane)	NO		
	Refinery gas	NO		
	Gas/diesel oil and Kerosene	NO		
	Natural gas	x	2.B.1. Ammonia production 2.B.2. Nitric acid production 2.B.8.a. Methanol production 2.B.8.b. Ethylene production	
	Ethane	x		
Reductant	Coke oven coke (metallurgical coke)	x	2.C.1. Iron and steel production	x
	Petroleum coke	NO		
	Coal and coal tar/pitch	NO		
	Natural gas	NO		
Non-energy products	Bitumen	Use	2.D.3.b. Road paving with asphalt 2.D.3.c. Asphalt roofing	x
		Disposal	5.A. Solid waste disposal 5.C.1.b Waste Incineration - Non-biogenic	
	Lubricants	Use	2.D.1. Lubricant use 5.C	x
		Disposal	5.A. Solid waste disposal 5.C.1.b Waste Incineration - Non-biogenic	
	Paraffin waxes	x	2.D.2. Paraffin wax use	x
	White spirit	x		x

3.2.1.1.5 Emission factor

3.2.1.1.6 Carbon content

Step 3: Multiply by carbon content to compute the total carbon

For estimation of emissions that arise from combustion of fossil fuels, the default carbon content has been used according to 2006 IPCC Guidelines and presented in the following table.

3.2.1.1.7 Fraction of carbon oxidized

Step 5a: Correct for carbon unoxidized

For estimation of emissions that arise from combustion of fossil fuels, the default fraction of carbon oxidated has been used according to 2006 IPCC Guidelines and presented in the following table.

A small part of the fuel carbon entering the combustion process escapes oxidation. This fraction is usually small (99 to 100 % of the carbon is oxidized) and it is assumed that 100% is oxidated.

Table 63 Reference approach: Default net calorific values (NCVs), default values of carbon content (CC), default fraction of carbon oxidized and indication which fuel was used in Algeria

Fuels		**Default Net Calorific Values (NCVs)**	**Default values of Carbon Content (CC)**	**Default Fraction of carbon oxidized**	**Fuel provided in Energy balance**
		TJ/Gg	**kg/GJ**	**%**	
LIQUID (Crude oil and petroleum products)					
Crude Oil		42.3	20	1	X
Natural Gas Liquids		44.2	17.5	1	X
Gasoline	Motor Gasoline	44.3	18.9	1	X
	Navigation Gasoline	44.3	19.1	1	
	Jet Gasoline	44.3	19.1	1	
Jet Kerosene		44.1	19.5	1	X
Other Kerosene		43.8	19.6	1	
Gas/Diesel Oil		43.0	20.2	1	X
Residual Fuel Oil		40.4	21.1	1	X
Liquefied Petroleum Gases		47.3	17.2	1	X
Ethane		46.4	16.8	1	
Naphtha		44.5	20	1	
Bitumen		40.2	22	1	X
Lubricants		40.2	20	1	
Refinery Feedstocks		43.0	20	1	
Other Oil	Refinery Gas [2]	49.5	15.7	1	X
	White Spirit and SBP	40.2	20	1	
	Other Petroleum Products	40.2	20	1	
SOLID (Coal and coal products)					
Anthracite		26.7	26.8	1	
Coking Coal		28.2	25.8	1	X
Other Bituminous Coal		25.8	25.8	1	

Fuels		Default Net Calorific Values (NCVs)	Default values of Carbon Content (CC)	Default Fraction of carbon oxidized	Fuel provided in Energy balance
		TJ/Gg	kg/GJ	%	
Sub-Bituminous Coal		18.9	26.2	1	
Lignite		11.9	27.6	1	
Patent Fuel		20.7	26.6	1	
Coke	Coke Oven Coke and Lignite Coke	28.2	29.2	1	x
	Gas Coke	28.2	29.2	1	
Coal Tar		28.0	22.0	1	
Derived Gases	Gas Works Gas [4]	38.7	12.1	1	
	Coke Oven Gas [5]	38.7	12.1	1	X
	Blast Furnace Gas [6]	2.5	70.8	1	X
	Oxygen Steel Furnace Gas [7]	7.1	49.6	1	
GAS (Natural Gas)					
Natural Gas		48.0	15.3	1	X
OTHER FOSSIL FUELS					
Municipal Wastes (non-biomass fraction)		10.0	25.0	1	
Industrial Wastes		NA	39.0	1	
Waste Oil 8		40.2	20.0	1	
PEAT					
Peat		9.8	28.9	1	
BIOMASS					
Solid Biofuels	Wood/Wood Waste [9]	15.6	30.5	1	X
	Charcoal [12]	29.5	30.5	1	
Source *Footnote (above) in this tables are reffered to footnotes provided in tables in 2006 IPCC Guidelines.*		*TABLE 1.2* [52]	*TABLE 1.3* [53]	*TABLE 1.4* [54]	

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[52] 2006 IPCC Guidelines, Volume 2: Energy, Chapter 1: Introduction, sub-chapter 1.4.1.3 ACTIVITY DATA SOURCES, page 1.17

[53] 2006 IPCC Guidelines, Volume 2: Energy, Chapter 1: Introduction, sub-chapter 1.4.2.1 CO_2 EMISSION FACTORS, page 1.20

[54] 2006 IPCC Guidelines, Volume 2: Energy, Chapter 1: Introduction, sub-chapter 1.4.2.1 CO_2 EMISSION FACTORS, page 1.23

3.2.2 International bunker fuels

International bunkers are relevant for

- International navigation: international airports;
- International navigation on Mediterranean Sea

Emission from International Bunkers are not included in the National Total.

3.2.2.1 International Aviation (International bunkers)

As described in the 2006 IPCC Guidelines, the IPCC category *International Aviation (International bunkers)* includes emissions from flights that depart in one country and arrive in a different country. Also, International navigations include take-offs and landings for these flight stages. It is *good practice*, that emissions from domestic navigation are reported separately from international navigation and it it is *good practice* to apply the definition presented in the following table.

Table 64 Criteria for defining international or domestic *Aviation*

Criteria for defining international or domestic navigation (applies to individual legs of journeys with more than one take-off and landing)		
Journey type between two airports	**Domestic**	**International**
• Departs and arrives in same country	Yes	No
• Departs from one country and arrives in another	No	Yes
Source: 2006 IPCC Guidelines, Volume 2, Chapter 3: Mobile Combustion, 3.6.1.3 Choice of activity data, TABLE 3.6.		

In Algeria the number of international airports increased from 11 in 1990 to 16 in 2010 and reached the number of 30 airports in 2020.

The number of passengers carried by international aviation remained until 2008 at the same level of 1990 but in generally increased by 180% from 3,748.000 in 1990 to 6,752.002 in 2019. Due to the covid pandemic in 2020 the number of passengers carried were only 1,460.077.

The number of registered carrier departures worldwide remained until 2007 at the same level of 1990 but in generally increased by 172% from 44,100 in 1990 to 76,049 in 2019. Due to the covid pandemic in 2020 the number of passengers carried were only 18,719.

The number of registered carrier departures worldwide remained until 2007 at the same level of 1990 but in generally increased by 172% from 14.6 million ton-kilometer in 1990 to 15.64 in 2020. The transport performance fluctuated due to political and economic circumstances but also due to the covid pandemic in 2020.

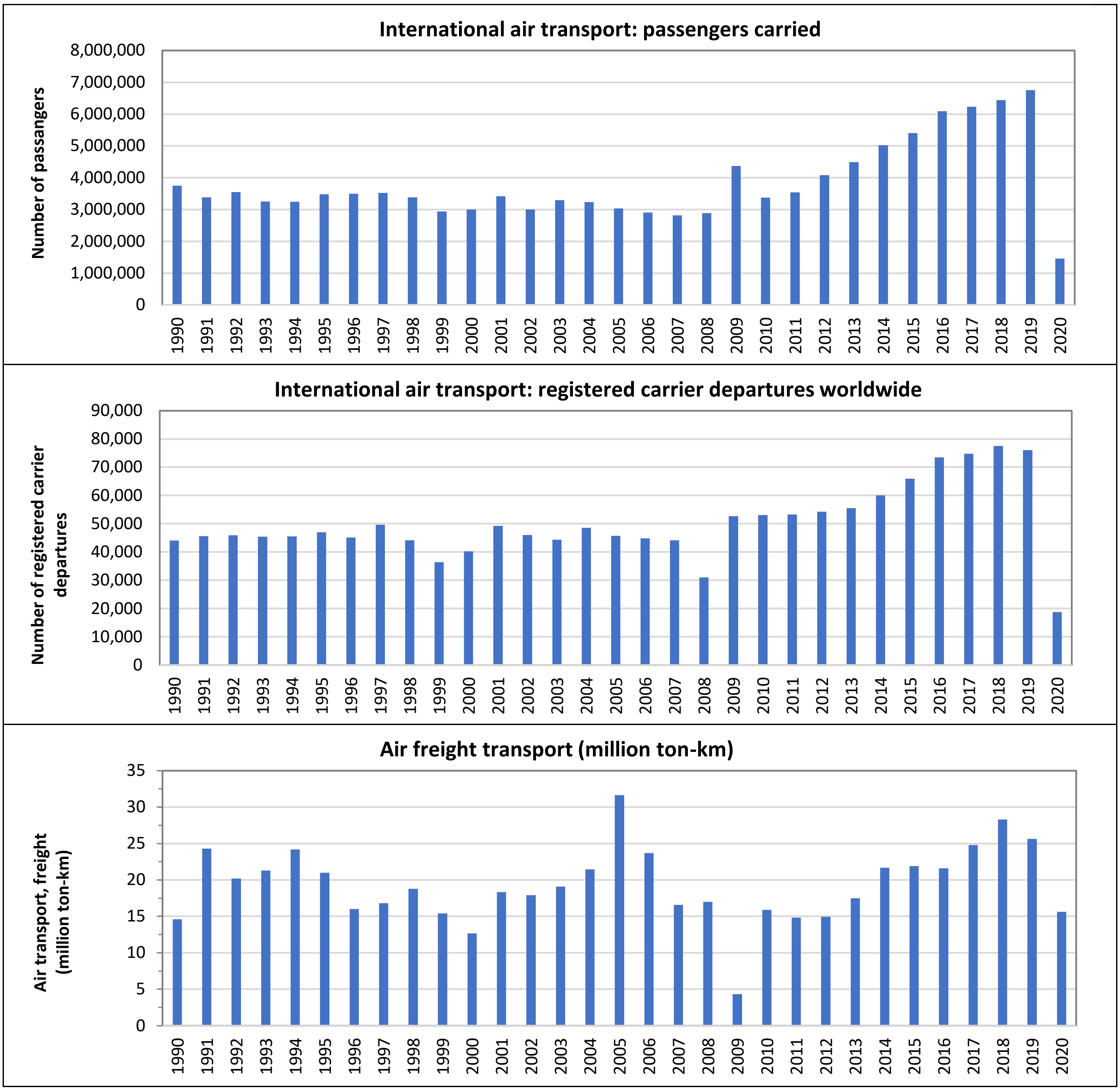

Figure 47 Number of passengers, freight transport in international aviation and Freight air transport [55]

GHG emissions from combustion of fuel in *international aviation* amounted to

- 481.38 kt CO_2 equivalent in the year 1990,
- 926.67 kt CO_2 equivalent in the year 2005.

GHG emissions from *international aviation* increased in the period 1990 – 2009, which is mainly caused by increasing activities in passenger and freight transport.

Energy balance: Due to allocation of Jet kerosene used *in international aviation* and Jet kerosene exported, the emission in the period 2010–2020 are not complete or not estimated. As the jet kerosene is exported, no double counting occurs.

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[55] Source: World bank (2022): Air transport, passengers carried, Air transport, registered carrier departures worldwide and Air transport, freight (million ton-km), based on data from International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates. Available on 02.10.2022 on https://data.worldbank.org/indicator/IS.AIR.PSGR?view=chart

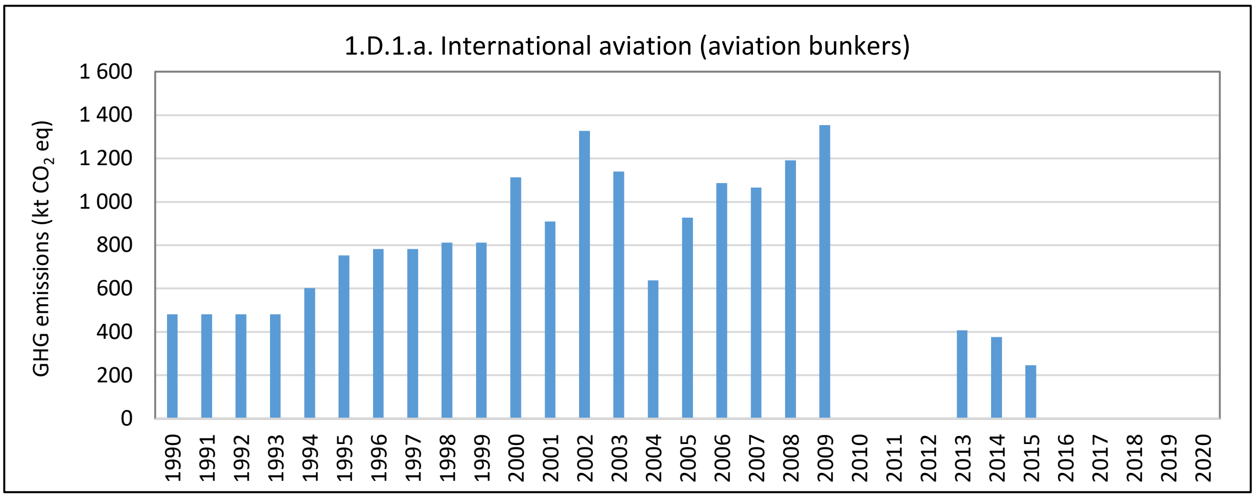

Figure 48 GHG emissions from International Bunkers: International aviation

Table 65 Activity data and Emissions from International Bunkers - International aviation

International aviation	**Emission**				**Activity data**	
	GHG	**CO_2**	**N_2O**	**CH_4**	**Jet Kerosene**	**Navigation fuel**
	Kt CO_2 equivalent	**Gg**	**Gg**	**Gg**	**[TJ]**	**[TJ]**
1990	481.38	477.32	0.013	0.003	6,675.84	NO
1991	481.38	477.32	0.013	0.003	6,675.84	NO
1992	481.38	477.32	0.013	0.003	6,675.84	NO
1993	481.38	477.32	0.013	0.003	6,675.84	NO
1994	601.73	596.65	0.017	0.004	8,344.80	NO
1995	752.16	745.82	0.021	0.005	10,431.00	NO
1996	782.25	775.65	0.022	0.005	10,848.24	NO
1997	782.25	775.65	0.022	0.005	10,848.24	NO
1998	812.34	805.48	0.023	0.006	11,265.48	NO
1999	812.34	805.48	0.023	0.006	11,265.48	NO
2000	1,113.20	1,103.81	0.031	0.008	15,437.88	NO
2001	908.61	900.95	0.025	0.006	12,600.65	NO
2002	1,326.82	1,315.62	0.037	0.009	18,400.28	NO
2003	1,140.28	1,130.66	0.032	0.008	15,813.40	NO
2004	637.83	632.45	0.018	0.004	8,845.49	NO
2005	926.67	918.85	0.026	0.006	12,850.99	NO
2006	1,086.12	1,076.96	0.030	0.008	15,062.36	NO
2007	1,065.06	1,056.08	0.030	0.007	14,770.30	NO
2008	1,191.43	1,181.37	0.033	0.008	16,522.70	NO
2009	1,353.89	1,342.47	0.038	0.009	18,775.80	NO
2010	NE	NE	NE	NE	NE	NO
2011	NE	NE	NE	NE	NE	NO
2012	NE	NE	NE	NE	NE	NO
2013	406.91	403.48	0.011	0.003	5,643.05	NO

International aviation	Emission				Activity data	
	GHG	CO_2	N_2O	CH_4	Jet Kerosene	Navigation fuel
	Kt CO_2 equivalent	Gg	Gg	Gg	[TJ]	[TJ]
2014	376.36	373.18	0.010	0.003	5,219.30	NO
2015	246.04	243.97	0.007	0.002	3,412.12	NO
2016	NE	NE	NE	NE	NE	NO
2017	NE	NE	NE	NE	NE	NO
2018	NE	NE	NE	NE	NE	NO
2019	NE	NE	NE	NE	NE	NO
2020	NE	NE	NE	NE	NE	NO
Trend						
1990 - 2020	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA
2019 - 2020	NA	NA	NA	NA	NA	NA

3.2.2.1.1 Methodological issues

3.2.2.1.1.1 Choice of methods – TIER 1

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[56] has been applied:

Equation 3.6.1: Aviation equation (2006 IPCC GL, Vol. 3, Chap. 3.6.1.1)

$$\boldsymbol{Emissions_{GHG,\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL, Vol. 2, Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG,\,fuel}}}$$

Where:

Emissions $_{\text{GHG, fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG, fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., jet kerosene, aviation gasoline

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[56] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.6.1.1 Methodological issues - Choice of method

3.2.2.1.1.2 Choice of activity data

The following fuels are used in international aviation:

Liquid fuels:
- Jet Kerosene

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[57] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[58].

The activity data are provided in Table 65.

The total fuel consumption decreased by 96% during the period 1990 –2015 due to the allocation of Jet kerosene used *in international aviation* with the Jet kerosene exported according to the energy balance. Due to allocation of Jet kerosene used in international aviation and Jet kerosene exported, the emission during the period 2010 – 2020 are not complete or not estimated.

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tons or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category *International Bunkers - International Navigation* are provided.

Table 66 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category *International Bunkers - International aviation*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV ***
liquid	Jet Kerosene	TJ / Gg	43.92 * 0.95 = 41.72	44.1
Conversion from GCV to NCV			**Default**	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[59]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines, Vol. 2, Chap. 1 (1.4.1.3), Table 1.2		
Note:				
D	Default	CS	Country specific	PS Plant specific
*	For comparison			

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[57] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[58] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[59] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'Energie et des mines.

3.2.2.1.1.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 67 GHG Emission factor TIER 1 for IPCC category International Bunkers - International aviation

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Jet Kerosene	71 500	D	0.5	D	2	D
Source	2006 IPCC Guidelines Vol. 2, Chap. 3 (3.6.1.2) Table 3.6.4 CO_2 emission factors and Table 3.6.5 NON-CO_2						
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

3.2.2.1.2 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category *International Bunkers - International aviation* are presented in the following table.

Table 68 Uncertainty for IPCC category International Bunkers - International aviation.

Uncertainty	**Jet Kerosene**			**Reference**
	CO_2	**CH_4**	**N_2O**	
Activity data (AD)	10%	10%	10%	2006 IPCC GL, Vol. 2, Chap. 3.6.1.7
Emission factor (EF)	5%	82%	133%	
Combined Uncertainty (U)	11%	83%	133%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[60]
- 2010 - 2020 are taken from the National Energy balance prepared by MEM[61].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [62];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [63].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be done for future submissions.

3.2.2.1.3 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series),
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
  - national statistic published by MEM and Office National des Statistiques (ONS)[64] and
  - international energy statistics of UN statistics[65] and International Energy Agency (IEA)[66]
  - World bank data[67]
- time series consistency - plausibility checks of dips and jumps.

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[60] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[61] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[62] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[63] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[64] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[65] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[66] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

[67] Worldbank (2022): World Bank Open Data. https://www.worldbank.org/en/home

3.2.2.1.4 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *International Bunkers - International aviation.*

Table 69 Recalculations done since NC in IPCC category International Bunkers - International aviation

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.3.1.a.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.3.1.a.ii	Fuel consumption data (activity data) were revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.3.1.a.ii	Revision of NCV	AD	Accuracy Comparability
1.3.1.a.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.2.1.5 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

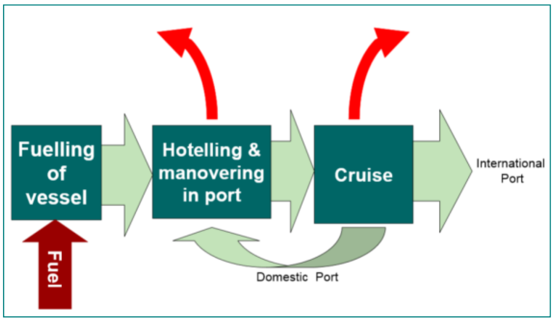
Table 70 Planned improvements for IPCC category International Bunkers - International Aviation

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.a.i 1.A.3.a.ii	Preparation of a consistent timeseries of activity data - National Energy balance - for the period 1990 – 2020 for all aviation related fuels: Jet Kerosene, Aviation Gasoline, Jet Gasoline, other	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Investigation regarding fuel consumption of aviation gasoline used by small planes and helicopters.	AD	Accuracy Completeness Comparability	high
1.A.3.a.i 1.A.3.a.ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC GL, Vol. 2, Chapter 3 Mobile Combustion (3.6.1.3 Choice of activity data). ⇒ Improvement of Energy balance: allocation of Jet kerosene used in international aviation and Jet kerosene exported	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Collection of data on aircraft movement for Tier 2 or 3 methodology and verification activities	AD	Accuracy Completeness Transparency	medium
1.A.3.a.i 1.A.3.a.ii	Application of Tier 2 methodology • Estimate fuel consumption for LTO and cruise for ○ international aviation ○ domestic aviation • Estimate emissions from LTO and cruise phases for ○ international aviation ○ domestic aviation	M EF	Accuracy Completeness Comparability Transparency Consistency	high

3.2.2.2 International navigation (International bunkers)

As described in the 2006 IPCC Guidelines, the IPCC category *International Water-borne Navigation (International bunkers)* includes emissions from fuels used by vessels of all flags that are engaged in international water-borne navigation. The international navigation may take place at sea, on inland lakes and waterways and in coastal waters. This category includes emissions from journeys that depart in one country and arrive in a different country. The category exclude consumption by fishing vessels (see here Other Sector - Fishing). It is *good practice*, that emissions from domestic navigation are reported separately from international navigation and it is *good practice* to apply the definition presented in the following table.

Table 71 Criteria for defining international or domestic water-borne navigation

<table>
<tr><td colspan="3">Criteria for defining international or domestic water-borne navigation (applies to each segment of a voyage calling at more than two ports)</td><td rowspan="5">
</td></tr>
<tr><td>Journey type between two ports</td><td>Domestic</td><td>International</td></tr>
<tr><td>• Departs and arrives in same country</td><td>Yes</td><td>No</td></tr>
<tr><td>• Departs from one country and arrives in another</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Source: 2006 IPCC Guidelines, Volume 2, Chapter 3: Mobile Combustion, 3.5.1.3 Choice of activity data, TABLE 3.5.4.[68]</td><td>Source: EMEP/EEA air pollutant emission inventory guidebook 2019, Chapter 1.A.3.d Navigation (shipping) 2019, Figure 2 – 1 Flow diagram for the contribution from navigation to mobile sources combustion emissions [69]</td></tr>
</table>

Algeria stretches for 1,622 km along the coastline including twelve commercial ports:

- 3 oil ports: Arzew, Skikda and Bejaia ports.
- 3 main multifunctional ports: Algiers, Oran and Annaba ports.
- 2 medium ports: Djen Djen and Mostaganem ports.
- 3 small ports: Ghazaouet, Dellys and Ténès ports.

In Algeria, there is almost no short sea shipping for goods, except for oil and petroleum products, neither short sea shipping for passengers. As presented in the following figure, the marine cargo and passenger transport increased significantly between 1995 and 1997.

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[68] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

[69] Source: EMEP/EEA air pollutant emission inventory guidebook 2016, Part B: sectoral guidance chapters, 1. Energy , 1.A Combustion, Chapter 1.A.3.d Navigation (shipping) 2016 https://www.eea.europa.eu/publications/emep-eea-guidebook-2016/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-d-navigation/view

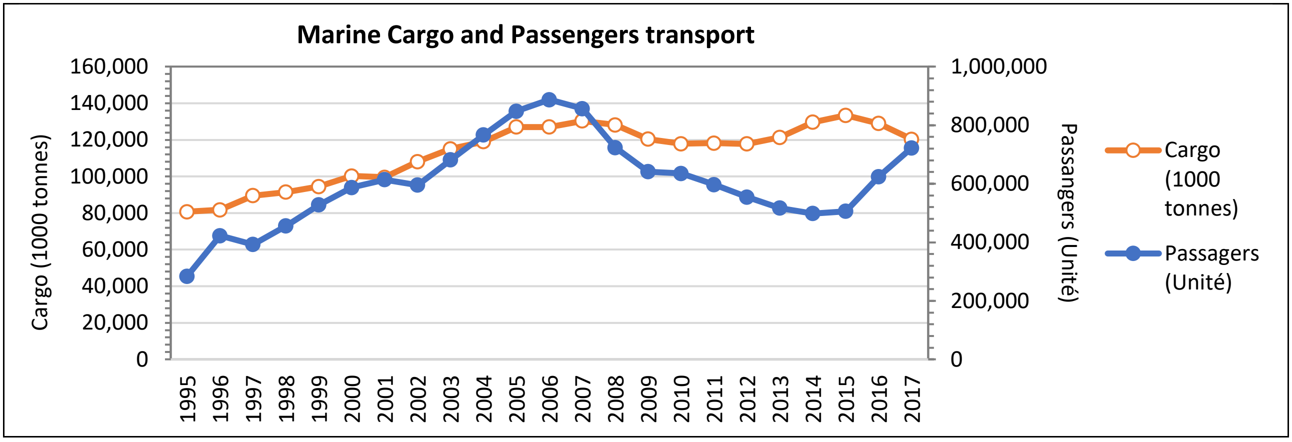

Figure 49 Marine cargo and passenger transport

Source: ONS (2018): Annuaire Statistique de l'Algérie. Several years. Available on 16.01.2023 on https://www.ons.dz/spip.php?rubrique362

GHG emissions from combustion of fuel in international navigation amounted to

- 544.65 kt CO_2 equivalent in the year 1990,
- 1,036.86 kt CO_2 equivalent in the year 2005.
- 299.47 kt CO_2 equivalent in the year 2020.

GHG emissions from international shipping have fluctuated over the period 1990 - 2020, which is mainly due to the variation in import and export activities and passenger transport. Prior to the pandemic, emissions increased significantly compared to 1990 due to the increase in the number of commuting goods and passengers resulting from imports and exports. The year 2020 was characterized by a decrease in emissions due to the Covid 19 pandemic.

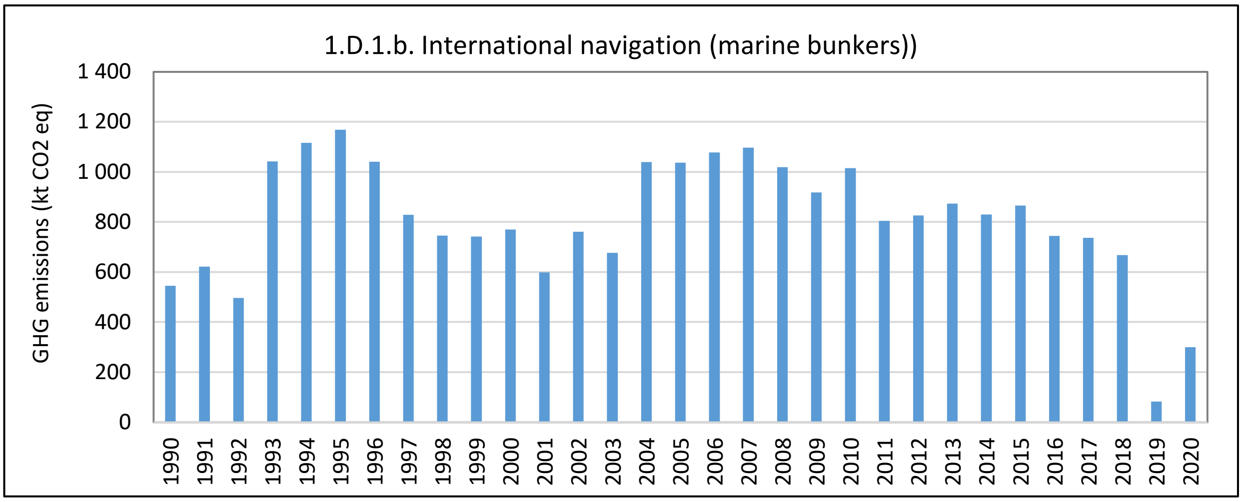

Figure 50 GHG emissions from International Bunkers - International Navigation

Table 72 Activity data and Emissions from International Bunkers - International Navigation

International Navigation	**Emission**				**Activity data**		
	GHG	**CO_2**	**N_2O**	**CH_4**	**Total Fuel consumption**	**Residual fuel oil**	**Gas/diesel oil**
	Kt CO_2 equivalent	**Gg**	**Gg**	**Gg**	**[TJ]**	**[TJ]**	**[TJ]**
1990	544.65	539.18	0,014	0.05	7,097.93	4,007.10	3,090.83
1991	621.79	615.52	0,016	0.06	8,128.20	4,007.10	4,121.10
1992	496.03	490.99	0,013	0.05	6,536.76	2,003.55	4,533.21
1993	1,042.19	1,031.79	0,027	0.09	13,481.75	9,937.61	3,544.15
1994	1,116.71	1,105.56	0,029	0.10	14,459.42	10,338.32	4,121.10
1995	1,168.79	1,157.09	0,030	0.11	15,169.13	10,017.75	5,151.38
1996	1,041.30	1,030.88	0,027	0.09	13,503.41	9,176.26	4,327.16
1997	829.23	820.94	0,022	0.08	10,755.79	7,252.85	3,502.94
1998	745.08	737.63	0,019	0.07	9,663.61	6,531.57	3,132.04
1999	742.27	734.86	0,019	0.07	9,615.56	6,772.00	2,843.56
2000	770.51	762.82	0,020	0.07	9,975.06	7,172.71	2,802.35
2001	598.98	593.00	0,016	0.05	7,752.91	5,609.94	2,142.97
2002	761.26	753.66	0,020	0.07	9,851.42	7,172.71	2,678.72
2003	676.63	669.87	0,018	0.06	8,770.65	6,050.72	2,719.93
2004	1,039.99	1,029.65	0,027	0.09	13,418.88	10,698.96	2,719.93
2005	1,036.86	1,026.54	0,027	0.09	13,378.81	10,658.89	2,719.93
2006	1,078.10	1,067.39	0,028	0.10	13,887.20	11,620.59	2,266.61
2007	1,096.84	1,085.95	0,028	0.10	14,128.76	11,820.95	2,307.82
2008	1,018.72	1,008.60	0,026	0.09	13,122.43	10,979.45	2,142.97
2009	918.39	909.26	0,024	0.08	11,842.43	9,617.04	2,225.39
2010	1,015.81	1,005.72	0,026	0.09	13,085.55	10,934.41	2,151.13
2011	804.50	796.51	0,021	0.07	10,369.74	8,518.17	1,851.57
2012	825.60	817.39	0,021	0.07	10,653.68	8,470.61	2,183.07
2013	873.79	865.08	0,023	0.08	11,289.99	8,635.30	2,654.69
2014	830.47	822.20	0,021	0.08	10,721.98	8,394.79	2,327.19
2015	865.18	856.57	0,022	0.08	11,171.87	8,706.63	2,465.24
2016	744.12	736.70	0,019	0.07	9,617.81	7,279.34	2,338.48
2017	736.42	729.07	0,019	0.07	9,531.40	6,906.92	2,624.48
2018	667.48	660.82	0,017	0.06	8,639.32	6,255.80	2,383.52
2019	81.80	80.98	0,002	0.01	1,063.27	665.26	398.02
2020	299.47	296.50	0,008	0.03	3,857.87	3,220.67	637.20
Trend							
1990 - 2020	-45.0%	-45.0%	-45.6%	-45.6%	-45.6%	-19.6%	-79.4%
2005 - 2020	-71.1%	-71.1%	-71.2%	-71.2%	-71.2%	-69.8%	-76.6%
2019 - 2020	266.1%	266.1%	262.8%	262.8%	262.8%	384.1%	60.1%

3.2.2.2.1 Methodological issues

3.2.2.2.1.1 Choice of methods

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[70] has been applied:

Equation 3.5.1: Water-borne navigation equation (2006 IPCC GL, Vol. 3, Chap. 3.5.1.1)

$$Emissions_{GHG,\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,\,fuel}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL, Vol. 2, Chap. 2)

$$Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG,\,fuel}}$$

Where:

Emissions $_{\text{GHG, fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG, fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., Residual fuel oil, Gas/diesel oil

3.2.2.2.1.2 Choice of activity data

The following fuels are used in international navigation:

Liquid fuels:
- Gas/Diesel Oil
- Residual fuel oil

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[71];
- 2010 – 2020 are taken from the National Energy balance provided by MEM[72].

The activity data are provided in Table 65.

The total fuel consumption decreased by 45.6 % in the period 1990 – 2020. Concerning the period from 2005 to 2020 the total fuel consumption decreased by 71,2 %. From 2019 to 2020 the total fuel consumption increased by 262 %. The decrease in fuel consumption during the period 1990-2000 is due to a decrease of international import-Export activities.

In energy statistics production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g. in tons or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category *International Bunkers - International Navigation* are provided.

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[70] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.5.1.1 Methodological issues - Choice of method

[71] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[72] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 73 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category *International Bunkers - International Navigation*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV***
liquid	Residual fuel oil	TJ / Gg	42.18 * 0.95 = 40.07	40.4
liquid	Gas/diesel oil	TJ / Gg	43.38 * 0.95 = 41.21	43.0
Conversion from GCV to NCV			**Default**	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annexe 3.[73]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines, Vol. 2, Chap. 1 (1.4.1.3), Table 1.2		
Note:				
D	Default	CS Country specific	PS Plant specific	
*	For comparision			

3.2.2.2.1.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 74 GHG Emission factor TIER 1 for IPCC category International Bunkers - International Navigation

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Gas/diesel oil	74,100	D	7	D	2	D
liquid	Residual Fuel Oil	77,400	D	7	D	2	D
Source	2006 IPCC Guidelines Vol. 2, Chap. 3 (3.5.1.2) Table 3.5.2 CO_2 EF and Table 3.5.3 NON-CO_2 EF						
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

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[73] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'Energie et des Mines.

3.2.2.2.2 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category *International Bunkers - International Navigation* are presented in the following table.

Table 75 Uncertainty for IPCC category International Bunkers - International Navigation.

Uncertainty	**Gas/Diesel Oil**			**Residual Fuel Oil**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	
Activity data (AD)	15%	15%	15%	15%	15%	15%	2006 IPCC GL, Vol. 2, Chap. 3.5.1.7
Emission factor (EF)	1.5%			3.0%	+/-50%	-40% to 140%	
		+/-50%					
			-40% to 140%				
Combined Uncertainty (U)	15%	72%	135%	15%	72%	135%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[74] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[75].
- In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the
- International Standard Industrial Classification of all Economic Activities (ISIC) [76];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [77].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be done for future submissions.

3.2.2.2.3 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series),
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.

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[74] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[75] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[76] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[77] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[78] and
    - international energy statistics of UN statistics[79] and International Energy Agency (IEA)[80]
    - World bank data[81]
- time series consistency - plausibility checks of dips and jumps.

3.2.2.2.4 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *International Bunkers - International Navigation*.

Table 76 Recalculations done since NC in IPCC category International Bunkers - International Navigation

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.3.d.i	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.d.i	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
[2]1.A.3.d.i	Revision of NCV Default → country specific: Gasoil/diesel, fuel oil	AD	Accuracy Comparability
1.A.3.d.i	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.2.2.5 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 77 Planned improvements for IPCC category International Bunkers - International Navigation

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.d.i 1.A.3.d.ii	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all navigation related fuels ○ motor gasoline, gas/diesel oil ○ fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d. ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC Guidelines, Volume	AD	Accuracy Comparability	high

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[78] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[79] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[80] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

[81] Worldbank (2022): World Bank Open Data. https://www.worldbank.org/en/home

GHG source & sink category	Planned improvement	Type of improvement		Priority
	2, Chapter 3: Mobile Combustion, 3.5.1.3 Choice of activity data.		Transparency Consistency	
1.A.3.d.i 1.A.3.d.ii	Data on fuel consumption by fuel type and engine type • Surveys of shipping companies (including ferry and freight) • Surveys of individual port and marine authorities	AD	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.d.i 1.A.3.d.ii	Ship movement data and standard passenger and freight ferry schedules Fishery boot movements	AD	Transparency	medium
1.A.3.d.i 1.A.3.d.ii	Application of Tier 2 methodology • Estimate fuel consumption for movements and cruise for navigation. • Estimate emissions from for movements and cruise for navigation.	M EF	Accuracy Completeness Comparability Transparency Consistency	medium

3.2.2.3 Feedstocks and non-energy use of fuels

Feedstocks and non-energy use of fuels, also final non-energy consumption, includes quantities of primary or derived fossil fuels that were not combusted but were used for their chemical properties.[82]

An overview on fuel used as feedstock, reductant and/or non-energy products in Algeria is provided in the following tables (same as Table 62 Fuel used as feedstock, reductant and/or non-energy products in).

Table 78 Activity data for Feedstocks and non-energy use of fuels

	Natural gas	Naphtha	LPG	Refinery gas	Gas/ diesel oil	Ethane	Coke oven coke	Bitumen	Lubricants	White spirit
	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ
1990	36,388	4,450	NO	NO	NO	NE	NO	12,864	NO	NE
1991	37,181	6,675	NO	NO	NO	NE	NO	13,467	NO	NE
1992	46,658	NE	NO	NO	NO	NE	NO	13,668	NO	NE
1993	47,716	NE	NO	NO	NO	NE	NO	12,985	NO	NE
1994	40,623	NE	NO	NO	NO	NE	NO	10,090	NO	NE
1995	36,128	NE	NO	NO	NO	NE	NO	10,331	NO	NE
1996	NE	NE	NO	NO	NO	NE	NO	9,085	NO	NE
1997	NE	NE	NO	NO	NO	NE	NO	7,397	NO	NE
1998	NE	NE	NO	NO	NO	NE	NO	7,638	NO	NE
1999	NE	NE	NO	NO	NO	NE	NO	8,000	NO	NE
2000	52,047	13,973	NO	NO	NO	NE	NO	10,331	NO	NE
2001	NE	NE	NO	NO	NO	NE	NO	11,537	NO	NE
2002	NE	12,327	NO	NO	NO	NE	NO	14,713	NO	523
2003	NE	12,460	NO	NO	NO	NE	NO	15,437	NO	603
2004	NE	13,350	NO	NO	NO	NE	NO	13,829	NO	643
2005	58,500	NE	NO	NO	NO	NE	NO	16,160	NO	523
2006	53,015	NE	NO	NO	NO	NE	NO	18,331	NO	NE
2007	52,264	2,359	NO	NO	NO	NE	NO	26,210	NO	NE
2008	47,966	8,366	NO	NO	NO	NE	NO	31,396	NO	NE
2009	52,736	9,256	NO	NO	NO	NE	NO	30,753	NO	NE
2010	58,491	NE	NO	NO	NO	835	NO	21,386	NO	NE
2011	57,653	NE	NO	NO	NO	NE	NO	16,683	NO	NE
2012	80,403	NE	NO	NO	NO	1,260	NO	17,005	NO	NE
2013	71,100	NE	NO	NO	NO	NE	NO	35,698	NO	NE
2014	110,453	NE	NO	NO	NO	NE	NO	35,014	NO	NE
2015	142,794	NE	NO	NO	NO	NE	NO	20,221	NO	NE
2016	156,165	NE	NO	NO	NO	NE	NO	18,693	NO	NE
2017	124,170	NE	NO	NO	NO	NE	NO	15,356	NO	NE
2018	185,369	NE	NO	NO	NO	NE	NO	15,718	NO	NE
2019	153,777	NE	NO	NO	NO	NE	NO	14,633	NO	NE
2020	140,373	NE	NO	NO	NO	NE	NO	NO	NO	NE

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[82] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_balance_-_new_methodology#What_is_an_energy_balance.3F

3.2.2.3.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 79 Planned improvements for IPCC category feedstock

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A	Preparation of a consistent timeseries of activity data - National Energy balance - for the period 1990 – 2020 for all fuels	AD	Accuracy Comparability Transparency Consistency	high
1.A	Identification of fuel used as feedstock, reductant and/or non-energy products	AD	Accuracy Comparability Transparency Consistency Completeness	high

3.2.3 Energy Industries (IPCC category 1.A.1)

Energy industries are defined as consisting of economic units whose principal activity is primary energy production, transformation of energy or distribution[83]. This section describes GHG emissions resulting from fuel combustion activities (fuel extraction or energy-producing industries) in energy industries, which, originate from

- public electricity and heat production plants (IPCC category 1.A.1.a);
- petroleum refining (IPCC category 1.A.1.b);
- manufacturing of solid fuels (IPCC category 1.A.1.c).

An overview of the GHG emission from fuel combustion in IPCC category 1.A.1. *Energy industries* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020, 2019 – 2020;

Greenhouse gas emissions in IPCC category 1.A.1. Energy industries amounted to 21,799.5kt CO_2 equivalent in 1990, 33,202.1kt CO_2 equivalent in 2005 and 60,336.1 kt CO_2 equivalent in 2020.

The overall trend of GHG emissions in IPCC category 1.A.1. Energy industries shows an increase of 176.8% from 1990 to 2020, 81.7% from 2005 to 2020 and a decrease of 4.8% from 2019 to 2020. The increase in emissions from the energy industry is explained by the increase in domestic and international demand for gas and oil, particularly the increase of CO2 emissions from fossil fuel combustion by end-use sector including electric power emissions which has increased domestic production. The peak in 2005 is explained by the increase in oil prices since the invasion of Iraq. The decrease in emissions in 2020 is explained by the impact of the Covid 19 pandemic on the various industrial activities and national and international transport, leading to a slight decrease in energy production.

The fluctuation in emissions is explained by the variation in international demand for Algerian oil and gas and the maintenance periods of power plants and refineries as explained in the national energy balances. The most important fuel is natural gas.

In 2020, the part of IPCC category 1.A.1. The energy industries contribute with

- 59.5% to IPCC category 1.A.1.a. public electricity and heat production,
- 4.0% to IPCC category 1.A.1.b. Oil refining,
- 36.5% IPCC 1.A.1.c. Solid fuel production and other energy industries.

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[83] For more information see https://unstats.un.org/unsd/energy/ires/IRES-web.pdf

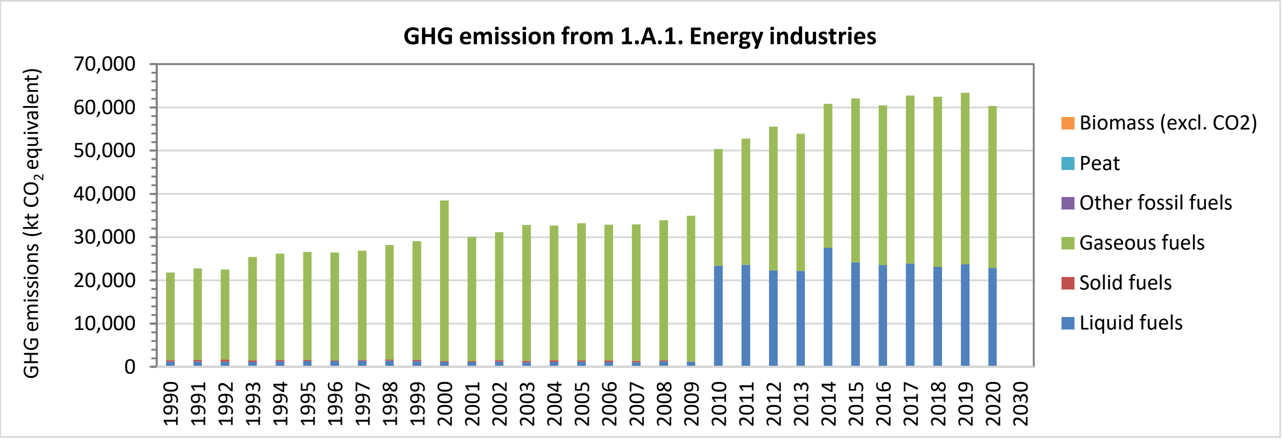


Figure 51 GHG Emissions from IPCC category 1.A.1. *Energy industries* by category

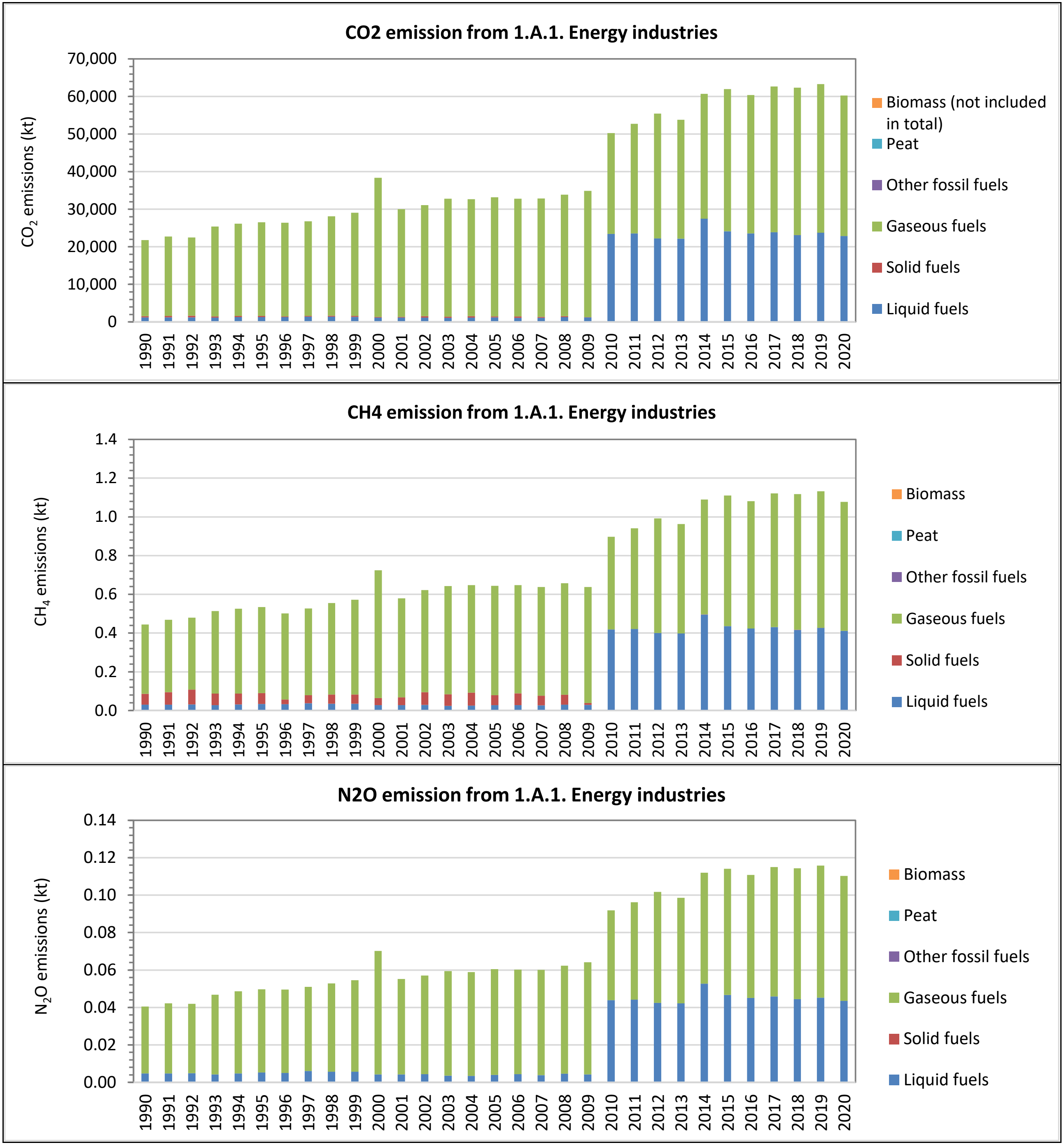


Figure 52 Emissions from IPCC category 1.A.1. *Energy industries*

Table 80 GHG Emissions by fuels from IPCC category 1.A.1. *Energy industries*

GHG emissions	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.1	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	21,799.48	1,227.43	320.28	20,251.77	NO	NO	NO
1991	22,775.04	1,226.57	371.00	21,177.47	NO	NO	NO
1992	22,537.02	1,234.17	442.24	20,860.60	NO	NO	NO
1993	25,409.91	1,160.56	344.22	23,905.13	NO	NO	NO
1994	26,200.44	1,271.54	325.41	24,603.49	NO	NO	NO
1995	26,585.69	1,314.81	325.41	24,945.47	NO	NO	NO
1996	26,457.63	1,324.31	135.64	24,997.68	NO	NO	NO
1997	26,852.17	1,402.45	235.94	25,213.78	NO	NO	NO
1998	28,187.03	1,392.11	268.42	26,526.50	NO	NO	NO
1999	29,108.34	1,336.53	270.13	27,501.68	NO	NO	NO
2000	38,449.96	1,149.93	208.01	37,092.02	NO	NO	NO
2001	30,059.99	1,143.44	233.66	28,682.89	NO	NO	NO
2002	31,125.79	1,186.87	381.83	29,557.09	NO	NO	NO
2003	32,820.70	1,073.23	339.09	31,408.38	NO	NO	NO
2004	32,700.59	1,140.45	389.24	31,170.90	NO	NO	NO
2005	33,202.12	1,201.30	294.64	31,706.18	NO	NO	NO
2006	32,848.80	1,131.20	347.64	31,369.97	NO	NO	NO
2007	32,939.22	1,096.24	289.51	31,553.47	NO	NO	NO
2008	33,896.77	1,267.31	289.51	32,339.95	NO	NO	NO
2009	34,932.38	1,219.38	58.13	33,654.87	NO	NO	NO
2010	50,346.66	23,438.31	NO	26,908.35	NO	NO	NO
2011	52,813.84	23,591.97	NO	29,221.88	NO	NO	NO
2012	55,552.24	22,284.09	NO	33,268.15	NO	NO	NO
2013	53,872.58	22,191.63	NO	31,680.95	NO	NO	NO
2014	60,805.73	27,540.53	6.55	33,258.65	NO	NO	NO
2015	62,030.64	24,165.14	NO	37,865.50	NO	NO	NO
2016	60,456.12	23,568.98	NO	36,887.14	NO	NO	NO
2017	62,721.73	23,903.93	NO	38,817.80	NO	NO	NO
2018	62,456.90	23,141.18	4.97	39,310.75	NO	NO	NO
2019	63,362.84	23,764.25	3.00	39,595.59	NO	NO	NO
2020	60,336.12	22,876.29	NO	37,459.84	NO	NO	NO
Trend							
1990 - 2020	176.8%	1763.8%	NA	85.0%	NA	NA	NA
2005 - 2020	81.7%	1804.3%	NA	18.1%	NA	NA	NA
2019 - 2020	-4.8%	-3.7%	NA	-5.4%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 81 CO_2 Emissions by fuels from IPCC category 1.A.1. *Energy industries*

CO_2 emissions	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	21,776.31	1,225.24	318.89	20,232.17	NO	NO	NO
1991	22,750.76	1,224.39	369.39	21,156.98	NO	NO	NO
1992	22,512.51	1,231.95	440.32	20,840.24	NO	NO	NO
1993	25,383.15	1,158.62	342.72	23,881.80	NO	NO	NO
1994	26,172.81	1,269.34	324.00	24,579.48	NO	NO	NO
1995	26,557.51	1,312.38	324.00	24,921.13	NO	NO	NO
1996	26,430.31	1,321.98	135.05	24,973.28	NO	NO	NO
1997	26,823.79	1,399.71	234.91	25,189.17	NO	NO	NO
1998	28,157.41	1,389.54	267.26	26,500.61	NO	NO	NO
1999	29,077.77	1,333.97	268.96	27,474.84	NO	NO	NO
2000	38,410.92	1,147.99	207.11	37,055.82	NO	NO	NO
2001	30,029.04	1,141.50	232.64	28,654.90	NO	NO	NO
2002	31,093.27	1,184.84	380.17	29,528.25	NO	NO	NO
2003	32,786.90	1,071.56	337.62	31,377.72	NO	NO	NO
2004	32,666.85	1,138.82	387.55	31,140.48	NO	NO	NO
2005	33,168.02	1,199.42	293.36	31,675.24	NO	NO	NO
2006	32,814.67	1,129.18	346.13	31,339.36	NO	NO	NO
2007	32,905.36	1,094.43	288.25	31,522.68	NO	NO	NO
2008	33,861.79	1,265.15	288.25	32,308.39	NO	NO	NO
2009	34,897.30	1,217.39	57.88	33,622.03	NO	NO	NO
2010	50,296.86	23,414.77	NO	26,882.09	NO	NO	NO
2011	52,761.63	23,568.27	NO	29,193.36	NO	NO	NO
2012	55,497.12	22,261.44	NO	33,235.68	NO	NO	NO
2013	53,819.14	22,169.11	NO	31,650.04	NO	NO	NO
2014	60,745.14	27,512.43	6.52	33,226.19	NO	NO	NO
2015	61,968.89	24,140.34	NO	37,828.55	NO	NO	NO
2016	60,396.10	23,544.96	NO	36,851.14	NO	NO	NO
2017	62,659.43	23,879.51	NO	38,779.92	NO	NO	NO
2018	62,394.86	23,117.53	4.95	39,272.39	NO	NO	NO
2019	63,300.02	23,740.09	2.99	39,556.95	NO	NO	NO
2020	60,276.32	22,853.03	NO	37,423.28	NO	NO	NO
Trend							
1990 - 2020	176.8%	1765.2%	NA	85.0%	NA	NA	NA
2005 - 2020	81.7%	1805.3%	NA	18.1%	NA	NA	NA
2019 - 2020	-4.8%	-3.7%	NA	-5.4%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 82 N_2O Emissions by fuels from IPCC category 1.A.1. *Energy industries*

N_2O emissions	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.041	0.005	NO	0.036	NO	NO	NO
1991	0.042	0.005	NO	0.037	NO	NO	NO
1992	0.042	0.005	NO	0.037	NO	NO	NO
1993	0.047	0.004	NO	0.043	NO	NO	NO
1994	0.049	0.005	NO	0.044	NO	NO	NO
1995	0.050	0.005	NO	0.044	NO	NO	NO
1996	0.050	0.005	NO	0.045	NO	NO	NO
1997	0.051	0.006	NO	0.045	NO	NO	NO
1998	0.053	0.006	NO	0.047	NO	NO	NO
1999	0.055	0.006	NO	0.049	NO	NO	NO
2000	0.070	0.004	NO	0.066	NO	NO	NO
2001	0.055	0.004	NO	0.051	NO	NO	NO
2002	0.057	0.004	NO	0.053	NO	NO	NO
2003	0.059	0.004	NO	0.056	NO	NO	NO
2004	0.059	0.003	NO	0.056	NO	NO	NO
2005	0.060	0.004	NO	0.056	NO	NO	NO
2006	0.060	0.004	NO	0.056	NO	NO	NO
2007	0.060	0.004	NO	0.056	NO	NO	NO
2008	0.062	0.005	NO	0.058	NO	NO	NO
2009	0.064	0.004	NO	0.060	NO	NO	NO
2010	0.092	0.044	NO	0.048	NO	NO	NO
2011	0.096	0.044	NO	0.052	NO	NO	NO
2012	0.102	0.042	NO	0.059	NO	NO	NO
2013	0.099	0.042	NO	0.056	NO	NO	NO
2014	0.112	0.053	NO	0.059	NO	NO	NO
2015	0.114	0.047	NO	0.067	NO	NO	NO
2016	0.111	0.045	NO	0.066	NO	NO	NO
2017	0.115	0.046	NO	0.069	NO	NO	NO
2018	0.114	0.044	NO	0.070	NO	NO	NO
2019	0.116	0.045	NO	0.071	NO	NO	NO
2020	0.110	0.044	NO	0.067	NO	NO	NO
Trend							
1990 - 2020	172.2%	816.6%	NA	86.6%	NA	NA	NA
2005 - 2020	82.4%	994.2%	NA	18.1%	NA	NA	NA
2019 - 2020	-4.8%	-3.8%	NA	-5.4%	NA	NA	NA

Table 83 CH_4 Emissions by fuels from IPCC category 1.A.1. *Energy industries*

CH_4 emissions	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.444	0.031	0.056	0.358	NO	NO	NO
1991	0.469	0.031	0.064	0.374	NO	NO	NO
1992	0.480	0.031	0.077	0.371	NO	NO	NO
1993	0.513	0.028	0.060	0.426	NO	NO	NO
1994	0.526	0.031	0.057	0.438	NO	NO	NO
1995	0.535	0.034	0.057	0.444	NO	NO	NO
1996	0.502	0.033	0.024	0.445	NO	NO	NO
1997	0.527	0.037	0.041	0.449	NO	NO	NO
1998	0.555	0.036	0.047	0.472	NO	NO	NO
1999	0.572	0.035	0.047	0.490	NO	NO	NO
2000	0.725	0.028	0.036	0.661	NO	NO	NO
2001	0.579	0.028	0.041	0.511	NO	NO	NO
2002	0.622	0.029	0.066	0.526	NO	NO	NO
2003	0.643	0.025	0.059	0.559	NO	NO	NO
2004	0.648	0.025	0.068	0.555	NO	NO	NO
2005	0.644	0.028	0.051	0.565	NO	NO	NO
2006	0.647	0.028	0.060	0.559	NO	NO	NO
2007	0.638	0.026	0.050	0.562	NO	NO	NO
2008	0.657	0.031	0.050	0.576	NO	NO	NO
2009	0.638	0.029	0.010	0.599	NO	NO	NO
2010	0.897	0.418	NO	0.479	NO	NO	NO
2011	0.941	0.421	NO	0.520	NO	NO	NO
2012	0.993	0.400	NO	0.592	NO	NO	NO
2013	0.962	0.398	NO	0.564	NO	NO	NO
2014	1.089	0.496	0.001	0.592	NO	NO	NO
2015	1.110	0.436	NO	0.674	NO	NO	NO
2016	1.081	0.424	NO	0.657	NO	NO	NO
2017	1.122	0.430	NO	0.691	NO	NO	NO
2018	1.118	0.417	0.001	0.700	NO	NO	NO
2019	1.133	0.427	0.001	0.705	NO	NO	NO
2020	1.078	0.411	NO	0.667	NO	NO	NO
Trend							
1990 - 2020	142.8%	1233.4%	NA	86.6%	*NA*	*NA*	*NA*
2005 - 2020	67.5%	1382.0%	NA	18.1%	*NA*	*NA*	*NA*
2019 - 2020	-4.8%	-3.8%	NA	-5.4%	*NA*	*NA*	*NA*

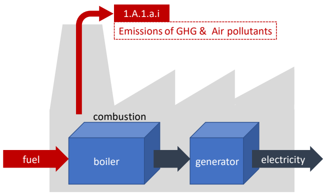
3.2.3.1 Main Activity Electricity and Heat Production (IPCC category 1.A.1.a) [2]

3.2.3.1.1 Category description

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.1.a.i	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
1.A.1.a.ii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.A.1.a.iii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Key Category	-	-	LA 1990 & 2020 TA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

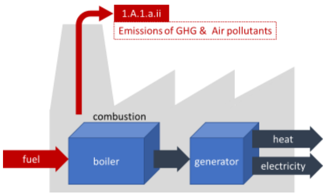
The following sub-categories are defined in the 2006 IPCC Guidelines:

1.A.1.a.i Electricity Generation



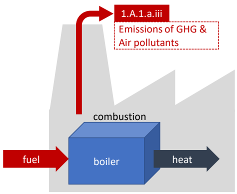
Comprises emissions from all fuel use for electricity generation from main activity producers except those from combined heat and power plants.

1.A.1.a.ii Combined Heat and Power Generation (CHP)



Emissions from production of both heat and electrical power from main activity producers for sale to the public. at a single CHP facility.

1.A.1.a.iii Heat Plants



Production of heat from main activity producers for sale by pipe network.

This section describes GHG emissions resulting from fuel combustion activities in energy industries which originate from public electricity and heat production plants. Two types of producers can be distinguished: Main activity producer and auto-producer. According to 2006 IPCC Guidelines main activity producers are defined as those undertakings whose primary activity is to supply the public. Electricity Generation is a key source with regards to CO_2 emissions from gaseous fuels.

Type of producer	**Reporting**	**Electricity plant**	**Heat plant**	**Remark**
Main activity producer	1.A.1.a	• units that produce electricity or heat as their principal activity;		They may be in public or private ownership. Emissions from own on-site use of fuel are also included.
Auto-producer	1.A.2.m	• units that produce electricity but for which the production is not their principal activity;	units that produce heat for sale but for which the production is not their principal activity;	

An overview of the emission from fuel combustion in IPCC category 1.A.1.a *Main Activity Electricity and Heat Production* is provided in the following figures and tables.

The greenhouse gas emissions from IPCC category 1.A.1.a *Main Activity Electricity and Heat Production* amounted to 9,689.46kt CO_2 equivalents in 1990, 20,905.49kt CO_2 equivalents in 2005. and 35,898.82 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.1.a *Main Activity Electricity and Heat*

Production shows an increase by 270.5% from 1990 to 2020. an increase by 71.7% from 2005 to 2020. a decrease by 3.8% from 2019 to 2020.

The overall increasing trend of emissions is result of rising electricity production due to increased demand by households explained by the increase of population, these trends due also to the increased demand and consumption of electricity by commercial and public and private institutions. The dips and jumps from year to year are mainly due to:

- the weather circumstances in the corresponding years
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning
- the economic situation as reflected in the gross domestic product (GDP)
- national lockdown due to the COVID pandemic (2020).

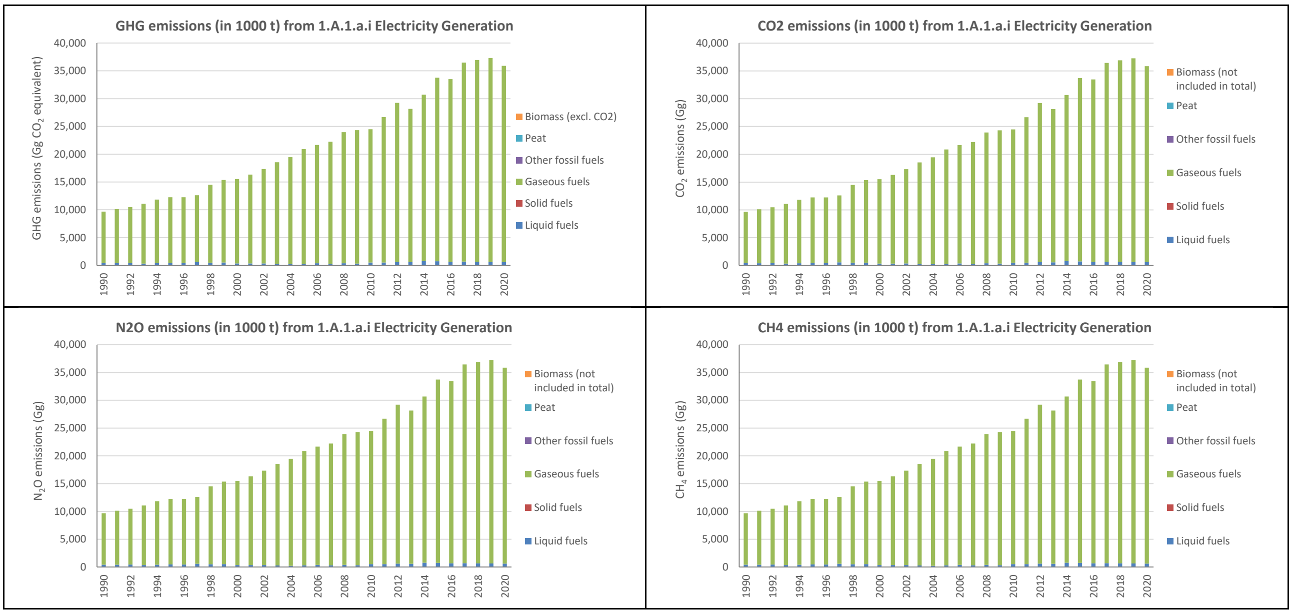


Figure 53 Emissions from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

Table 84 Emissions from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

GHG emissions	**TOTAL GHG** (excluding CO_2 from biomass)	**CO_2**	**N_2O** (including biomass)	**CH_4** (including biomass)	**N_2O** (including biomass)	**CH_4** (including biomass)	**CO_2** (biomass) (1)
1.A.1.a	**Kt CO_2 equivalent**	**kt**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**kt**	**kt**	**kt**
1990	9,689	9,679	5.92	4.55	0.02	0.18	NO
1991	10,122	10,111	6.15	4.74	0.02	0.19	NO
1992	10,484	10,472	6.36	4.91	0.02	0.20	NO
1993	11,084	11,072	6.52	5.13	0.02	0.21	NO
1994	11,845	11,832	7.04	5.50	0.02	0.22	NO
1995	12,259	12,246	7.40	5.73	0.02	0.23	NO
1996	12,272	12,259	7.33	5.71	0.02	0.23	NO
1997	12,623	12,610	7.77	5.94	0.03	0.24	NO
1998	14,515	14,500	8.65	6.75	0.03	0.27	NO
1999	15,368	15,352	9.14	7.14	0.03	0.29	NO
2000	15,523	15,507	8.88	7.11	0.03	0.28	NO
2001	16,327	16,310	9.32	7.46	0.03	0.30	NO
2002	17,350	17,332	9.89	7.93	0.03	0.32	NO
2003	18,566	18,548	10.35	8.42	0.03	0.34	NO
2004	19,481	19,462	10.76	8.80	0.04	0.35	NO
2005	20,905	20,884	11.66	9.48	0.04	0.38	NO
2006	21,680	21,657	12.22	9.87	0.04	0.39	NO
2007	22,236	22,213	12.38	10.07	0.04	0.40	NO
2008	23,964	23,940	13.44	10.89	0.05	0.44	NO
2009	24,332	24,308	13.55	11.02	0.05	0.44	NO
2010	24,510	24,485	13.96	11.20	0.05	0.45	NO
2011	26,699	26,672	15.14	12.18	0.05	0.49	NO
2012	29,251	29,221	16.64	13.36	0.06	0.53	NO
2013	28,171	28,142	16.04	12.87	0.05	0.51	NO
2014	30,714	30,682	17.76	14.11	0.06	0.56	NO
2015	33,758	33,723	19.30	15.45	0.06	0.62	NO
2016	33,510	33,476	19.01	15.29	0.06	0.61	NO
2017	36,484	36,446	20.65	16.63	0.07	0.67	NO
2018	36,956	36,919	20.87	16.83	0.07	0.67	NO
2019	37,316	37,278	21.00	16.97	0.07	0.68	NO
2020	35,899	35,862	20.20	16.33	0.07	0.65	NO
Trend							
1990 - 2020	270.5%	270.5%	241.3%	259.1%	241.3%	259.1%	*NA*
2005 - 2020	71.7%	71.7%	73.3%	72.3%	73.3%	72.3%	*NA*
2019 - 2020	-3.8%	-3.8%	-3.8%	-3.8%	-3.8%	-3.8%	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 85 GHG Emissions by fuels from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

GHG emissions	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.a	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**
1990	9,689.46	414.06	NO	9,275.40	NO	NO	NO
1991	10,121.64	413.21	NO	9,708.43	NO	NO	NO
1992	10,483.58	426.52	NO	10,057.06	NO	NO	NO
1993	11,084.11	341.49	NO	10,742.62	NO	NO	NO
1994	11,844.93	403.95	NO	11,440.98	NO	NO	NO
1995	12,258.72	475.76	NO	11,782.96	NO	NO	NO
1996	12,271.91	436.75	NO	11,835.16	NO	NO	NO
1997	12,623.23	571.96	NO	12,051.27	NO	NO	NO
1998	14,515.10	507.40	NO	14,007.70	NO	NO	NO
1999	15,367.82	523.16	NO	14,844.66	NO	NO	NO
2000	15,522.84	345.13	NO	15,177.71	NO	NO	NO
2001	16,327.08	347.20	NO	15,979.88	NO	NO	NO
2002	17,350.13	364.94	NO	16,985.18	NO	NO	NO
2003	18,566.48	265.57	NO	18,300.90	NO	NO	NO
2004	19,481.46	224.35	NO	19,257.11	NO	NO	NO
2005	20,905.49	299.47	NO	20,606.03	NO	NO	NO
2006	21,679.57	380.62	NO	21,298.95	NO	NO	NO
2007	22,235.93	311.41	NO	21,924.52	NO	NO	NO
2008	23,964.28	388.31	NO	23,575.98	NO	NO	NO
2009	24,332.36	337.52	NO	23,994.84	NO	NO	NO
2010	24,509.90	510.82	NO	23,999.08	NO	NO	NO
2011	26,699.09	516.92	NO	26,182.17	NO	NO	NO
2012	29,251.39	596.51	NO	28,654.88	NO	NO	NO
2013	28,171.02	579.80	NO	27,591.22	NO	NO	NO
2014	30,713.61	781.13	NO	29,932.47	NO	NO	NO
2015	33,757.70	740.85	NO	33,016.85	NO	NO	NO
2016	33,510.11	656.04	NO	32,854.06	NO	NO	NO
2017	36,483.70	688.83	NO	35,794.87	NO	NO	NO
2018	36,956.47	670.87	NO	36,285.60	NO	NO	NO
2019	37,315.52	639.58	NO	36,675.93	NO	NO	NO
2020	35,898.82	612.64	NO	35,286.18	NO	NO	NO
Trend							
1990 - 2020	270.5%	48.0%	NA	280.4%	*NA*	*NA*	*NA*
2005 - 2020	71.7%	104.6%	NA	71.2%	*NA*	*NA*	*NA*
2019 - 2020	-3.8%	-4.2%	NA	-3.8%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 86 CO$_2$ Emissions by fuels from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

CO$_2$ emissions	**Total CO$_2$ emissions** (excluding CO$_2$ from biomass)	**CO$_2$ emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	9,679.00	412.65	NO	9,266.35	NO	NO	NO
1991	10,110.76	411.80	NO	9,698.96	NO	NO	NO
1992	10,472.31	425.06	NO	10,047.25	NO	NO	NO
1993	11,072.46	340.32	NO	10,732.14	NO	NO	NO
1994	11,832.38	402.57	NO	11,429.81	NO	NO	NO
1995	12,245.60	474.13	NO	11,771.46	NO	NO	NO
1996	12,258.87	435.26	NO	11,823.61	NO	NO	NO
1997	12,609.52	570.01	NO	12,039.51	NO	NO	NO
1998	14,499.70	505.67	NO	13,994.03	NO	NO	NO
1999	15,351.55	521.38	NO	14,830.17	NO	NO	NO
2000	15,506.85	343.95	NO	15,162.90	NO	NO	NO
2001	16,310.30	346.01	NO	15,964.29	NO	NO	NO
2002	17,332.31	363.70	NO	16,968.61	NO	NO	NO
2003	18,547.71	264.67	NO	18,283.04	NO	NO	NO
2004	19,461.90	223.58	NO	19,238.32	NO	NO	NO
2005	20,884.36	298.44	NO	20,585.92	NO	NO	NO
2006	21,657.48	379.32	NO	21,278.16	NO	NO	NO
2007	22,213.47	310.35	NO	21,903.12	NO	NO	NO
2008	23,939.95	386.98	NO	23,552.97	NO	NO	NO
2009	24,307.79	336.37	NO	23,971.42	NO	NO	NO
2010	24,484.73	509.07	NO	23,975.66	NO	NO	NO
2011	26,671.77	515.16	NO	26,156.62	NO	NO	NO
2012	29,221.39	594.47	NO	28,626.92	NO	NO	NO
2013	28,142.12	577.82	NO	27,564.29	NO	NO	NO
2014	30,681.73	778.47	NO	29,903.26	NO	NO	NO
2015	33,722.95	738.32	NO	32,984.63	NO	NO	NO
2016	33,475.81	653.81	NO	32,822.00	NO	NO	NO
2017	36,446.42	686.48	NO	35,759.94	NO	NO	NO
2018	36,918.77	668.58	NO	36,250.19	NO	NO	NO
2019	37,277.54	637.40	NO	36,640.14	NO	NO	NO
2020	35,862.29	610.55	NO	35,251.74	NO	NO	NO
Trend							
1990 - 2020	270.5%	48.0%	NA	280.4%	*NA*	*NA*	*NA*
2005 - 2020	71.7%	104.6%	NA	71.2%	*NA*	*NA*	*NA*
2019 - 2020	-3.8%	-4.2%	NA	-3.8%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 87 N_2O Emissions by fuels from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

N_2O emissions	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.022	0.003	NO	0.019	NO	NO	NO
1991	0.024	0.003	NO	0.020	NO	NO	NO
1992	0.025	0.004	NO	0.021	NO	NO	NO
1993	0.025	0.004	NO	0.021	NO	NO	NO
1994	0.026	0.005	NO	0.021	NO	NO	NO
1995	0.029	0.004	NO	0.025	NO	NO	NO
1996	0.031	0.004	NO	0.026	NO	NO	NO
1997	0.030	0.003	NO	0.027	NO	NO	NO
1998	0.031	0.003	NO	0.028	NO	NO	NO
1999	0.033	0.003	NO	0.030	NO	NO	NO
2000	0.035	0.002	NO	0.033	NO	NO	NO
2001	0.036	0.002	NO	0.034	NO	NO	NO
2002	0.039	0.002	NO	0.037	NO	NO	NO
2003	0.041	0.003	NO	0.038	NO	NO	NO
2004	0.042	0.003	NO	0.039	NO	NO	NO
2005	0.045	0.003	NO	0.042	NO	NO	NO
2006	0.045	0.003	NO	0.043	NO	NO	NO
2007	0.047	0.004	NO	0.043	NO	NO	NO
2008	0.051	0.004	NO	0.047	NO	NO	NO
2009	0.056	0.005	NO	0.051	NO	NO	NO
2010	0.054	0.005	NO	0.049	NO	NO	NO
2011	0.060	0.006	NO	0.053	NO	NO	NO
2012	0.065	0.006	NO	0.059	NO	NO	NO
2013	0.064	0.005	NO	0.059	NO	NO	NO
2014	0.069	0.006	NO	0.064	NO	NO	NO
2015	0.070	0.005	NO	0.065	NO	NO	NO
2016	0.070	0.005	NO	0.065	NO	NO	NO
2017	0.068	0.005	NO	0.063	NO	NO	NO
2018	0.022	0.003	NO	0.019	NO	NO	NO
2019	0.024	0.003	NO	0.020	NO	NO	NO
2020	0.025	0.004	NO	0.021	NO	NO	NO
Trend							
1990 - 2020	241.3%	48.0%	NA	280.4%	NA	NA	NA
2005 - 2020	73.3%	104.6%	NA	71.2%	NA	NA	NA
2019 - 2020	-3.8%	-4.2%	NA	-3.8%	NA	NA	NA

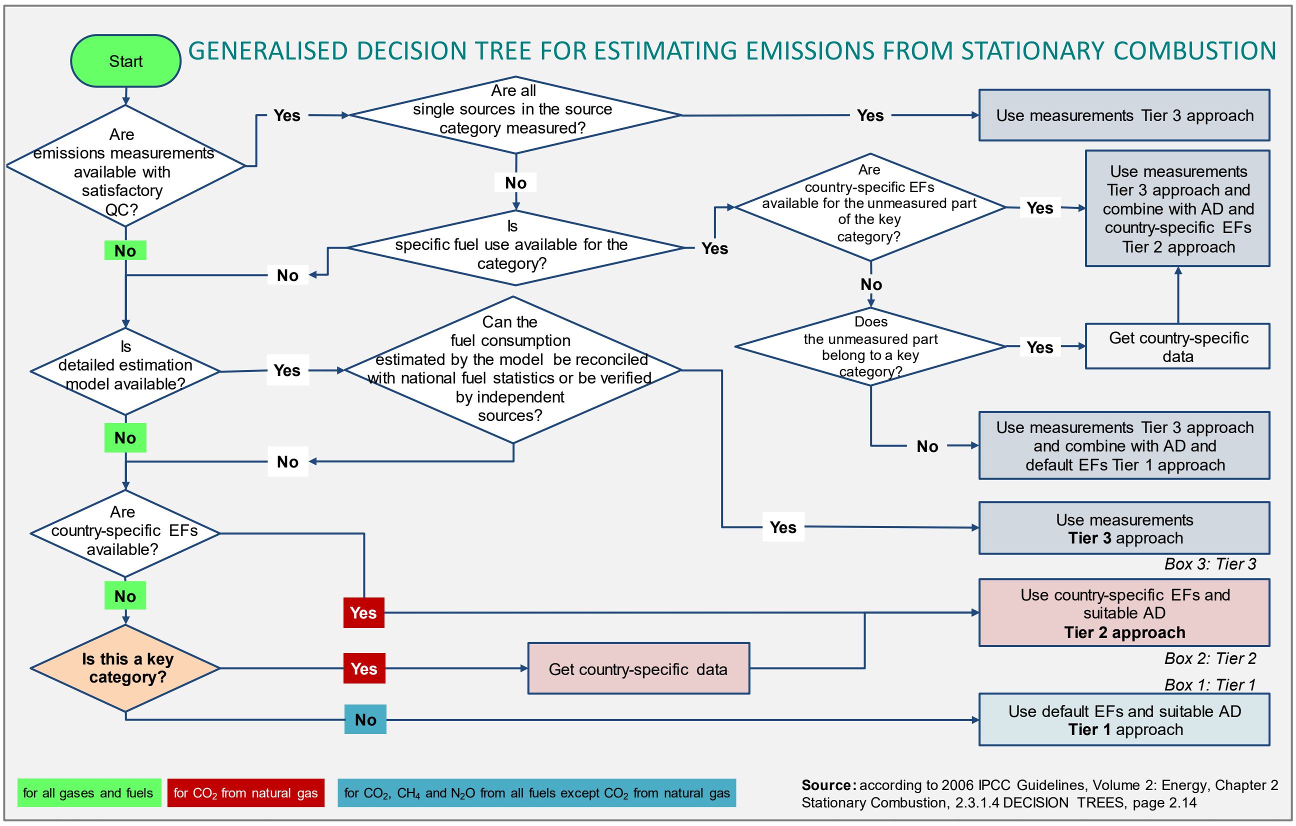
Table 88 CH_4 Emissions by fuels from IPCC category 1.A.1.a Main Activity Electricity and Heat Production

CH_4 emissions	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.18	0.02	NO	0.17	NO	NO	NO
1991	0.19	0.02	NO	0.17	NO	NO	NO
1992	0.20	0.02	NO	0.18	NO	NO	NO
1993	0.21	0.01	NO	0.19	NO	NO	NO
1994	0.22	0.02	NO	0.20	NO	NO	NO
1995	0.23	0.02	NO	0.21	NO	NO	NO
1996	0.23	0.02	NO	0.21	NO	NO	NO
1997	0.24	0.02	NO	0.21	NO	NO	NO
1998	0.27	0.02	NO	0.25	NO	NO	NO
1999	0.29	0.02	NO	0.26	NO	NO	NO
2000	0.28	0.01	NO	0.27	NO	NO	NO
2001	0.30	0.01	NO	0.28	NO	NO	NO
2002	0.32	0.01	NO	0.30	NO	NO	NO
2003	0.34	0.01	NO	0.33	NO	NO	NO
2004	0.35	0.01	NO	0.34	NO	NO	NO
2005	0.38	0.01	NO	0.37	NO	NO	NO
2006	0.39	0.02	NO	0.38	NO	NO	NO
2007	0.40	0.01	NO	0.39	NO	NO	NO
2008	0.44	0.02	NO	0.42	NO	NO	NO
2009	0.44	0.01	NO	0.43	NO	NO	NO
2010	0.45	0.02	NO	0.43	NO	NO	NO
2011	0.49	0.02	NO	0.47	NO	NO	NO
2012	0.53	0.02	NO	0.51	NO	NO	NO
2013	0.51	0.02	NO	0.49	NO	NO	NO
2014	0.56	0.03	NO	0.53	NO	NO	NO
2015	0.62	0.03	NO	0.59	NO	NO	NO
2016	0.61	0.03	NO	0.59	NO	NO	NO
2017	0.67	0.03	NO	0.64	NO	NO	NO
2018	0.67	0.03	NO	0.65	NO	NO	NO
2019	0.68	0.03	NO	0.65	NO	NO	NO
2020	0.65	0.02	NO	0.63	NO	NO	NO
Trend							
1990 - 2020	259.1%	48.0%	NA	280.4%	*NA*	*NA*	*NA*
2005 - 2020	72.3%	104.6%	NA	71.2%	*NA*	*NA*	*NA*
2019 - 2020	-3.8%	-4.2%	NA	-3.8%	*NA*	*NA*	*NA*

3.2.3.1.2 Methodological issues

In the following figure is provided the decision tree and the decision (highlighted) for Tier 1 method for estimating CO_2. CH_4 and N_2O emissions from 1.A.1.a Main Activity Electricity and Heat Production.

Figure 54 Decision tree for estimating GHG emission from 1.A Fuel Combustion Activities



Source: according to 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2 Stationary Combustion, 2.3.1.4 DECISION TREES, page 2.14

3.2.3.1.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[84] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg/TJ)
GHG = CO_2. CH_4. N_2O
Fuel = liquid fuels. solid fuels. gaseous fuels. other fossil fuel. biomass. peat

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[84] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

3.2.3.1.2.2 Choice of activity data

The following fuels are used for electricity production:

Liquid fuels:	• Gas/Diesel Oil
Gaseous fuels:	• Natural gas

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[85]
- 2010 – 2020 are taken from the National Energy balance provided by MEM[86].

The total fuel consumption increased by 272.8%% in the period 1990 – 2020. increased by 71.6% during the period 2005 – 2020. and decreased by 3.8% during the period 2019 – 2020.

The higher consumption of fuels is the result of increased heat and electricity demand by commercial/institutions and households per building and household but also due to the growing number of buildings and households. The dips and jumps from year to year are mainly due to:[87]

- the weather circumstances in the corresponding years
  - cold or mild winters: affecting the heating demand.
  - hot summers: affecting the electricity demand for air conditioning.
- the economic situation as reflected in the gross domestic product (GDP).
- national lockdown due to the COVID pandemic (2020).

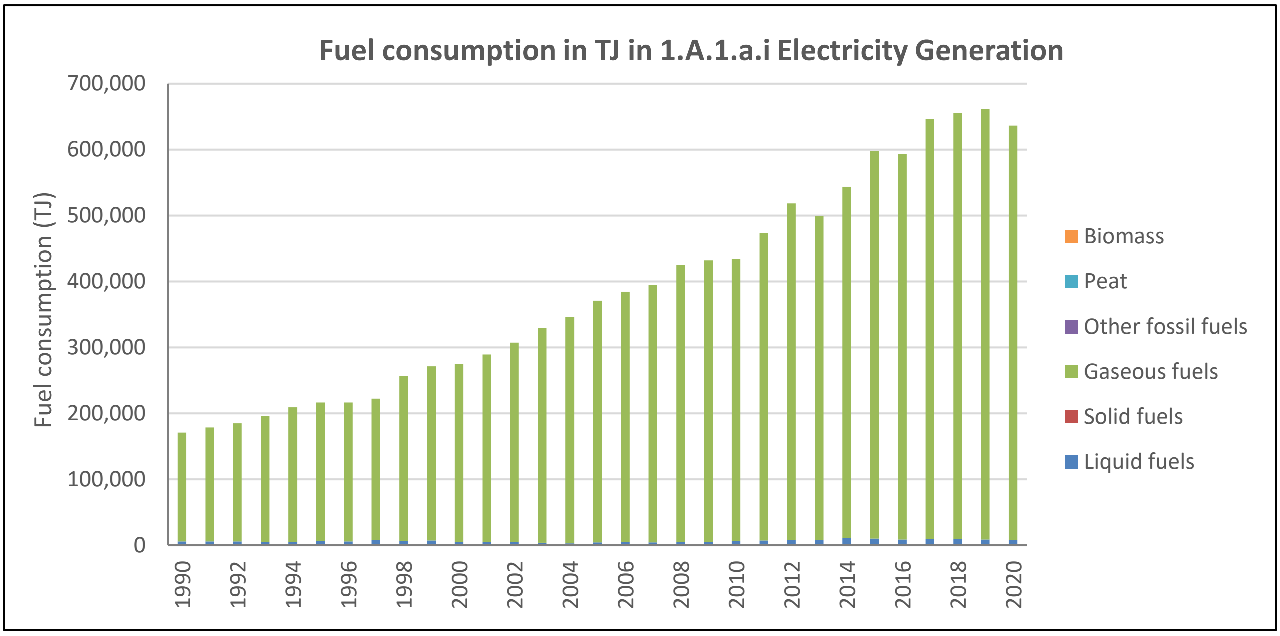

Figure 55 Activity data for IPCC category 1.A.1.a Main Activity Electricity and Heat Production

The following tables provides an overview of installed capacity and produced electricity per technology in Algeria. In the period 1990 and 2017. the installed capacity increased by 463% and the produced electricity increased by 418%.

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[85] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[86] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[87] Please add further explanations if possible maybe in different words compared to text used for emissions trend description

Table 89 Installed capacity and produced electricity per technology

	Unit	1990	2000	2006	2010	2016	2017
SPE[88]	MW	4,686		6,736	8,446	12,702	13,039
SKTM[89]	MW	-		-	-	1,007	1,133
Autres producteurs	MW	-		1,170	3,036	5,412	5,414
Total	**MW**	**4,686**		**7,906**	**11,482**	**19,121**	**19,586**
Thermique vapeur	GWh	8,397	15,757	14,558	9,692	11,512	10,074
Thermique gaz	GWh	6,704	8,830	16,463	19,564	24,441	31,009
Cycle combiné	GWh	-	-	3,419	15,341	28,899	29,508
Hydraulique	GWh	135	54	218	173	72	71
Diesel	GWh	216	368	264	403	281	286
Eolien	GWh	-	-	-	-	19	21
Photovoltaïque	GWh	-	-	-	-	205	500
Total	**GWh**	**15,452**	**25,008**	**34,922**	**45,174**	**66,263 (*)**	**71,470 (*)**

(*) Y compris les injections des tiers (29,607 GWh)

Source : MEM (2022) : Tableau 1 - Evolution de la puissance installée 1980- 2017 par producteur (MW)

Source : MEM (2022) : Tableau 2 - Evolution de l'énergie électrique produite 1980- 2017 (GWh). par type d'équipement. [90]

Taux d'électrification	98 %
Capacité installée	24,561 MW
Réseau de Transport	32,720 km
Réseau de Distribution	367,573 km
Longueur du réseau Electrique	400,293 km
Nombre de clients	10,983,538

Figure 56 **Map of power plants. Source: Sonelgaz**[91]

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[88] SPE – Société Algérienne de Production de l'Eléctricité

[89] SKTM – Shariket Kahraba wa Taket Moutajadida

[90] Available at 23.09.2022 on https://www.energy.gov.dz/?rubrique=electricite-et-gaz#527

[91] Sonalgaz (2022): Carte des centrales electricité; Available at 23.09.2022 on https://www.sonelgaz.dz/fr/3434/electricite-2

Table 90 Activity data for IPCC category 1.A.1.a Main Activity Electricity and Heat Production

Activity data 1.A.1.a.i	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	170,744.38	5,568.84	NO	165,175.54	NO	NO	NO
1991	178,444.30	5,557.31	NO	172,887.00	NO	NO	NO
1992	184,831.64	5,736.29	NO	179,095.35	NO	NO	NO
1993	195,896.45	4,592.77	NO	191,303.68	NO	NO	NO
1994	209,172.80	5,432.81	NO	203,739.98	NO	NO	NO
1995	216,228.56	6,398.54	NO	209,830.02	NO	NO	NO
1996	216,633.53	5,873.91	NO	210,759.62	NO	NO	NO
1997	222,300.40	7,692.41	NO	214,608.00	NO	NO	NO
1998	256,272.16	6,824.13	NO	249,448.03	NO	NO	NO
1999	271,388.58	7,036.13	NO	264,352.45	NO	NO	NO
2000	274,925.17	4,641.70	NO	270,283.48	NO	NO	NO
2001	289,237.96	4,669.54	NO	284,568.42	NO	NO	NO
2002	307,378.94	4,908.19	NO	302,470.76	NO	NO	NO
2003	329,472.69	3,571.76	NO	325,900.93	NO	NO	NO
2004	345,946.36	3,017.30	NO	342,929.06	NO	NO	NO
2005	370,978.02	4,027.58	NO	366,950.45	NO	NO	NO
2006	384,408.90	5,118.99	NO	379,289.91	NO	NO	NO
2007	394,618.25	4,188.27	NO	390,429.98	NO	NO	NO
2008	425,061.43	5,222.40	NO	419,839.03	NO	NO	NO
2009	431,837.46	4,539.41	NO	427,298.04	NO	NO	NO
2010	434,243.71	6,870.08	NO	427,373.63	NO	NO	NO
2011	473,202.03	6,952.20	NO	466,249.83	NO	NO	NO
2012	518,306.31	8,022.60	NO	510,283.72	NO	NO	NO
2013	499,139.99	7,797.88	NO	491,342.12	NO	NO	NO
2014	543,540.64	10,505.64	NO	533,034.99	NO	NO	NO
2015	597,925.18	9,963.89	NO	587,961.29	NO	NO	NO
2016	593,885.70	8,823.28	NO	585,062.42	NO	NO	NO
2017	646,696.29	9,264.19	NO	637,432.09	NO	NO	NO
2018	655,193.64	9,022.63	NO	646,171.01	NO	NO	NO
2019	661,723.87	8,601.89	NO	653,121.97	NO	NO	NO
2020	636,612.84	8,239.54	NO	628,373.30	NO	NO	NO
Trend							
1990 - 2020	272.8%	48.0%	NA	280.4%	NA	NA	NA
2005 - 2020	71.6%	104.6%	NA	71.2%	NA	NA	NA
2019 - 2020	-3.8%	-4.2%	NA	-3.8%	NA	NA	NA

In energy statistics production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units. e.g., in tonnes or cubic metres. To convert these data to energy units. in this case terajoules. requires calorific values. The emission calculations are based on net calorific values. In the following table, the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.1.a *Main Activity Electricity and Heat Production*.

Table 91 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.1.a Main Activity Electricity and Heat Production

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil*	TJ / Gg	43.38 * 0.95 = 41.21	43.0 2006 IPCC default

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source		
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[92]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [93]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

3.2.3.1.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines.

For liquid and gaseous fuels, the default emission factors for CO_2, CH_4 and N_2O were taken from IPCC 2006 Guidelines and are presented in the following table.

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[92] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'Energie et des Mines.

[93] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 92 GHG Emission factor TIER 1 for IPCC category 1.A.1.a Main Activity Electricity and Heat Production

Fuel	**Fuel type**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
Natural gas	gaseous	56 100	D	1	D	0.1	D
Gas / Diesel Oil	liquid	74 100	D	3	D	0.6	D
Source		2006 IPCC Guidelines. Vol. 2. Chap. 2 (2.3.2.1) Table 2.2 Default emission factors for stationary combustion in the energy industries (page 2.16)					
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

3.2.3.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.1.a Main Activity Electricity and Heat Production are presented in the following table.

Table 93 Uncertainty for IPCC category 1.A.1.a Main Activity Electricity and Heat Production.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent, the data sets used for the period 1990 - 2020 is provided by Sonelgaz.

- International Standard Industrial Classification of all Economic Activities (ISIC)[94];
- 2006 IPCC Guidelines - Sectoral Approach. where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities[95].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.3.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series),
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,

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[94] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[95] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
  - Sonelgaz: Chiffres Clés (different years)[96]
  - Sonatrach: Rapport Annuel (different years)[97]
  - national statistic published by MEM and Office National des Statistiques (ONS)[98] and
  - international energy statistics of UN statistics[99]. and Joint Organizations Data Initiative - Oil and Gas Data[100]. International Energy Agency (IEA)[101]
  - Organization of the Petroleum Exporting Countries (OPEC)[102]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.3.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.1.a Main Activity Electricity and Heat Production*.

Table 94 Recalculations done since NC in IPCC category 1.A.1.a Main Activity Electricity and Heat Production

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.1.a	Revision of NCV and application of country specific GCV and NCV	AD	Accuracy
1.A.1.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy
1.A.1.a	Application of 2006 IPCC Guidelines 1994: revision of CH_4 EF	EF	Comparability
1.A.2.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability

3.2.3.1.5.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

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[96] https://www.sonelgaz.dz/fr

[97] https://sonatrach.com/rapports

[98] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[99] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[100] https://www.jodidata.org/

[101] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

[102] https://asb.opec.org/data/ASB_Data.php

Table 95 Planned improvements for IPCC category 1.A.1.a Main Activity Electricity and Heat Production

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.1.a.i	Preparation of country specific GCV and NCV per year instead of using a constant value for whole timeseries	AD	Completeness Transparency	high
1.A.1.a.ii 1.A.1.a.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion	AD	Completeness Transparency	high
1.A.1.a	Further refinement of the country specific emission factor (CS EF) based on plant specific data for each year	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.a	Carbon content (%) of gas/diesel oil, residual fuel oil, and natural gas etc. for preparing country specific emission factor (CS EF) ⇒ **CS EF**$_{CO2}$ [t/TJ] = (C [%] • 44 • Ox)/(NCV [TJ/t] • 12• 100)	EF	Accuracy Transparency	medium
1.A.1.a	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.a	Input – output analysis: Electricity supply, gross production, imports, exports and net imports [GWh]	AD	Transparency	High
1.A.1.a.ii 1.A.1.a.iii	Survey for use of fuels in Heat Plants and CHP	AD	Completeness	medium
1.A.1.a 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low

3.2.3.2 Petroleum Refining (IPCC category 1.A.1.b)

3.2.3.2.1 Category description

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.1.b	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	LA 1990	-	LA 1990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

This section describes GHG emissions resulting from all combustion activities supporting the refining of petroleum products including on-site combustion for the generation of electricity and/or heat for own use. Fugitive emissions (evaporative emissions) occurring at the refinery are not included and should be reported separately under 1.B.2.a category. Petroleum Refining is a key source with regards to CO_2 emissions from liquid and gaseous fuels. It is important to specify that oil refining and petrochemical production are physically distinct because they are produced by two different divisions (activities).

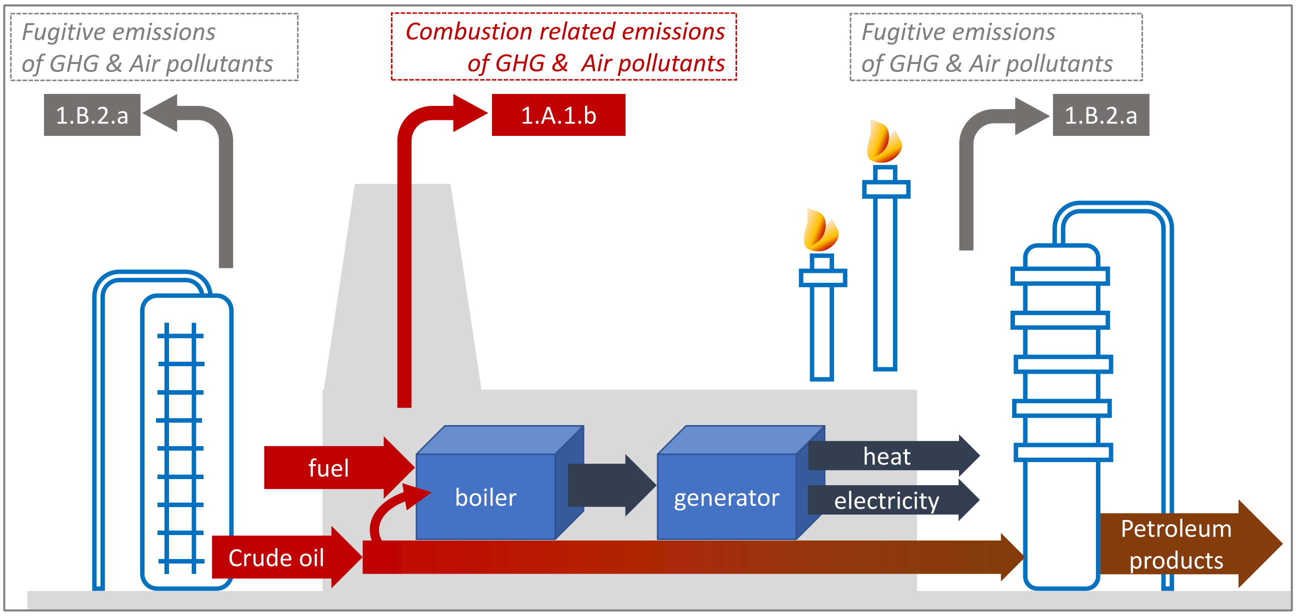
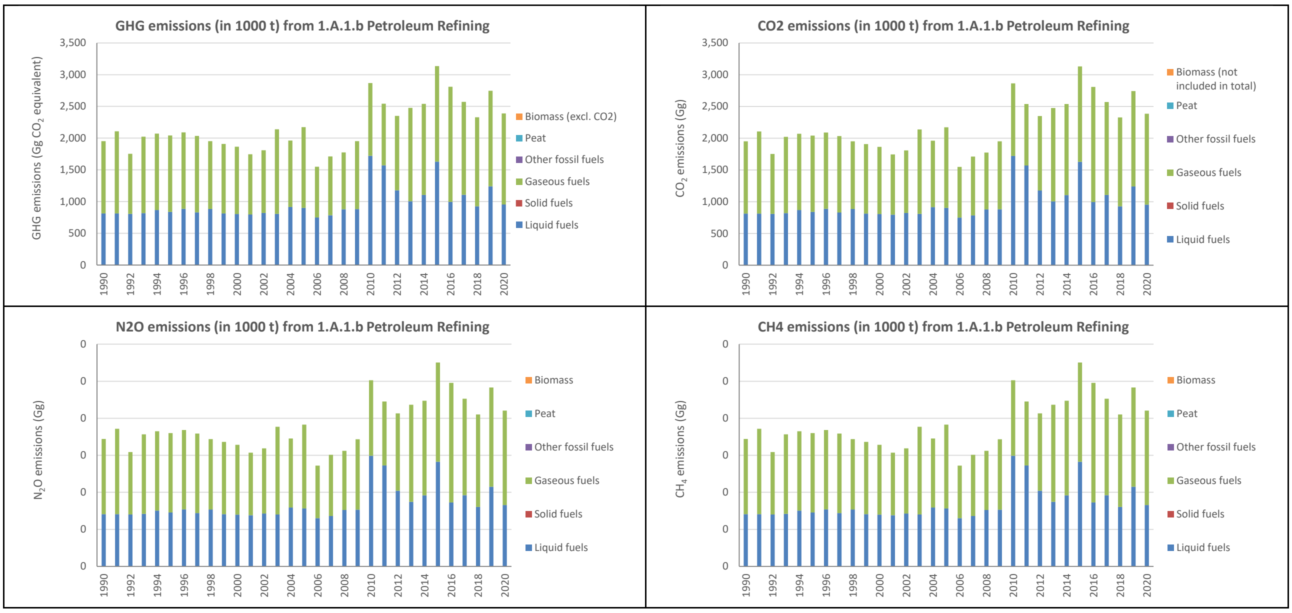


Figure 57 Reporting of emission from refinery: fuel combustion and fugitive emissions.

An overview of the emission from fuel combustion in IPCC category 1.A.1.b Petroleum *Refining* is provided in the following figures and tables.

The greenhouse gas emissions from IPCC category 1.A.1.b Petroleum *Refining* amounted to 1,953.58 kt CO_2 equivalents in 1990, 2,173.10 kt CO_2 equivalents in 2005 and 2,388.37 kt CO_2 equivalents in 2020.
The overall trend in GHG emissions from the IPCC category 1.A.1.b Petroleum *Refining* shows an increase by 22.3% from 1990 to 2020, an increase by 9.9% from 2005 to 2020, a decrease by -13.0% from 2019 to 2020.

The overall increasing trend of emissions is the result of the increase in petroleum refining capacity in Algeria due to the implementation of two new refineries, namely Adrar (RA1D) with a processing capacity of 0.6 Mt per year and Skikda (RA2K) with a processing capacity of 5 Mt per year. In addition, the extension of the processing capacities of the refineries of ARZEW (RA1Z), Skikda (RA1K) and Algiers (RA1G) in 2012,2013 and 2019 successively, contributed to the increase of emissions from petroleum refining. However, the decrease of emissions trend from 2019 to 2020 is mainly due to the COVID19 pandemic.



GHG emissions (in 1000 t) from 1.A.1.b Petroleum Refining

CO2 emissions (in 1000 t) from 1.A.1.b Petroleum Refining

N2O emissions (in 1000 t) from 1.A.1.b Petroleum Refining

CH4 emissions (in 1000 t) from 1.A.1.b Petroleum Refining

Figure 58 Emissions from IPCC category 1.A.1.b *Petroleum Refining*

Table 96 Emissions from IPCC category 1.A.1.b *Petroleum Refining*

GHG emissions	**TOTAL GHG** (excluding CO_2 from biomass)	**CO_2**	**N_2O** (including biomass)	**CH_4** (including biomass)	**N_2O** (including biomass)	**CH_4** (including biomass)	**CO_2** (biomass) (1)
1.A.1.b	**Kt CO_2 equivalent**	**kt**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**kt**	**kt**	**kt**
1990	1,953.58	1,951.70	1.03	0.86	0.0036	0.036	NO
1991	2,107.47	2,105.44	1.11	0.93	0.0036	0.036	NO
1992	1,753.75	1,752.06	0.92	0.77	0.0036	0.036	NO
1993	2,023.32	2,021.37	1.06	0.89	0.0037	0.037	NO
1994	2,071.84	2,069.84	1.09	0.91	0.0036	0.036	NO
1995	2,043.30	2,041.33	1.07	0.90	0.0034	0.034	NO
1996	2,091.82	2,089.80	1.10	0.92	0.0034	0.034	NO
1997	2,034.74	2,032.77	1.07	0.90	0.0033	0.033	NO
1998	1,952.56	1,950.68	1.02	0.86	0.0031	0.031	NO
1999	1,909.71	1,907.87	1.00	0.84	0.0032	0.032	NO
2000	1,864.01	1,862.21	0.98	0.82	0.0038	0.038	NO
2001	1,744.92	1,743.23	0.91	0.77	0.0035	0.035	NO
2002	1,810.17	1,808.43	0.95	0.80	0.0038	0.038	NO
2003	2,138.61	2,136.54	1.12	0.94	0.0027	0.027	NO
2004	1,962.62	1,960.73	1.03	0.86	0.0030	0.030	NO
2005	2,173.10	2,171.00	1.14	0.96	0.0031	0.031	NO
2006	1,548.65	1,547.15	0.81	0.68	0.0034	0.034	NO
2007	1,711.62	1,709.97	0.90	0.75	0.0050	0.050	NO
2008	1,776.18	1,774.47	0.93	0.78	0.0045	0.045	NO
2009	1,951.62	1,949.74	1.02	0.86	0.0041	0.041	NO
2010	2,867.14	2,864.39	1.50	1.26	0.0044	0.044	NO
2011	2,541.58	2,539.14	1.33	1.11	0.0045	0.045	NO
2012	2,351.37	2,349.11	1.23	1.03	0.0055	0.055	NO
2013	2,477.60	2,475.21	1.30	1.09	0.0050	0.050	NO
2014	2,540.42	2,537.97	1.33	1.12	0.0045	0.045	NO
2015	3,134.80	3,131.78	1.64	1.38	0.0041	0.041	NO
2016	2,809.60	2,806.89	1.48	1.24	0.0048	0.048	NO
2017	2,572.40	2,569.92	1.35	1.13	0.0042	0.042	NO
2018	2,329.09	2,326.84	1.22	1.03	0.0036	0.036	NO
2019	2,745.85	2,743.20	1.44	1.21	0.0036	0.036	NO
2020	2,388.37	2,386.06	1.25	1.05	0.0036	0.036	NO
Trend							
1990 - 2020	22.3%	22.3%	22.3%	22.3%	22.3%	22.3%	*NA*
2005 - 2020	9.9%	9.9%	10.0%	10.0%	10.0%	10.0%	*NA*
2019 - 2020	-13.0%	-13.0%	-12.9%	-12.9%	-12.9%	-12.9%	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 97 GHG Emissions by fuels from IPCC category 1.A.1.b *Petroleum Refining*

GHG emissions	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.b	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**	**Kt CO_2 equivalent**
1990	1,953.58	813.37	NO	1,140.22	NO	NO	NO
1991	2,107.47	813.37	NO	1,294.11	NO	NO	NO
1992	1,753.75	807.66	NO	946.10	NO	NO	NO
1993	2,023.32	819.07	NO	1,204.25	NO	NO	NO
1994	2,071.84	867.59	NO	1,204.25	NO	NO	NO
1995	2,043.30	839.05	NO	1,204.25	NO	NO	NO
1996	2,091.82	887.57	NO	1,204.25	NO	NO	NO
1997	2,034.74	830.49	NO	1,204.25	NO	NO	NO
1998	1,952.56	884.71	NO	1,067.85	NO	NO	NO
1999	1,909.71	813.37	NO	1,096.35	NO	NO	NO
2000	1,864.01	804.80	NO	1,059.20	NO	NO	NO
2001	1,744.92	796.24	NO	948.67	NO	NO	NO
2002	1,810.17	821.93	NO	988.25	NO	NO	NO
2003	2,138.61	807.66	NO	1,330.95	NO	NO	NO
2004	1,962.62	916.11	NO	1,046.52	NO	NO	NO
2005	2,173.10	901.84	NO	1,271.27	NO	NO	NO
2006	1,548.65	750.58	NO	798.07	NO	NO	NO
2007	1,711.62	784.83	NO	926.79	NO	NO	NO
2008	1,776.18	879.01	NO	897.17	NO	NO	NO
2009	1,951.62	881.86	NO	1,069.77	NO	NO	NO
2010	2,867.14	1,722.76	NO	1,144.38	NO	NO	NO
2011	2,541.58	1,571.69	NO	969.89	NO	NO	NO
2012	2,351.37	1,178.04	NO	1,173.33	NO	NO	NO
2013	2,477.60	1,005.06	NO	1,472.54	NO	NO	NO
2014	2,540.42	1,105.63	NO	1,434.78	NO	NO	NO
2015	3,134.80	1,629.32	NO	1,505.48	NO	NO	NO
2016	2,809.60	995.14	NO	1,814.47	NO	NO	NO
2017	2,572.40	1,107.11	NO	1,465.29	NO	NO	NO
2018	2,329.09	926.16	NO	1,402.93	NO	NO	NO
2019	2,745.85	1,241.28	NO	1,504.57	NO	NO	NO
2020	2,388.37	954.01	NO	1,434.36	NO	NO	NO
Trend							
1990 - 2020	22.3%	17.3%	NA	25.8%	*NA*	*NA*	*NA*
2005 - 2020	9.9%	5.8%	NA	12.8%	*NA*	*NA*	*NA*
2019 - 2020	-13.0%	-23.1%	NA	-4.7%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 98 CO_2 Emissions by fuels from IPCC category 1.A.1.b *Petroleum Refining*

CO_2 emissions	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.b	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	1,951.697	812.592	NO	1,139.105	NO	NO	NO
1991	2,105.439	812.592	NO	1,292.847	NO	NO	NO
1992	1,752.062	806.890	NO	945.173	NO	NO	NO
1993	2,021.370	818.294	NO	1,203.076	NO	NO	NO
1994	2,069.841	866.765	NO	1,203.076	NO	NO	NO
1995	2,041.329	838.253	NO	1,203.076	NO	NO	NO
1996	2,089.799	886.723	NO	1,203.076	NO	NO	NO
1997	2,032.775	829.699	NO	1,203.076	NO	NO	NO
1998	1,950.675	883.872	NO	1,066.803	NO	NO	NO
1999	1,907.872	812.592	NO	1,095.280	NO	NO	NO
2000	1,862.208	804.038	NO	1,058.169	NO	NO	NO
2001	1,743.233	795.485	NO	947.748	NO	NO	NO
2002	1,808.427	821.146	NO	987.281	NO	NO	NO
2003	2,136.544	806.890	NO	1,329.654	NO	NO	NO
2004	1,960.732	915.235	NO	1,045.496	NO	NO	NO
2005	2,171.005	900.979	NO	1,270.025	NO	NO	NO
2006	1,547.153	749.866	NO	797.288	NO	NO	NO
2007	1,709.966	784.080	NO	925.886	NO	NO	NO
2008	1,774.468	878.170	NO	896.298	NO	NO	NO
2009	1,949.743	881.021	NO	1,068.722	NO	NO	NO
2010	2,864.386	1,721.122	NO	1,143.264	NO	NO	NO
2011	2,539.143	1,570.201	NO	968.942	NO	NO	NO
2012	2,349.108	1,176.923	NO	1,172.185	NO	NO	NO
2013	2,475.208	1,004.109	NO	1,471.099	NO	NO	NO
2014	2,537.966	1,104.583	NO	1,433.384	NO	NO	NO
2015	3,131.784	1,627.774	NO	1,504.010	NO	NO	NO
2016	2,806.888	994.190	NO	1,812.697	NO	NO	NO
2017	2,569.920	1,106.063	NO	1,463.857	NO	NO	NO
2018	2,326.840	925.281	NO	1,401.560	NO	NO	NO
2019	2,743.200	1,240.101	NO	1,503.099	NO	NO	NO
2020	2,386.063	953.106	NO	1,432.957	NO	NO	NO
Trend							
1990 - 2020	22.3%	17.3%	NA	25.8%	*NA*	*NA*	*NA*
2005 - 2020	9.9%	5.8%	NA	12.8%	*NA*	*NA*	*NA*
2019 - 2020	-13.0%	-23.1%	NA	-4.7%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 99 N_2O Emissions by fuels from IPCC category 1.A.1.b *Petroleum Refining*

N_2O emissions	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.b	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.004	0.001	NO	0.002	NO	NO	NO
1991	0.004	0.002	NO	0.002	NO	NO	NO
1992	0.004	0.001	NO	0.002	NO	NO	NO
1993	0.004	0.002	NO	0.002	NO	NO	NO
1994	0.004	0.001	NO	0.002	NO	NO	NO
1995	0.003	0.002	NO	0.002	NO	NO	NO
1996	0.003	0.001	NO	0.002	NO	NO	NO
1997	0.003	0.001	NO	0.002	NO	NO	NO
1998	0.003	0.001	NO	0.002	NO	NO	NO
1999	0.003	0.001	NO	0.002	NO	NO	NO
2000	0.004	0.001	NO	0.002	NO	NO	NO
2001	0.003	0.002	NO	0.002	NO	NO	NO
2002	0.004	0.002	NO	0.002	NO	NO	NO
2003	0.003	0.001	NO	0.001	NO	NO	NO
2004	0.003	0.001	NO	0.002	NO	NO	NO
2005	0.003	0.002	NO	0.002	NO	NO	NO
2006	0.003	0.002	NO	0.002	NO	NO	NO
2007	0.005	0.003	NO	0.002	NO	NO	NO
2008	0.004	0.003	NO	0.002	NO	NO	NO
2009	0.004	0.002	NO	0.002	NO	NO	NO
2010	0.004	0.002	NO	0.003	NO	NO	NO
2011	0.004	0.002	NO	0.003	NO	NO	NO
2012	0.006	0.003	NO	0.003	NO	NO	NO
2013	0.005	0.002	NO	0.003	NO	NO	NO
2014	0.005	0.002	NO	0.003	NO	NO	NO
2015	0.004	0.002	NO	0.002	NO	NO	NO
2016	0.005	0.002	NO	0.003	NO	NO	NO
2017	0.004	0.002	NO	0.003	NO	NO	NO
2018	0.004	0.001	NO	0.002	NO	NO	NO
2019	0.004	0.002	NO	0.002	NO	NO	NO
2020	0.004	0.001	NO	0.002	NO	NO	NO
Trend							
1990 - 2020	22.3%	17.3%	NA	25.8%	*NA*	*NA*	*NA*
2005 - 2020	10.0%	5.8%	NA	12.8%	*NA*	*NA*	*NA*
2019 - 2020	-12.9%	-23.1%	NA	-4.7%	*NA*	*NA*	*NA*

Table 100CH$_4$ Emissions by fuels from IPCC category 1.A.1.b *Petroleum Refining*

CH$_4$ emissions	**Total CH$_4$ emissions**	**CH$_4$ emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.b	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.034	0.014	NO	0.020	NO	NO	NO
1991	0.037	0.014	NO	0.023	NO	NO	NO
1992	0.031	0.014	NO	0.017	NO	NO	NO
1993	0.036	0.014	NO	0.021	NO	NO	NO
1994	0.036	0.015	NO	0.021	NO	NO	NO
1995	0.036	0.015	NO	0.021	NO	NO	NO
1996	0.037	0.015	NO	0.021	NO	NO	NO
1997	0.036	0.014	NO	0.021	NO	NO	NO
1998	0.034	0.015	NO	0.019	NO	NO	NO
1999	0.034	0.014	NO	0.020	NO	NO	NO
2000	0.033	0.014	NO	0.019	NO	NO	NO
2001	0.031	0.014	NO	0.017	NO	NO	NO
2002	0.032	0.014	NO	0.018	NO	NO	NO
2003	0.038	0.014	NO	0.024	NO	NO	NO
2004	0.035	0.016	NO	0.019	NO	NO	NO
2005	0.038	0.016	NO	0.023	NO	NO	NO
2006	0.027	0.013	NO	0.014	NO	NO	NO
2007	0.030	0.014	NO	0.017	NO	NO	NO
2008	0.031	0.015	NO	0.016	NO	NO	NO
2009	0.034	0.015	NO	0.019	NO	NO	NO
2010	0.050	0.030	NO	0.020	NO	NO	NO
2011	0.045	0.027	NO	0.017	NO	NO	NO
2012	0.041	0.020	NO	0.021	NO	NO	NO
2013	0.044	0.017	NO	0.026	NO	NO	NO
2014	0.045	0.019	NO	0.026	NO	NO	NO
2015	0.055	0.028	NO	0.027	NO	NO	NO
2016	0.050	0.017	NO	0.032	NO	NO	NO
2017	0.045	0.019	NO	0.026	NO	NO	NO
2018	0.041	0.016	NO	0.025	NO	NO	NO
2019	0.048	0.022	NO	0.027	NO	NO	NO
2020	0.042	0.017	NO	0.026	NO	NO	NO
Trend							
1990 - 2020	22.3%	17.3%	NA	25.8%	*NA*	*NA*	*NA*
2005 - 2020	10.0%	5.8%	NA	12.8%	*NA*	*NA*	*NA*

CH_4 emissions	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.1.b	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2019 - 2020	-12.9%	-23.1%	NA	-4.7%	*NA*	*NA*	*NA*

3.2.3.2.2 Methodological issues

3.2.3.2.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2. CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[103] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{GHG.\ fuel}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{fuel}$ = amount of fuel combusted (TJ)
Emission factor $_{GHG.\ fuel}$ = default emission factor of a given GHG by type of fuel (kg/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

3.2.3.2.2.2 Choice of activity data

The following fuels are used for petroleum refining:

Liquid fuels:
- Refinery gas

Gaseous fuels:
- Natural gas

Fuel consumption used for estimating the GHG and non-GHG emissions for the years:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[104];
- 2010 – 2020 are taken from the data provided by MEM[105].

The total fuel consumption increased by 22.3% in the period 1990 – 2020, increased by 10.0% in the period 2005 – 2020, and decreased by 12.9% during the period 2019 – 2020.

The higher fuel consumption is the result of the implementation of two new refineries, namely Adrar (RA1D) with a processing capacity of 0.6 Mt per year and Skikda (RA2K) with a processing capacity of 5Mt per year. In addition. the rehabilitation and extension of the processing capacities of the refineries of ARZEW (RA1Z). Skikda (RA1K) and Algiers (RA1G) in 2012, 2013 and 2019 successively, contributed to the increase in fuel consumption. Finally, in 2020 the national and international lockdown due to the COVID pandemic led to

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[103] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[104] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[105] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

decreased demand of petroleum product.

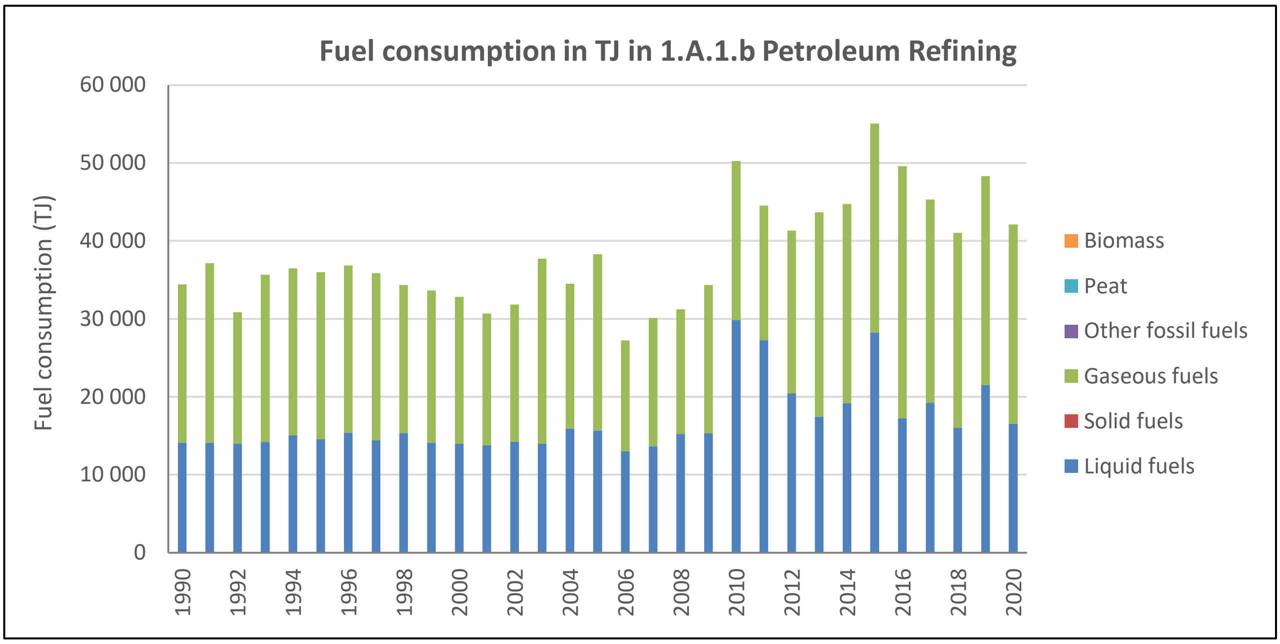

Figure 59 Activity data for IPCC category 1.A.1.b *Petroleum Refining*

Additionally, the following figure provides an overview of installed capacity of the Algerian refineries.

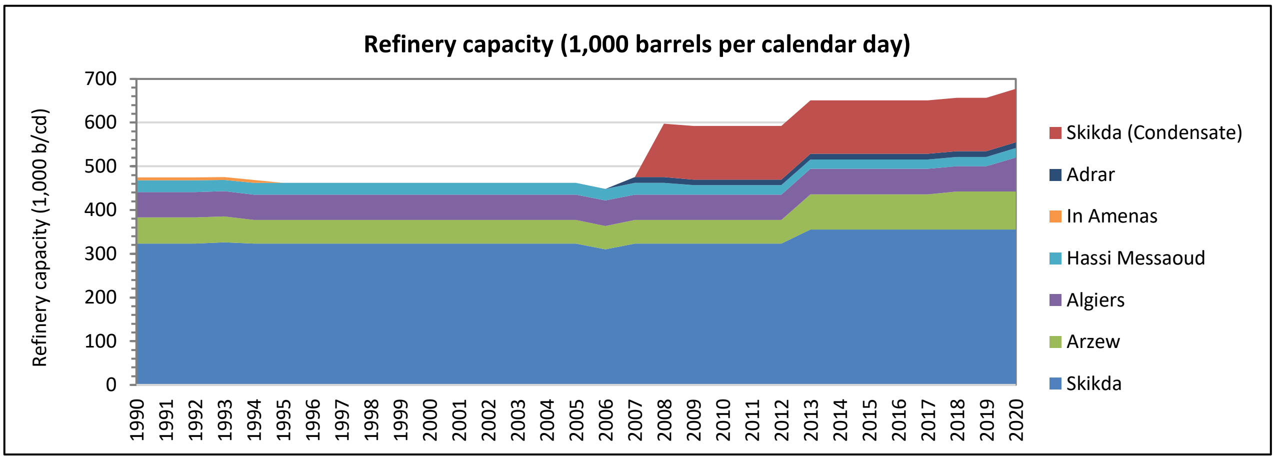

Figure 60 Refinery capacity. Source: OPEC[106]

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[106] OPEC (2022): Oil data: downstream - Table 4.1: Refinery capacity in OPEC Members by company and location; Available at 23.09.2022 on https://asb.opec.org/data/ASB_Data.php

Table 101 Activity data for IPCC category 1.A.1.b *Petroleum Refining*

Activity data 1. A.1.b	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	34,412.40	14,107.50	NO	20,304.90	NO	NO	NO
1991	37,152.90	14,107.50	NO	23,045.40	NO	NO	NO
1992	30,856.50	14,008.50	NO	16,848.00	NO	NO	NO
1993	35,651.70	14,206.50	NO	21,445.20	NO	NO	NO
1994	36,493.20	15,048.00	NO	21,445.20	NO	NO	NO
1995	35,998.20	14,553.00	NO	21,445.20	NO	NO	NO
1996	36,839.70	15,394.50	NO	21,445.20	NO	NO	NO
1997	35,849.70	14,404.50	NO	21,445.20	NO	NO	NO
1998	34,361.10	15,345.00	NO	19,016.10	NO	NO	NO
1999	33,631.20	14,107.50	NO	19,523.70	NO	NO	NO
2000	32,821.20	13,959.00	NO	18,862.20	NO	NO	NO
2001	30,704.40	13,810.50	NO	16,893.90	NO	NO	NO
2002	31,854.60	14,256.00	NO	17,598.60	NO	NO	NO
2003	37,710.00	14,008.50	NO	23,701.50	NO	NO	NO
2004	34,525.80	15,889.50	NO	18,636.30	NO	NO	NO
2005	38,280.60	15,642.00	NO	22,638.60	NO	NO	NO
2006	27,230.40	13,018.50	NO	14,211.90	NO	NO	NO
2007	30,116.70	13,612.50	NO	16,504.20	NO	NO	NO
2008	31,222.80	15,246.00	NO	15,976.80	NO	NO	NO
2009	34,345.80	15,295.50	NO	19,050.30	NO	NO	NO
2010	50,259.62	29,880.59	NO	20,379.03	NO	NO	NO
2011	44,532.13	27,260.43	NO	17,271.70	NO	NO	NO
2012	41,327.25	20,432.69	NO	20,894.56	NO	NO	NO
2013	43,655.24	17,432.44	NO	26,222.80	NO	NO	NO
2014	44,727.30	19,176.79	NO	25,550.51	NO	NO	NO
2015	55,069.42	28,259.97	NO	26,809.45	NO	NO	NO
2016	49,572.15	17,260.25	NO	32,311.90	NO	NO	NO
2017	45,296.19	19,202.48	NO	26,093.72	NO	NO	NO
2018	41,047.14	16,063.90	NO	24,983.24	NO	NO	NO
2019	48,322.74	21,529.54	NO	26,793.21	NO	NO	NO
2020	42,089.89	16,546.98	NO	25,542.91	NO	NO	NO
Trend							
1990 - 2020	22.3%	17.3%	NA	25.8%	NA	NA	NA
2005 - 2020	10.0%	5.8%	NA	12.8%	NA	NA	NA
2019 - 2020	-12.9%	-23.1%	NA	-4.7%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.1.b *Petroleum Refining*.

Table 102Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.1.b *Petroleum Refining*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Refinery gas	TJ / Gg	MEM/Sonatrach	49.5 2006 IPCC default
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)		Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[107]	
	Default Net Calorific values (NCVs)		2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)	
	Conversion from GCV to NCV		International Recommendations for Energy Statistics (IRES) (2018) [108]: Table 4 Difference between net and gross calorific values for selected fuels	
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

3.2.3.2.2.3 Choice of emission factors

For liquid fuels the default emission factors for CO_2, CH_4 and N_2O were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 103 GHG Emission factor TIER 1 for IPCC category 1.A.1.b *Petroleum Refining*

Fuel	**Fuel type**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
Natural gas	gaseous	56 100	D	1	D	0.1	D
Refinery Gas	liquid	57 600	D	1	D	0.1	D
Source		2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.2 Default emission factors for stationary combustion in the energy industries (page 2.16)					
Note:							
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor	

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[107] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines.

[108] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.3.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.1.b *Petroleum Refining* are presented in the following table.

Table 104Uncertainty for IPCC category 1.A.1.b *Petroleum Refining.*

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[109] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[110].
- In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the
- International Standard Industrial Classification of all Economic Activities (ISIC) [111];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [112]. A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.3.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series),
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.

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[109] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[110] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[111] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[112] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

- cross-checked from different sources:
    - Sonatrach RAPPORT ANNUEL (different years)[113]
    - national statistic published by MEM and Office National des Statistics (ONS)[114] and
    - international energy statistics of UN statistics[115], and Joint Organizations Data Initiative - Oil and Gas Data[116]. International Energy Agency (IEA)[117]
    - Organization of the Petroleum Exporting Countries (OPEC)[118]
- cross checks with other relevant sectors are performed to avoid double counting or omissions.
- time series consistency - plausibility checks of dips and jumps.

3.2.3.2.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.1.b *Petroleum Refining*.

Table 105Recalculations done since NC in IPCC category 1.A.1.b *Petroleum Refining*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.1.b	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.1.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.1.b	Revision of NCV Default → country specific: Natural gas. Refinery gas	AD	Accuracy Comparability
1.A.1.b	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.3.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 106Planned improvements for IPCC category 1.A.1.b *Petroleum Refining*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.1.b	Preparation of country specific GCV and NCV per year instead of using a constant value for whole timeseries	AD	Completeness Transparency	high
1.A.1.b	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion	AD	Completeness Transparency	high

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[113] https://sonatrach.com/rapports

[114] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[115] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[116] https://www.jodidata.org/

[117] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

[118] https://asb.opec.org/data/ASB_Data.php

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.1.b	Further refinement of the country specific CO_2 emission factor (CS EF) for natural gas based on plant specific data for each year	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.b	Carbon content (%) of gas/diesel oil, residual fuel oil and natural gas etc. for preparing country specific emission factor (CS EF) $\Rightarrow$ **CS EF**$_{CO2}$ [t/TJ] = (C [%] • 44 • Ox)/(NCV [TJ/t] • 12• 100)	EF	Accuracy Transparency	medium
1.A.1.b	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.b	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.b	Preparation of an overview of national refinery sector - processes and functional units including related emissions[119] • fundamental processes. • separation processes. • conversion processes • refining processes • extractions • other processes	AD	Transparency Completeness Accuracy	high

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[119] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

3.2.3.3 Manufacture of Solid Fuels and Other Energy Industries (IPCC category 1.A.1.c)

The IPCC category 1.A.1.c *Manufacture of Solid Fuels and Other Energy Industries* is divided in two sub-categories:

1.A.1.c.i Manufacture *of Solid Fuels*
    Coke production
1.A.1.c.ii *Oil and gas extraction*
1.A.1.c.iii Other Energy Industries
    1.A.1. c.iii.1 *Wood charcoal production*
    1.A.1. c.iii.2
- Refinery gas: SH-*Raffinage et Pétrochimie*[120]
- LPG. Motor gasoline. Gas/Diesel Oil: SH *Liquefaction et séparation*[138]
- Natural_gaz_includ_LNG: 12.3-*Unites_de liquefaction*[121]

    1.A.1. c.iii.3 Consumption in Energy industries under "*Other/Autres*" in the Energy balance

GHG emissions/ removals	CO_2						CH_4						N_2O					
Estimated	liquid	solid	gaseous	Other fossil fuel	Peat	Biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass
1.A.1.c.i	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO
1.A.1.c.ii	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO
1.A.1. c.iii																		
1.A.1. c.iii.1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NE	✓	NO	✓	NO	NO	NO
1.A.1. c.iii.2	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
1.A.1. c.iii.3	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

3.2.3.3.1 Manufacture of Solid Fuels – Coke production (IPCC category 1.A.1.c.i)

3.2.3.3.1.1 Category description

GHG emissions/ removals	CO_2						CH_4						N_2O					
Estimated	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass
1.A.1.c.i	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	NA	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

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[120] consommation énergétique du secteur de l''énergie finale le 03.06.2021.xlsx]

[121] 1990-2009 : Energy balance UNE stat ;
2010-2020 : consommation énergétique du secteur de l''énergie finale le 03.06.2021.xlsx

This section describes the emissions arising during the production of coke. As described in the 2019 IPCC Refinements to the 2006 IPCC GL.

[1] Coke is the most important reducing agent used in primary metal production. Other uses of coke include as a heating fuel and feedstock.

(1) coal handling and preparation, including transportation, discharge, storage, crushing, bed blending, that in all cases cause dust emissions, but not GHG emissions

(2) coke oven battery operations. including coal charging. chamber heating and firing. coking. coke pushing and quenching and coke handling (i.e, storing. transporting. crushing and screening).

The coke is produced by the pyrolysis of coal in so called “coke oven battery operations”. This is a managed thermal treatment of the coal which limits combustion or oxidation of the coal or coke product. Coal pyrolysis at high temperature is called carbonization. The process produces coke, volatile compounds, and a range of other gases. In the coke production process, the coal is heated indirectly up to 1 000 – 1 100°C for 14 – 28 hours.

(3) Fugitive emissions, which have to be reported in 1. B.1.b.ii., can occur during coking operations from leakages at the battery, for example, because of leakage from vessels, oven doors, flanges, or at the by-product plant. Fugitive emissions occur also from the ascension pipe and charging hole sealings.

(4) coke oven gas treatment.

The following table 4.1a presents a summary of the allocation of emissions from metallurgical coke production

Table 107 Emission allocation from metallurgical coke production

Processes	**Gases**	**GHG emissions from**		**Fugitive GHG emissions**	
		carbonisation	**combustion**	**diffuse**	**flaring**
Coal charging	CO_2	NO	NO	NO	NO
	CH_4	NO	NO	1.B.1c (3)	NO
	N_2O	NO	NO	NO	NO
Chamber heating and firing	CO_2	NO	1.A.1.c	NS	NO
	CH_4	NO		1.B.1c (3)	NO
	N_2O	NO		NO	NO
Coking	CO_2	1.A.1.c	NO	NS	NO
	CH_4			1.B.1c (3)	NO
	N_2O			NO	NO
Coke pushing	CO_2	NO	NO	NS	NO
	CH_4	NO	NO	1.B.1c (3)	NO
	N_2O	NO	NO	NO	NO
Coke quenching	CO_2	NO	NO	NS	NO
	CH_4	1.A.1.c (1)	NO	1.B.1c (3)	NO
	N_2O	NO	NO	NO	NO
Emergencies and Coke oven gas (COG) consumer maintenance among other reasons	CO_2	NO	NO	NS	1.B.1c (3) and 1.A.1.c (1) (4)
	CH_4	NO	NO	1.B.1c (3)	1.B.1c
	N_2O	NO	NO	NS	

Note: (1) Methodology described in this Chapter 4 Volume 3 of the 2019 Refinement

(2) Methodology described in Chapter 2. Volume 2 of 2006 IPCC Guidelines

(3) Methodology described in Chapter 4 Volume 2 of the 2019 Refinement

(4) When simplified carbon balance approach is used (Tier 1.b)

Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential. NS: Not significant

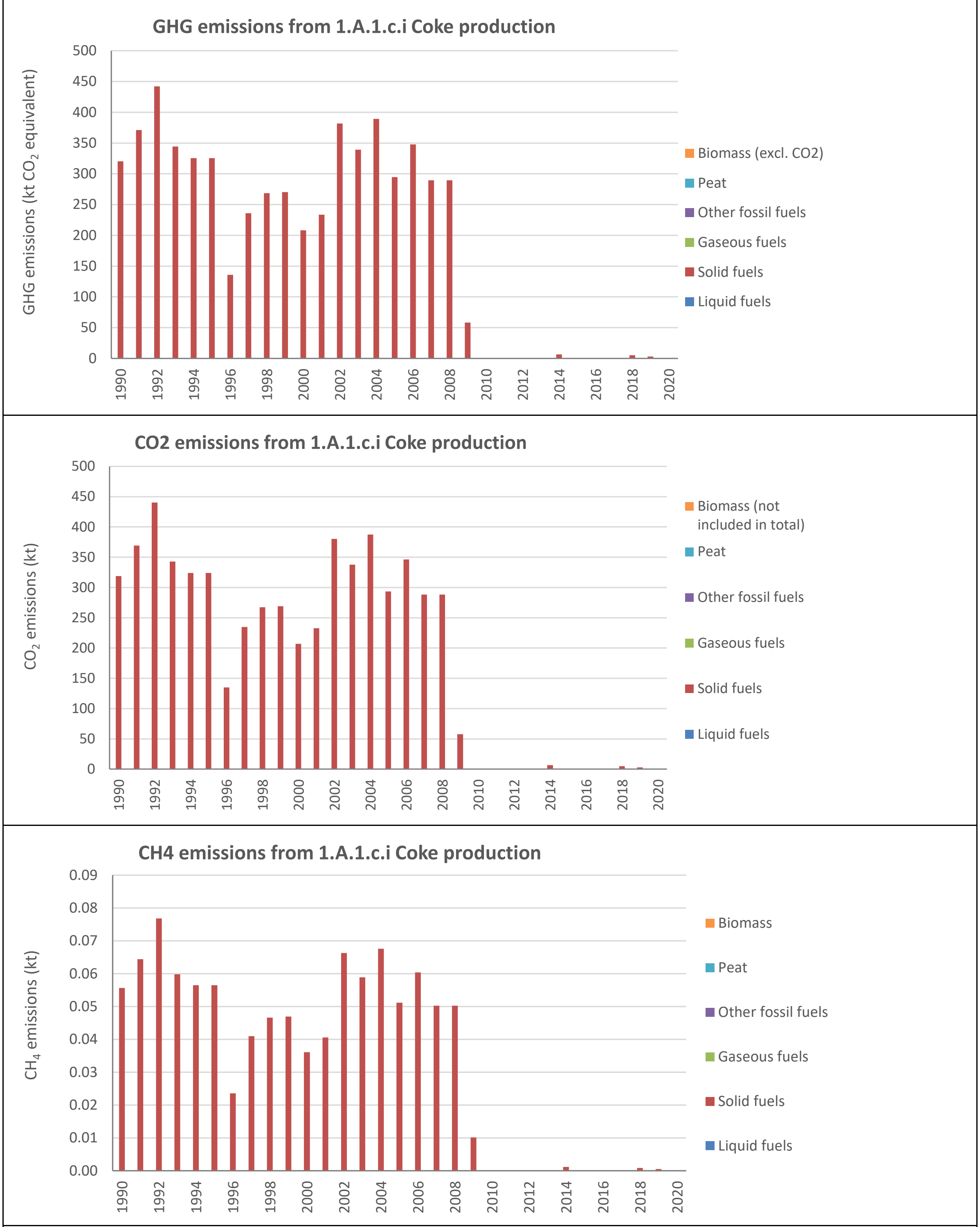
Source: 2019 Refinement to the 2006 IPCC GL. Volume 3: Energy. Chapter 4: Metal Industry Emissions – 4.2.2 Methodological issues. TABLE 4.1A (NEW). Page 4.12.

Fugitive emissions (evaporative emissions) occurring during coke production are not included and should be reported separately under IPCC category 1.B.1.b.ii.

An overview of the emission from fuel combustion in IPCC category 1.A.1.c.i *Coke production* is provided in the following figures and tables.

The greenhouse gas emissions from IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production* amounted to 320.28 kt CO_2 equivalents in 1990 and 3.0 kt CO_2 equivalents in 2019.

The overall trend in GHG emissions from the IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production* shows a decrease by 99 % from 1990 to 2019.



No N_2O emission are occuring.

Figure 61 Emissions from IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production oil and gas extraction*

Table 108 GHG Emissions by fuels from IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

GHG emissions	**Total GHG emissions**	**Emission from use of solid fuels**			**Emission from use of liquid, gaseous, or other fuels or biomass** (1)		
		CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	320.28	318.89	1.391	NA	NO	NO	NO
1991	371.00	369.39	1.612	NA	NO	NO	NO
1992	442.24	440.32	1.921	NA	NO	NO	NO
1993	344.22	342.72	1.495	NA	NO	NO	NO
1994	325.41	324.00	1.414	NA	NO	NO	NO
1995	325.41	324.00	1.414	NA	NO	NO	NO
1996	135.64	135.05	0.589	NA	NO	NO	NO
1997	235.94	234.91	1.025	NA	NO	NO	NO
1998	268.42	267.26	1.166	NA	NO	NO	NO
1999	270.13	268.96	1.173	NA	NO	NO	NO
2000	208.01	207.11	0.904	NA	NO	NO	NO
2001	233.66	232.64	1.015	NA	NO	NO	NO
2002	381.83	380.17	1.659	NA	NO	NO	NO
2003	339.09	337.62	1.473	NA	NO	NO	NO
2004	389.24	387.55	1.691	NA	NO	NO	NO
2005	294.64	293.36	1.280	NA	NO	NO	NO
2006	347.64	346.13	1.510	NA	NO	NO	NO
2007	289.51	288.25	1.258	NA	NO	NO	NO
2008	289.51	288.25	1.258	NA	NO	NO	NO
2009	58.13	57.88	0.253	NA	NO	NO	NO
2010	NE	NE	NE	NA	NO	NO	NO
2011	NE	NE	NE	NA	NO	NO	NO
2012	NE	NE	NE	NA	NO	NO	NO
2013	NE	NE	NE	NA	NO	NO	NO
2014	6.55	6.52	0.028	NA	NO	NO	NO
2015	NE	NE	NE	NA	NO	NO	NO
2016	NE	NE	NE	NA	NO	NO	NO
2017	NE	NE	NE	NA	NO	NO	NO
2018	4.97	4.95	0.022	NA	NO	NO	NO
2019	3.00	2.99	0.013	NA	NO	NO	NO
2020	NO	NO	NO	NA	NO	NO	NO
Trend							
1990 - 2019	*-99.06%%*	*-99.06%%*	*-99.06%%*	*NA*	*NA*	*NA*	*NA*
2005 - 2019	*-98.98%*	*-98.98%*	*-98.98%*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

3.2.3.3.1.2 Methodological issues

3.2.3.3.1.2.1 Choice of methods

For estimating the CO_2, CH_4 and N_2O emissions, the Tier 1 a: Production based method[122] of the 2019 Refinements to the 2006 IPCC Guidelines has been applied:

Equation 4.1: CO_2 emissions from coke production (TIER 1A) (2006 IPCC GL. Vol. 3. Chap. 4)

$$\boldsymbol{Emissions_{CO2.\,coke} = CK \quad \times Emission\ Factor_{coke}}$$

Equation 4.1a: CH_4 emissions from coke production (TIER 1A) (2006 IPCC GL. Vol. 3. Chap. 4)

$$\boldsymbol{Emissions_{CH4.\,coke} = CK \quad \times Emission\ Factor_{coke}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum emissions_{\mathbf{GHG.\,coke}}}$$

Where:

Emissions $_{GHG}$ = emissions of GHG (kg CO_2eq)
Emissions $_{CH4}$ = emissions of CH_4 (kg CH_4)
Emissions $_{CO2}$ = emissions of CO_2 (kg GHG)
CK = quantity of coke produced nationally, tonnes
Emission factor $_{CO2.\ coke}$ = Coke production using by-product recovery technology (tonne of CO_2/tonne of coke)
Emission factor $_{CH4.\ coke}$ = default emission factor of Coke Production (kg CH4/tonne of coke produced)
GHG = CO_2, CH_4, N_2O

3.2.3.3.1.2.2 Choice of activity data

The following fuels are used for Manufacture of Solid Fuels – Coke production:

Solid fuels:
- Hard coal / coking coal transformed to coke oven coke

The amount of coking coal imported is used for estimating the GHG and non-GHG emissions for the years:

- 1990 – 2020 are taken from the data provided by MEM [123].

The total fuel consumption decreased by 99% during the period 1990 – 2019 due to

- reduced pig iron production
- substitution of nationally produced coke oven coke with imported coke oven coke.
- consumption data in pig iron production facility are different to imported and data: stock change
- stopped production of iron with blast furnace.

As presented below in the figure and table, the data provided by international institutions differ significant,

The data set from MEM, import of hardcoal (houille et charbon) , was available for the entire time series but

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[122] Source: 2019 Refinement to the 2006 IPCC GL, Volume 3: Energy, Chapter 4: Metal Industry Emissions – 4.2.2.1 Choice of method: metallurgical coke production – non fugitive emissions. Page 4.12.

[123] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

with some gaps. However, it is planned to collect activity data at plant level but also to review the national datasets from ONS and MEM as well as the international data sets.

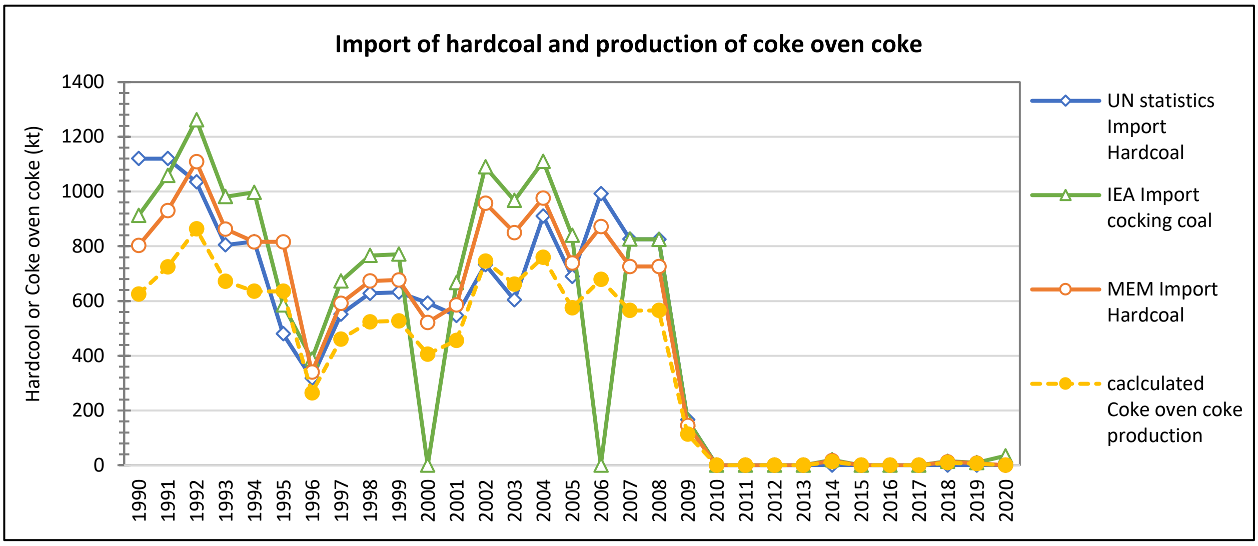

Figure 62 Activity data for IPCC category 1.A.1.c.i *Manufacture of Solid Fuels*

Table 109 Activity data for IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

Data set used	⇓ for comparison ⇓		⇓ for emission calculation ⇓			⇓ for verification ⇓
Activity data 1.A.1.c.i	**Import**			**Conversion factor**	**Transformed**	**Pig iron production**
	Hardcoal	**Coking coal**	**Hardcoal (Houille et charbon)**		**Coke oven coke**	
	kt	**kt**	**kt**	**kg/t coke**	**kt**	**kt**
1990	1,120.00	913	802.86	1284 = AVERAGE (1220;1350)	625.28	930.00
1991	1,120.00	1,058	930.00		724.30	925.00
1992	1,035.00	1,262	1,108.57		863.37	919.00
1993	805.00	981	862.86		672.01	940.00
1994	817.00	997	815.71		635.29	919.00
1995	480.00	586	815.71		635.29	962.00
1996	318.00	388	340.00		264.80	850.00
1997	552.00	673	591.43		460.61	526.00
1998	628.00	766	672.86		524.03	757.00
1999	632.00	771	677.14		527.37	807.00
2000	593.00	NE	521.43		406.10	767.00
2001	547.00	667	585.71		456.16	800.00
2002	733.00	1,090	957.14		745.44	960.00
2003	604.00	967	850.00		661.99	965.00
2004	910.00	1,110	975.71		759.90	994.00
2005	689.00	840	738.57		575.21	952.00
2006	992.00	NE	871.43		678.68	1,093.00
2007	826.00	826	725.71		565.20	1,193.00
2008	825.00	825	725.71		565.20	690.00
2009	166.00	166	145.71		113.48	680.00

Data set used	⇓ for comparison ⇓		⇓ for emission calculation ⇓			⇓ for verification ⇓
Activity data 1.A.1.c.i	**Import**			**Conversion factor**	**Transformed**	**Pig iron production**
	Hardcoal	**Coking coal**	**Hardcoal (Houille et charbon)**		**Coke oven coke**	
	kt	**kt**	**kt**	**kg/t coke**	**kt**	**kt**
2010	NE	NE	NE	1284 = AVERAGE (1220; 1350)	0.00	696.00
2011	NE	NE	NE		0.00	360.00
2012	NE	NE	NE		0.00	350.00
2013	NE	NE	NE		0.00	300.00
2014	NE	20	16.42		12.79	300.00
2015	NE	NE	NE		0.00	300.00
2016	NE	NE	NE		0.00	300.00
2017	NE	NE	NE		0.00	300.00
2018	NE	15	12.45		9.70	300.00
2019	NE	10	7.52		5.86	300.00
2020	NE	NE	NE		0.00	300.00
Trend						
1990 - 2019	-	-	*-99.06%%*	NA	*-99.06%%*	
2005 - 2019	-	-	*-98.98%*	NA	*-98.98%*	
Note	NE: not clear if data are not estimated. not occurring or not provided; see planned improvements					
Source	UN statistics Energy statistics[124]	IEA Energy balance[125]	MEM Energy balance[126]	BAT document Table 5.2: Input and output data from coke oven plants in different EU MS from 2005[127]	calculated	See chapter 2.C.1 Iron and steel

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[124] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[125] Available at 10.09.2022 on https://www.iea.org/reports/greenhouse-gas-emissions-from-energy-overview/data-explorer
https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=ALGERIA&fuel=Coal&indicator=CoalConsByType

[126] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years
https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[127] European Commission - Joint Research Centre (EC-JRC)(2013): JRC Reference Report: Best Available Techniques (BAT) Reference Document for Iron and Steel Production. Table 5.2: Input and output data from coke oven plants in different EU Member States from 2005 complemented by other references. Page 224. Available at 10.07.2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/IS_Adopted_03_2012.pdf

3.2.3.3.1.2.3 Choice of emission factors

For liquid fuels the default emission factors for CO_2, CH_4 and N_2O were taken from 2019 Refinement to the IPCC 2006 Guidelines and are presented in the following table.

Table 110 GHG Emission factor TIER 1 for IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

Fuel	**CO_2 * (tonne of CO_2/tonne of coke)**		**CH_4 ** (CH_4/tonne of coke produced)**		**N_2O**	
	EF	**type**	**EF**	**type**	**EF**	**type**
Coke Production	0.51	D	0.089	D	NO	
Source	2019 Refinement to the 2006 IPCC Guidelines. Vol. 3. Chap. 4.2.2.3 Choice of emission factors. Table 4.1 (updated) Tier 1 default CO_2 emission factors for coke production Table 4.2 (updated) Tier 1 default CH_4 emission factors for coke production (non fugitives). iron and steel production					
Note:						
D Default	CS Country specific		PS Plant specific		IEF Implied emission factor	
* Coke production using by-product recovery technology						

3.2.3.3.1.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.1.c.i *Coke production* are presented in the following table.

Table 111Uncertainty for IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

Uncertainty	**CO_2**	**CH_4**	**N_2O**	**Reference**
Activity data (AD)	10%	10%	-	2019 Refinement to the 2006 IPCC GL. Vol.3. Chap. (4.2.3 Uncertainty assessment) TABLE 4.4 (UPDATED)
Emission factor (EF)	10%	400%	-	
Combined Uncertainty (U)	14%	400%	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied and same data set is used to the whole period.

3.2.3.3.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross checks with category 1.A.2.a and 2.C.1 are performed to avoid double counting or omissions;

- cross-checked from different sources (see Figure 62 & Table 65):
    - national statistic published by MEM and Office National des Statistiques (ONS)[128] and
    - international energy statistics of UN statistics[129] and International Energy Agency (IEA)[130]
- time series consistency - plausibility checks of dips and jumps.

3.2.3.3.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*.

Table 112Recalculations done since NC in IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.1.c.i	No revision was carried out.	-	-

3.2.3.3.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 113Planned improvements for IPCC category 1.A.1.c.i *Manufacture of Solid Fuels – Coke production*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.1.c.i	Revision of the energy balance (1990-2020): improvement of data set by collection of plant specific data: • Consumption of various fuels for combustion – hardcoal / coking coal. coke oven gas (COG) • Production data of coke oven coke • Import and use of imported hardcoal / coking coal and coke oven coke	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.c.i	Investigation of carbon content of • coke oven coke produced • imported coke oven coke (relevant for 2.C.1)	EF	Accuracy Transparency	high
1.A.1.c.i	Application of Tier 2 methodology of 2019 Refinement to the 2006 IPCC Guidelines	EF	Accuracy	high
1.A.1.c.i	Investigation of the guidance of the • by-product recovery technology in coke production • outputs of coke production process: ○ products ○ by-products: coke oven gas (COG). tars and benzenes. flaring of coke oven gas (COG)	EF	Accuracy Transparency Consistency CompletenessC omparability	high
1.A.1.c.i	Information about fitted/non-fitted equipment for flue gas cleaning. improvement in combustion	EF non-GHG	Accuracy Transparency	Medium

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[128] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[129] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[130] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.3.3.2 Oil and gas extraction (IPCC category 1.A.1.c.ii)

3.2.3.3.2.1 Category description

GHG emissions/ removals	CO_2						CH_4						N_2O					
Estimated	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass	liquid	solid	gaseous	Other fossil fuel	Peat	biomass
1.A.1.c.ii	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO
Key Category	LA 2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

This section describes GHG emissions resulting from all combustion activities supporting the oil and gas extraction including on-site combustion for the generation of electricity and/or heat for own use. Fugitive emissions (evaporative emissions) occurring at the oil and gas extraction are not included and should be reported separately under 1.B.2.a. The IPCC category 1.A.1.c.ii Oil and gas extraction is for C02 and liquid fuels key category.

An overview of the emission from fuel combustion in IPCC category 1.A.1.c.ii *oil and gas extraction* is provided in the following figures and tables.

The greenhouse gas emissions from IPCC category 1.A.1.c.ii *oil and gas extraction* amounted to 15,771.16 kt CO_2 equivalents in 2010 and 15,997.24 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.1.c.ii *oil and gas extraction* show an increase by 1.43 % from 2010 to 2020 and a decrease by 2.8% from 2019 to 2020.

The overall increasing trend of emissions is result of the increase in oil and gas production during the period 2010 to 2020, while the decrease in the emission trend between 2019-2020 is mainly due to the COVID19 crisis.

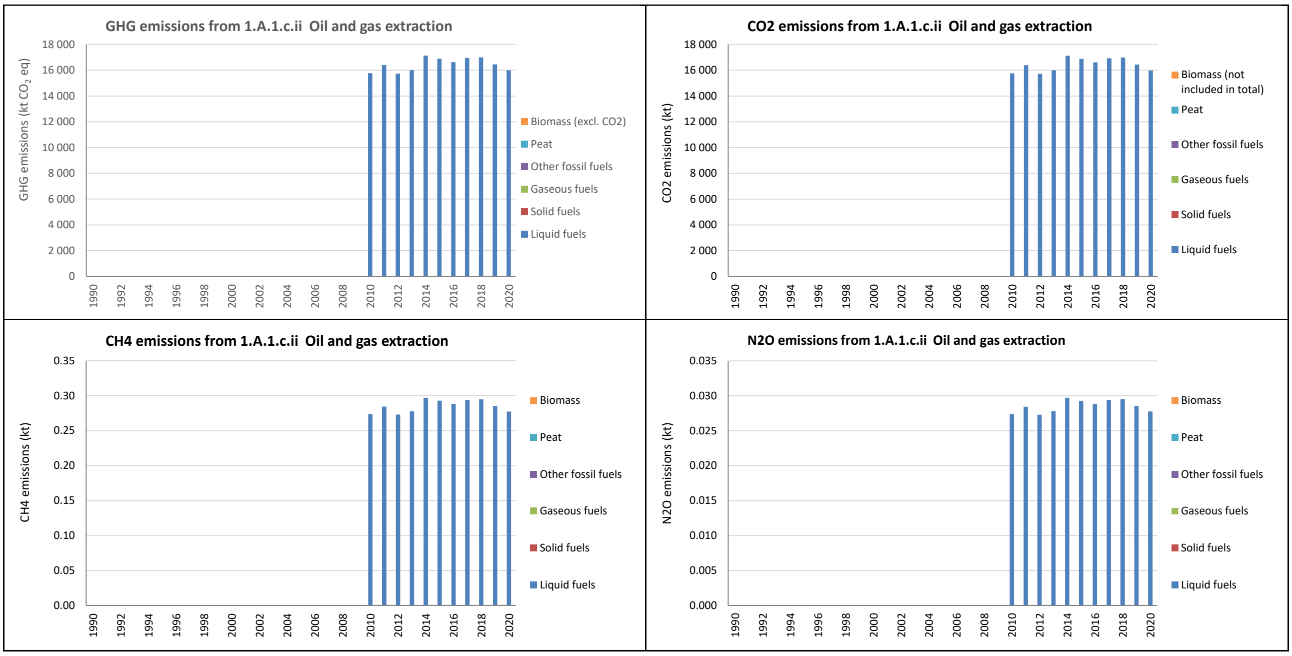

Figure 63 Emissions from IPCC category 1.A.1.C.II *Oil and Gas extraction*

Table 114 GHG Emissions by fuels from IPCC 1.A.1.c.ii *Oil and Gas Extraction and processing*

GHG emissions	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.1.c.ii	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
1990	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1991	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1992	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1993	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1994	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1995	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1996	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1997	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1998	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1999	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2000	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2001	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2002	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2003	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2004	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2005	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2006	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2007	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2008	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2009	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2010	15,771.16	15,771.16	*NO*	*NO*	NO	NO	NO
2011	16,400.97	16,400.97	*NO*	*NO*	NO	NO	NO
2012	15,735.53	15,735.53	*NO*	*NO*	NO	NO	NO
2013	16,009.67	16,009.67	*NO*	*NO*	NO	NO	NO
2014	17,132.85	17,132.85	*NO*	*NO*	NO	NO	NO
2015	16,885.88	16,885.88	*NO*	*NO*	NO	NO	NO
2016	16,624.96	16,624.96	*NO*	*NO*	NO	NO	NO
2017	16,944.46	16,944.46	*NO*	*NO*	NO	NO	NO
2018	17,001.93	17,001.93	*NO*	*NO*	NO	NO	NO
2019	16,451.88	16,451.88	*NO*	*NO*	NO	NO	NO
2020	15,997.24	15,997.24	*NO*	*NO*	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-2.8%*	*-2.8%*	*NA*	*NA*	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 115 CO_2 Emissions by fuels from IPCC 1.A.1.c.ii *Oil and Gas Extraction and processing*

CO_2 emissions	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1991	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1992	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1993	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1994	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1995	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1996	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1997	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1998	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1999	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2000	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2001	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2002	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2003	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2004	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2005	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2006	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2007	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2008	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2009	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2010	15,756.167	15,756.167	*NO*	*NO*	NO	NO	NO
2011	16,385.381	16,385.381	*NO*	*NO*	NO	NO	NO
2012	15,720.573	15,720.573	*NO*	*NO*	NO	NO	NO
2013	15,994.457	15,994.457	*NO*	*NO*	NO	NO	NO
2014	17,116.565	17,116.565	*NO*	*NO*	NO	NO	NO
2015	16,869.829	16,869.829	*NO*	*NO*	NO	NO	NO
2016	16,609.156	16,609.156	*NO*	*NO*	NO	NO	NO
2017	16,928.352	16,928.352	*NO*	*NO*	NO	NO	NO
2018	16,985.770	16,985.770	*NO*	*NO*	NO	NO	NO
2019	16,436.241	16,436.241	*NO*	*NO*	NO	NO	NO
2020	15,982.031	15,982.031	*NO*	*NO*	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-2.8%*	*-2.8%*	*NA*	*NA*	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 116 N_2O Emissions by fuels from IPCC category 1.A.1.c.ii *Oil and Extraction and processing*

N_2O emissions	Total N_2O emissions	N_2O emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.1.c.ii	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1991	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1992	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1993	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1994	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1995	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1996	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1997	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1998	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1999	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2000	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2001	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2002	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2003	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2004	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2005	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2006	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2007	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2008	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2009	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2010	*0.027*	*0.027*	*NO*	*NO*	NO	NO	NO
2011	*0.028*	*0.028*	*NO*	*NO*	NO	NO	NO
2012	*0.027*	*0.027*	*NO*	*NO*	NO	NO	NO
2013	*0.028*	*0.028*	*NO*	*NO*	NO	NO	NO
2014	*0.030*	*0.030*	*NO*	*NO*	NO	NO	NO
2015	*0.029*	*0.029*	*NO*	*NO*	NO	NO	NO
2016	*0.029*	*0.029*	*NO*	*NO*	NO	NO	NO
2017	*0.029*	*0.029*	*NO*	*NO*	NO	NO	NO
2018	*0.029*	*0.029*	*NO*	*NO*	NO	NO	NO
2019	*0.029*	*0.029*	*NO*	*NO*	NO	NO	NO
2020	*0.028*	*0.028*	*NO*	*NO*	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-2.8%*	*-2.8%*	*NA*	*NA*	*NA*	*NA*	*NA*

Table 117CH₄ Emissions by fuels from IPCC category 1.A.1.c.ii *Oil and Gas Extraction and processing*

CH_4 emissions	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.c.ii	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1991	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1992	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1993	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1994	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1995	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1996	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1997	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1998	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
1999	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2000	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2001	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2002	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2003	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2004	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2005	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2006	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2007	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2008	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2009	*IE*	*IE*	*NO*	*NO*	NO	NO	NO
2010	*0.274*	*0.274*	*NO*	*NO*	NO	NO	NO
2011	*0.284*	*0.284*	*NO*	*NO*	NO	NO	NO
2012	*0.273*	*0.273*	*NO*	*NO*	NO	NO	NO
2013	*0.278*	*0.278*	*NO*	*NO*	NO	NO	NO
2014	*0.297*	*0.297*	*NO*	*NO*	NO	NO	NO
2015	*0.293*	*0.293*	*NO*	*NO*	NO	NO	NO
2016	*0.288*	*0.288*	*NO*	*NO*	NO	NO	NO
2017	*0.294*	*0.294*	*NO*	*NO*	NO	NO	NO
2018	*0.295*	*0.295*	*NO*	*NO*	NO	NO	NO
2019	*0.285*	*0.285*	*NO*	*NO*	NO	NO	NO
2020	*0.277*	*0.277*	*NO*	*NO*	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-2.8%*	*-2.8%*	*NA*	*NA*	*NA*	*NA*	*NA*

3.2.3.3.2.2 Methodological issues

3.2.3.3.2.2.1 Choice of methods

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[131] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}$$

Where:

Emissions $_{\mathrm{GHG.\,fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\mathrm{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\mathrm{GHG.\,fuel}}$ = default emission factor of a given GHG by type of fuel (kg/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

3.2.3.3.2.2.2 Choice of activity data

The following fuels are used for oil and gas extraction:

Liquid fuels:
- Refinery gas

Fuel consumption used for estimating the GHG and non-GHG emissions for the years:

- 2010 – 2020 are taken from the data provided by MEM[132].

The total fuel consumption increased by 1.4% during the period 2010 – 2020 and decreased by 2.9% during the period 2019 – 2020.

The higher fuel consumption is due to the increase in oil and gas production over the period 2010 to 2020. while the decrease in fuel consumption between 2019-2020 is mainly due to the COVID19 Pandemic.

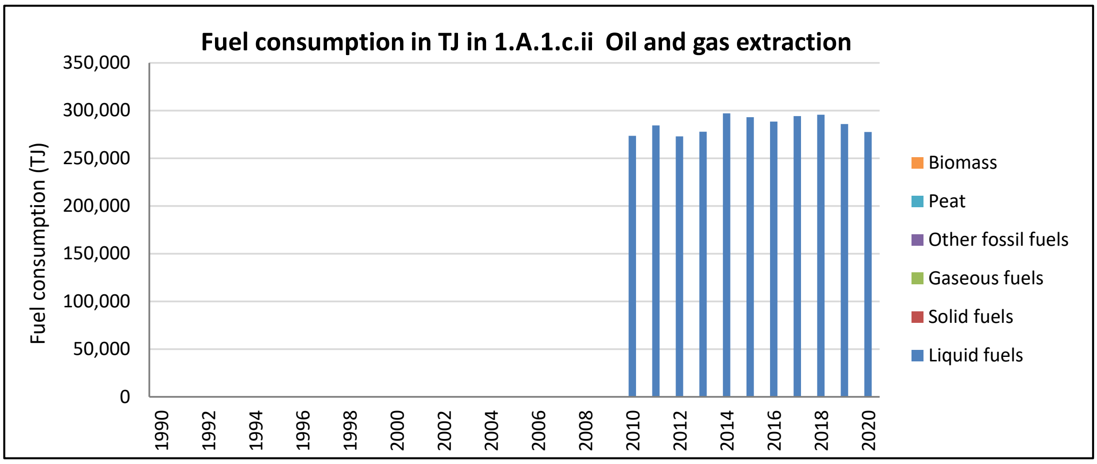

Figure 64 Activity data for IPCC category 1.A.1.c.ii *Oil and Gas Extraction*

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[131] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[132] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 118 Activity data for IPCC category 1.A.1.c.ii *Oil and Gas Extraction and processing*

Activity data 1.A.1.c.ii	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	NO	NO	NO	NO
1991	IE	IE	NO	NO	NO	NO	NO
1992	IE	IE	NO	NO	NO	NO	NO
1993	IE	IE	NO	NO	NO	NO	NO
1994	IE	IE	NO	NO	NO	NO	NO
1995	IE	IE	NO	NO	NO	NO	NO
1996	IE	IE	NO	NO	NO	NO	NO
1997	IE	IE	NO	NO	NO	NO	NO
1998	IE	IE	NO	NO	NO	NO	NO
1999	IE	IE	NO	NO	NO	NO	NO
2000	IE	IE	NO	NO	NO	NO	NO
2001	IE	IE	NO	NO	NO	NO	NO
2002	IE	IE	NO	NO	NO	NO	NO
2003	IE	IE	NO	NO	NO	NO	NO
2004	IE	IE	NO	NO	NO	NO	NO
2005	IE	IE	NO	NO	NO	NO	NO
2006	IE	IE	NO	NO	NO	NO	NO
2007	IE	IE	NO	NO	NO	NO	NO
2008	IE	IE	NO	NO	NO	NO	NO
2009	IE	IE	NO	NO	NO	NO	NO
2010	273,544.571	273,544.571	NO	NO	NO	NO	NO
2011	284,468.420	284,468.420	NO	NO	NO	NO	NO
2012	272,926.621	272,926.621	NO	NO	NO	NO	NO
2013	277,681.545	277,681.545	NO	NO	NO	NO	NO
2014	297,162.585	297,162.585	NO	NO	NO	NO	NO
2015	292,878.983	292,878.983	NO	NO	NO	NO	NO
2016	288,353.971	288,353.971	NO	NO	NO	NO	NO
2017	294,153.887	294,153.887	NO	NO	NO	NO	NO
2018	295,557.343	295,557.343	NO	NO	NO	NO	NO
2019	285,789.960	285,789.960	NO	NO	NO	NO	NO
2020	277,466.956	277,466.956	NO	NO	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-2.9%	-2.9%	NA	NA	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.1.c.ii *Oil and Gas Extraction*.

Table 119Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.1.c.ii *Oil and Gas Extraction*

<table>
<tr><th rowspan="2">Fuel type</th><th rowspan="2">Fuel</th><th rowspan="2">Unit</th><th colspan="2">Net calorific value (NCV)</th></tr>
<tr><th>Country specific NCV (CS NCV) (GVC * Conversion factor)</th><th>default NCV for comparison</th></tr>
<tr><td>liquid</td><td>Refinery Gas</td><td>TJ / Gg</td><td>MEM/Sonatrach</td><td>49.5</td></tr>
<tr><td>Source</td><td></td><td></td><td>MEM (2012) Décision n°271</td><td>2006 IPCC GL. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2</td></tr>
<tr><td colspan="5"></td></tr>
<tr><th colspan="3">Conversion from GCV to NCV</th><th colspan="2">Default</th></tr>
<tr><td colspan="3">Natural gas</td><td colspan="2">1 NCV = 0.9 x GCV</td></tr>
<tr><td colspan="3">Petroleum products</td><td colspan="2">1 NCV = 0.95 x GCV</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td rowspan="3">Source</td><td colspan="2">CS Gross Caloric Value (GCV)</td><td colspan="2">Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[133]</td></tr>
<tr><td colspan="2">Default Net Calorific values (NCVs)</td><td colspan="2">2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2
International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)</td></tr>
<tr><td colspan="2">Conversion from GCV to NCV</td><td colspan="2">International Recommendations for Energy Statistics (IRES) (2018) [134]:
Table 4 Difference between net and gross calorific values for selected fuels</td></tr>
<tr><td colspan="5"><i>Note:</i></td></tr>
<tr><td colspan="5">D Default   CS Country specific   PS Plant specific</td></tr>
</table>

3.2.3.3.2.2.3 Choice of emission factors

For liquid fuels the default emission factors for CO_2, CH_4 and N_2O were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 120 GHG Emission factor TIER 1 for IPCC category 1.A.1.c.ii Oil and Gas *Extraction and processing*

<table>
<tr><th rowspan="2">Fuel</th><th rowspan="2">Fuel type</th><th colspan="4">CO_2 (kg/TJ)</th><th colspan="2">CH_4 (kg/TJ)</th><th colspan="2">N_2O (kg/TJ)</th></tr>
<tr><th>EF</th><th>type</th><th>EF</th><th>type</th><th>EF</th><th>type</th><th>EF</th><th>type</th></tr>
<tr><td>refinery gas</td><td>liquid</td><td>-</td><td>-</td><td>57.600</td><td>D</td><td>1</td><td>D</td><td>0.1</td><td>D</td></tr>
<tr><td>Source</td><td></td><td colspan="2"></td><td colspan="6">2006 IPCC Guidelines
Vol. 2. Chap. 2 (2.3.2.1) Table 2.2 Default emission factors for stationary combustion in the energy industries (page 2.16)</td></tr>
<tr><td colspan="10"><i>Note:</i></td></tr>
<tr><td colspan="10">D Default   CS Country specific   PS Plant specific   IEF Implied emission factor</td></tr>
</table>

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[133] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[134] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.3.3.2.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.1.c.ii *Oil and gas extraction* are presented in the following table.

Table 121Uncertainty for IPCC category 1.A.1.c.ii Oil and gas extraction.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. For 1990 – 2009 no activity data were available. For 2010 - 2020 activity data were from the National Energy balance prepared by MEM[135].

3.2.3.3.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[136] and
    - national data related to the energetic consumption provided by MEM;
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.3.3.2.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.1.c.ii *Oil and Gas Extraction and processing*.

Table 122Recalculations done since NC in IPCC category 1.A.1.c.ii Oil and Gas *Extraction and processing*

GHG source & sink category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.A.1.c. ii	No revision was carried out.	EF	Comparability

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[135] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[136] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

3.2.3.3.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 123Planned improvements for IPCC category 1.A.1.c.ii Oil and Gas *Extraction and processing*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.1.c.ii	Preparation of country specific GCV and NCV per year instead of using a constant value and/or default NCV for whole timeseries	AD	Completeness Transparency	high
1.A.1.c.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion – refinery gas, natural gas, etc.	AD	Completeness Transparency	high
1.A.1.c.ii	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.c.ii	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.c.ii	Preparation of an overview of segment Oil and gas extraction - processes and equipment used including related emissions[137]	AD	Transparency Completeness Accuracy	high

3.2.3.3.3 Other energy industries (IPCC category 1.A.1.c.iii)

3.2.3.3.3.1 Category description

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.1. c.iii																		
1.A.1. c.iii.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NA	NA	NA	NA	NA	NA
1.A.1. c.iii.2	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
1.A.1. c.iii.3	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	LA 1990 & 2020 TA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

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[137] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

1.A.1. c.iii.1	Wood charcoal production	This category was not estimated due to lack of data and resources.
1.A.1. c.iii.2	• Refinery gas: SH-Raffinage et Pétrochimie[138] • LPG. Motor gasoline. Gas/Diesel Oil: SH Liquéfaction et séparation[138] • Natural_gaz_includ_LNG: 12.3-Unites_de liquefaction[139]	These categories were estimated as described below. Activity data and emissions are summed up.
1.A.1. c.iii.3	Consumption in Energy industries under "Other/Autres" in the Energy balance	

This section describes GHG emissions resulting from all combustion activities

- supporting the **gas liquification** and
- **other energy industry** including on-site combustion for the generation of electricity and/or heat for own use.

The IPCC category 1.A.1.c.iii Other energy industries is for C02 and gaseous fuels key source.

Fugitive emissions (evaporative emissions) occurring at the oil and gas extraction are not included and are reported separately under 1.B.2.b.

An overview of the emission from fuel combustion in IPCC category 1.A.1.c.iii *Other energy industrie*s including *gas liquification and other energy industry* is provided in the following figures and tables.

The greenhouse gas emissions from IPCC category 1.A.1.c.iii *Other energy industrie*s including *gas liquification and other energy industry* amounted to 9,836.15 kt CO_2 equivalents in 1990, 9,828.89 kt CO_2 equivalents in 2005 and 6,051.70 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.1.c.iii *Other energy industrie*s including *gas liquification and other energy industry* shows a decrease by 38.5 % from 1990 to 2020. a decrease of 38.4 % during the period 2005-2020 and a decrease by 11.6% from 2019 to 2020.

The highly decreasing trend of emissions is due to the decrease in the natural gas liquefaction activity as well as the decrease in the quantity of natural gas used in the category others energy industry during the period 1990 to 2020, while the decrease in the emission trend between 2019-2020 is mainly due to the COVID19 crisis. The pick constated in the year 2000 will be further investigated.

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[138] consommation énergétique du secteur de l''énergie finale le 03.06.2021.xlsx]

[139] 1990-2009: Energy balance UN stat;
2010-2020 : consommation énergétique du secteur de l''énergie finale le 03.06.2021.xlsx

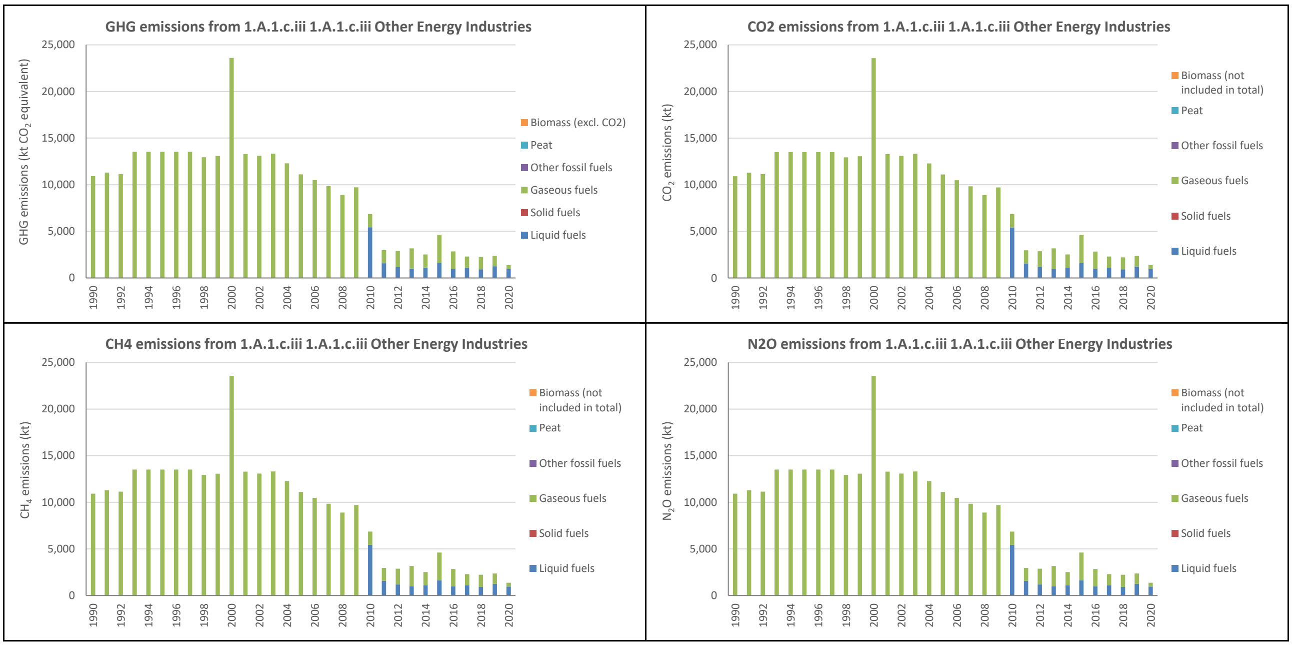

Figure 65 Emissions from IPCC category 1.A.1.c.iii Other energy industries

Table 124 GHG Emissions by fuels from IPCC 1.A.1.c.iii Other energy industries

GHG emissions	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.c.iii	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt CO_2 equivalent**
1990	9,836.15	NO	NO	9,836.15	NO	NO	NO
1991	10,174.92	NO	NO	10,174.92	NO	NO	NO
1992	9,857.44	NO	NO	9,857.44	NO	NO	NO
1993	11,958.26	NO	NO	11,958.26	NO	NO	NO
1994	11,958.26	NO	NO	11,958.26	NO	NO	NO
1995	11,958.26	NO	NO	11,958.26	NO	NO	NO
1996	11,958.26	NO	NO	11,958.26	NO	NO	NO
1997	11,958.26	NO	NO	11,958.26	NO	NO	NO
1998	11,450.95	NO	NO	11,450.95	NO	NO	NO
1999	11,560.67	NO	NO	11,560.67	NO	NO	NO
2000	20,855.10	NO	NO	20,855.10	NO	NO	NO
2001	11,754.33	NO	NO	11,754.33	NO	NO	NO
2002	11,583.66	NO	NO	11,583.66	NO	NO	NO
2003	11,776.52	NO	NO	11,776.52	NO	NO	NO
2004	10,867.27	NO	NO	10,867.27	NO	NO	NO
2005	9,828.89	NO	NO	9,828.89	NO	NO	NO
2006	9,272.95	NO	NO	9,272.95	NO	NO	NO
2007	8,702.16	NO	NO	8,702.16	NO	NO	NO
2008	7,866.80	NO	NO	7,866.80	NO	NO	NO
2009	8,590.27	NO	NO	8,590.27	NO	NO	NO
2010	7,198.46	5,433.58	NO	1,764.88	NO	NO	NO
2011	7,172.20	5,102.38	NO	2,069.82	NO	NO	NO
2012	8,213.94	4,774.00	NO	3,439.94	NO	NO	NO
2013	7,214.29	4,597.09	NO	2,617.20	NO	NO	NO
2014	10,412.30	8,520.91	NO	1,891.39	NO	NO	NO
2015	8,252.25	4,909.08	NO	3,343.17	NO	NO	NO
2016	7,511.45	5,292.84	NO	2,218.61	NO	NO	NO
2017	6,721.17	5,163.53	NO	1,557.64	NO	NO	NO
2018	6,164.44	4,542.22	NO	1,622.22	NO	NO	NO
2019	6,846.59	5,431.51	NO	1,415.08	NO	NO	NO
2020	6,051.70	5,312.40	NO	739.30	NO	NO	NO
Trend							
1990 - 2020	-38.5%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2005 - 2020	-38.4%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2019 - 2020	-11.6%	-2.2%	NA	-47.8%	*NA*	*NA*	*NA*

Note: (1) Emissions of CO_2 from biomass fuels are estimated and reported in sector Land use. Land use Change and Forestry (LULUCF) as part of the as part of net changes in carbon stocks. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 125 CO_2 Emissions by fuels from IPCC 1.A.1.c.iii Other energy industries

CO_2 emissions	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.1.c.iii	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	9,826.722	NE	NO	9,826.722	NO	NO	NO
1991	10,165.169	NE	NO	10,165.169	NO	NO	NO
1992	9,847.822	NE	NO	9,847.822	NO	NO	NO
1993	11,946.590	NE	NO	11,946.590	NO	NO	NO
1994	11,946.590	NE	NO	11,946.590	NO	NO	NO
1995	11,946.590	NE	NO	11,946.590	NO	NO	NO
1996	11,946.590	NE	NO	11,946.590	NO	NO	NO
1997	11,946.590	NE	NO	11,946.590	NO	NO	NO
1998	11,439.772	NE	NO	11,439.772	NO	NO	NO
1999	11,549.386	NE	NO	11,549.386	NO	NO	NO
2000	20,834.749	NE	NO	20,834.749	NO	NO	NO
2001	11,742.863	NE	NO	11,742.863	NO	NO	NO
2002	11,572.358	NE	NO	11,572.358	NO	NO	NO
2003	11,765.028	NE	NO	11,765.028	NO	NO	NO
2004	10,856.663	NE	NO	10,856.663	NO	NO	NO
2005	9,819.295	NE	NO	9,819.295	NO	NO	NO
2006	9,263.905	NE	NO	9,263.905	NO	NO	NO
2007	8,693.671	NE	NO	8,693.671	NO	NO	NO
2008	7,859.122	NE	NO	7,859.122	NO	NO	NO
2009	8,581.886	NE	NO	8,581.886	NO	NO	NO
2010	7,191.575	5,428.413	NO	1,763.162	NO	NO	NO
2011	7,165.333	5,097.532	NO	2,067.801	NO	NO	NO
2012	8,206.048	4,769.466	NO	3,436.582	NO	NO	NO
2013	7,207.364	4,592.720	NO	2,614.644	NO	NO	NO
2014	10,402.360	8,512.814	NO	1,889.545	NO	NO	NO
2015	8,244.325	4,904.416	NO	3,339.909	NO	NO	NO
2016	7,504.251	5,287.810	NO	2,216.441	NO	NO	NO
2017	6,714.744	5,158.622	NO	1,556.122	NO	NO	NO
2018	6,158.537	4,537.902	NO	1,620.635	NO	NO	NO
2019	6,840.047	5,426.343	NO	1,413.703	NO	NO	NO
2020	6,045.930	5,307.347	NO	738.583	NO	NO	NO
Trend							
1990 - 2020	-38.5%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2005 - 2020	-38.4%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2019 - 2020	-11.6%	-2.2%	NA	-47.8%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 126 N_2O Emissions by fuels from IPCC category 1.A.1.c.iii Other energy industries

N_2O emissions	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.c.iii	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.021	NE	NO	0.021	NO	NO	NO
1991	0.021	NE	NO	0.021	NO	NO	NO
1992	0.021	NE	NO	0.021	NO	NO	NO
1993	0.021	NE	NO	0.021	NO	NO	NO
1994	0.021	NE	NO	0.021	NO	NO	NO
1995	0.020	NE	NO	0.020	NO	NO	NO
1996	0.021	NE	NO	0.021	NO	NO	NO
1997	0.037	NE	NO	0.037	NO	NO	NO
1998	0.021	NE	NO	0.021	NO	NO	NO
1999	0.021	NE	NO	0.021	NO	NO	NO
2000	0.021	NE	NO	0.021	NO	NO	NO
2001	0.019	NE	NO	0.019	NO	NO	NO
2002	0.018	NE	NO	0.018	NO	NO	NO
2003	0.017	NE	NO	0.017	NO	NO	NO
2004	0.015	NE	NO	0.015	NO	NO	NO
2005	0.014	NE	NO	0.014	NO	NO	NO
2006	0.015	NE	NO	0.015	NO	NO	NO
2007	0.013	0.009	NO	0.003	NO	NO	NO
2008	0.013	0.009	NO	0.004	NO	NO	NO
2009	0.014	0.008	NO	0.006	NO	NO	NO
2010	0.013	0.008	NO	0.005	NO	NO	NO
2011	0.018	0.015	NO	0.003	NO	NO	NO
2012	0.014	0.009	NO	0.006	NO	NO	NO
2013	0.013	0.009	NO	0.004	NO	NO	NO
2014	0.012	0.009	NO	0.003	NO	NO	NO
2015	0.011	0.008	NO	0.003	NO	NO	NO
2016	0.012	0.009	NO	0.003	NO	NO	NO
2017	0.011	0.009	NO	0.001	NO	NO	NO
2018	0.021	NE	NO	0.021	NO	NO	NO
2019	0.021	NE	NO	0.021	NO	NO	NO
2020	0.021	NE	NO	0.021	NO	NO	NO
Trend							
1990 - 2020	-38.8%	NA	NA	-92.3%	*NA*	*NA*	*NA*
2005 - 2020	-39.8%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2019 - 2020	-11.8%	-2.2%	NA	-47.8%	*NA*	*NA*	*NA*

Table 127CH_4 Emissions by fuels from IPCC category 1.A.1.c.iii Other energy industries

CH_4 emissions	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.1.c.iii	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.172	NE	NO	0.172	NO	NO	NO
1991	0.178	NE	NO	0.178	NO	NO	NO
1992	0.176	NE	NO	0.176	NO	NO	NO
1993	0.213	NE	NO	0.213	NO	NO	NO
1994	0.213	NE	NO	0.213	NO	NO	NO
1995	0.213	NE	NO	0.213	NO	NO	NO
1996	0.213	NE	NO	0.213	NO	NO	NO
1997	0.213	NE	NO	0.213	NO	NO	NO
1998	0.204	NE	NO	0.204	NO	NO	NO
1999	0.206	NE	NO	0.206	NO	NO	NO
2000	0.371	NE	NO	0.371	NO	NO	NO
2001	0.209	NE	NO	0.209	NO	NO	NO
2002	0.206	NE	NO	0.206	NO	NO	NO
2003	0.210	NE	NO	0.210	NO	NO	NO
2004	0.194	NE	NO	0.194	NO	NO	NO
2005	0.175	NE	NO	0.175	NO	NO	NO
2006	0.165	NE	NO	0.165	NO	NO	NO
2007	0.155	NE	NO	0.155	NO	NO	NO
2008	0.140	NE	NO	0.140	NO	NO	NO
2009	0.153	NE	NO	0.153	NO	NO	NO
2010	0.126	0.094	NO	0.031	NO	NO	NO
2011	0.125	0.088	NO	0.037	NO	NO	NO
2012	0.144	0.083	NO	0.061	NO	NO	NO
2013	0.126	0.080	NO	0.047	NO	NO	NO
2014	0.181	0.148	NO	0.034	NO	NO	NO
2015	0.145	0.085	NO	0.060	NO	NO	NO
2016	0.131	0.092	NO	0.040	NO	NO	NO
2017	0.117	0.090	NO	0.028	NO	NO	NO
2018	0.108	0.079	NO	0.029	NO	NO	NO
2019	0.119	0.094	NO	0.025	NO	NO	NO
2020	0.105	0.092	NO	0.013	NO	NO	NO
Trend							
1990 - 2020	-38.8%	NA	NA	-92.3%	*NA*	*NA*	*NA*
2005 - 2020	-39.8%	NA	NA	-92.5%	*NA*	*NA*	*NA*
2019 - 2020	-11.8%	-2.2%	NA	-47.8%	*NA*	*NA*	*NA*

3.2.3.3.3.2 Methodological issues

3.2.3.3.3.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[140] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, gaseous fuels, other fossil fuel, biomass, peat

3.2.3.3.3.2.2 Choice of activity data

The following fuels are used for *other energy industries* including Gas liquification and Other energy industries:

Liquid fuels:	• Refinery gas
Gaseous fuels:	• Natural gas

Fuel consumption used for estimating the GHG for the years:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[141] ;
- 2010 – 2020 are taken from the data provided by MEM [142].

The total fuel consumption decreased by 81.8% over the period 1990 – 2020. This consumption was decreased by 82.2% between 1990 and 2005 and, while the period 2005-2020 was marked by a decrease of 49.2%.

The highly decreasing in fuel consumption is due to the decrease in the natural gas liquefaction activity as well as the decrease in the quantity of natural gas used in the category other energy industry, during the period from 1990 to 2020, while the decrease of fuel consumption between 2019-2020 is mainly due to the COVID19 pandemic. The dips and jumps from year to year are mainly due to:

- Diminution of liquification gas activity;
- Economic situation during the year 2000;
- national lockdown due to the COVID pandemic (2020)[143].

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[140] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[141] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[142] Ministère de l'Énergie et des Mines (MEM): ConsommationEnergetique_Secteur_Energie_03.06.2021.xlsx https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[143] • Please add further explanations if possible maybe in different words compared to text used for emissions trend description

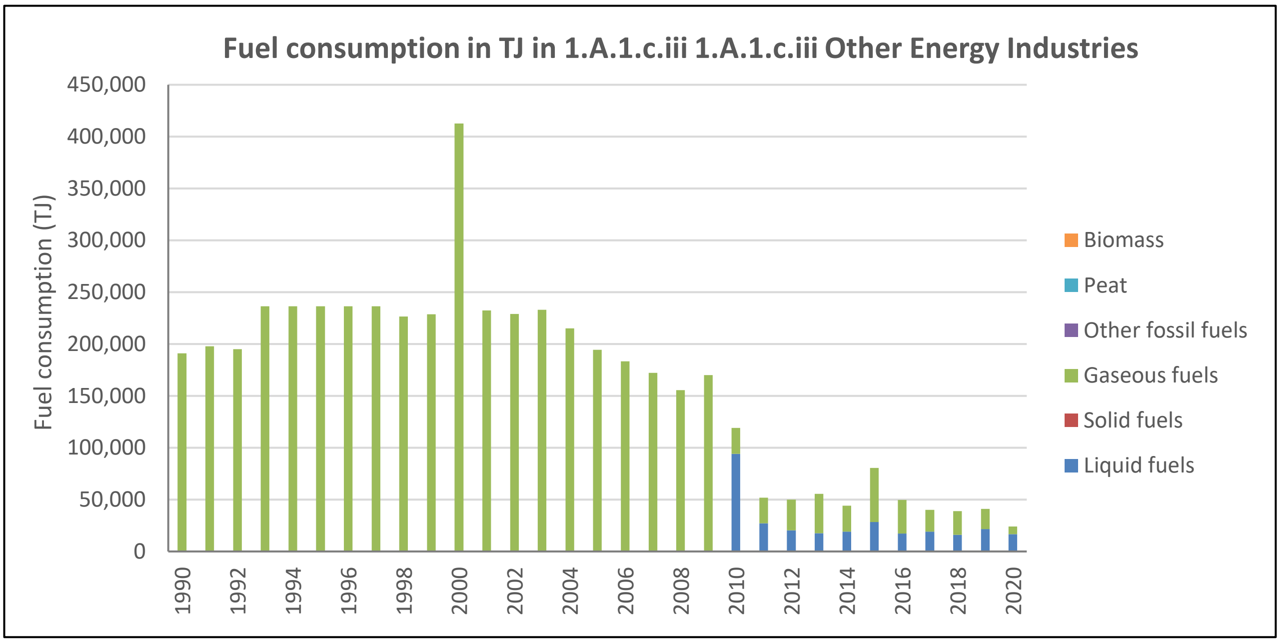

Figure 66 Activity data for IPCC category 1.A.1.c.iii Other energy industries

Table 128 Activity data for IPCC category 1.A.1.c.iii other energy industries

Activity data 1.A.1.c.iii	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
				TJ			
1990	172,048.500	NE	NO	172,048.500	NO	NO	NO
1991	177,974.100	NE	NO	177,974.100	NO	NO	NO
1992	175,540.500	NE	NO	175,540.500	NO	NO	NO
1993	212,951.700	NE	NO	212,951.700	NO	NO	NO
1994	212,951.700	NE	NO	212,951.700	NO	NO	NO
1995	212,951.700	NE	NO	212,951.700	NO	NO	NO
1996	212,951.700	NE	NO	212,951.700	NO	NO	NO
1997	212,951.700	NE	NO	212,951.700	NO	NO	NO
1998	203,917.500	NE	NO	203,917.500	NO	NO	NO
1999	205,871.400	NE	NO	205,871.400	NO	NO	NO
2000	371,385.900	NE	NO	371,385.900	NO	NO	NO
2001	209,320.200	NE	NO	209,320.200	NO	NO	NO
2002	206,280.900	NE	NO	206,280.900	NO	NO	NO
2003	209,715.300	NE	NO	209,715.300	NO	NO	NO
2004	193,523.401	NE	NO	193,523.401	NO	NO	NO
2005	175,032.000	NE	NO	175,032.000	NO	NO	NO
2006	165,132.000	NE	NO	165,132.000	NO	NO	NO
2007	154,967.400	NE	NO	154,967.400	NO	NO	NO
2008	140,091.300	NE	NO	140,091.300	NO	NO	NO
2009	152,974.800	NE	NO	152,974.800	NO	NO	NO
2010	125,672.187	94,243.274	NO	31,428.913	NO	NO	NO
2011	125,358.021	88,498.825	NO	36,859.196	NO	NO	NO
2012	144,061.376	82,803.228	NO	61,258.148	NO	NO	NO
2013	126,341.567	79,734.722	NO	46,606.845	NO	NO	NO
2014	181,473.648	147,791.915	NO	33,681.733	NO	NO	NO
2015	144,681.036	85,146.107	NO	59,534.929	NO	NO	NO
2016	131,311.001	91,802.250	NO	39,508.751	NO	NO	NO
2017	117,297.765	89,559.408	NO	27,738.357	NO	NO	NO
2018	107,671.341	78,783.013	NO	28,888.328	NO	NO	NO
2019	119,407.056	94,207.351	NO	25,199.705	NO	NO	NO
2020	105,306.906	92,141.438	NO	13,165.468	NO	NO	NO
Trend							
1990 - 2020	-38.8%	NA	NA	-92.3%	NA	NA	NA
2005 - 2020	-39.8%	NA	NA	-92.5%	NA	NA	NA
2019 - 2020	-11.8%	-2.2%	NA	-47.8%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tonnes or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.1.c.iii *other energy industries*.

Table 129Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.1.c.iii other energy industries

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Rafinery Gas	TJ / Gg	--[144]	49.5 2006 IPCC default

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source		
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[145]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [146]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* No bio-gas/diesel oil or biogasoline is not consumed in Algeria.

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[144] MEM, Sonatrach, please provide reference and value for NCV of refinery gas used to convert from unit physics to Tj.

[145] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[146] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.3.3.3.2.3 Choice of emission factors

For liquid and gaseous fuels, the default emission factors for CO_2, CH_4 and N_2O were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 130 GHG Emission factor TIER 1 for IPCC category 1.A.1.c.iii Other energy industries

Fuel	**Fuel type**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
Natural gas	gaseous	56 100	D	1	D	0.1	D
Refinery Gas	liquid	57.600	D	1	D	0.1	D
Source		2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.2 Default emission factors for stationary combustion in the energy industries (page 2.16)					

Note:
D Default CS Country specific PS Plant specific IEF Implied emission factor

3.2.3.3.3.3 Uncertainties and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.1.c.iii Other energy industries are presented in the following table.

Table 131Uncertainty for IPCC category 1.A.1.c.iii Other energy industries.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[147]
- 2010 - 2020 are taken from the National Energy balance provided by MEM[148].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the:

- International Standard Industrial Classification of all Economic Activities (ISIC) [149];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [150]. A revision of the years 1990-2009 is still pending.

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[147] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[148] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[149] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[150] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.3.3.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series) ,
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
  - national statistic published by MEM and Office National des Statistiques (ONS)[151] and
  - national data related to the energetic consumption provided by MEM;
  - international energy statistics of UN statistics[152] and International Energy Agency (IEA)[153]
- +cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.3.3.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.1.c.iii *Other energy industries.*

Table 132Recalculations done since NC in IPCC category 1.A.1.c.iii Other energy industries.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.1.c.iii	No revision was carried out		

3.2.3.3.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective. developments presented in following table will be explored.

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[151] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[152] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[153] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

Table 133Planned improvements for IPCC category 1.A.1.c.iii Other energy industries.

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.1.c.iii.1	Cross-check of national and international data sources on charcoal production (1) Raw materials for carbonization: fuelwood & wood residue, type of wood (2) charcoal making technologies (3) efficiencies of various types of kilns	AD	Consistency Transparency	medium
1.A.1.c.iii.1	Cross-check of national data and international data (e.g., FAO) on charcoal production	AD	Consistency Transparency	medium
1.A.1.c.iii.2 **1.A.1.c.iii.3**	Preparation of country specific GCV and NCV per year instead of using a constant value and/or default NCV for whole timeseries	AD	Completeness Transparency	high
1.A.1.c.iii.2 **1.A.1.c.iii.3**	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion in energy industries according to Energy balance	AD	Completeness Transparency	high
1.A.1.c.iii.2	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.c.iii.2 **1.A.1.c.iii.3**	Preparation of an overview of segment Gas liquification - processes and equipment used including related emissions[154]	AD	Transparency Completeness Accuracy	High

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[154] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

3.2.4 Manufacturing Industries and Construction (IPCC category 1.A.2)

This section describes GHG emissions resulting from fuel combustion activities in manufacturing industries and construction. In IPCC category 1.A.2 *Manufacturing Industries and Construction* is also including combustion for the generation of electricity and/or heat for own use in these industries. The GHG Emissions from the manufacturing industries and construction sector should be specified by sub-categories that correspond to the International Standard Industrial Classification of all Economic Activities (ISIC)[155]. The GHG emissions originate from the following sources:

IPCC code	**Description**	**Occurrent**			**Not occurrent (NO)**
		Estimated	**Not estimated (NE)**	**Included elsewhere (IE)**	
1.A.2.a	Iron and Steel	✓		1990-1996 in 1.A.2.m	
1.A.2.b	Non-Ferrous Metals			1990-2020 in 1.A.2.m	
1.A.2.c	Chemicals	✓		1990-1994 in 1.A.2.m	
1.A.2.d	Pulp. Paper and Print			1990-2020 in 1.A.2.m	
1.A.2.e	Food Processing. Beverages and Tobacco	✓		1990-2008 in 1.A.2.m	
1.A.2.f	Non-Metallic Minerals	✓		1990-2008 in 1.A.2.m	
1.A.2.g	Manufacturing of transport equipment				✓
1.A.2.h	Manufacturing of machinery				✓
1.A.2.i	Mining (excluding fuels) and Quarrying				✓
1.A.2.j	Wood and wood products				✓
1.A.2.k	Construction	✓			
1.A.2.l	Textile and Leather	✓			
1.A.2.m	Other	✓			
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential					

In general:

- No bio-gasoline or bio-gas/diesel oil was consumed.
- No CO_2 emission were captured.
- Emissions from the combustion of Wood charcoal were not estimated due to lack of data.

An overview of the GHG emission from fuel combustion in IPCC category 1.A.2 *Manufacturing Industries and Construction* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020, 2019 – 2020;

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[155] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

The greenhouse gas emissions from IPCC category 1.A.2 *Manufacturing Industries and Construction* amounted to 4,344.70 kt CO_2 equivalents in 1990, 5,623.14 kt CO_2 equivalents in 2005 and 18,036.67 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.2 *Manufacturing Industries and Construction* shows an increase by 319.1% from 1990 to 2020, 223.2% from 2005 to 2020 and a decrease by 1.9%from 2019 to 2020. The increase in emissions between 1990 and 2020 is explained by the increase in manufacturing and construction activities following the increase in the price of oil per barrel, which led to the launch of several infrastructure projects. The decrease in emissions during 2019 and 2020 is due to the impact of the Covid 19 pandemic.

The most important fuel is natural gas. While natural gas accounted for 63.4% of total fuel consumption in 1990, this figure had already risen to 83.4% by 2020, whereas in 2005 the share was only 50%.

In 2020. the share in IPCC category 1.A.2 *Manufacturing Industries and Construction* contribute with

- 44.4% the IPCC category 1.A.2.f Non-metallic minerals, which includes the fuel combustion from cement and lime production.
- 22.1% the IPCC category 1.A.2.m. Other
- 12.5% the IPCC category 1.A.2.k. Construction
- 12.3% the IPCC category 1.A.2.a. Iron and steel.

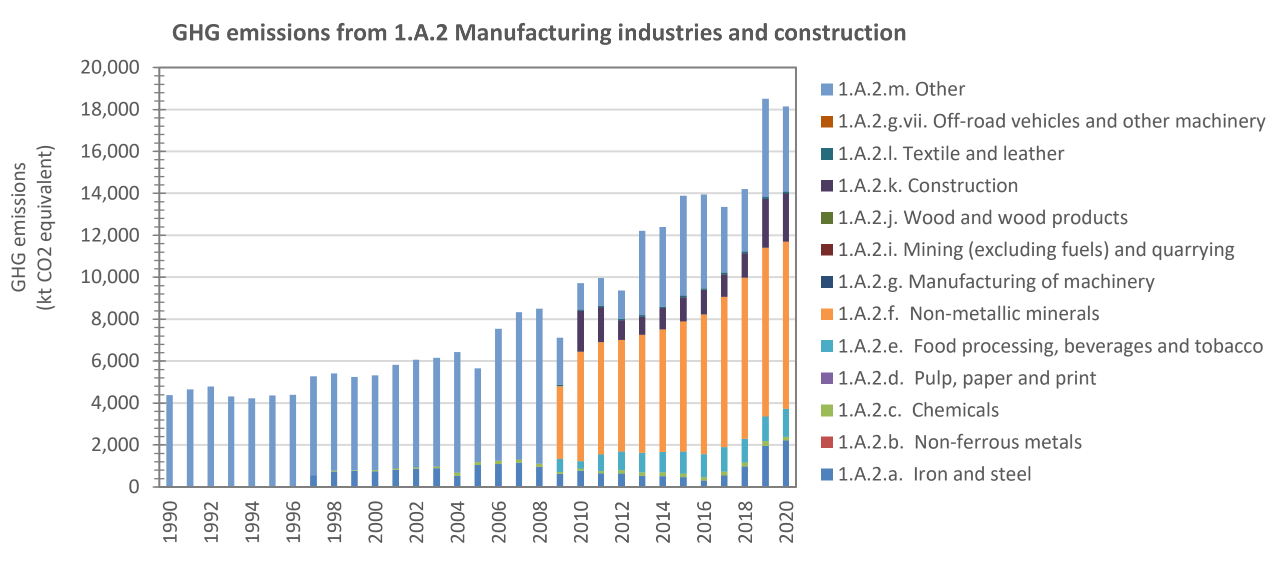


Figure 67 GHG Emissions from IPCC category 1.A.2 Manufacturing industries and construction by category

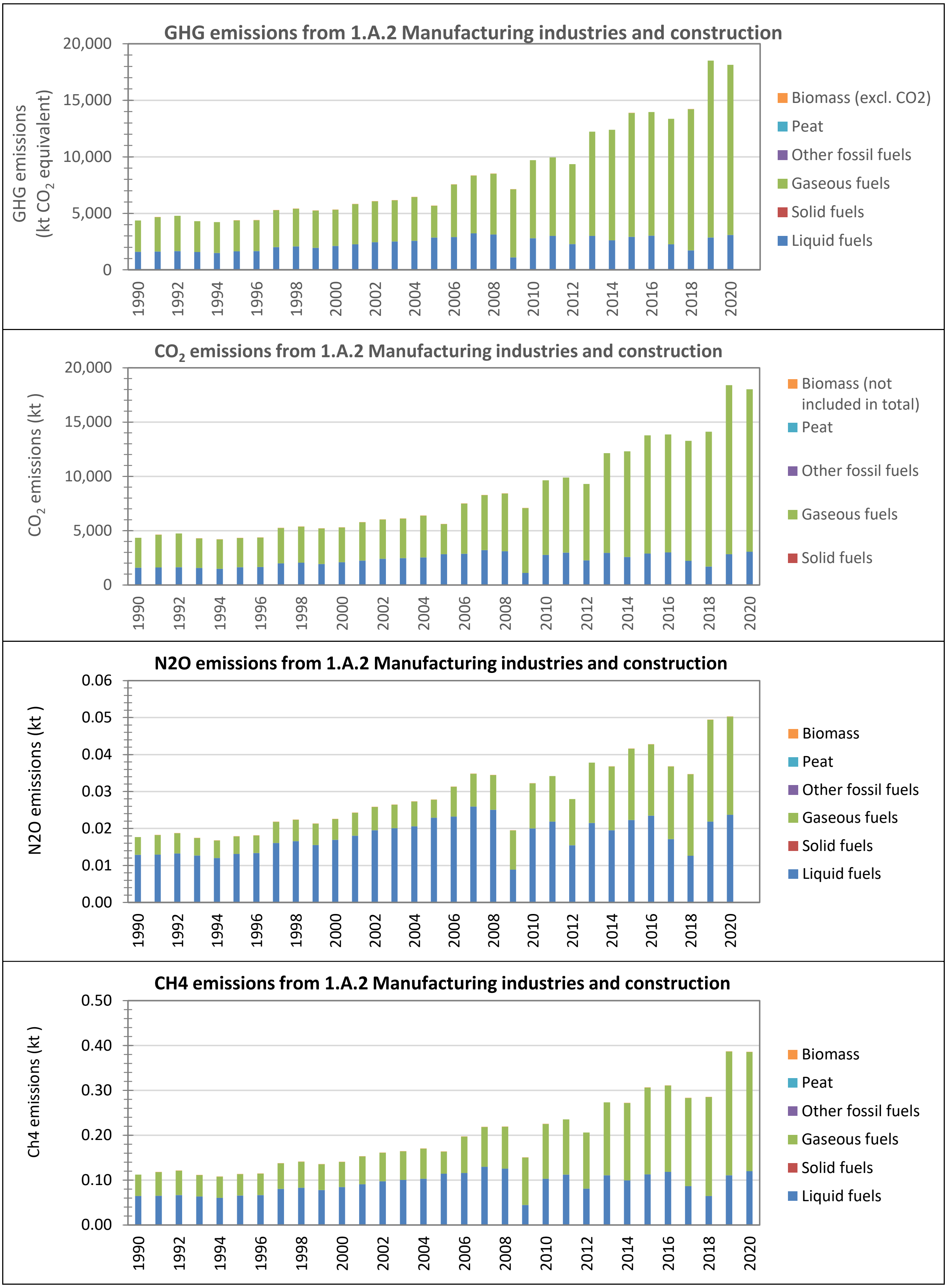


Figure 68 Emissions from IPCC category 1.A.2 Manufacturing industries and construction

Table 134 GHG Emissions by fuels from IPCC category 1.A.2 *Manufacturing Industries and Construction*

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	4,344.70	1,609.26	NO	2,763.67	NO	NO	NO
1991	4,628.60	1,621.45	NO	3,036.78	NO	NO	0.00670
1992	4,754.53	1,658.62	NO	3,126.31	NO	NO	0.00738
1993	4,286.99	1,590.48	NO	2,724.38	NO	NO	0.01246
1994	4,204.04	1,506.73	NO	2,724.38	NO	NO	0.01246
1995	4,338.36	1,642.35	NO	2,724.38	NO	NO	0.01246
1996	4,365.92	1,670.17	NO	2,724.38	NO	NO	0.01246
1997	5,244.64	2,012.90	NO	3,266.21	NO	NO	0.01662
1998	5,371.38	2,072.81	NO	3,333.93	NO	NO	0.01766
1999	5,210.43	1,945.96	NO	3,298.45	NO	NO	0.01766
2000	5,290.01	2,116.12	NO	3,209.08	NO	NO	0.01766
2001	5,784.82	2,261.51	NO	3,561.53	NO	NO	0.01766
2002	6,022.84	2,440.94	NO	3,622.12	NO	NO	0.02378
2003	6,114.93	2,512.08	NO	3,643.84	NO	NO	0.01938
2004	6,389.75	2,577.04	NO	3,855.29	NO	NO	0.01938
2005	5,623.14	2,864.75	NO	2,798.81	NO	NO	0.02354
2006	7,497.19	2,901.87	NO	4,644.71	NO	NO	0.02125
2007	8,284.59	3,242.17	NO	5,097.17	NO	NO	0.02354
2008	8,441.16	3,140.08	NO	5,356.05	NO	NO	0.01535
2009	7,069.85	1,113.72	NO	5,995.14	NO	NO	0.01768
2010	9,644.44	2,792.60	NO	6,909.36	NO	NO	0.00995
2011	9,894.99	3,004.23	NO	6,950.64	NO	NO	NO
2012	9,307.94	2,284.93	NO	7,076.07	NO	NO	NO
2013	12,145.64	2,998.15	NO	9,217.69	NO	NO	NO
2014	12,326.15	2,613.11	NO	9,783.10	NO	NO	0.00231
2015	13,799.72	2,921.71	NO	10,956.79	NO	NO	0.00232
2016	13,871.71	3,036.79	NO	10,914.85	NO	NO	0.00225
2017	13,284.66	2,253.82	NO	11,104.20	NO	NO	0.00387
2018	14,128.14	1,720.37	NO	12,482.37	NO	NO	0.00834
2019	18,413.42	2,872.00	NO	15,641.89	NO	NO	0.00388
2020	18,036.67	3,096.67	NO	15,039.90	NO	NO	0.00381
Trend							
1990 - 2020	315.1%	92.4%	NA	444.2%	*NA*	*NA*	*NA*
2005 - 2020	220.8%	8.1%	NA	437.4%	*NA*	*NA*	*-83.8%*
2019 - 2020	-2.0%	7.8%	NA	-3.8%	*NA*	*NA*	*-1.6%*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 135 CO_2 Emissions by fuels from IPCC category 1.A.2 *Manufacturing Industries and Construction*

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	4,336.62	1,588.49	NO	2,748.13	NO	NO	NO
1991	4,620.22	1,600.52	NO	3,019.70	NO	NO	0.00008
1992	4,745.94	1,637.21	NO	3,108.73	NO	NO	0.00008
1993	4,279.01	1,569.95	NO	2,709.06	NO	NO	0.00014
1994	4,196.34	1,487.28	NO	2,709.06	NO	NO	0.00014
1995	4,330.21	1,621.15	NO	2,709.06	NO	NO	0.00014
1996	4,357.68	1,648.61	NO	2,709.06	NO	NO	0.00014
1997	5,234.71	1,986.91	NO	3,247.79	NO	NO	0.00019
1998	5,361.19	2,046.06	NO	3,315.13	NO	NO	0.00020
1999	5,200.70	1,920.85	NO	3,279.85	NO	NO	0.00020
2000	5,279.79	2,088.80	NO	3,190.98	NO	NO	0.00020
2001	5,773.77	2,232.32	NO	3,541.45	NO	NO	0.00020
2002	6,011.12	2,409.43	NO	3,601.69	NO	NO	0.00027
2003	6,102.95	2,479.66	NO	3,623.29	NO	NO	0.00022
2004	6,377.36	2,543.77	NO	3,833.58	NO	NO	0.00022
2005	5,610.78	2,827.77	NO	2,783.00	NO	NO	0.00027
2006	7,482.93	2,864.42	NO	4,618.52	NO	NO	0.00024
2007	8,268.75	3,200.32	NO	5,068.43	NO	NO	0.00027
2008	8,425.42	3,099.54	NO	5,325.88	NO	NO	0.00018
2009	7,061.52	1,099.35	NO	5,960.94	NO	NO	0.00020
2010	9,638.36	2,759.38	NO	6,869.83	NO	NO	0.00011
2011	9,880.11	2,968.06	NO	6,910.87	NO	NO	NO
2012	9,295.64	2,258.87	NO	7,035.59	NO	NO	NO
2013	12,128.87	2,962.42	NO	9,165.12	NO	NO	NO
2014	12,309.80	2,581.06	NO	9,727.34	NO	NO	0.00003
2015	13,781.10	2,885.29	NO	10,894.38	NO	NO	0.00003
2016	13,852.60	2,998.57	NO	10,852.64	NO	NO	0.00003
2017	13,268.13	2,225.79	NO	11,040.85	NO	NO	0.00004
2018	14,112.22	1,699.50	NO	12,411.17	NO	NO	0.00010
2019	18,390.79	2,836.23	NO	15,552.80	NO	NO	0.00004
2020	18,013.96	3,057.90	NO	14,954.15	NO	NO	0.00004
Trend							
1990 - 2020	315.4%	92.5%	NA	444.2%	*NA*	*NA*	*NA*
2005 - 2020	221.1%	8.1%	NA	437.4%	*NA*	*NA*	*-83.8%*
2019 - 2020	-2.0%	7.8%	NA	-3.8%	*NA*	*NA*	*-1.6%*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 136 N_2O Emissions by fuels from IPCC category 1.A.2 *Manufacturing Industries and Construction*

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.018	0.013	NO	0.005	NO	NO	NO
1991	0.018	0.013	NO	0.005	NO	NO	2.73E-09
1992	0.019	0.013	NO	0.005	NO	NO	3.01E-09
1993	0.017	0.013	NO	0.005	NO	NO	5.09E-09
1994	0.017	0.012	NO	0.005	NO	NO	5.09E-09
1995	0.018	0.013	NO	0.005	NO	NO	5.09E-09
1996	0.018	0.013	NO	0.005	NO	NO	5.09E-09
1997	0.022	0.016	NO	0.006	NO	NO	6.78E-09
1998	0.022	0.017	NO	0.006	NO	NO	7.21E-09
1999	0.021	0.016	NO	0.006	NO	NO	7.21E-09
2000	0.023	0.017	NO	0.006	NO	NO	7.21E-09
2001	0.024	0.018	NO	0.006	NO	NO	7.21E-09
2002	0.026	0.020	NO	0.006	NO	NO	9.70E-09
2003	0.026	0.020	NO	0.006	NO	NO	7.91E-09
2004	0.027	0.021	NO	0.007	NO	NO	7.91E-09
2005	0.028	0.023	NO	0.005	NO	NO	9.61E-09
2006	0.031	0.023	NO	0.008	NO	NO	8.67E-09
2007	0.035	0.026	NO	0.009	NO	NO	9.61E-09
2008	0.034	0.025	NO	0.009	NO	NO	6.26E-09
2009	0.019	0.009	NO	0.011	NO	NO	7.22E-09
2010	0.032	0.020	NO	0.012	NO	NO	4.06E-09
2011	0.034	0.022	NO	0.012	NO	NO	NO
2012	0.028	0.015	NO	0.013	NO	NO	NO
2013	0.038	0.022	NO	0.016	NO	NO	NO
2014	0.037	0.019	NO	0.017	NO	NO	9.44E-10
2015	0.042	0.022	NO	0.019	NO	NO	9.46E-10
2016	0.043	0.023	NO	0.019	NO	NO	9.17E-10
2017	0.037	0.017	NO	0.020	NO	NO	1.58E-09
2018	0.035	0.013	NO	0.022	NO	NO	3.40E-09
2019	0.049	0.022	NO	0.028	NO	NO	1.58E-09
2020	0.050	0.024	NO	0.027	NO	NO	1.56E-09
Trend							
1990 - 2020	184.4%	84.4%	NA	451.7%	*NA*	*NA*	*NA*
2005 - 2020	80.8%	3.6%	NA	442.3%	*NA*	*NA*	*-83.8%*
2019 - 2020	1.7%	8.6%	NA	-3.8%	*NA*	*NA*	*-1.6%*

Table 137 CH_4 Emissions by fuels from IPCC category 1.A.2 *Manufacturing Industries and Construction*

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.112	0.064	NO	0.048	NO	NO	NO
1991	0.118	0.065	NO	0.053	NO	NO	2.05E-08
1992	0.121	0.066	NO	0.054	NO	NO	2.26E-08
1993	0.111	0.064	NO	0.047	NO	NO	3.81E-08
1994	0.108	0.060	NO	0.047	NO	NO	3.81E-08
1995	0.113	0.066	NO	0.047	NO	NO	3.81E-08
1996	0.114	0.067	NO	0.047	NO	NO	3.81E-08
1997	0.138	0.080	NO	0.057	NO	NO	5.09E-08
1998	0.141	0.083	NO	0.058	NO	NO	5.40E-08
1999	0.135	0.078	NO	0.058	NO	NO	5.40E-08
2000	0.141	0.085	NO	0.056	NO	NO	5.40E-08
2001	0.153	0.090	NO	0.062	NO	NO	5.40E-08
2002	0.161	0.098	NO	0.063	NO	NO	7.28E-08
2003	0.164	0.100	NO	0.064	NO	NO	5.93E-08
2004	0.170	0.103	NO	0.067	NO	NO	5.93E-08
2005	0.164	0.114	NO	0.049	NO	NO	7.20E-08
2006	0.197	0.116	NO	0.081	NO	NO	6.51E-08
2007	0.219	0.130	NO	0.089	NO	NO	7.20E-08
2008	0.219	0.125	NO	0.093	NO	NO	4.70E-08
2009	0.150	0.045	NO	0.106	NO	NO	5.41E-08
2010	0.225	0.103	NO	0.122	NO	NO	3.05E-08
2011	0.235	0.112	NO	0.123	NO	NO	NO
2012	0.206	0.081	NO	0.125	NO	NO	NO
2013	0.273	0.111	NO	0.163	NO	NO	NO
2014	0.272	0.099	NO	0.173	NO	NO	7.08E-09
2015	0.306	0.113	NO	0.193	NO	NO	7.10E-09
2016	0.311	0.118	NO	0.193	NO	NO	6.88E-09
2017	0.283	0.087	NO	0.196	NO	NO	1.18E-08
2018	0.285	0.065	NO	0.220	NO	NO	2.55E-08
2019	0.387	0.111	NO	0.276	NO	NO	1.19E-08
2020	0.386	0.120	NO	0.265	NO	NO	1.17E-08
Trend							
1990 - 2020	242.9%	86.7%	NA	451.7%	*NA*	*NA*	*NA*
2005 - 2020	135.8%	4.9%	NA	442.3%	*NA*	*NA*	*-83.8%*
2019 - 2020	-0.3%	8.4%	NA	-3.8%	*NA*	*NA*	*-1.6%*

3.2.4.1 Iron and steel (IPCC category 1.A.2.a)

3.2.4.1.1 Category description

The IPCC category 1.A.2.a *Iron and steel* includes GHG emissions resulting from fuel combustion activities in

- Manufacture of basic iron and steel (ISIC Class 2410)
- Casting of iron and steel (ISIC Class 2431).

The consumption of energy products in coke ovens and blast furnaces is excluded, as these plants are considered part of the energy industries.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.a	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

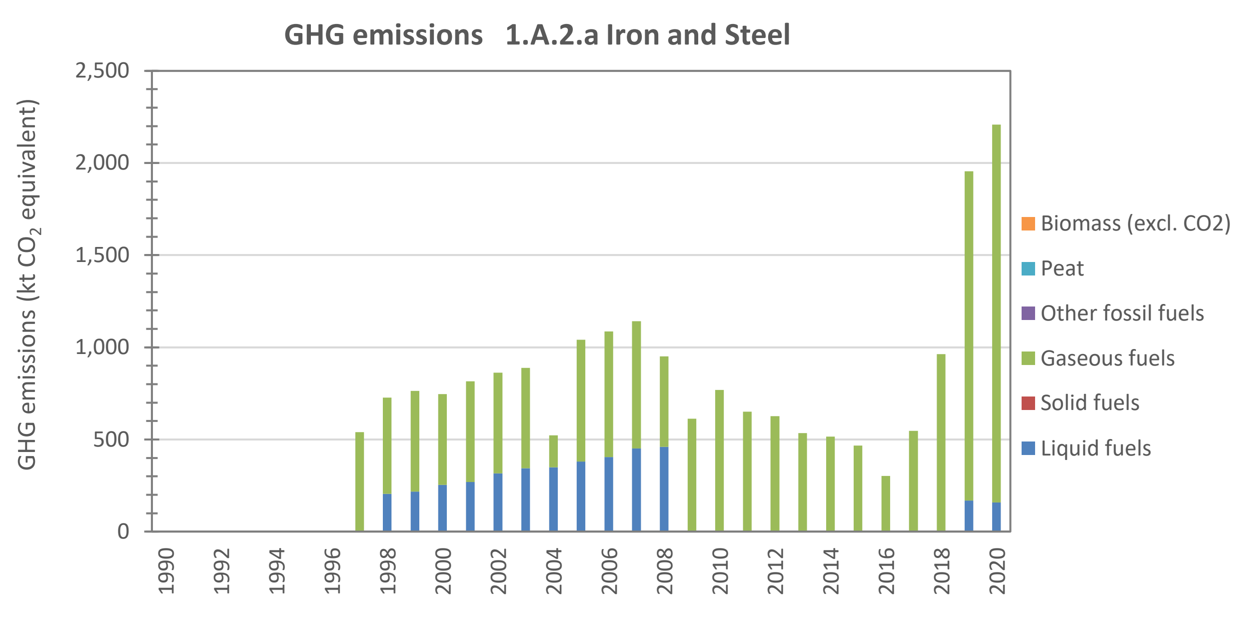
IPCC code	**Description**	**Occurrent**			**Not occurrent (NO)**
		Estimated	**Not estimated (NE)**	**Included elsewhere (IE)**	
1.A.2.a	Iron and Steel	✓		1990-1996 in 1.A.2.m	

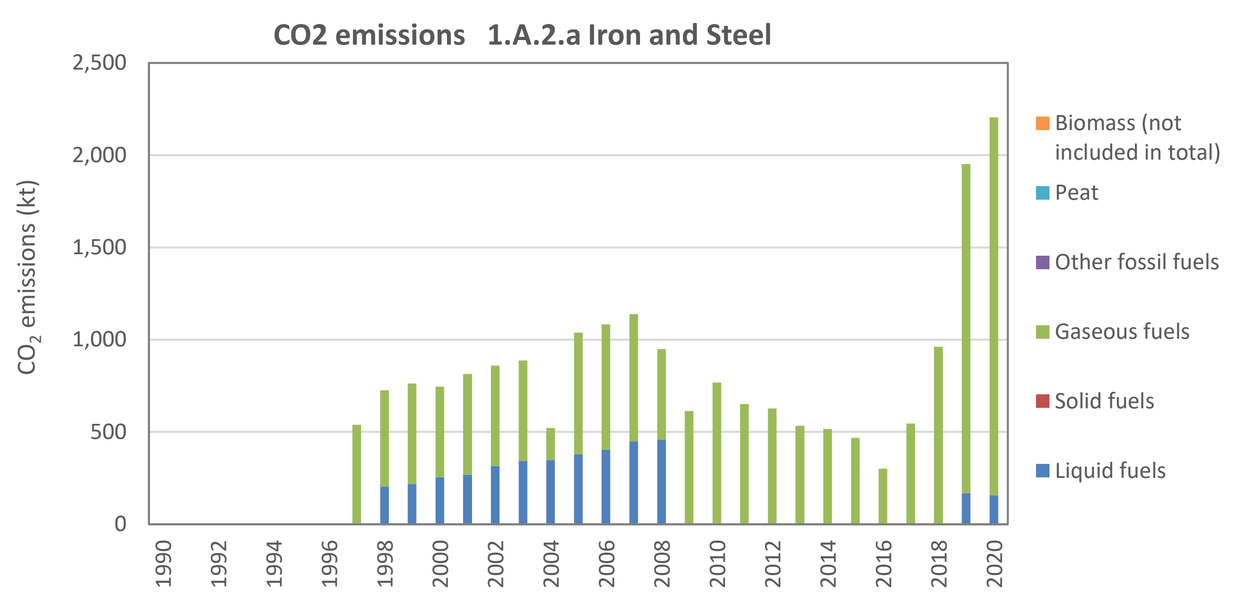
An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.a *Iron and steel* is provided in the following figures and tables:

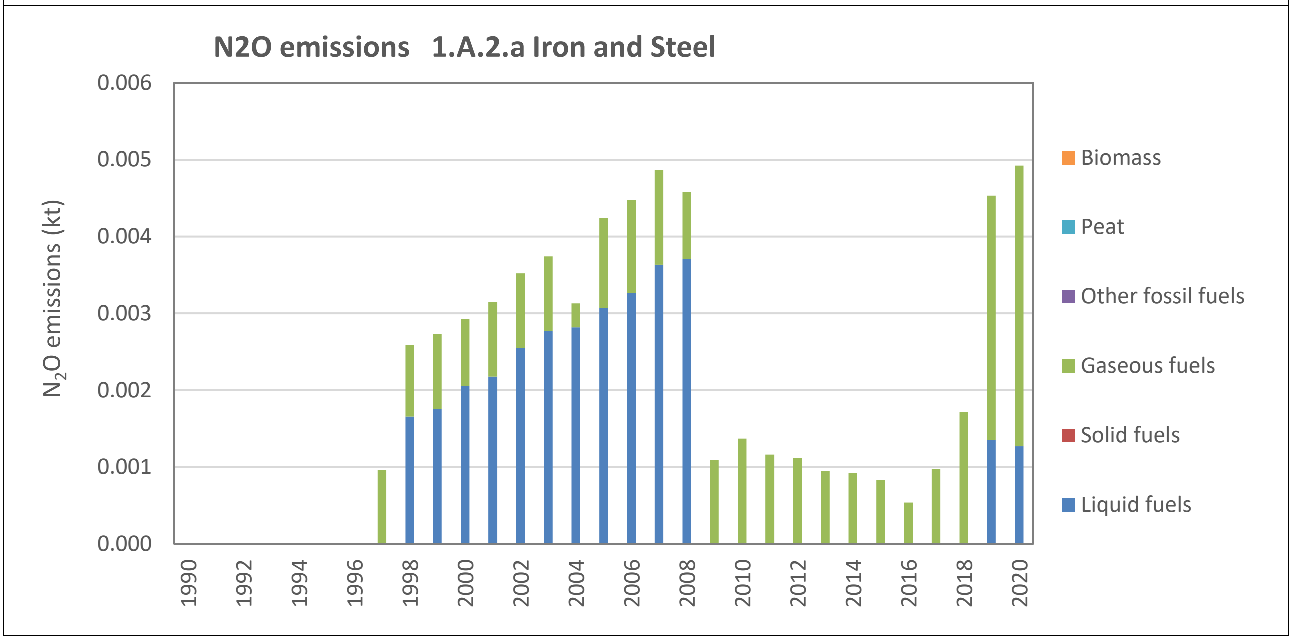
- annual GHG emissions;
- Trend of the periods 1997 – 2020, 2005 – 2020, 2019 – 2020.

The greenhouse gas emissions from IPCC category 1.A.2.a Iron and steel amounted to 541.83 kt CO_2 equivalents in 1997, 1,047.06 kt CO_2 equivalents in 2005 and 2,218.72 kt CO_2 equivalents in 2020. The overall trend in GHG emissions from the IPCC category 1.A.2.a Iron and steel shows an increase by 309.5% from 1997 to 2020, 111.9% from 2005 to 2020 and by 12.9% from 2019 to 2020.

Fluctuation of emissions (emissions decreasing), in particular, since 2008 is mainly due to the suspension of the activities of blast furnace N°2 of the El-Hadjar steel complex in the wilaya of Annaba because of a malfunction in the supply of raw material. However, the increase in emissions from 2017 is the result of the increase in Algeria's production capacity due to the commissioning of two new complexes, the Tosyali steel complex in Oran in 2013 and the Bellara complex in Jijel in 2017.


GHG emissions 1.A.2.a Iron and Steel
GHG emissions (kt CO_2 equivalent)
2,500
2,000
1,500
1,000
500
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions 1.A.2.a Iron and Steel
CO_2 emissions (kt)
2,500
2,000
1,500
1,000
500
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


N2O emissions 1.A.2.a Iron and Steel
N_2O emissions (kt)
0.006
0.005
0.004
0.003
0.002
0.001
0.000
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

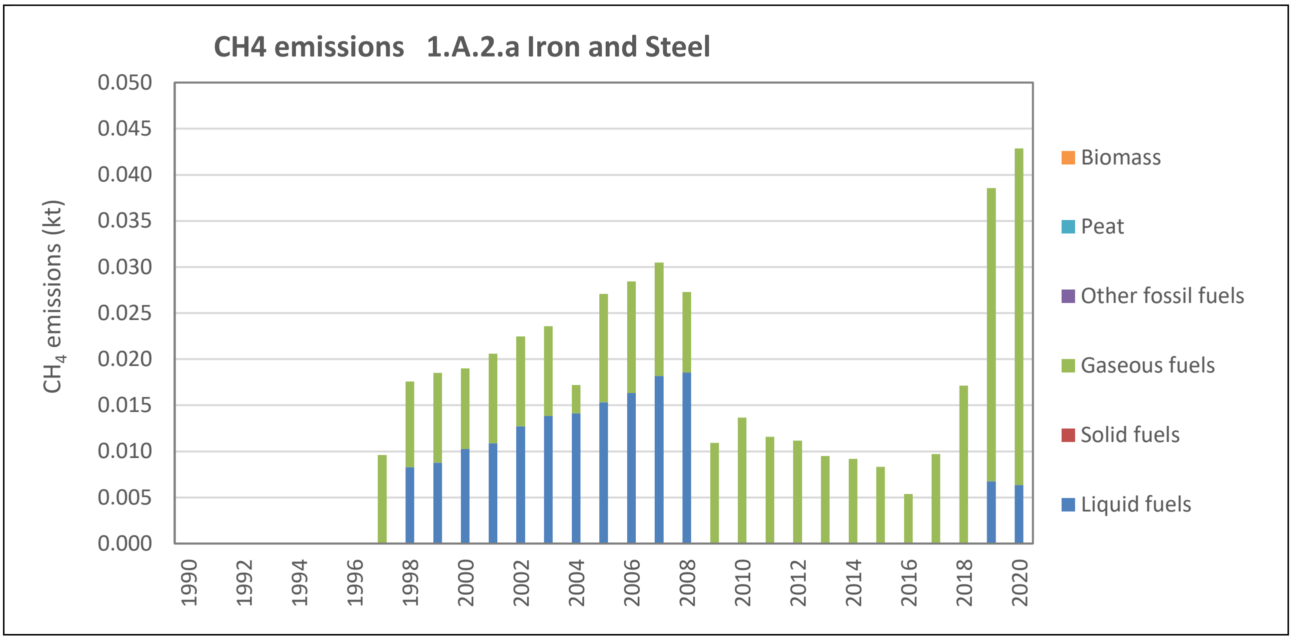


Figure 69 Emissions from IPCC category 1.A.2.a Iron and steel

Table 138 GHG Emissions by fuels from IPCC category 1.A.2.a Iron and steel

GHG	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.a	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	541.83	IE	NO	541.83	NO	NO	NO
1998	732.04	207.28	NO	524.77	NO	NO	NO
1999	768.23	219.65	NO	548.58	NO	NO	NO
2000	750.36	256.77	NO	493.59	NO	NO	NO
2001	820.83	272.24	NO	548.58	NO	NO	NO
2002	867.23	318.65	NO	548.58	NO	NO	NO
2003	894.67	346.49	NO	548.18	NO	NO	NO
2004	527.16	352.68	NO	174.48	NO	NO	NO
2005	1,047.06	383.61	NO	663.45	NO	NO	NO
2006	1,092.43	408.36	NO	684.07	NO	NO	NO
2007	1,149.14	454.77	NO	694.38	NO	NO	NO
2008	957.64	464.05	NO	493.59	NO	NO	NO
2009	615.97	IE	NO	615.97	NO	NO	NO
2010	771.41	IE	NO	771.41	NO	NO	NO
2011	654.06	IE	NO	654.06	NO	NO	NO
2012	629.74	0.20	NO	629.54	NO	NO	NO
2013	536.29	0.26	NO	536.03	NO	NO	NO
2014	518.60	0.41	NO	518.19	NO	NO	NO
2015	469.54	0.62	NO	468.92	NO	NO	NO
2016	303.23	1.44	NO	301.79	NO	NO	NO
2017	548.69	1.07	NO	547.62	NO	NO	NO
2018	966.63	2.12	NO	964.51	NO	NO	NO
2019	1,964.47	169.51	NO	1,794.97	NO	NO	NO
2020	2,218.72	159.09	NO	2,059.63	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	111.9%	-58.5%	NA	210.4%	NA	NA	NA
2019 - 2020	12.9%	-6.1%	NA	14.7%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 139 CO_2 Emissions by fuels from IPCC category 1.A.2.a Iron and steel

CO_2	Total CO_2 emissions (excluding CO_2 from biomass)	CO_2 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	538.728	IE	NO	538.728	NO	NO	NO
1998	726.364	204.600	NO	521.764	NO	NO	NO
1999	762.259	216.815	NO	545.443	NO	NO	NO
2000	744.223	253.460	NO	490.763	NO	NO	NO
2001	814.172	268.729	NO	545.443	NO	NO	NO
2002	859.978	314.535	NO	545.443	NO	NO	NO
2003	887.058	342.018	NO	545.040	NO	NO	NO
2004	521.609	348.126	NO	173.484	NO	NO	NO
2005	1,038.315	378.663	NO	659.652	NO	NO	NO
2006	1,083.244	403.093	NO	680.151	NO	NO	NO
2007	1,139.299	448.899	NO	690.400	NO	NO	NO
2008	948.823	458.060	NO	490.763	NO	NO	NO
2009	612.444	IE	NO	612.444	NO	NO	NO
2010	766.990	IE	NO	766.990	NO	NO	NO
2011	650.313	IE	NO	650.313	NO	NO	NO
2012	626.135	0.196	NO	625.939	NO	NO	NO
2013	533.220	0.259	NO	532.961	NO	NO	NO
2014	515.628	0.406	NO	515.223	NO	NO	NO
2015	466.850	0.612	NO	466.238	NO	NO	NO
2016	301.496	1.432	NO	300.064	NO	NO	NO
2017	545.548	1.065	NO	544.483	NO	NO	NO
2018	961.097	2.110	NO	958.987	NO	NO	NO
2019	1,952.018	167.327	NO	1,784.690	NO	NO	NO
2020	2,204.877	157.040	NO	2,047.837	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	112.4%	-58.5%	NA	210.4%	NA	NA	NA
2019 - 2020	13.0%	-6.1%	NA	14.7%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 140 N_2O Emissions by fuels from IPCC category 1.A.2.a Iron and steel

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	0.001	IE	NO	0.001	NO	NO	NO
1998	0.003	0.002	NO	0.001	NO	NO	NO
1999	0.003	0.002	NO	0.001	NO	NO	NO
2000	0.003	0.002	NO	0.001	NO	NO	NO
2001	0.003	0.002	NO	0.001	NO	NO	NO
2002	0.004	0.003	NO	0.001	NO	NO	NO
2003	0.004	0.003	NO	0.001	NO	NO	NO
2004	0.003	0.003	NO	0.000	NO	NO	NO
2005	0.004	0.003	NO	0.001	NO	NO	NO
2006	0.004	0.003	NO	0.001	NO	NO	NO
2007	0.005	0.004	NO	0.001	NO	NO	NO
2008	0.005	0.004	NO	0.001	NO	NO	NO
2009	0.001	IE	NO	0.001	NO	NO	NO
2010	0.001	IE	NO	0.001	NO	NO	NO
2011	0.001	IE	NO	0.001	NO	NO	NO
2012	0.001	0.000	NO	0.001	NO	NO	NO
2013	0.001	0.000	NO	0.001	NO	NO	NO
2014	0.001	0.000	NO	0.001	NO	NO	NO
2015	0.001	0.000	NO	0.001	NO	NO	NO
2016	0.001	0.000	NO	0.001	NO	NO	NO
2017	0.001	0.000	NO	0.001	NO	NO	NO
2018	0.002	0.000	NO	0.002	NO	NO	NO
2019	0.005	0.001	NO	0.003	NO	NO	NO
2020	0.005	0.001	NO	0.004	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*16.0%*	*-58.6%*	*NA*	*210.4%*	*NA*	*NA*	*NA*
019 - 2020	*8.6%*	*-5.8%*	*NA*	*14.7%*	*NA*	*NA*	*NA*

Table 141 CH_4 Emissions by fuels from IPCC category 1.A.2.a Iron and steel

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.a	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	0.010	IE	NO	0.010	NO	NO	NO
1998	0.018	0.008	NO	0.009	NO	NO	NO
1999	0.019	0.009	NO	0.010	NO	NO	NO
2000	0.019	0.010	NO	0.009	NO	NO	NO
2001	0.021	0.011	NO	0.010	NO	NO	NO
2002	0.022	0.013	NO	0.010	NO	NO	NO
2003	0.024	0.014	NO	0.010	NO	NO	NO
2004	0.017	0.014	NO	0.003	NO	NO	NO
2005	0.027	0.015	NO	0.012	NO	NO	NO
2006	0.028	0.016	NO	0.012	NO	NO	NO
2007	0.030	0.018	NO	0.012	NO	NO	NO
2008	0.027	0.019	NO	0.009	NO	NO	NO
2009	0.011	IE	NO	0.011	NO	NO	NO
2010	0.014	IE	NO	0.014	NO	NO	NO
2011	0.012	IE	NO	0.012	NO	NO	NO
2012	0.011	0.000	NO	0.011	NO	NO	NO
2013	0.010	0.000	NO	0.010	NO	NO	NO
2014	0.009	0.000	NO	0.009	NO	NO	NO
2015	0.008	0.000	NO	0.008	NO	NO	NO
2016	0.005	0.000	NO	0.005	NO	NO	NO
2017	0.010	0.000	NO	0.010	NO	NO	NO
2018	0.017	0.000	NO	0.017	NO	NO	NO
2019	0.039	0.007	NO	0.032	NO	NO	NO
2020	0.043	0.006	NO	0.037	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*58.2%*	*-58.5%*	*NA*	*210.4%*	*NA*	*NA*	*NA*
2019 - 2020	*11.1%*	*-5.9%*	*NA*	*14.7%*	*NA*	*NA*	*NA*

3.2.4.1.2 Methodological issues

3.2.4.1.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[156] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, gaseous fuels

3.2.4.1.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:
- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil)
- Liquefied Petroleum Gas

Gaseous fuels:
- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1997 - 2009 are taken from the Energy balance provided by MEM and UN statistics[157] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[158].

The total fuel consumption increased by 302% in the period 1997 – 2020. From 2005 to 2020, the total fuel consumption increased by 129%. From 2019 to 2020 the total fuel consumption increased by 13.4%, as a result of the commissioning of two new steel complexes, the Tosyali steel complex in Oran in 2013 and the Bellara steel complex in Jijel in 2017, which contributed directly to the increase of fuel consumption.

The fluctuation of the fuel consumption is mainly due to the suspension of the activities of blast furnace n° 2 of the El-Hadjar steel complex in Annaba because of a malfunction in the supply of raw material and the implementation of two new steel complexes, the Tosyali steel complex in Oran in 2013 and the Bellara steel complex in Jijel in 2017.

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[156] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[157] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[158] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

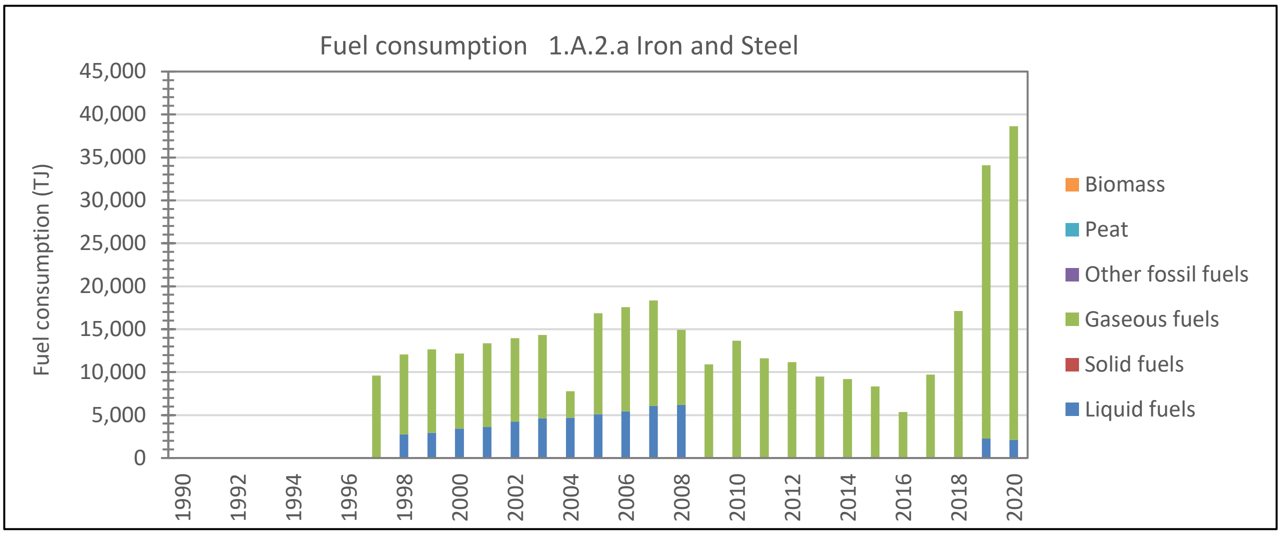

Figure 70 Activity data for IPCC category 1.A.2.a Iron and steel

Table 142 Activity data for IPCC category 1.A.2.a Iron and steel

Activity data 1.A.2.a	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	9,603.00	IE	NO	9,603.00	NO	NO	NO
1998	12,061.74	2,761.14	NO	9,300.60	NO	NO	NO
1999	12,648.68	2,925.98	NO	9,722.70	NO	NO	NO
2000	12,168.51	3,420.51	NO	8,748.00	NO	NO	NO
2001	13,349.27	3,626.57	NO	9,722.70	NO	NO	NO
2002	13,967.43	4,244.73	NO	9,722.70	NO	NO	NO
2003	14,331.13	4,615.63	NO	9,715.50	NO	NO	NO
2004	7,790.45	4,698.05	NO	3,092.40	NO	NO	NO
2005	16,868.66	5,110.16	NO	11,758.50	NO	NO	NO
2006	17,563.75	5,439.85	NO	12,123.90	NO	NO	NO
2007	18,364.62	6,058.02	NO	12,306.60	NO	NO	NO
2008	14,929.65	6,181.65	NO	8,748.00	NO	NO	NO
2009	10,917.00	IE	NO	10,917.00	NO	NO	NO
2010	13,671.83	IE	NO	13,671.83	NO	NO	NO
2011	11,592.03	IE	NO	11,592.03	NO	NO	NO
2012	11,160.66	3.10	NO	11,157.55	NO	NO	NO
2013	9,504.30	4.11	NO	9,500.19	NO	NO	NO
2014	9,190.44	6.43	NO	9,184.01	NO	NO	NO

Activity data 1.A.2.a	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2015	8,320.54	9.71	NO	8,310.83	NO	NO	NO
2016	5,371.42	22.69	NO	5,348.73	NO	NO	NO
2017	9,722.45	16.88	NO	9,705.58	NO	NO	NO
2018	17,127.69	33.45	NO	17,094.24	NO	NO	NO
2019	34,072.98	2,260.32	NO	31,812.66	NO	NO	NO
2020	38,622.92	2,119.60	NO	36,503.33	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	129.0%	-58.5%	NA	210.4%	NA	NA	NA
2019 - 2020	13.4%	-6.2%	NA	14.7%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g, in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.a Iron and steel are provided.

Table 143 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.a Iron and steel

Fuel type	Fuel	Unit	Net calorific value (NCV) Country specific NCV (CS NCV) (GVC * Conversion factor)	Net calorific value (NCV) default NCV for comparison
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[159]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)		

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[159] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [160]: Table 4 Difference between net and gross calorific values for selected fuels		
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

3.2.4.1.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines.

For liquid fuels the default emission factors for greenhouse gases were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 144 GHG Emission factor TIER 1 for IPCC category 1.A.2.a Iron and steel

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	1	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	3	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63,100	D	1	D	0.1	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor	

3.2.4.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.2.a Iron and steel are presented in the following table.

Table 145 Uncertainty for IPCC category 1.A.2.a Iron and steel.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

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[160] https://unstats.un.org/unsd/energystats/methodology/ires/

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1997 - 2009 are taken from the Energy balance provided by MEM and UN statistics[161] .
- 2010 - 2020 are taken from the National Energy balance provided by MEM[162].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [163].
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [164]. A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.4.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[165] and
    - international energy statistics of UN statistics[166] and International Energy Agency (IEA)[167]
- cross checks with sectors 1.A.c.i and 2.c.1 are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

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[161] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[162] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[163] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[164] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[165] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[166] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[167] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.4.1.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.2.a Iron and steel*.

Table 146Recalculations done since NC in IPCC category 1.A.2.a Iron and steel

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.a	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel, fuel oil, LPG	AD	Accuracy Comparability
1.A.2.a	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 147Planned improvements for IPCC category 1.A.2.a Iron and steel

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.a	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data (production and consumption, NCV, carbon content) • Consumption of various fuels for combustion • Consumption of coking coal for production of coke • Production and consumption of coke oven coke in the process • Production and consumption of coke oven gas • Production and consumption of blast furnace gas	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.a 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.2.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.2 Non-ferrous metals (IPCC category 1.A.2.b)

3.2.4.2.1 Category description

The IPCC category 1.A.2.b *Non-ferrous metals* includes GHG emissions resulting from fuel combustion activities in

- Manufacture of basic precious and other non-ferrous metals (ISIC Class 2420)
- Casting of non-ferrous metals (ISIC Class 2432).

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.b	**IE**	NO	**IE**	NO	NO	NO	**IE**	NO	**IE**	NO	NO	NO	**IE**	NO	**IE**	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

IPCC code	**Description**	**Occurrent**			**Not occurrent (NO)**
		Estimated	**Not estimated (NE)**	**Included elsewhere (IE)**	
1.A.2.b	Non-Ferrous Metals			1990-2020 in 1.A.2.m	

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacture of basic precious and other non-ferrous metals* and *Casting of non-ferrous metals.* However, as there are activities like zinc and zamak production in Algeria, fuel combustion in this sector can be assumed. Therefore, the notation key IE (included elsewhere) was used.

3.2.4.2.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 148Planned improvements for IPCC category 1.A.2.b Non-ferrous metals

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.b	Energy balance - Survey on use of fuel for combustion activities in Manufacture of basic precious and other non-ferrous metals (ISIC Class 2420) and Casting of non-ferrous metals (ISIC Class 2432).	AD	Accuracy Completeness Comparability Transparency	medium

3.2.4.3 Chemicals (IPCC category 1.A.2.c)

3.2.4.3.1 Category description

The IPCC category 1.A.2.c *Chemicals* includes GHG emissions resulting from fuel combustion activities in Manufacture of chemicals and chemical products (ISIC division 20) and Manufacture of pharmaceuticals, medicinal chemical and botanical products (ISIC Class 21). However, the consumption of energy products by plants manufacturing charcoal (classified in ISIC 2011) is excluded, as these plants are considered part of the energy industries.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.c	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

IPCC code	**Description**	**Occurrent**			**Not occurrent (NO)**
		Estimated	**Not estimated (NE)**	**Included elsewhere (IE)**	
1.A.2.c	Chemicals	✓	-	1990-1994 in 1.A.2.m	-

An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.c *Chemicals* is provided in the following figures and tables:

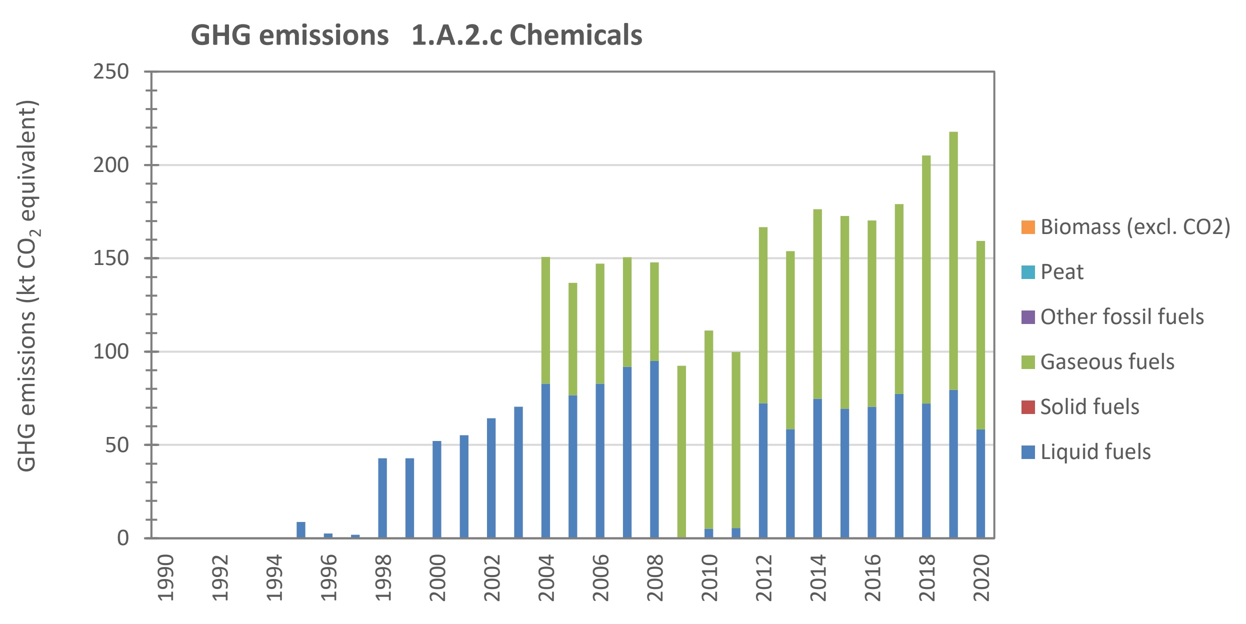
- annual GHG emissions.
- Trend of the periods 1995 – 2020, 2005 – 2020, 2019 – 2020.

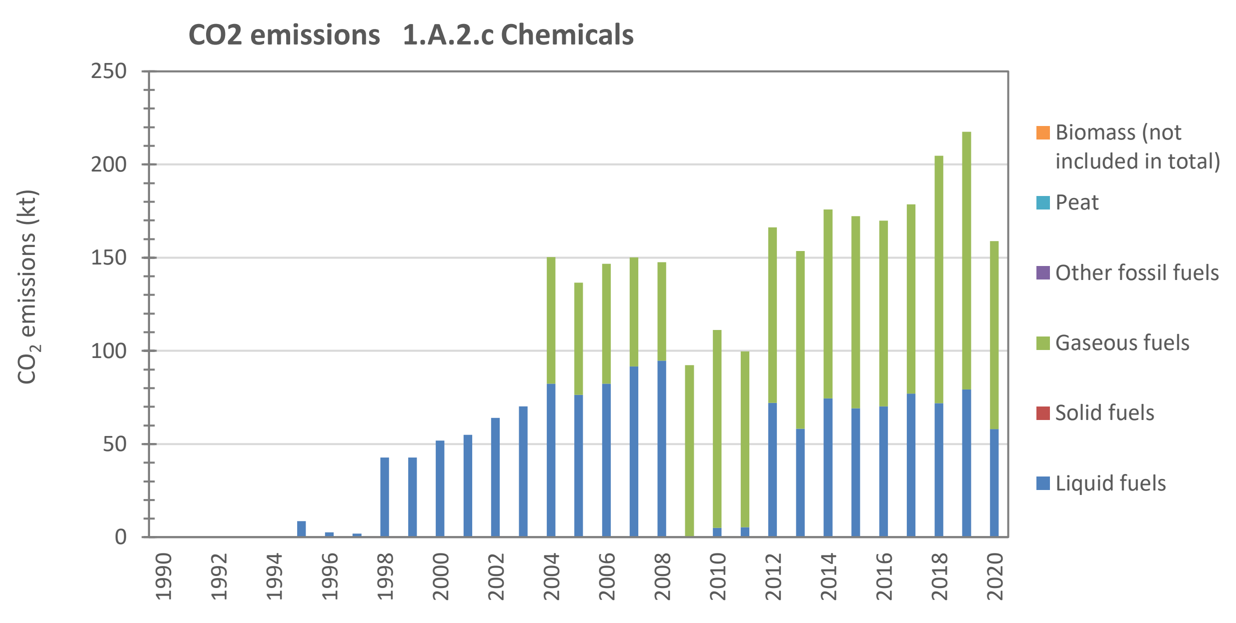
The greenhouse gas emissions from IPCC category 1.A.2.c Chemicals amounted to 8.80 kt CO_2 equivalents in 1995, 137.92 kt CO_2 equivalents in 2005 and 160.33 kt CO_2 equivalents in 2020. The overall trend in GHG emissions from the IPCC category 1.A.2.c Chemicals shows an increase by 1,721.4% from 1995 to 2020 and an increase by 16.2% from 2005 to 2020. However, the period from 2019 to 2020 is marked by a decrease of 26.9%.

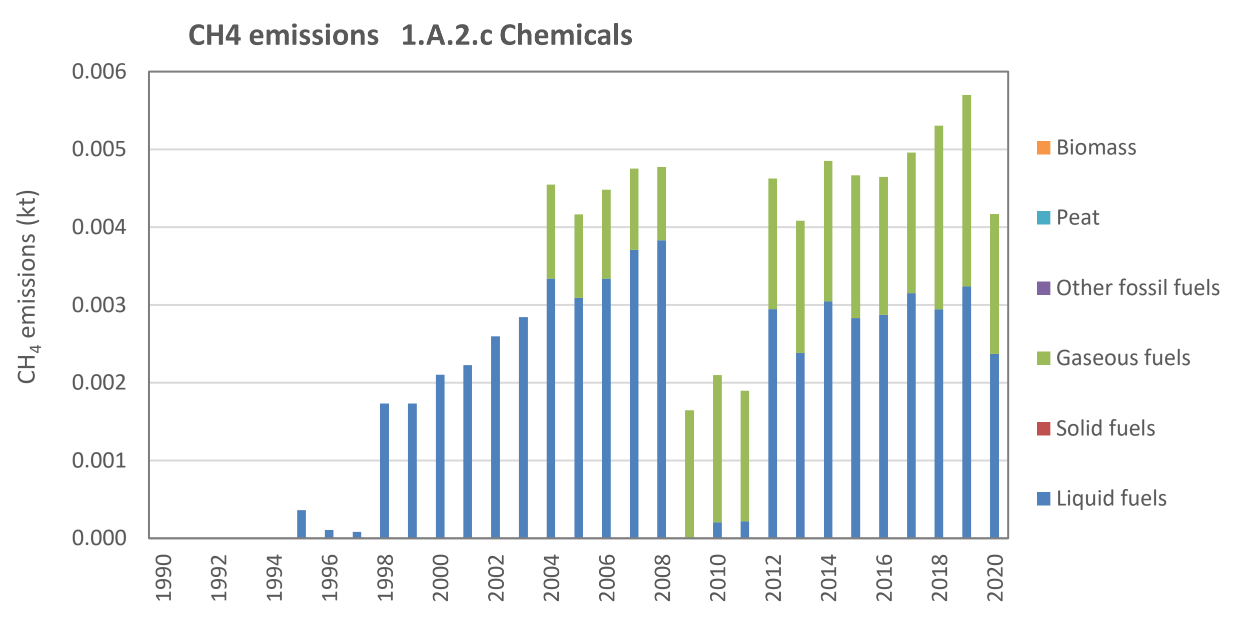
The significant increase is a result of the development and diversification of the chemical and petrochemical industry. The decrease in the last 15 years could be due to a fluctuation in the national production.

No bio-gasoline or bio-gas/diesel oil was consumed.

No CO_2 emission were captured.


GHG emissions 1.A.2.c Chemicals
GHG emissions (kt CO_2 equivalent)
0
50
100
150
200
250
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions 1.A.2.c Chemicals
CO_2 emissions (kt)
0
50
100
150
200
250
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CH4 emissions 1.A.2.c Chemicals
CH_4 emissions (kt)
0.000
0.001
0.002
0.003
0.004
0.005
0.006
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

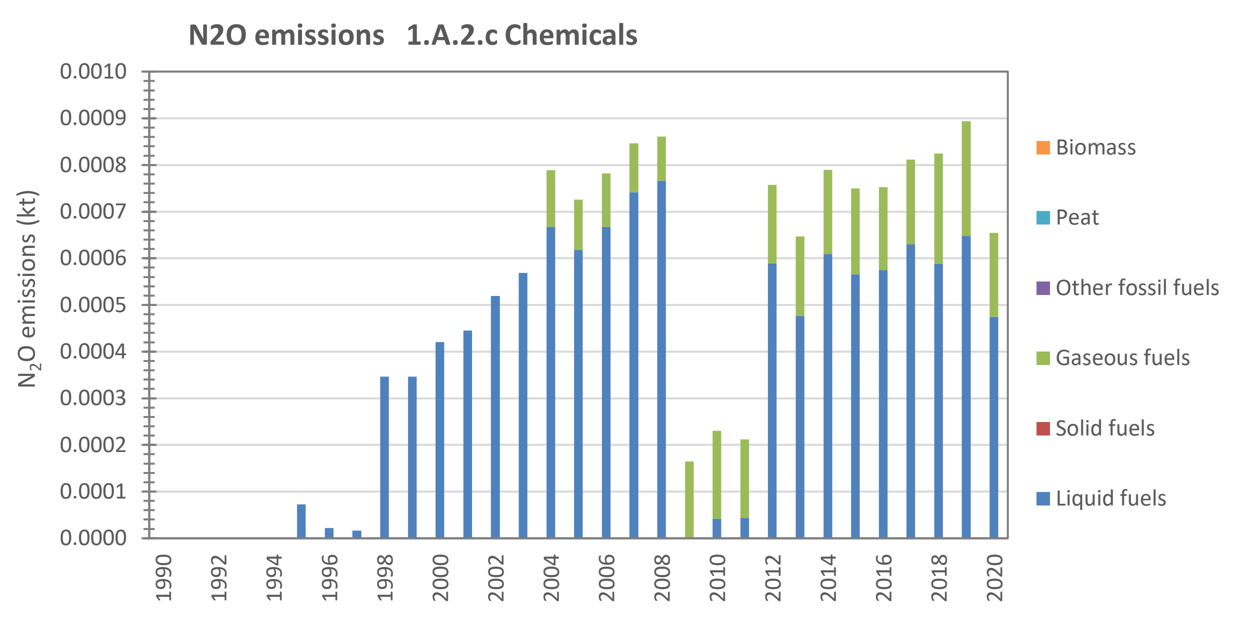


Figure 71 Emissions from IPCC category 1.A.2.c Chemicals

Table 149 GHG Emissions by fuels from IPCC category 1.A.2.c Chemicals

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.c	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	8.80	8.80	NO	NO	NO	NO	NO
1996	2.61	2.61	NO	NO	NO	NO	NO
1997	1.96	1.96	NO	NO	NO	NO	NO
1998	43.31	43.31	NO	NO	NO	NO	NO
1999	43.31	43.31	NO	NO	NO	NO	NO
2000	52.59	52.59	NO	NO	NO	NO	NO
2001	55.69	55.69	NO	NO	NO	NO	NO
2002	64.97	64.97	NO	NO	NO	NO	NO
2003	71.15	71.15	NO	NO	NO	NO	NO
2004	151.83	83.53	NO	68.30	NO	NO	NO
2005	137.92	77.34	NO	60.58	NO	NO	NO
2006	148.17	83.53	NO	64.64	NO	NO	NO
2007	151.72	92.81	NO	58.91	NO	NO	NO
2008	149.07	95.90	NO	53.17	NO	NO	NO
2009	92.88	NO	NO	92.88	NO	NO	NO
2010	111.88	5.18	NO	106.70	NO	NO	NO
2011	100.29	5.44	NO	94.84	NO	NO	NO
2012	167.85	73.01	NO	94.84	NO	NO	NO
2013	154.89	59.03	NO	95.86	NO	NO	NO
2014	177.44	75.47	NO	101.97	NO	NO	NO
2015	173.81	70.17	NO	103.64	NO	NO	NO
2016	171.41	71.24	NO	100.17	NO	NO	NO
2017	180.26	78.13	NO	102.13	NO	NO	NO
2018	206.48	72.95	NO	133.53	NO	NO	NO
2019	219.32	80.36	NO	138.95	NO	NO	NO
2020	160.33	58.86	NO	101.47	NO	NO	NO
Trend							
1995 *- 2020*	1721.4%	568.8%	NA	NA	*NA*	*NA*	*NA*
2005 - 2020	16.2%	-23.9%	NA	67.5%	*NA*	*NA*	*NA*
2019 - 2020	-26.9%	-26.8%	NA	-27.0%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 150 CO_2 Emissions by fuels from IPCC category 1.A.2.c Chemicals

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.c	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	8.69	8.69	NO	IE	NO	NO	NO
1996	2.58	2.58	NO	IE	NO	NO	NO
1997	1.94	1.94	NO	IE	NO	NO	NO
1998	42.75	42.75	NO	IE	NO	NO	NO
1999	42.75	42.75	NO	IE	NO	NO	NO
2000	51.91	51.91	NO	IE	NO	NO	NO
2001	54.97	54.97	NO	IE	NO	NO	NO
2002	64.13	64.13	NO	IE	NO	NO	NO
2003	70.24	70.24	NO	IE	NO	NO	NO
2004	150.36	82.45	NO	67.91	NO	NO	NO
2005	136.58	76.34	NO	60.23	NO	NO	NO
2006	146.72	82.45	NO	64.27	NO	NO	NO
2007	150.18	91.61	NO	58.57	NO	NO	NO
2008	147.53	94.67	NO	52.86	NO	NO	NO
2009	92.35	IE	NO	92.35	NO	NO	NO
2010	111.20	5.11	NO	106.09	NO	NO	NO
2011	99.67	5.37	NO	94.30	NO	NO	NO
2012	166.36	72.06	NO	94.30	NO	NO	NO
2013	153.57	58.26	NO	95.31	NO	NO	NO
2014	175.87	74.49	NO	101.38	NO	NO	NO
2015	172.30	69.26	NO	103.04	NO	NO	NO
2016	169.91	70.31	NO	99.60	NO	NO	NO
2017	178.66	77.12	NO	101.54	NO	NO	NO
2018	204.77	72.00	NO	132.77	NO	NO	NO
2019	217.48	79.32	NO	138.16	NO	NO	NO
2020	158.98	58.09	NO	100.89	NO	NO	NO
Trend							
***1995** - 2020*	1721.4%	568.8%	NA	NA	NA	*NA*	*NA*
2005 - 2020	16.2%	-23.9%	NA	67.5%	NA	*NA*	*NA*
2019 - 2020	-26.9%	-26.8%	NA	-27.0%	NA	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 151 N_2O Emissions by fuels from IPCC category 1.A.2.c Chemicals

N_2O	Total N_2O emissions	N_2O emission from					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.c	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	0.00007	0.00007	NO	IE	NO	NO	NO
1996	0.00002	0.00002	NO	IE	NO	NO	NO
1997	0.00002	0.00002	NO	IE	NO	NO	NO
1998	0.00035	0.00035	NO	IE	NO	NO	NO
1999	0.00035	0.00035	NO	IE	NO	NO	NO
2000	0.00042	0.00042	NO	IE	NO	NO	NO
2001	0.00045	0.00045	NO	IE	NO	NO	NO
2002	0.00052	0.00052	NO	IE	NO	NO	NO
2003	0.00057	0.00057	NO	IE	NO	NO	NO
2004	0.00079	0.00067	NO	0.00012	NO	NO	NO
2005	0.00073	0.00062	NO	0.00011	NO	NO	NO
2006	0.00078	0.00067	NO	0.00011	NO	NO	NO
2007	0.00085	0.00074	NO	0.00010	NO	NO	NO
2008	0.00086	0.00077	NO	0.00009	NO	NO	NO
2009	0.00016	IE	NO	0.00016	NO	NO	NO
2010	0.00023	0.00004	NO	0.00019	NO	NO	NO
2011	0.00021	0.00004	NO	0.00017	NO	NO	NO
2012	0.00076	0.00059	NO	0.00017	NO	NO	NO
2013	0.00065	0.00048	NO	0.00017	NO	NO	NO
2014	0.00079	0.00061	NO	0.00018	NO	NO	NO
2015	0.00075	0.00057	NO	0.00018	NO	NO	NO
2016	0.00075	0.00057	NO	0.00018	NO	NO	NO
2017	0.00081	0.00063	NO	0.00018	NO	NO	NO
2018	0.00082	0.00059	NO	0.00024	NO	NO	NO
2019	0.00089	0.00065	NO	0.00025	NO	NO	NO
2020	0.00065	0.00047	NO	0.00018	NO	NO	NO
Trend							
1995 *- 2020*	802.6%	554.5%	NA	NA	NA	NA	NA
2005 - 2020	-9.8%	-23.3%	NA	67.5%	NA	NA	NA
2019 - 2020	-26.8%	-26.8%	NA	-27.0%	NA	NA	NA

Table 152 CH_4 Emissions by fuels from IPCC category 1.A.2.c Chemicals

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.c	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	0.00036	0.00036	NO	IE	NO	NO	NO
1996	0.00011	0.00011	NO	IE	NO	NO	NO
1997	0.00008	0.00008	NO	IE	NO	NO	NO
1998	0.00173	0.00173	NO	IE	NO	NO	NO
1999	0.00173	0.00173	NO	IE	NO	NO	NO
2000	0.00210	0.00210	NO	IE	NO	NO	NO
2001	0.00223	0.00223	NO	IE	NO	NO	NO
2002	0.00260	0.00260	NO	IE	NO	NO	NO
2003	0.00284	0.00284	NO	IE	NO	NO	NO
2004	0.00455	0.00334	NO	0.00121	NO	NO	NO
2005	0.00416	0.00309	NO	0.00107	NO	NO	NO
2006	0.00448	0.00334	NO	0.00115	NO	NO	NO
2007	0.00475	0.00371	NO	0.00104	NO	NO	NO
2008	0.00477	0.00383	NO	0.00094	NO	NO	NO
2009	0.00165	IE	NO	0.00165	NO	NO	NO
2010	0.00210	0.00021	NO	0.00189	NO	NO	NO
2011	0.00190	0.00022	NO	0.00168	NO	NO	NO
2012	0.00463	0.00295	NO	0.00168	NO	NO	NO
2013	0.00408	0.00238	NO	0.00170	NO	NO	NO
2014	0.00485	0.00305	NO	0.00181	NO	NO	NO
2015	0.00467	0.00283	NO	0.00184	NO	NO	NO
2016	0.00465	0.00287	NO	0.00178	NO	NO	NO
2017	0.00496	0.00315	NO	0.00181	NO	NO	NO
2018	0.00531	0.00294	NO	0.00237	NO	NO	NO
2019	0.00570	0.00324	NO	0.00246	NO	NO	NO
2020	0.00417	0.00237	NO	0.00180	NO	NO	NO
Trend							
***1995** - 2020*	1050.8%	554.5%	NA	NA	*NA*	*NA*	*NA*
2005 - 2020	0.1%	-23.3%	NA	67.5%	*NA*	*NA*	*NA*
2019 - 2020	-26.9%	-26.8%	NA	-27.0%	*NA*	*NA*	*NA*

3.2.4.3.2 Methodological issues

3.2.4.3.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[168] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$Emissions_{GHG} = \sum_{fuel} emissions_{GHG.\,fuel}$$

Where:

Emissions $_{GHG.\,fuel}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{fuel}$ = amount of fuel combusted (TJ)
Emission factor $_{GHG.\,fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.4.3.2.2 Choice of activity data

The following fuels are used for combustion in IPCC category 1.2.c:

Liquid fuels:

- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil)
- Liquefied Petroleum Gases
- Other Kerosene
- Other Oil - Other Petroleum Products

Gaseous fuels:

- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[169] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[170].

Total fuel consumption increased by 1721.4% during the period 1995 - 2020 due to the development and diversification of the chemical and petrochemical industry. In addition, fuel consumption increased by 16.2% between 2005 and 2020. From 2019 to 2020, total fuel consumption decreased by 26.9% due to the decrease in chemical industry activities during the Covid 19 pandemic. The fluctuation in fuel consumption is mainly due to the fluctuation of the domestic market for chemical industry products.

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[168] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[169] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[170] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

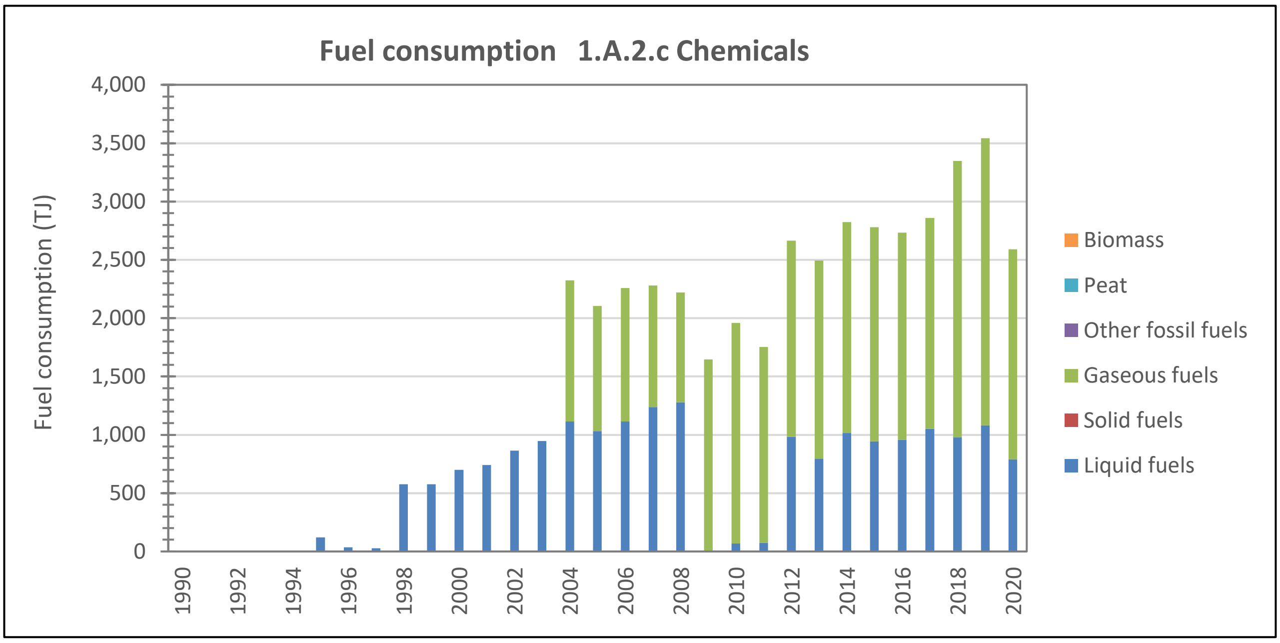

Figure 72 Activity data for IPCC category 1.A.2.c Chemicals

Table 153 Activity data for IPCC category 1.A.2.c Chemicals

Activity data 1.A.2.c	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	120.80	120.80	NO	IE	NO	NO	NO
1996	35.87	35.87	NO	IE	NO	NO	NO
1997	26.94	26.94	NO	IE	NO	NO	NO
1998	576.95	576.95	NO	IE	NO	NO	NO
1999	576.95	576.95	NO	IE	NO	NO	NO
2000	700.59	700.59	NO	IE	NO	NO	NO
2001	741.80	741.80	NO	IE	NO	NO	NO
2002	865.43	865.43	NO	IE	NO	NO	NO
2003	947.85	947.85	NO	IE	NO	NO	NO
2004	2,323.20	1,112.70	NO	1,210.50	NO	NO	NO
2005	2,103.98	1,030.28	NO	1,073.70	NO	NO	NO
2006	2,258.40	1,112.70	NO	1,145.70	NO	NO	NO
2007	2,280.33	1,236.33	NO	1,044.00	NO	NO	NO
2008	2,219.84	1,277.54	NO	942.30	NO	NO	NO
2009	1,646.10	IE	NO	1,646.10	NO	NO	NO
2010	1,960.04	68.99	NO	1,891.05	NO	NO	NO
2011	1,753.45	72.51	NO	1,680.93	NO	NO	NO
2012	2,663.15	982.21	NO	1,680.93	NO	NO	NO
2013	2,493.71	794.83	NO	1,698.87	NO	NO	NO
2014	2,822.43	1,015.25	NO	1,807.18	NO	NO	NO
2015	2,780.37	943.57	NO	1,836.80	NO	NO	NO
2016	2,733.12	957.75	NO	1,775.37	NO	NO	NO
2017	2,860.41	1,050.36	NO	1,810.04	NO	NO	NO
2018	3,346.88	980.22	NO	2,366.66	NO	NO	NO
2019	3,542.49	1,079.77	NO	2,462.72	NO	NO	NO
2020	2,589.10	790.65	NO	1,798.46	NO	NO	NO
Trend							
1995 - 2020	2043.3%	554.5%	NA	NA	NA	NA	NA
2005 - 2020	23.1%	-23.3%	NA	67.5%	NA	NA	NA
2019 - 2020	-26.9%	-26.8%	NA	-27.0%	NA	NA	NA

In energy statistics, production, transformation, and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.c Chemicals are provided.

Table 154Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.c Chemicals

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Residual Fuel Oil Fiouls résiduels	TJ / Gg	42.18 * 0.95 = 40.07	40.4
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
	Other Kerosene Autres kérosènes	TJ / Gg	43.92 * 0.95 = 41.72	43.8
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	MEM/Sonatrach	40.2

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[171]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [172]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

3.2.4.3.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas and liquid fuels were taken from IPCC 2006 Guidelines and are presented in the following table.

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[171] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[172] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 155 GHG Emission factor TIER 1 for IPCC category 1.A.2.c Chemicals

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56.100	D	1	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74.100	D	3	D	0.6	D
	Residual Fuel Oil Fiouls résiduels	77.400	D	3	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63.100	D	1	D	0.1	D
	Other Kerosene Autres kérosènes	71.900	D	3	D	0.6	D
	Other Petroleum Products Autres produits pétroliers	77.400	D	3	D	0.6	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

3.2.4.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.2.c Chemicals are presented in the following table.

Table 156Uncertainty for IPCC category 1.A.2.c Chemicals.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[173] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[174].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

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[173] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[174] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

- International Standard Industrial Classification of all Economic Activities (ISIC) [175];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [176].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be done for future submissions.

3.2.4.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[177] and
    - international energy statistics of UN statistics[178] and International Energy Agency (IEA)[179]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

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[175] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[176] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[177] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[178] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[179] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.4.3.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC category *1.A.2.c Chemicals*.

Table 157Recalculations done since NC in IPCC category 1.A.2.c Chemicals.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.c	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.c	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel, fuel oil, LPG	AD	Accuracy Comparability
1.A.2.c	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 158Planned improvements for IPCC category 1.A.2.c Chemicals

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.c	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data (consumption and production, NCV, carbon content) • Consumption of various fuels for combustion • Production and consumption of refinery gas	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.c 1.B.2.a. iv	Venting and flaring activities (fugitive emission from Oil Refining)	AD	Accuracy Transparency Completeness	high
1.A.2.c	Input – output analysis	AD	Transparency Completeness	high
1.A.2.c 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Transparency	low
1.A.2.c	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.4 IPCC category 1.A.2.d Pulp. paper and print

3.2.4.4.1 Category description

The IPCC category 1.A.2.d Pulp, paper and print include GHG emissions resulting from fuel combustion activities in:

- Manufacture of paper and paper products (ISIC Division 17) which consists out of
  - ISIC Group 1701 Manufacture of pulp, paper and paperboard.
  - ISIC Group 1702 Manufacture of corrugated paper and paperboard and of containers of paper and paperboard and ISIC Group
  - ISIC Group 1709 Manufacture of other articles of paper and paperboard.
- Printing and reproduction of recorded media (ISIC Division 18)
  - ISIC Group 181 Printing and service activities related to printing.
  - ISIC Group 182 Reproduction of recorded media

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.d	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

IPCC code	**Description**	**Occurrent**			**Not occurrent (NO)**
		Estimated	**Not estimated (NE)**	**Included elsewhere (IE)**	
1.A.2.d	Pulp. Paper and Print			1990-2020 in 1.A.2.m	

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacture of paper and paper products* and *Printing and reproduction of recorded media.* However, as there are activities like paper converting to bags, crates, boxes but in Algeria, fuel combustion in this sector can be assumed. Therefore, the notation key IE (included elsewhere) was used.

3.2.4.4.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 159Planned improvements for IPCC category 1.A.2.d Pulp. paper and print

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.d	Industries allocated to ISIC Division 17 and ISIC Division 18 'Manufacture of paper and paper products and Printing and reproduction of recorded media' • Identification of activities • Survey on use of fuel for combustion activities	AD	Accuracy Completeness Comparability Consistency Transparency	high/ medium

3.2.4.5 Food processing. beverages and tobacco (IPCC category 1.A.2.e)

3.2.4.5.1 Category description

The IPCC category 1.A.2.e Food processing, beverages and tobacco include GHG emissions resulting from fuel combustion activities in:

- ISIC Divisions 10 Manufacture of food products
  - Processing and preserving of meat, fish, crustaceans and mollusks, fruit and vegetables
  - Manufacture of vegetable and animal oils and fats, dairy products, grain mill products, starches and starch products and of other food products.
- ISIC Divisions 11 Manufacture of beverages
  - Distilling, rectifying and blending
  - Manufacture of wines, malt liquors and malt, soft drinks;
  - production of mineral waters and other bottled waters
- ISIC Divisions 12 Manufacture of tobacco products.

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.2.e	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

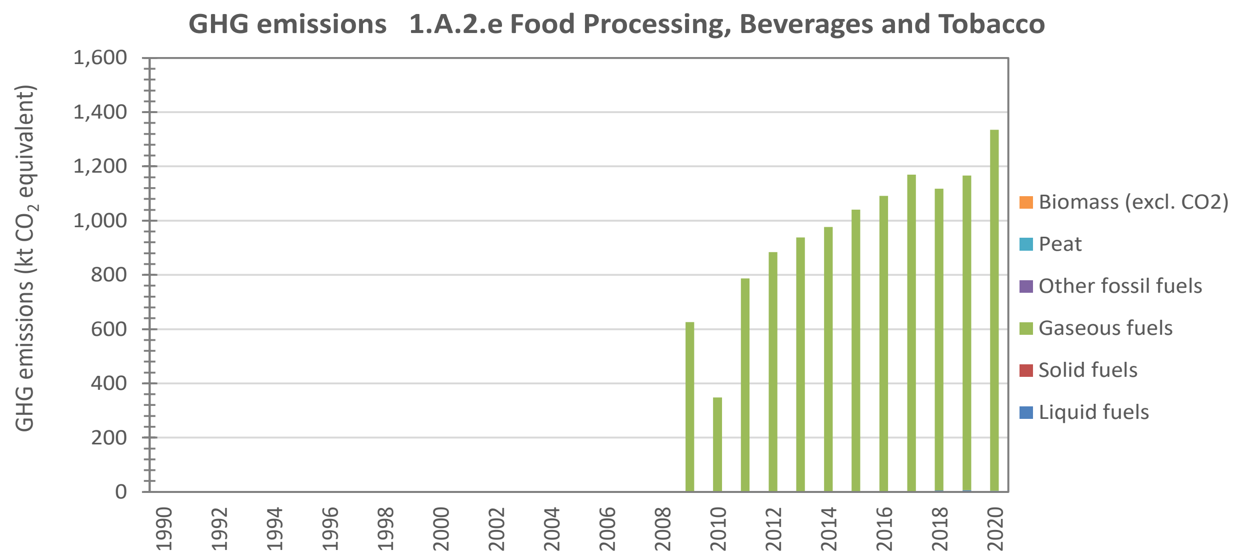
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

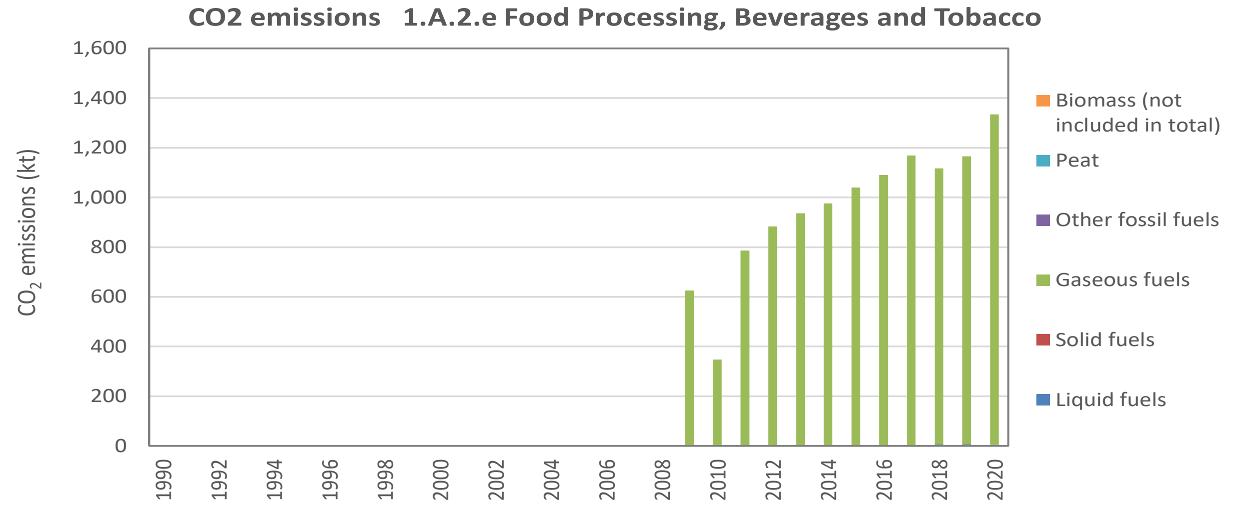
An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.e Food processing, beverages and tobacco are provided in the following figures and tables:

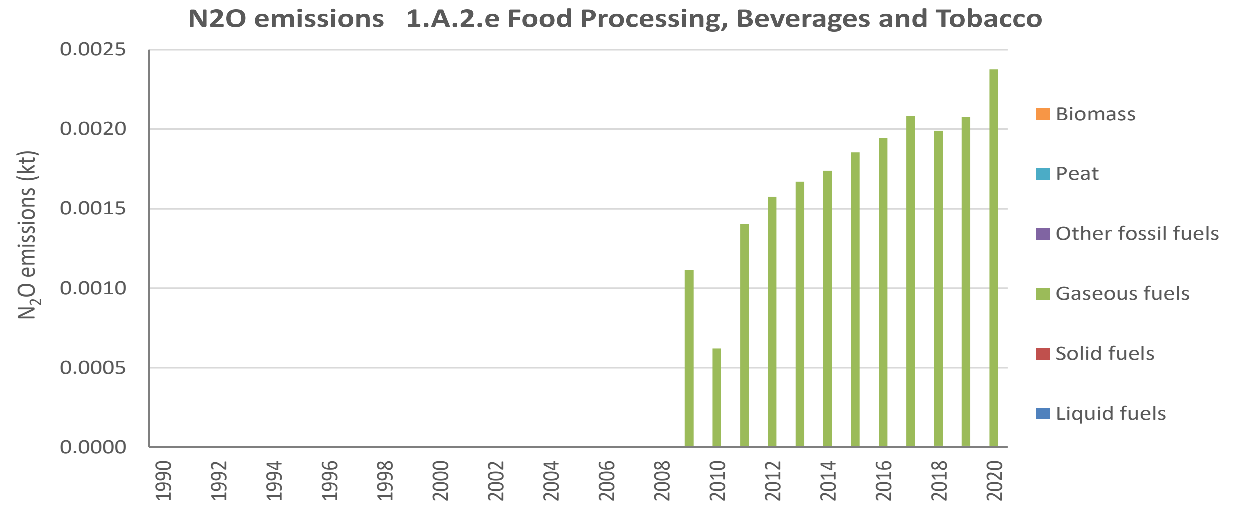
- annual GHG emissions.
- Trend of the periods 2009 – 2020, 2019– 2020.

Greenhouse gas emissions from IPCC category 1.A.2.e "Food, beverage and tobacco processing" amounted to 625.47 kt CO_2 equivalents in 2009 and 1.335.30 kt CO_2 equivalents in 2020. The overall trend of GHG emissions from IPCC category 1.A.2.e "Food, beverage and tobacco processing" shows an increase of 113.5% between 2009 and 2020. However, the period from 2019 to 2020 is marked by an increase of 14.4%. The increase in emissions is the result of the increase in food production and processing, which depends on the increase in national demand with the increase in population and the improvement in the standard of living of Algerians.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.


GHG emissions 1.A.2.e Food Processing, Beverages and Tobacco
GHG emissions (kt CO_2 equivalent)
1,600
1,400
1,200
1,000
800
600
400
200
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions 1.A.2.e Food Processing, Beverages and Tobacco
CO_2 emissions (kt)
1,600
1,400
1,200
1,000
800
600
400
200
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


N2O emissions 1.A.2.e Food Processing, Beverages and Tobacco
N_2O emissions (kt)
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

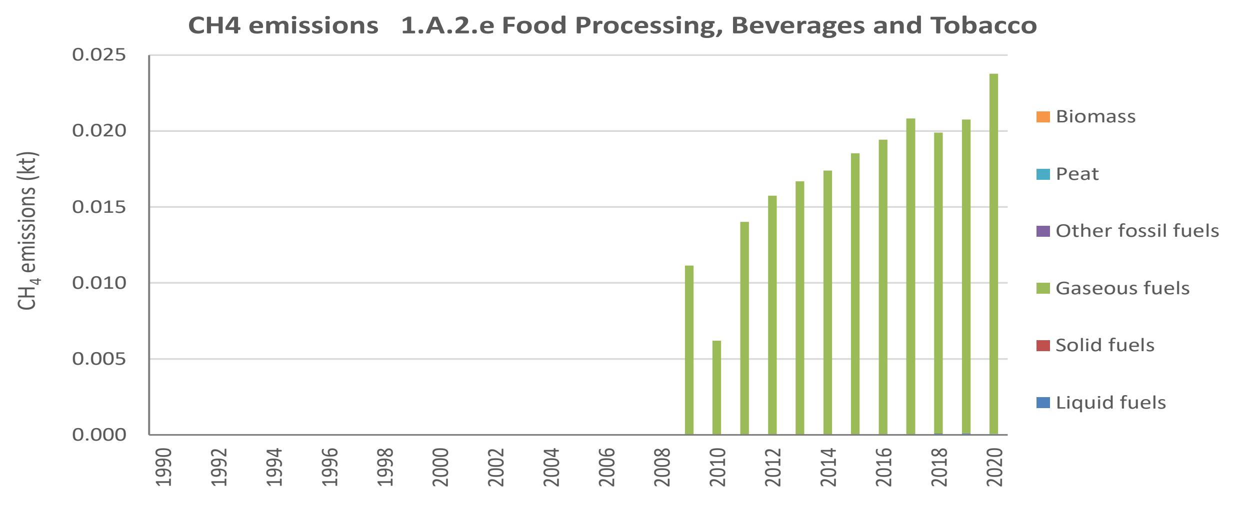


Figure 73 Emissions from IPCC category 1.A.2.e Food processing, beverages and tobacco

Table 160 GHG Emissions by fuels from IPCC category 1.A.2.e Food processing, beverages and tobacco

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.e	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	628.46	NO	NO	628.46	NO	NO	NO
2010	349.99	0.15	NO	349.84	NO	NO	NO
2011	791.23	0.13	NO	791.10	NO	NO	NO
2012	888.63	0.28	NO	888.35	NO	NO	NO
2013	942.04	0.14	NO	941.91	NO	NO	NO
2014	981.37	0.34	NO	981.03	NO	NO	NO

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.e	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
2015	1,046.12	0.45	NO	1,045.67	NO	NO	NO
2016	1,096.70	1.10	NO	1,095.60	NO	NO	NO
2017	1,175.60	1.39	NO	1,174.21	NO	NO	NO
2018	1,123.26	5.66	NO	1,117.60	NO	NO	NO
2019	1,172.34	5.89	NO	1,166.45	NO	NO	NO
2020	1,341.68	4.23	NO	1,337.45	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2009 *- 2020*	*113.5%*	*NA*	*NA*	*112.8%*	*NA*	*NA*	*NA*
2019 - 2020	*14.4%*	*-28.2%*	*NA*	*14.7%*	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 161 CO_2 Emissions by fuels from IPCC category 1.A.2.e Food processing, beverages and tobacco

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	624.86	IE	NO	624.86	NO	NO	NO
2010	347.98	0.15	NO	347.83	NO	NO	NO

CO_2	Total CO_2 emissions (excluding CO_2 from biomass)	CO_2 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2011	786.70	0.13	NO	786.57	NO	NO	NO
2012	883.54	0.28	NO	883.27	NO	NO	NO
2013	936.65	0.14	NO	936.51	NO	NO	NO
2014	975.75	0.34	NO	975.41	NO	NO	NO
2015	1,040.13	0.44	NO	1,039.68	NO	NO	NO
2016	1,090.42	1.09	NO	1,089.33	NO	NO	NO
2017	1,168.87	1.38	NO	1,167.49	NO	NO	NO
2018	1,116.84	5.63	NO	1,111.21	NO	NO	NO
2019	1,165.63	5.86	NO	1,159.77	NO	NO	NO
2020	1,334.00	4.21	NO	1,329.80	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 - 2020	113.5%	NA		112.8%	NA	NA	NA
2019 - 2020	14.4%	-28.2%	NA	14.7%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 162 N_2O Emissions by fuels from IPCC category 1.A.2.e Food processing, beverages and tobacco

N_2O	Total N_2O emissions	N_2O emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO

N_2O	Total N_2O emissions	N_2O emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.0011	IE	NO	0.0011	NO	NO	NO
2010	0.0006	0.0000002	NO	0.0006	NO	NO	NO
2011	0.0014	0.0000002	NO	0.0014	NO	NO	NO
2012	0.0016	0.0000004	NO	0.0016	NO	NO	NO
2013	0.0017	0.0000002	NO	0.0017	NO	NO	NO
2014	0.0017	0.0000005	NO	0.0017	NO	NO	NO
2015	0.0019	0.0000007	NO	0.0019	NO	NO	NO
2016	0.0019	0.0000017	NO	0.0019	NO	NO	NO
2017	0.0021	0.0000022	NO	0.0021	NO	NO	NO
2018	0.0020	0.0000089	NO	0.0020	NO	NO	NO
2019	0.0021	0.0000093	NO	0.0021	NO	NO	NO
2020	0.0024	0.0000067	NO	0.0024	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 - 2020	113.4%	NA	NA	112.8%	NA	NA	NA
2019 - 2020	14.5%	-28.2%	NA	14.7%	NA	NA	NA

Table 163 CH_4 Emissions by fuels from IPCC category 1.A.2.e Food processing, beverages and tobacco

CH_4	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO

CH_4	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.e	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.011	IE	NO	0.011	NO	NO	NO
2010	0.006	0.000002	NO	0.006	NO	NO	NO
2011	0.014	0.000002	NO	0.014	NO	NO	NO
2012	0.016	0.000004	NO	0.016	NO	NO	NO
2013	0.017	0.000002	NO	0.017	NO	NO	NO
2014	0.017	0.000005	NO	0.017	NO	NO	NO
2015	0.019	0.000007	NO	0.019	NO	NO	NO
2016	0.019	0.000017	NO	0.019	NO	NO	NO
2017	0.021	0.000022	NO	0.021	NO	NO	NO
2018	0.020	0.000089	NO	0.020	NO	NO	NO
2019	0.021	0.000093	NO	0.021	NO	NO	NO
2020	0.024	0.000067	NO	0.024	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	113.4%	NA		112.8%	NA	NA	NA
2019 - 2020	14.5%	-28.2%	NA	14.7%	NA	NA	NA

3.2.4.5.2 Methodological issues

3.2.4.5.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[180] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{GHG.\ fuel}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{fuel}$ = amount of fuel combusted (TJ)
Emission factor $_{GHG.\ fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, pea

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[180] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

3.2.4.5.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:	• Liquefied Petroleum Gases
Gasous fuels:	• Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[181];
- 2010 – 2020 are taken from the National Energy balance provided by MEM[182].

The total fuel consumption increased by 113.41% over the period 2009 – 2020. From 2019 to 2020 the total fuel consumption increased by 14.4%. Due to increased food production and processing the food and beverage industry grew significantly.

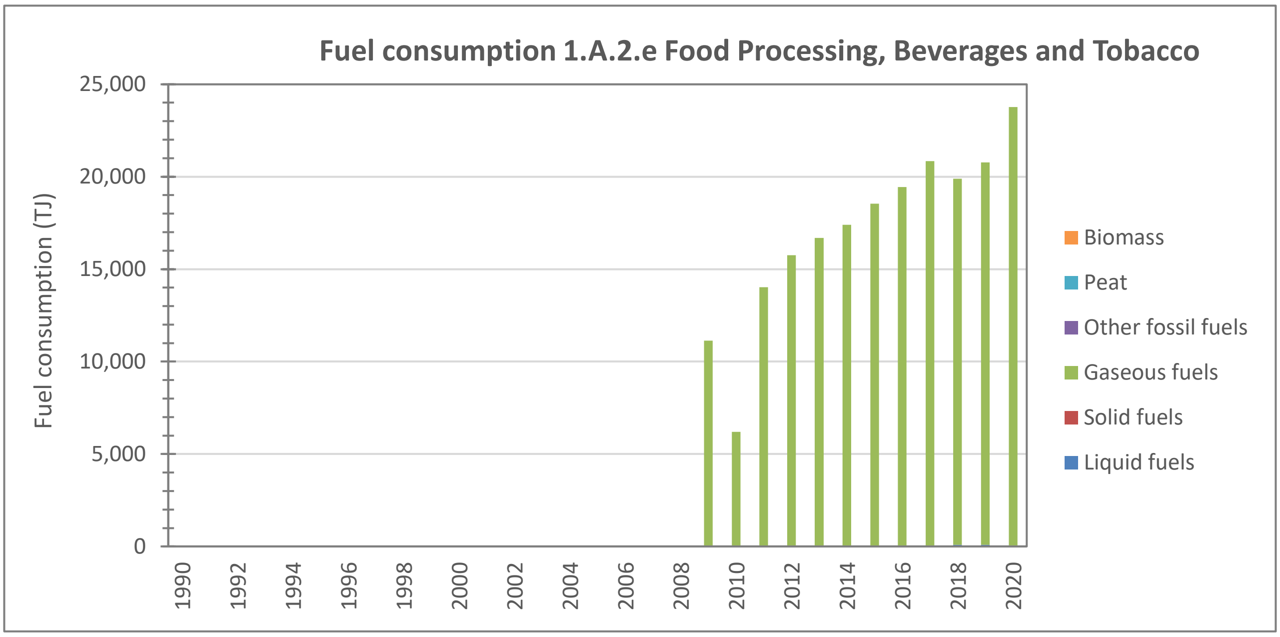

Figure 74 Activity data for IPCC category 1.A.2.e Food processing, beverages and tobacco

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[181] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[182] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 164 Activity data for IPCC category 1.A.2.e Food processing, beverages and tobacco

Activity data 1.A.2.e	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	11,138.40	IE	NO	11,138.40	NO	NO	NO
2010	6,202.59	2.36	NO	6,200.22	NO	NO	NO
2011	14,022.86	2.02	NO	14,020.84	NO	NO	NO
2012	15,748.88	4.37	NO	15,744.51	NO	NO	NO
2013	16,695.78	2.14	NO	16,693.64	NO	NO	NO
2014	17,392.44	5.42	NO	17,387.02	NO	NO	NO
2015	18,539.74	7.04	NO	18,532.70	NO	NO	NO
2016	19,434.88	17.31	NO	19,417.56	NO	NO	NO
2017	20,832.71	21.90	NO	20,810.81	NO	NO	NO
2018	19,896.84	89.23	NO	19,807.61	NO	NO	NO
2019	20,766.14	92.90	NO	20,673.24	NO	NO	NO
2020	23,770.68	66.67	NO	23,704.01	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	113.4%	NA	NA	112.8%	NA	NA	NA
2019 - 2020	14.5%	-28.2%	NA	14.7%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tons or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.e Food processing, beverages and tobacco are provided.

Table 165 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.e Food processing, beverages and tobacco

Fuel type	Fuel	Unit	Net calorific value (NCV)	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	default NCV for comparison
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3

Conversion from GCV to NCV	Default
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[183]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [184]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

3.2.4.5.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas and liquid fuels were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 166 GHG Emission factor TIER 1 for IPCC category 1.A.2.e Food processing. beverages and tobacco

Fuel type	Fuel	CO_2 (kg/TJ)		CH_4 (kg/TJ)		N_2O (kg/TJ)	
		EF	type	EF	type	EF	type
gaseous	Natural Gas Gaz naturel	56.100	D	1	D	0.1	D
liquid	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63.100	D	1	D	0.1	D
Source	CS – country specific EF - D – Default EF -	Ministry of Energy and Mines (2021): Development of Country specific emission factor. 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category					

Note:

D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

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[183] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[184] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.4.5.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.2.e Food processing, beverages and tobacco are presented in the following table.

Table 167Uncertainty for IPCC category 1.A.2.e Food processing, beverages and tobacco.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided MEM and by UN statistics[185] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[186].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [187];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [188].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be done for future submissions.

3.2.4.5.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,

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[185] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[186] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[187] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[188] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
  - national statistic published by MEM and Office National des Statistiques (ONS)[189] and
  - international energy statistics of UN statistics[190] and International Energy Agency (IEA)[191]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.4.5.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.2.e Food processing, beverages and tobacco*.

Table 168Recalculations done since NC in IPCC category 1.A.2.e Food processing, beverages and tobacco

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.e	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.e	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.e	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel, fuel oil, LPG	AD	Accuracy Comparability
1.A.2.e	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.5.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 169Planned improvements for IPCC category 1.A.2.e Food processing, beverages and tobacco

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.e	Energy balance • Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content) • Survey on consumption of fuel for combustion activities in industry sector ‘Manufacture of food products, beverages and tobacco products’.	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.c 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and	AD	Accuracy Completeness	low

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[189] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[190] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[191] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

GHG source & sink category	Planned improvement	Type of improvement		Priority
	Off-road vehicles and other machinery		Comparability Transparency	
1.A.2.e	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.6 Non-metallic minerals (IPCC category 1.A.2.f)

3.2.4.6.1 Category description

The IPCC category 1.A.2.f Non-metallic minerals includes GHG emissions resulting from fuel combustion activities in:

- ISIC Divisions 23 Manufacture of other non-metallic mineral products
    - Manufacture of glass and glass products
    - Manufacture of non-metallic mineral products n.e.c.
        - Manufacture of refractory products. Manufacture of clay building materials
        - Manufacture of other porcelain and ceramic products
        - Manufacture of cement, lime and plaster
        - Manufacture of articles of concrete. cement and plaster
        - Cutting, shaping and finishing of stone
        - Manufacture of other non-metallic mineral products n.e.c.

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.2.f	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	LA 2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

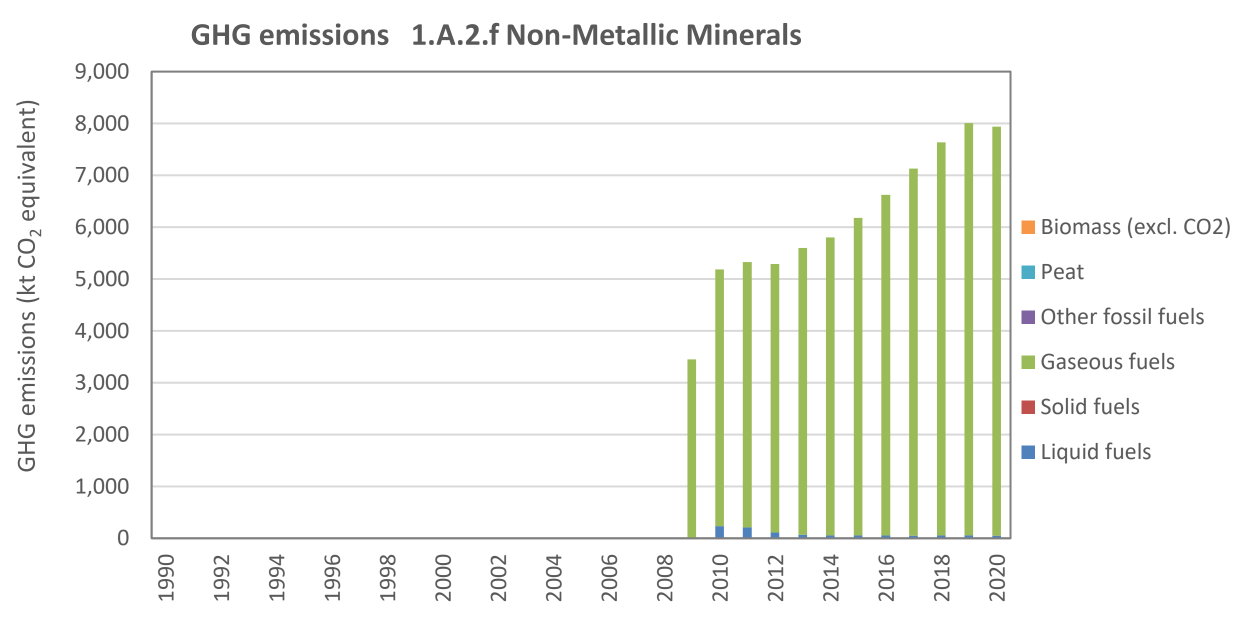
IPCC code	Description	Occurrent			Not occurrent (NO)
		Estimated	Not estimated (NE)	Included elsewhere (IE)	
1.A.2.f	Non-Metallic Minerals	✓		1990-2008 in 1.A.2.m	

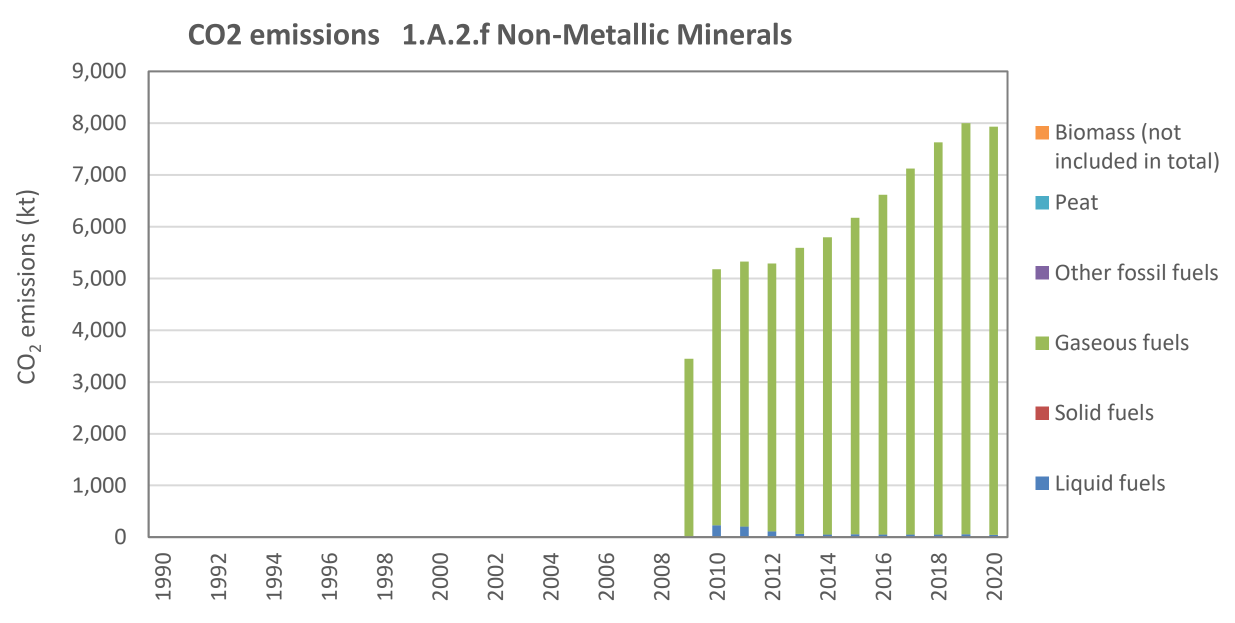
An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.f Non-metallic minerals is provided in the following figures and tables:

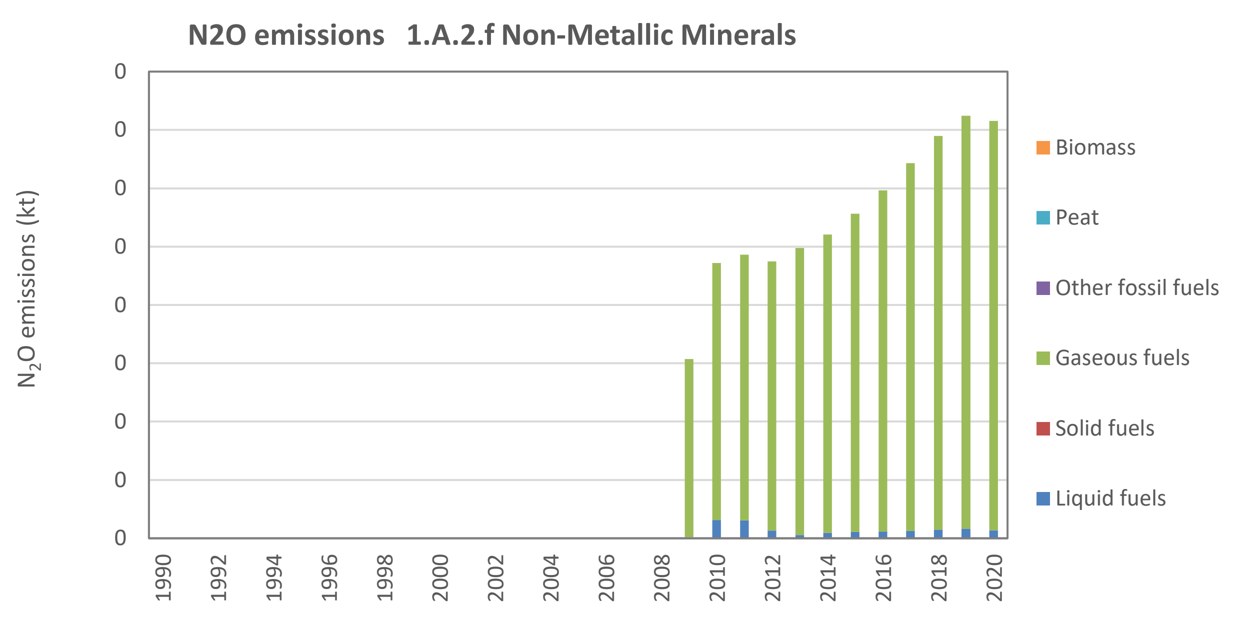
- annual GHG emissions;
- Trend of the periods 2009 – 2020, 2019 – 2020.

The greenhouse gas emissions from IPCC category 1.A.2.f Non-metallic minerals represent a total of 3,465.33 kt CO_2 equivalents in 2009 and 7,975.54 kt CO_2 equivalents in 2020. The overall trend in GHG emissions from the IPCC category 1.A.2.f Non-metallic minerals shows an increase by 130.1% from 2009 to 2020. While, in the period from 2019 to 2020 is marked by a decrease of 0.9%. The doubling of emissions can be explained by the increased cement production capacity and cement production. The IPCC category 1.A.2.f Non-metallic minerals is for C02 and gaseous fuels key source.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.


GHG emissions 1.A.2.f Non-Metallic Minerals
GHG emissions (kt CO_2 equivalent)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions 1.A.2.f Non-Metallic Minerals
CO_2 emissions (kt)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


N2O emissions 1.A.2.f Non-Metallic Minerals
N_2O emissions (kt)
0
0
0
0
0
0
0
0
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

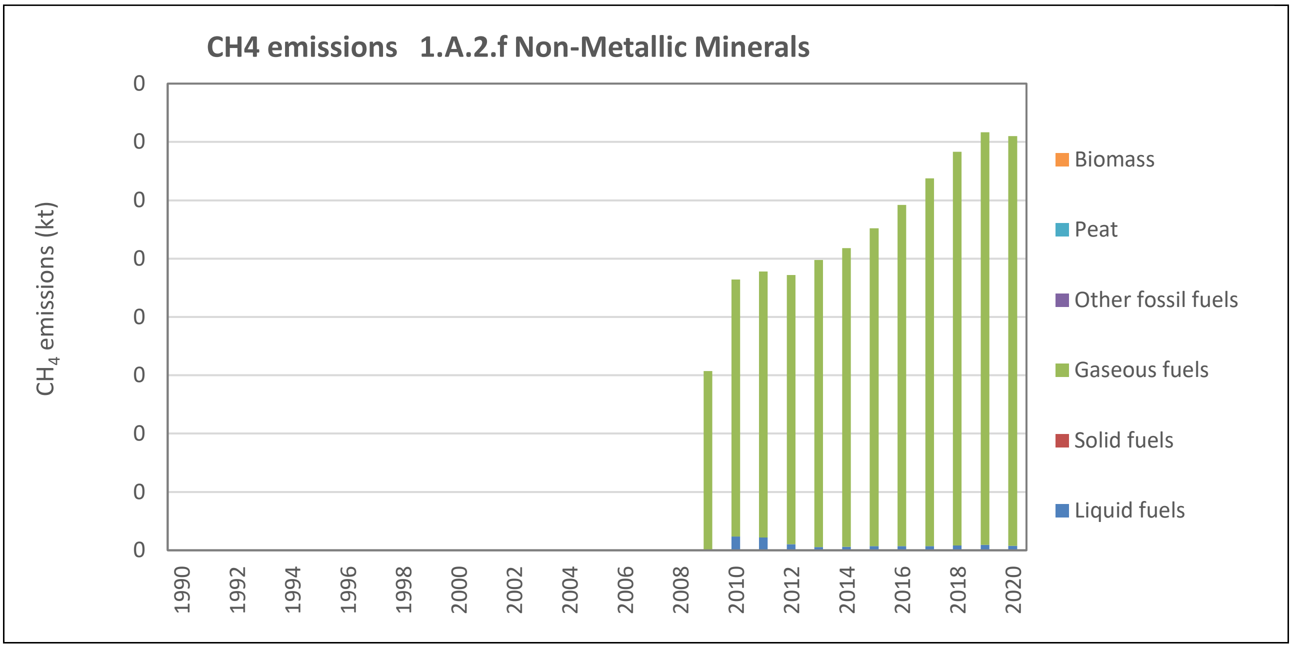


Figure 75 Emissions from IPCC category 1.A.2.f Non-metallic minerals

Table 170 GHG Emissions by fuels from IPCC category 1.A.2.f Non-metallic minerals

GHG	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.f	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	3,465.33	NO	NO	3,465.33	NO	NO	NO
2010	5,209.00	234.35	NO	4,974.65	NO	NO	NO

GHG	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.f	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
2011	5,354.21	209.76	NO	5,144.45	NO	NO	NO
2012	5,317.82	112.08	NO	5,205.73	NO	NO	NO
2013	5,625.35	66.28	NO	5,559.06	NO	NO	NO
2014	5,828.53	54.05	NO	5,774.48	NO	NO	NO
2015	6,207.59	55.64	NO	6,151.95	NO	NO	NO
2016	6,655.17	55.07	NO	6,600.10	NO	NO	NO
2017	7,165.20	50.81	NO	7,114.40	NO	NO	NO
2018	7,673.56	54.88	NO	7,618.68	NO	NO	NO
2019	8,045.30	57.16	NO	7,988.14	NO	NO	NO
2020	7,975.54	48.29	NO	7,927.25	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	NA	NA	NA
2009 - 2020	*130.1%*	*NA*	*NA*	*128.8%*	NA	NA	NA
2019 - 2020	*-0.9%*	*-15.5%*	*NA*	*-0.8%*	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 171 CO_2 Emissions by fuels from IPCC category 1.A.2.f Non-metallic minerals

CO_2	Total CO_2 emissions (excluding CO_2 from biomass)	CO_2 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	3,445.49	IE	NO	3,445.49	NO	NO	NO
2010	5,179.02	232.84	NO	4,946.17	NO	NO	NO
2011	5,323.35	208.35	NO	5,115.00	NO	NO	NO
2012	5,287.34	111.41	NO	5,175.93	NO	NO	NO
2013	5,593.19	65.95	NO	5,527.24	NO	NO	NO
2014	5,795.08	53.66	NO	5,741.43	NO	NO	NO
2015	6,171.92	55.19	NO	6,116.73	NO	NO	NO
2016	6,616.93	54.62	NO	6,562.32	NO	NO	NO
2017	7,124.01	50.34	NO	7,073.67	NO	NO	NO
2018	7,629.42	54.35	NO	7,575.07	NO	NO	NO
2019	7,998.99	56.58	NO	7,942.42	NO	NO	NO
2020	7,929.68	47.81	NO	7,881.87	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 - 2020	130.1%	NA	NA	128.8%	NA	NA	NA
2019 - 2020	-0.9%	-15.5%	NA	-0.8%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 172 N_2O Emissions by fuels from IPCC category 1.A.2.f Non-metallic minerals

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO

N_2O	Total N_2O emissions	N_2O emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.006	IE	NO	0.006	NO	NO	NO
2010	0.009	0.0006	NO	0.009	NO	NO	NO
2011	0.010	0.0006	NO	0.009	NO	NO	NO
2012	0.009	0.0003	NO	0.009	NO	NO	NO
2013	0.010	0.0001	NO	0.010	NO	NO	NO
2014	0.010	0.0002	NO	0.010	NO	NO	NO
2015	0.011	0.0002	NO	0.011	NO	NO	NO
2016	0.012	0.0002	NO	0.012	NO	NO	NO
2017	0.013	0.0003	NO	0.013	NO	NO	NO
2018	0.014	0.0003	NO	0.014	NO	NO	NO
2019	0.014	0.0003	NO	0.014	NO	NO	NO
2020	0.014	0.0003	NO	0.014	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	NA	NA	NA
2009 - 2020	*133.1%*	*NA*	*NA*	*128.8%*	NA	NA	NA
2019 - 2020	*-1.2%*	*-18.7%*	*NA*	*-0.8%*	NA	NA	NA

Table 173 CH_4 Emissions by fuels from IPCC category 1.A.2.f Non-metallic minerals

CH_4	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO

CH_4	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.f	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.061	IE	NO	0.061	NO	NO	NO
2010	0.093	0.005	NO	0.088	NO	NO	NO
2011	0.096	0.004	NO	0.091	NO	NO	NO
2012	0.094	0.002	NO	0.092	NO	NO	NO
2013	0.100	0.001	NO	0.099	NO	NO	NO
2014	0.104	0.001	NO	0.102	NO	NO	NO
2015	0.110	0.001	NO	0.109	NO	NO	NO
2016	0.118	0.001	NO	0.117	NO	NO	NO
2017	0.128	0.001	NO	0.126	NO	NO	NO
2018	0.137	0.002	NO	0.135	NO	NO	NO
2019	0.143	0.002	NO	0.142	NO	NO	NO
2020	0.142	0.001	NO	0.140	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2009 - 2020	*131.2%*	*NA*	*NA*	*128.8%*	*NA*	*NA*	*NA*
2019 - 2020	*-1.0%*	*-17.7%*	*NA*	*-0.8%*	*NA*	*NA*	*NA*

3.2.4.6.2 Methodological issues

3.2.4.6.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[192] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.4.6.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:

- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil)
- Liquefied Petroleum Gases
- Other Oil - Other Petroleum Products

Gasous fuels:

- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[193];
- 2010 – 2020 are taken from the National Energy balance provided by MEM[194].

Total fuel consumption increased by 129.9% over the period 2009 - 2020. The doubling of fuel consumption is the result of the increase in cement production due to the high national demand caused by various construction projects (mega state projects such as the 1 million housing programmed and the East-West motorway as well as construction by the private sector and individuals).

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[192] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[193] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[194] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

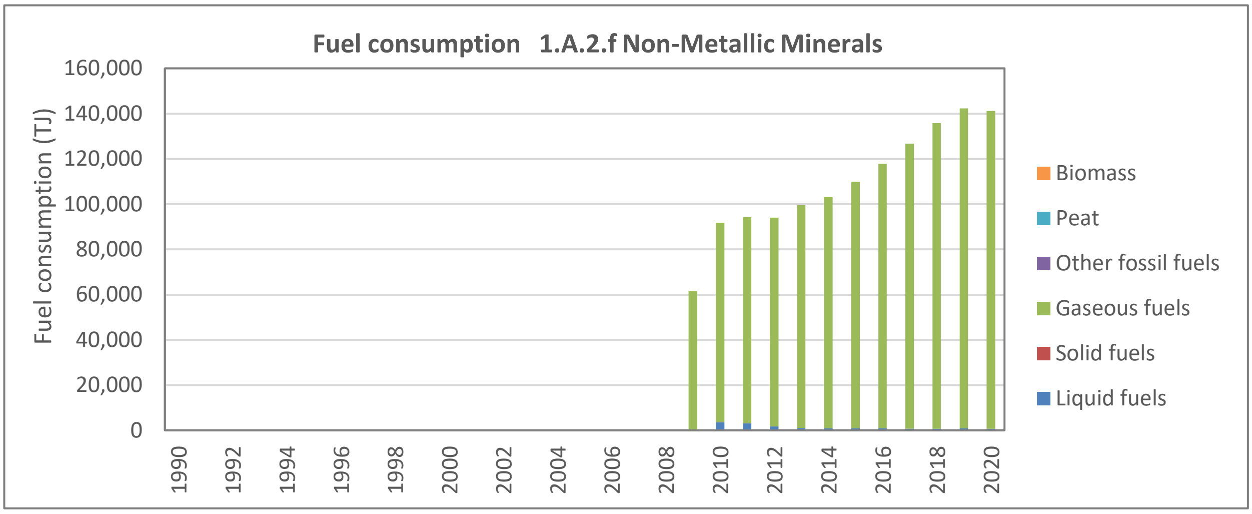

Figure 76 Activity data for IPCC category 1.A.2.f Non-metallic minerals

Table 174 Activity data for IPCC category 1.A.2.f Non-metallic minerals

Activity data 1.A.2.f	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	61,416.90	IE	NO	61,416.90	NO	NO	NO
2010	91,764.68	3,597.58	NO	88,167.10	NO	NO	NO
2011	94,377.21	3,200.80	NO	91,176.40	NO	NO	NO
2012	93,996.84	1,734.24	NO	92,262.60	NO	NO	NO
2013	99,569.88	1,045.10	NO	98,524.78	NO	NO	NO
2014	103,159.25	816.53	NO	102,342.72	NO	NO	NO

Activity data 1.A.2.f	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2015	109,858.84	826.15	NO	109,032.69	NO	NO	NO
2016	117,788.04	812.72	NO	116,975.33	NO	NO	NO
2017	126,825.67	735.30	NO	126,090.37	NO	NO	NO
2018	135,814.13	786.22	NO	135,027.91	NO	NO	NO
2019	142,386.30	810.27	NO	141,576.03	NO	NO	NO
2020	141,185.35	688.51	NO	140,496.85	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 - 2020	129.9%	NA	NA	128.8%	NA	NA	NA
2019 - 2020	-0.8%	-15.0%	NA	-0.8%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.f Non-metallic minerals are provided.

Table 175Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.f Non-metallic minerals.

Fuel type	Fuel	Unit	Net calorific value (NCV)	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	default NCV for comparison
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	-	40.2
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)		Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[195]	
	Default Net Calorific values (NCVs)		2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2	

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[195] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
			International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)	
	Conversion from GCV to NCV		International Recommendations for Energy Statistics (IRES) (2018) [196]: Table 4 Difference between net and gross calorific values for selected fuels	
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

3.2.4.6.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas and liquid fuels were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 176 GHG Emission factor TIER 1 for IPCC category 1.A.2.f Non-metallic minerals

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	1	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	3	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63,100	D	1	D	0.1	D
	Other Petroleum Products Autres produits pétroliers	77,400	D	3	D	0.6	D
Source	CS – country specific EF D – Default EF	Ministry of Energy and Mines (2021): Development of Country specific emission factor. 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category					
Note:							
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor	

3.2.4.6.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.2.f Non-metallic minerals are presented in the following table.

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[196] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 177Uncertainty for IPCC category 1.A.2.f Non-metallic minerals.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[197] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[198].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [199];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [200].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.4.6.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[201] and

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[197] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[198] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[199] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[200] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[201] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

  - international energy statistics of UN statistics[202] and International Energy Agency (IEA)[203]
- cross checks with sector 2.A.1 are performed to avoid double counting or omissions.
- time series consistency - plausibility checks of dips and jumps.

3.2.4.6.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submissions to the UNFCCC and relevant to IPCC category *1.A.2.f Non-metallic minerals*.

Table 178Recalculations done since NC in IPCC category 1.A.2.f Non-metallic minerals.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.f	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.f	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.f	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel, fuel oil, LPG	AD	Accuracy Comparability
1.A.2.f	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.6.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 179Planned improvements for IPCC category 1.A.2.f Non-metallic minerals

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.f	Energy balance • Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content) • Survey on consumption of fuel for combustion activities in Manufacture of glass and glass products, clay building materials, porcelain and ceramic products, cement, lime and plaster, etc.	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.f 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low

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[202] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[203] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.f	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.7 IPCC category 1.A.2.g Other (CRT category 1.A.2.g)

According to the CRT, category[204] 1.A.2.g Other is further divided into the following IPCC categories and as described in Table 2.1 of the 2006 IPCC Guidelines[205].

IPCC category	Name of source categories	CRT category
1.A.2.g	Manufacturing of transport equipment	1.A.2.g.i
1.A.2.h	Manufacturing of machinery	1.A.2.g.ii
1.A.2.i	Mining (excluding fuels) and Quarrying	1.A.2.g.iii
1.A.2.j	Wood and wood products	1.A.2.g.iv
1.A.2.k	Construction	1.A.2.g.v
1.A.2.l	Textile and Leather	1.A.2.g.vi
1.A.2.m	Other	1.A.2.g.viii

But this report follows the IPCC category nomenclature - IPCC category. This will be changes once Algeria reports under the Paris Agreement.

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[204] CRT Common Reporting Tables (CRT) on NIR. CRT reporting tables are used under the Paris agreement available on 01.08.2022 at https://unfccc.int/documents/311076

[205] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 22.2 Description of sources

3.2.4.8 Manufacturing of transport equipment (IPCC category 1.A.2.g)

3.2.4.8.1 Category description

The IPCC category 1.A.2.g *Manufacturing of transport equipment* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 29 Manufacture of motor vehicles, trailers and semi-trailers.
- ISIC Division 30 Manufacture of other transport equipment.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.g	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

The IPCC category 1.A.2.g *Manufacturing of transport equipment* does not exist in Algeria.

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacturing of transport equipment.* However, an automotive industry is existing in Algeria whereby it is an "assembler" for cars from VW, Renault, Peugeot, Kia and other. It is assumed that no combustion activities occur. Therefore, the notation key NO (not occurrent) was used.

3.2.4.8.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 180Planned improvements for IPCC 1.A.2.g *Manufacturing of transport equipment*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.g	Energy balance - Survey on use of fuel for combustion activities in • ISIC Division 29 Manufacture of motor vehicles, trailers and semi-trailers (ISIC Class 2420) and • ISIC Division 30 Manufacture of other transport equipment Casting of non-ferrous metals (ISIC Class 2432).	AD	Completeness	medium

3.2.4.9 Manufacturing of machinery (IPCC category 1.A.2.h)

3.2.4.9.1.1 Category description

The IPCC category 1.A.2.h *Manufacturing of machinery* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 25 Manufacture of fabricated metal products, except machinery and equipment
  - Manufacture of structural metal products, tanks, reservoirs and steam generators
  - Manufacture of weapons and ammunition
  - Manufacture of other fabricated metal products; metalworking service activities
- ISIC Division 26 Manufacture of computer, electronic and optical products
  - Manufacture of electronic components and boards
  - Manufacture of computers and peripheral equipment
  - Manufacture of communication equipment
  - Manufacture of consumer electronics
  - Manufacture of measuring, testing, navigating and control equipment; watches and clocks
  - Manufacture of irradiation, electromedical and electrotherapeutic equipment
  - Manufacture of optical instruments and photographic equipment
  - Manufacture of magnetic and optical media
- ISIC Division 27 Manufacture of electrical equipment
  - Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
  - Manufacture of batteries and accumulators
  - Manufacture of wiring and wiring devices
  - Manufacture of electric lighting equipment
  - Manufacture of domestic appliances
  - Manufacture of other electrical equipment
- ISIC Division 28 Manufacture of machinery and equipment n.e.c.
  - Manufacture of general-purpose machinery
  - Manufacture of special-purpose machinery

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.h	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

The IPCC category 1.A.2.h *Manufacturing of machinery* does not exist in Algeria.

The Energy balance currently does not provide information on the consumption of fuels in activities under *Manufacturing of transport equipment.* However, a machinery industry is existing in Algeria whereby it is an "assembler" for different fabricated products. It is assumed that no combustion activities occur. Therefore, the notation key NO (not occurrent) was used.

3.2.4.9.1.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 181Planned improvements for IPCC category 1.A.2.h *Manufacturing of machinery*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.h	Energy balance - Survey on consumption of fuel for combustion activities in • ISIC Division 25 Manufacture of fabricated metal products, except machinery and equipment • ISIC Division 26 Manufacture of computer, electronic and optical products • ISIC Division 27 Manufacture of electrical equipment • ISIC Division 28 Manufacture of machinery and equipment n.e.c.	AD	Completeness	medium

3.2.4.10 Mining (excluding fuels) and quarrying (IPCC category 1.A.2.i)

3.2.4.10.1.1 Category description

The IPCC category 1.A.2.i *Mining (excluding fuels) and quarrying* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 07 Mining of metal ores (iron ores and non-ferrous metal ores).
- ISIC Division 08 Other mining and quarrying
  - Quarrying of stone, sand and clay
  - Mining and quarrying n.e.c.:
    - Mining of chemical and fertilizer minerals (Extraction of peat, salt)
    - Other mining and quarrying n.e.c.
- ISIC Division 09 Mining support service activities
  - Support activities for petroleum and natural gas extraction
  - Support activities for other mining and quarrying

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.i	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 1.A.2.i *Mining (excluding fuels) and quarrying* exists in Algeria. It is assumed that the liquids fuel consumed during mining activities is allocated in 1.A.3 road transport.

The Energy balance currently does not provide information on the consumption of fuels in activities under *Mining (excluding fuels) and quarrying.* However, a mining industry is existing in Algeria.

3.2.4.10.1.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 182Planned improvements for IPCC category 1.A.2.i *Mining (excluding fuels) and quarrying*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.h	Energy balance - Survey on consumption of fuel for combustion activities in • ISIC Division 07 Mining of metal ores (iron ores and non-ferrous metal ores). • ISIC Division 08 Other mining and quarrying • ISIC Division 09 Mining support service activities	AD	Completeness	medium

3.2.4.11 Wood and wood products (IPCC 1.A.2.j)

3.2.4.11.1.1 Category description

The IPCC category *1.A.2.j Wood and wood products* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 16 Manufacture of wood and of products of wood and cork (except furniture), and manufacture of articles of straw and plaiting materials.
  - Sawmilling and planing of wood.
  - Manufacture of products of wood, cork, straw and plaiting materials.
    - Manufacture of veneer sheets and wood-based panels.
    - Manufacture of builders' carpentry and joinery.
    - Manufacture of wooden containers.
    - Manufacture of other products of wood; manufacture of articles of cork. straw and plaiting materials Quarrying.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.j	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

The IPCC category *1.A.2.j Wood and wood products* does not exist in Algeria. It is assumed that the liquid fuels consumed during mining activities is allocated in 1.A.3 road transport.

The Energy balance currently does not provide information on the consumption of fuels in activities under *Wood and wood products.* However, a mining industry is existing in Algeria.

3.2.4.11.1.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 183Planned improvements for IPCC category *1.A.2.j Wood and wood products*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.j	Energy balance - Survey on consumption of fuel for combustion activities in • Manufacture of wood and of products of wood and cork (except furniture), and manufacture of articles of straw and plaiting materials	AD	Completeness	medium

3.2.4.12 Construction (IPCC category 1.A.2.k)

3.2.4.12.1.1 Category description

The IPCC category 1.A.2.k *Construction* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 41 Construction of buildings
- Division 42 Civil engineering
    - Construction of roads and railways
    - Construction of utility projects
    - Construction of other civil engineering projects
- Division 43 Specialized construction activities
    - Demolition and site preparation
    - Electrical, plumbing and heat and air-conditioning installation and other construction installation activities
    - Building completion and finishing
    - Other specialized construction activities Manufacture

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.2.k	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO	✓	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.k *Construction* is provided in the following figures and tables:

- annual GHG emissions.
- trend of the periods 2010 – 2020. 2019 – 2020.

The greenhouse gas emissions from IPCC category 1.A.2.k *Construction represent the total* of 1,949.48kt CO_2 equivalents in 2010 and 2,294.72 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.2.k *Construction* shows an increase by 17.7% from 2010 to 2020 due to rising activities in the construction sector. A decrease by 1.4% from 2019 to 2020 could be observed which is due to the COVID pandemic.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.

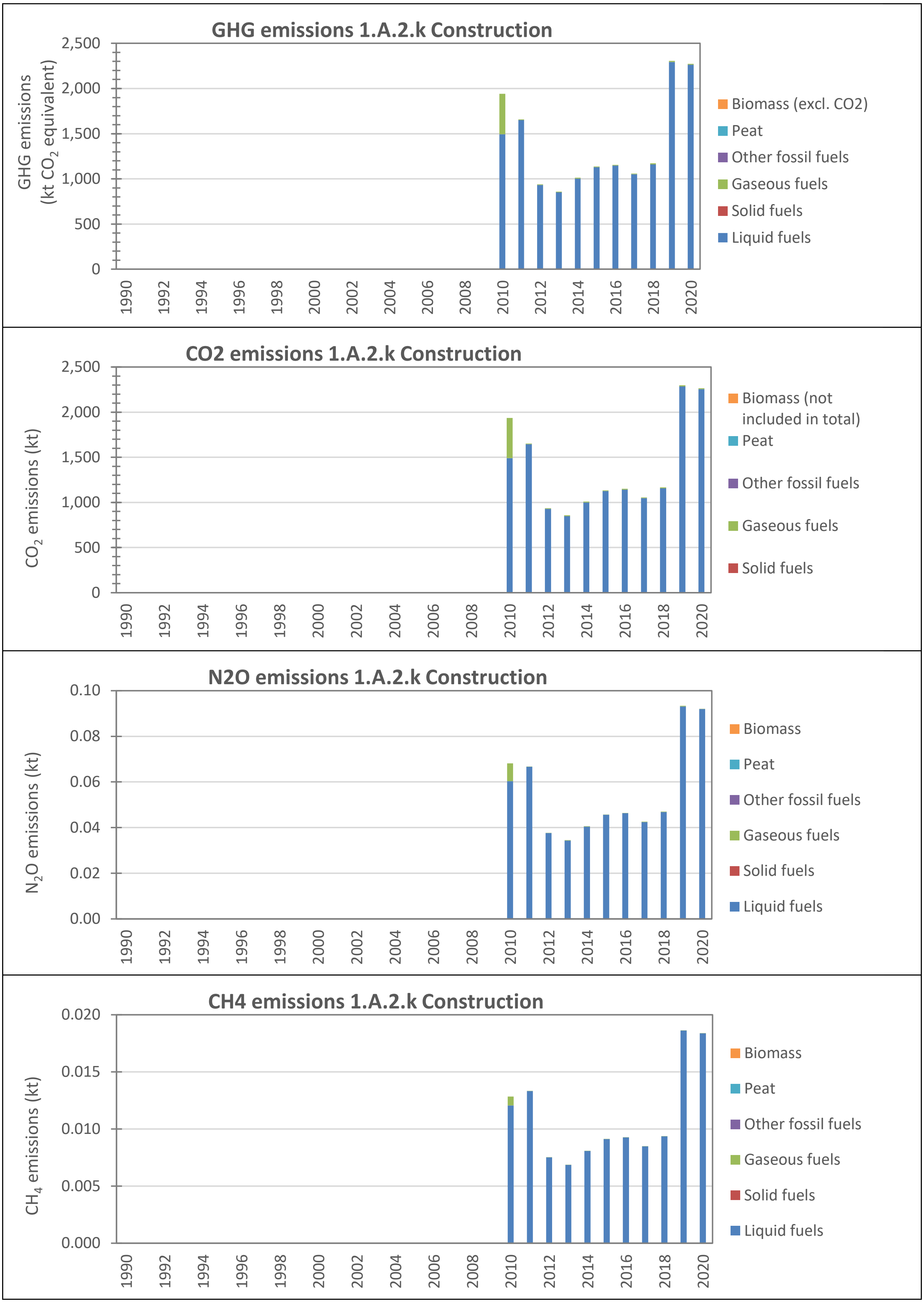

Figure 77 Emissions from IPCC category 1.A.2.k Construction

Table 184 GHG Emissions by fuels from IPCC category 1.A.2.k Construction

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.k	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	IE	IE	NO	IE	NO	NO	NO
2010	1,949.48	1,509.02	NO	440.46	NO	NO	NO
2011	1,674.03	1,666.19	NO	7.84	NO	NO	NO
2012	948.91	941.08	NO	7.84	NO	NO	NO
2013	867.67	858.99	NO	8.68	NO	NO	NO
2014	1,022.12	1,011.39	NO	10.74	NO	NO	NO
2015	1,148.61	1,140.85	NO	7.76	NO	NO	NO
2016	1,165.39	1,157.42	NO	7.97	NO	NO	NO
2017	1,069.63	1,060.93	NO	8.70	NO	NO	NO
2018	1,182.33	1,170.64	NO	11.69	NO	NO	NO
2019	2,328.39	2,316.22	NO	12.18	NO	NO	NO
2020	2,294.72	2,284.03	NO	10.69	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 *- 2020*	17.7%	51.3%	NA	-97.6%	NA	NA	NA
2019 - 2020	-1.4%	-1.4%	NA	-12.2%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 185 CO_2 Emissions by fuels from IPCC category 1.A.2.k Construction

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.k	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	IE	IE	NO	IE	NO	NO	NO
2010	1,927.48	1,489.54	NO	437.94	NO	NO	NO
2011	1,652.47	1,644.68	NO	7.79	NO	NO	NO
2012	936.72	928.93	NO	7.79	NO	NO	NO
2013	856.53	847.90	NO	8.63	NO	NO	NO
2014	1,009.00	998.32	NO	10.68	NO	NO	NO
2015	1,133.84	1,126.12	NO	7.72	NO	NO	NO
2016	1,150.39	1,142.47	NO	7.93	NO	NO	NO
2017	1,055.87	1,047.22	NO	8.65	NO	NO	NO
2018	1,167.14	1,155.51	NO	11.63	NO	NO	NO
2019	2,298.25	2,286.14	NO	12.11	NO	NO	NO
2020	2,264.97	2,254.34	NO	10.62	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
***2010** - 2020*	17.0%	51.3%	NA	-97.6%	NA	NA	NA
2019 - 2020	-1.4%	-1.4%	NA	-12.2%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 186 N_2O Emissions by fuels from IPCC category 1.A.2.k Construction

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.k	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	IE	IE	NO	IE	NO	NO	NO
2010	0.013	0.012	NO	0.00078	NO	NO	NO
2011	0.013	0.013	NO	0.00001	NO	NO	NO
2012	0.008	0.008	NO	0.00001	NO	NO	NO
2013	0.007	0.007	NO	0.00002	NO	NO	NO
2014	0.008	0.008	NO	0.00002	NO	NO	NO
2015	0.009	0.009	NO	0.00001	NO	NO	NO
2016	0.009	0.009	NO	0.00001	NO	NO	NO
2017	0.009	0.008	NO	0.00002	NO	NO	NO
2018	0.009	0.009	NO	0.00002	NO	NO	NO
2019	0.019	0.019	NO	0.00002	NO	NO	NO
2020	0.018	0.018	NO	0.00002	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 *- 2020*	43.3%	52.4%	NA	-97.6%	NA	NA	NA
2019 - 2020	-1.3%	-1.3%	NA	-12.2%	NA	NA	NA

Table 187 CH_4 Emissions by fuels from IPCC category 1.A.2.k Construction

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.k	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	IE	IE	NO	IE	NO	NO	NO
2010	0.068	0.060	NO	0.0078	NO	NO	NO
2011	0.067	0.067	NO	0.0001	NO	NO	NO
2012	0.038	0.038	NO	0.0001	NO	NO	NO
2013	0.034	0.034	NO	0.0002	NO	NO	NO
2014	0.041	0.040	NO	0.0002	NO	NO	NO
2015	0.046	0.046	NO	0.0001	NO	NO	NO
2016	0.046	0.046	NO	0.0001	NO	NO	NO
2017	0.043	0.042	NO	0.0002	NO	NO	NO
2018	0.047	0.047	NO	0.0002	NO	NO	NO
2019	0.093	0.093	NO	0.0002	NO	NO	NO
2020	0.092	0.092	NO	0.0002	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
***2010** - 2020*	35.2%	52.4%	NA	-97.6%	NA	NA	NA
2019 - 2020	-1.3%	-1.3%	NA	-12.2%	NA	NA	NA

3.2.4.12.1.2 Methodological issues

3.2.4.12.1.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[206] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\mathrm{GHG.\ fuel}}$	= emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\mathrm{fuel}}$	= amount of fuel combusted (TJ)
Emission factor $_{\mathrm{GHG.\ fuel}}$	= default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG	= CO_2, CH_4, N_2O
Fuel	= liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.4.12.1.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:	- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil) - Other Kerosene - Other Oil - Other Petroleum Products
Gasous fuels:	- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[207] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[208].

Total fuel consumption increased by 10.4% over the 2010-2020 period. This increase in emissions is explained by the large number of roads, rail and housing infrastructure projects launched during this period and with the increase in the country's oil and gas revenues after the year 2000. However, from 2019 to 2020, total fuel consumption decreased by 1.4% due to the COVID 19 pandemic.

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[206] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[207] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[208] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

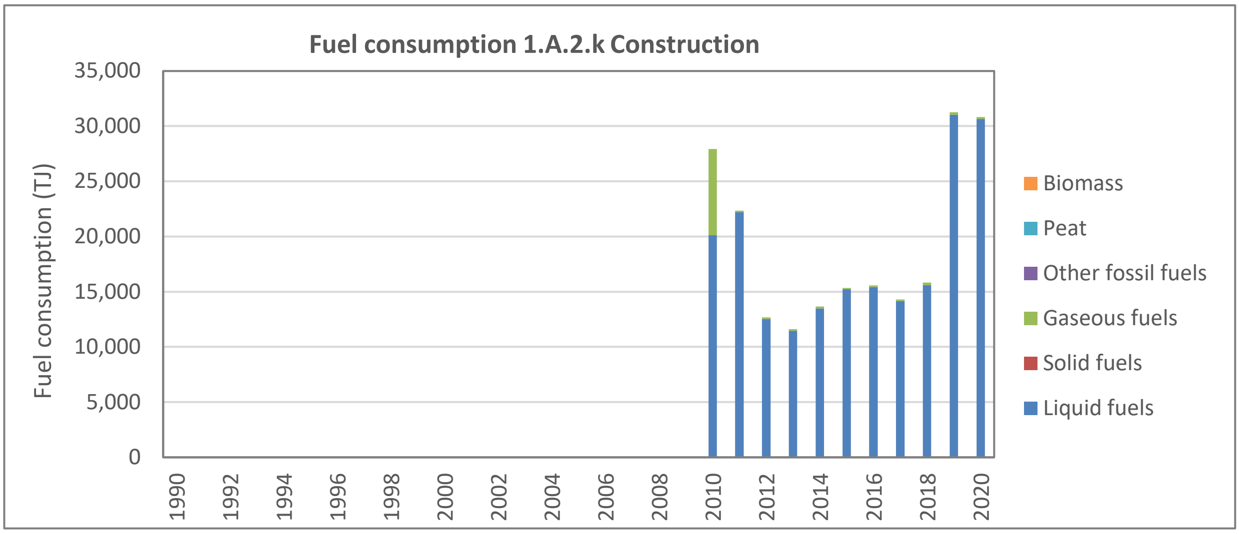

Figure 78 Activity data for IPCC category 1.A.2.k Construction

Table 188 Activity data for IPCC category 1.A.2.k Construction

Activity data 1.A.2.k	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	IE	IE	NO	IE	NO	NO	NO
2010	27,913.50	20,107.13	NO	7,806.37	NO	NO	NO
2011	22,339.98	22,201.09	NO	138.89	NO	NO	NO
2012	12,675.03	12,536.14	NO	138.89	NO	NO	NO
2013	11,596.45	11,442.69	NO	153.76	NO	NO	NO
2014	13,668.77	13,478.46	NO	190.31	NO	NO	NO
2015	15,342.30	15,204.75	NO	137.55	NO	NO	NO
2016	15,570.86	15,429.54	NO	141.32	NO	NO	NO
2017	14,297.07	14,142.93	NO	154.13	NO	NO	NO
2018	15,812.32	15,605.05	NO	207.27	NO	NO	NO
2019	31,252.94	31,037.15	NO	215.79			
2020	30,829.05	30,639.66	NO	189.39			
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
***2010** - 2020*	10.4%	52.4%	NA	-97.6%	NA	NA	NA
2019 - 2020	-1.4%	-1.3%	NA	-12.2%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.k Construction are provided.

Table 189Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.k Construction.

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Other Kerosene Autres kérosènes	TJ / Gg	43.92 * 0.95 = 41.72	43.8
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	-	40.2

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[209]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [210]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

3.2.4.12.1.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas and liquid fuels were taken from IPCC 2006 Guidelines and are presented in the following table.

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[209] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[210] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 190 GHG Emission factor TIER 1 for IPCC category 1.A.2.k Construction

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	1	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	3	D	0.6	D
	Other Kerosene Autres kérosènes	71,900	D	3	D	0.6	D
	Other Petroleum Products Autres produits pétroliers	77,400	D	3	D	0.6	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

3.2.4.12.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.2.k Construction are presented in the following table.

Table 191 Uncertainty for IPCC category 1.A.2.k Construction.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[211] .
- 2010 - 2020 are taken from the National Energy balance provided by MEM[212].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [213];

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[211] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[212] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[213] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [214].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.4.12.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and converson factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[215] and
    - international energy statistics of UN statistics[216] and International Energy Agency (IEA)[217]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.4.12.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.2.k Construction.*

Table 192Recalculations done since NC in IPCC category 1.A.2.k Construction

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.k	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.k	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.k	Revision of NCV Default → country specific : Natural gas, Gasoil/diesel	AD	Accuracy Comparability

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[214] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[215] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[216] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[217] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.k	Revision of CO_2 and CH_4 EF Country specific (CS) CO_2 emission factors for Natural gas	EF	Accuracy Comparability
1.A.2.k	Assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.12.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 193Planned improvements for IPCC category 1.A.2.k Construction

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.k	Energy balance • Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content) Survey on consumption of fuel for combustion activities in Manufacture of glass and glass products, clay building materials, porcelain and ceramic products, cement, lime and plaster, etc.	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.k 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.2.k	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.13 Textile and leather (IPCC category 1.A.2.l)

3.2.4.13.1.1 Category description

The IPCC category 1.A.2.l *Textile and leather* includes GHG emissions resulting from fuel combustion activities in

- ISIC Division 13 Manufacture of textiles
  - Spinning, weaving and finishing of textiles
  - Manufacture of other textiles
    - Manufacture of knitted and crocheted fabrics, made-up textile articles (except apparel)
    - Manufacture of carpets and rugs, cordage, rope, twine and netting
    - Manufacture of other textiles n.e.c.
- ISIC Division 14 Manufacture of wearing apparel
  - Manufacture of wearing apparel, except fur apparel
  - Manufacture of articles of fur
  - Manufacture of knitted and crocheted apparel
- ISIC Division 15 Manufacture of leather and related products
  - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur
  - Manufacture of footwear

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.2.l	IE	NO	✓	NO	NO	NO	IE	NO	✓	NO	NO	NO	IE	NO	✓	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.l Textile and leather is provided in the following figures and tables:

- annual GHG emissions;
- Trend of the periods 2009 – 2020. 2019 – 2020;

The greenhouse gas emissions from IPCC category 1.A.2.l Textile and leather represent a total of 68.55 kt CO_2 equivalents in 2009 and 95.25 kt CO_2 equivalents in 2020.
The overall trend of GHG emissions of IPCC category 1.A.2.l "Textiles and leather" shows an increase of 38.9% between 2009 and 2020. This increase in emissions is explained by the increase in demand for raw material (leather) in the domestic market. However, the period from 2019 to 2020 shows an increase of 11.1%.
This decrease in demand can be explained by the effects of the pandemic on the national market.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.

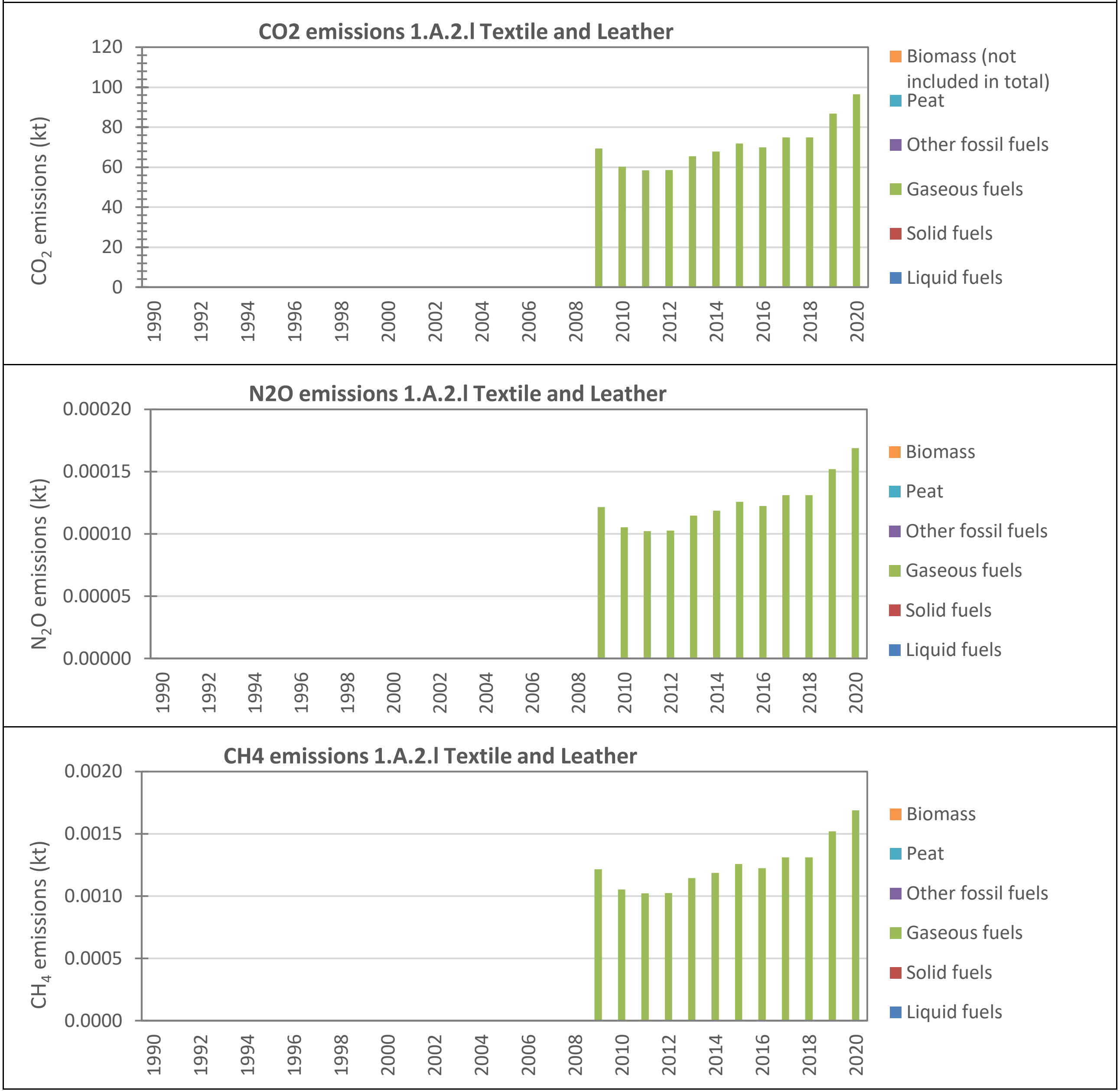

Figure 79 Emissions from IPCC category 1.A.2.l Textile and leather

Table 194 GHG Emissions by fuels from IPCC category 1.A.2.l Textile and leather

GHG	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.l	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO

GHG	Total GHG emissions (excluding CO_2 from biomass)	GHG emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.2.l	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	68.55	NO	NO	68.55	NO	NO	NO
2010	59.48	NO	NO	59.48	NO	NO	NO
2011	57.67	NO	NO	57.67	NO	NO	NO
2012	57.87	NO	NO	57.87	NO	NO	NO
2013	64.64	NO	NO	64.64	NO	NO	NO
2014	66.99	NO	NO	66.99	NO	NO	NO
2015	71.00	NO	NO	71.00	NO	NO	NO
2016	69.08	NO	NO	69.08	NO	NO	NO
2017	74.00	NO	NO	74.00	NO	NO	NO
2018	74.00	NO	NO	74.00	NO	NO	NO
2019	85.73	NO	NO	85.73	NO	NO	NO
2020	95.25	NO	NO	95.25	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 *- 2020*	38.9%	NA	NA	38.9%	NA	NA	NA
2019 - 2020	11.1%	NA	NA	11.1%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 195 CO_2 Emissions by fuels from IPCC category 1.A.2.l Textile and leather

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.l	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	68.16	IE	NO	68.16	NO	NO	NO
2010	59.14	IE	NO	59.14	NO	NO	NO
2011	57.34	IE	NO	57.34	NO	NO	NO
2012	57.54	IE	NO	57.54	NO	NO	NO
2013	64.27	IE	NO	64.27	NO	NO	NO
2014	66.60	IE	NO	66.60	NO	NO	NO
2015	70.59	IE	NO	70.59	NO	NO	NO
2016	68.69	IE	NO	68.69	NO	NO	NO
2017	73.57	IE	NO	73.57	NO	NO	NO
2018	73.57	IE	NO	73.57	NO	NO	NO
2019	85.24	IE	NO	85.24	NO	NO	NO
2020	94.70	IE	NO	94.70	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
***2009** - 2020*	38.9%	NA	NA	38.9%	NA	NA	NA
2019 - 2020	11.1%	NA	NA	11.1%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 196 N_2O Emissions by fuels from IPCC category 1.A.2.l Textile and leather

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.l	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.00012	IE	NO	0.00012	NO	NO	NO
2010	0.00011	IE	NO	0.00011	NO	NO	NO
2011	0.00010	IE	NO	0.00010	NO	NO	NO
2012	0.00010	IE	NO	0.00010	NO	NO	NO
2013	0.00011	IE	NO	0.00011	NO	NO	NO
2014	0.00012	IE	NO	0.00012	NO	NO	NO
2015	0.00013	IE	NO	0.00013	NO	NO	NO
2016	0.00012	IE	NO	0.00012	NO	NO	NO
2017	0.00013	IE	NO	0.00013	NO	NO	NO
2018	0.00013	IE	NO	0.00013	NO	NO	NO
2019	0.00015	IE	NO	0.00015	NO	NO	NO
2020	0.00017	IE	NO	0.00017	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2009 *- 2020*	38.9%	NA	NA	38.9%	NA	NA	NA
2019 - 2020	11.1%	NA	NA	11.1%	NA	NA	NA

Table 197 CH₄ Emissions by fuels from IPCC category 1.A.2.l Textile and leather

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.l	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	0.0012	IE	NO	0.0012	NO	NO	NO
2010	0.0011	IE	NO	0.0011	NO	NO	NO
2011	0.0010	IE	NO	0.0010	NO	NO	NO
2012	0.0010	IE	NO	0.0010	NO	NO	NO
2013	0.0011	IE	NO	0.0011	NO	NO	NO
2014	0.0012	IE	NO	0.0012	NO	NO	NO
2015	0.0013	IE	NO	0.0013	NO	NO	NO
2016	0.0012	IE	NO	0.0012	NO	NO	NO
2017	0.0013	IE	NO	0.0013	NO	NO	NO
2018	0.0013	IE	NO	0.0013	NO	NO	NO
2019	0.0015	IE	NO	0.0015	NO	NO	NO
2020	0.0017	IE	NO	0.0017	NO	NO	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	NA	NA	NA
***2009** - 2020*	*38.9%*	*NA*	*NA*	*38.9%*	NA	NA	NA
2019 - 2020	*11.1%*	*NA*	*NA*	*11.1%*	NA	NA	NA

3.2.4.13.1.2 Methodological issues

3.2.4.13.1.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[218] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG.\,fuel}}}$$

Where:

Emissions $_{GHG.\ fuel}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{fuel}$ = amount of fuel combusted (TJ)
Emission factor $_{GHG.\ fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

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[218] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

3.2.4.13.1.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Gaseous fuels:
- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[219] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[220].

The total fuel consumption increased by 38.9% in the period 2009 – 2020, from 2019 to 2020 the total fuel consumption increased by 11.1%. Due to increased demand of textiles in the retail and services sector the textile industry grew significantly.

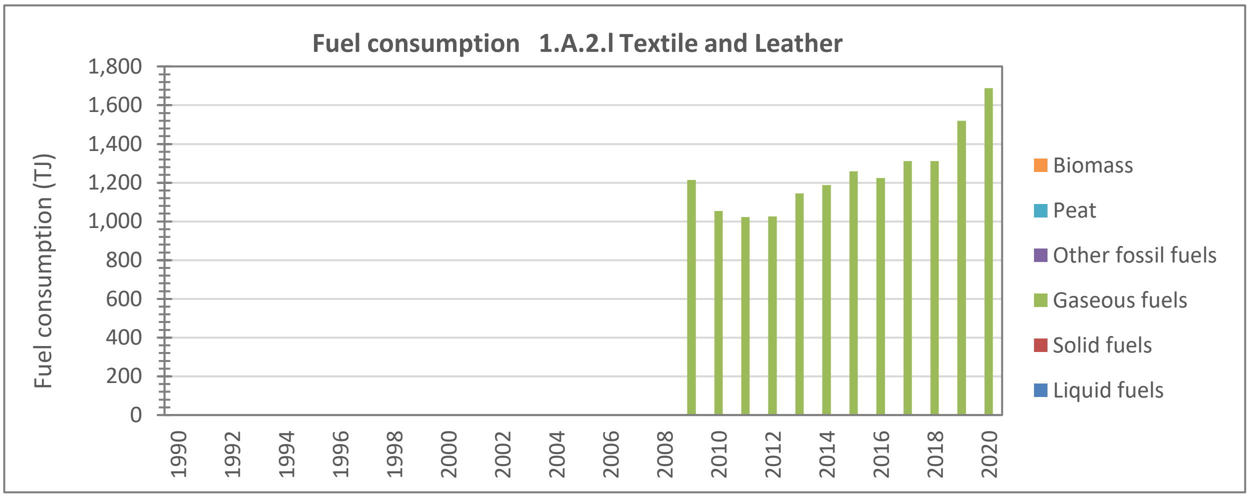

Figure 80 Activity data for IPCC category 1.A.2.l Textile and leather

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[219] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[220] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 198 Activity data for IPCC category 1.A.2.l Textile and leather

Activity data 1.A.2.l	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	NO
1991	IE	IE	NO	IE	NO	NO	NO
1992	IE	IE	NO	IE	NO	NO	NO
1993	IE	IE	NO	IE	NO	NO	NO
1994	IE	IE	NO	IE	NO	NO	NO
1995	IE	IE	NO	IE	NO	NO	NO
1996	IE	IE	NO	IE	NO	NO	NO
1997	IE	IE	NO	IE	NO	NO	NO
1998	IE	IE	NO	IE	NO	NO	NO
1999	IE	IE	NO	IE	NO	NO	NO
2000	IE	IE	NO	IE	NO	NO	NO
2001	IE	IE	NO	IE	NO	NO	NO
2002	IE	IE	NO	IE	NO	NO	NO
2003	IE	IE	NO	IE	NO	NO	NO
2004	IE	IE	NO	IE	NO	NO	NO
2005	IE	IE	NO	IE	NO	NO	NO
2006	IE	IE	NO	IE	NO	NO	NO
2007	IE	IE	NO	IE	NO	NO	NO
2008	IE	IE	NO	IE	NO	NO	NO
2009	1,215.00	IE	NO	1,215.00	NO	NO	NO
2010	1,054.14	IE	NO	1,054.14	NO	NO	NO
2011	1,022.09	IE	NO	1,022.09	NO	NO	NO
2012	1,025.65	IE	NO	1,025.65	NO	NO	NO
2013	1,145.65	IE	NO	1,145.65	NO	NO	NO
2014	1,187.24	IE	NO	1,187.24	NO	NO	NO
2015	1,258.33	IE	NO	1,258.33	NO	NO	NO
2016	1,224.41	IE	NO	1,224.41	NO	NO	NO
2017	1,311.46	IE	NO	1,311.46	NO	NO	NO
2018	1,311.46	IE	NO	1,311.46	NO	NO	NO
2019	1,519.50	IE	NO	1,519.50	NO	NO	NO
2020	1,688.06	IE	NO	1,688.06	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	38.9%	NA	NA	38.9%	NA	NA	NA
2019 - 2020	11.1%	NA	NA	11.1%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.*l Textile and leather* are provided.

Table 199Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.l Textile and leather.

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**			
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**		
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 48.0	UN default 2006 IPCC default	

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[221]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV	International Recommendations for Energy Statistics (IRES) (2018) [222]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

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[221] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[222] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.4.13.1.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines.

For liquid fuels and biomass, the default emission factors for greenhouse gases were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 200 GHG Emission factor TIER 1 for IPCC category 1.A.2.l Textile and leather

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	1	D	0.1	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default	CS Country specific	PS Plant specific	IEF Implied emission factor				

3.2.4.13.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for 1.A.2.l Textile and leather are presented in the following table.

Table 201Uncertainty for IPCC category 1.A.2.l Textile and leather.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[223];
- 2010 - 2020 are taken from the National Energy balance provided by MEM[224].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [225];

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[223] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[224] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[225] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [226].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.4.13.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[227] and
    - international energy statistics of UN statistics[228] and International Energy Agency (IEA)[229]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.4.13.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.2.l Textile and leather*.

Table 202Recalculations done since NC in IPCC category 1.A.2.l Textile and leather

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.l	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.l	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.l	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability

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[226] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[227] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[228] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[229] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.l	Revision of CO_2 and CH_4 EF	EF	Accuracy Comparability
1.A.2.l	Assumption of 100% oxidation	EF	Accuracy Comparability

3.2.4.13.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 203Planned improvements for IPCC category 1.A.2.l Textile and leather

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.l	Energy balance • Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content) Survey on consumption of fuel for combustion activities in Manufacture of glass and glass products, clay building materials, porcelain and ceramic products, cement, lime and plaster, etc.	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.l 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.2.l	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.4.14 Off-road vehicles and other machinery (CRT category 1.A.2.g.vii)

3.2.4.14.1 Category description

The CRT category 1.A.g.vii *Off-road vehicles and other machinery* includes GHG emissions resulting from fuel combustion in off-road vehicles which comprises vehicles and mobile equipment used primarily on commercial or industrial sites.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.2.g.vii	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

The emissions from combustion of liquid fuels (mainly gas/diesel oil, motor gasoline and liquefied petroleum gases (LPG)) of the CRT category 1.A.g.vii *Off-road vehicles and other machinery* are included either categories of 1.A.2 *Manufacturing industries and construction* or 1.A.3.b. Road transportation.

The Energy balance currently does not provide information on the consumption of liquid fuels in activities under *Off-road vehicles and other machinery.*

3.2.4.14.2 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 204Planned improvements for CRT category 1.A.g.vii *Off-road vehicles and other machinery*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.2.g.vii 1.A.2	• Energy balance - Survey on use/consumption of liquid fuels in stationary and off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low

3.2.4.15 Other (not-specified industry) (IPCC category 1.A.2.m)

3.2.4.15.1 Category description

The IPCC category 1.A.2.m *Other (not-specified industry)* GHG emissions resulting from fuel combustion activities

- in any manufacturing industry/construction not included in 1.A.2.a - 1.A.2.l;
- in transformation sector of autoproducer electricity plants, autoproducer CHP plants, autoproducer heat plants;
- in 1.A.2 (all categories) for the period 1990 – 2009 as the energy balance was not disaggregated in this period.

GHG emissions / removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.2.m	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓
Key Category	LA 1990 & TA	-	LA 1990 & 2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

An overview of the GHG emission from fuel combustion in IPCC category 1.A.2.m *Other (not-specified industry)* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2019, 2019 – 2020.

The greenhouse gas emissions from IPCC category 1.A.2.m *Other (not-specified industry)* represent a total of 4,372.93 kt CO_2 equivalents in 1990, 4 4,478.58 kt CO_2 equivalents in 2005, and 4,050.33 kt CO_2 equivalents in 2020. The IPCC category 1.A.2.m *Other (not-specified industry)* is a key category for CO_2 and gaseous and liquid fuels.

The overall trend in GHG emissions from IPCC category 1.A.2.m Other (unspecified industry) shows a decrease of 7.4% from 1990 to 2020, a decrease of 9.6% from 2005 to 2020, while the period from 2019 to 2020 is marked by a decrease of 13.8%.

This fluctuation in emissions may be due on the one hand to the fluctuation in fuel consumption in these industries due to market instability and on the other hand, to the lack of data for this category. The 2019-2020 period has parked all categories due to the Covid 19 pandemic, which has frozen all national and international industrial activities.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.

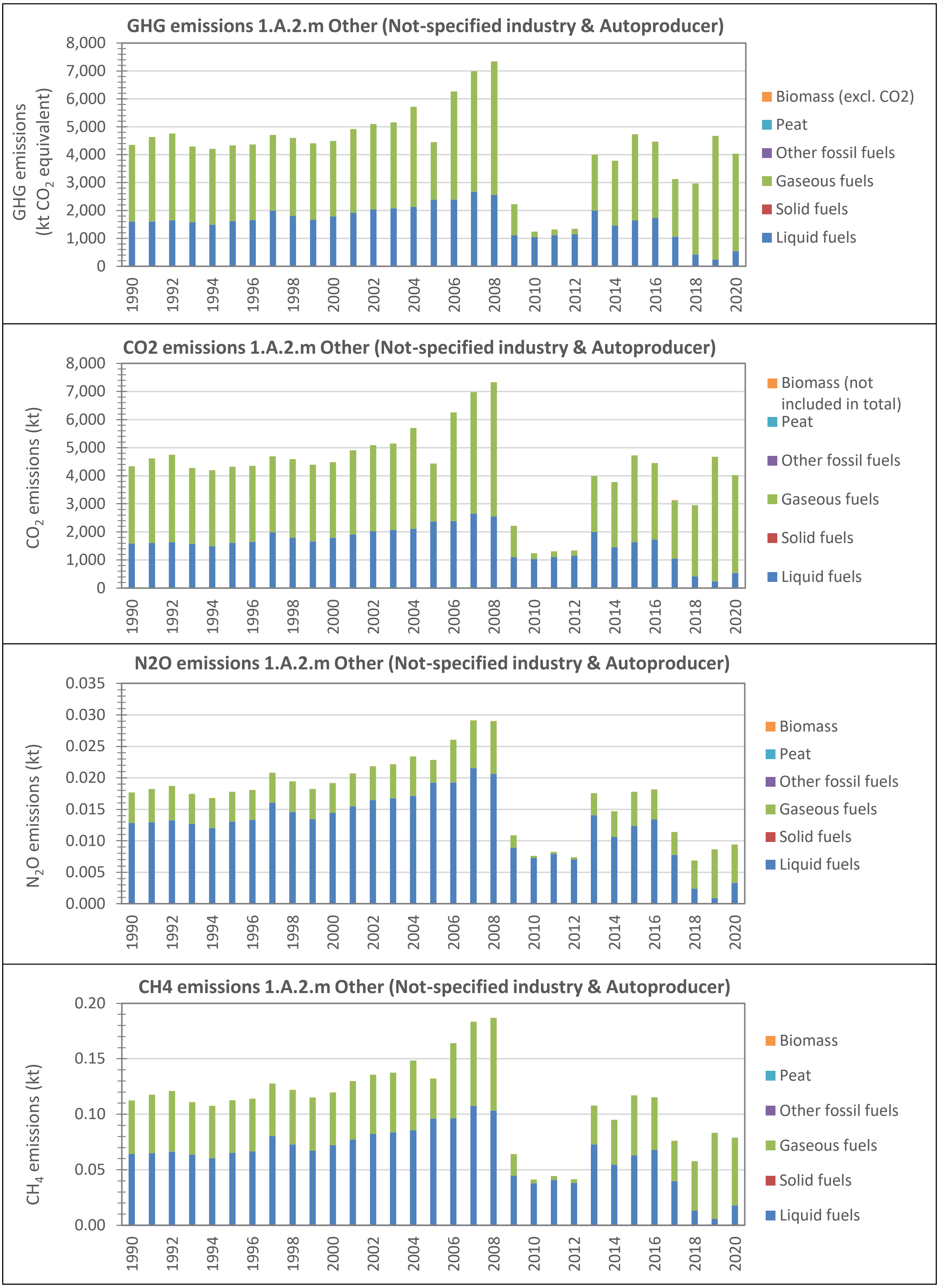

Figure 81 Emissions from IPCC category 1.A.2.m *Other (not-specified industry)*

Table 205 GHG Emissions by fuels from IPCC category 1.A.2.m *Other (not-specified industry)*

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.m	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	4,372.93	1,609.26	NO	2,763.67	NO	NO	NO
1991	4,658.22	1,621.45	NO	3,036.78	NO	NO	0.00008
1992	4,784.93	1,658.62	NO	3,126.31	NO	NO	0.00009
1993	4,314.86	1,590.48	NO	2,724.38	NO	NO	0.00014
1994	4,231.11	1,506.73	NO	2,724.38	NO	NO	0.00014
1995	4,357.93	1,633.55	NO	2,724.38	NO	NO	0.00014
1996	4,391.94	1,667.56	NO	2,724.38	NO	NO	0.00014
1997	4,735.32	2,010.93	NO	2,724.38	NO	NO	0.00019
1998	4,631.39	1,822.22	NO	2,809.16	NO	NO	0.00021
1999	4,432.87	1,683.00	NO	2,749.87	NO	NO	0.00021
2000	4,522.24	1,806.75	NO	2,715.49	NO	NO	0.00021
2001	4,946.53	1,933.58	NO	3,012.95	NO	NO	0.00021
2002	5,130.85	2,057.32	NO	3,073.53	NO	NO	0.00028
2003	5,190.10	2,094.44	NO	3,095.66	NO	NO	0.00023
2004	5,753.34	2,140.83	NO	3,612.51	NO	NO	0.00023
2005	4,478.58	2,403.80	NO	2,074.78	NO	NO	0.00027
2006	6,305.98	2,409.98	NO	3,896.00	NO	NO	0.00025
2007	7,038.48	2,694.59	NO	4,343.89	NO	NO	0.00027
2008	7,389.42	2,580.12	NO	4,809.30	NO	NO	0.00018
2009	2,237.68	1,113.72	NO	1,123.95	NO	NO	0.00021
2010	1,250.72	1,043.89	NO	206.83	NO	NO	0.00012
2011	1,323.40	1,122.71	NO	200.69	NO	NO	NO
2012	1,350.18	1,158.29	NO	191.90	NO	NO	NO
2013	4,024.96	2,013.45	NO	2,011.52	NO	NO	NO
2014	3,801.16	1,471.45	NO	2,329.71	NO	NO	0.00003
2015	4,761.83	1,653.98	NO	3,107.85	NO	NO	0.00003
2016	4,490.65	1,750.52	NO	2,740.13	NO	NO	0.00003
2017	3,144.65	1,061.49	NO	2,083.16	NO	NO	0.00004
2018	2,976.48	414.13	NO	2,562.35	NO	NO	0.00010
2019	4,698.33	242.86	NO	4,455.47	NO	NO	0.00005
2020	4,050.33	542.18	NO	3,508.16	NO	NO	0.00004
Trend							
1990 - 2020	-7.4%	-66.3%	NA	26.9%	NA	NA	NA
2005 - 2020	-9.4%	-77.4%	NA	69.1%	NA	NA	-83.8%
2019 - 2020	-13.8%	122.8%	NA	-21.3%	NA	NA	-1.6%

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 206 CO_2 Emissions by fuels from IPCC category 1.A.2.m *Other (not-specified industry)*

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.2.m	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	4,336.62	1,588.49	NO	2,748.13	NO	NO	NO
1991	4,620.22	1,600.52	NO	3,019.70	NO	NO	0.00008
1992	4,745.94	1,637.21	NO	3,108.73	NO	NO	0.00008
1993	4,279.01	1,569.95	NO	2,709.06	NO	NO	0.00014
1994	4,196.34	1,487.28	NO	2,709.06	NO	NO	0.00014
1995	4,321.53	1,612.46	NO	2,709.06	NO	NO	0.00014
1996	4,355.10	1,646.03	NO	2,709.06	NO	NO	0.00014
1997	4,694.04	1,984.98	NO	2,709.06	NO	NO	0.00019
1998	4,592.07	1,798.70	NO	2,793.37	NO	NO	0.00020
1999	4,395.68	1,661.28	NO	2,734.41	NO	NO	0.00020
2000	4,483.65	1,783.43	NO	2,700.22	NO	NO	0.00020
2001	4,904.63	1,908.62	NO	2,996.00	NO	NO	0.00020
2002	5,087.01	2,030.76	NO	3,056.25	NO	NO	0.00027
2003	5,145.65	2,067.40	NO	3,078.25	NO	NO	0.00022
2004	5,705.39	2,113.20	NO	3,592.19	NO	NO	0.00022
2005	4,435.88	2,372.77	NO	2,063.12	NO	NO	0.00027
2006	6,252.96	2,378.87	NO	3,874.09	NO	NO	0.00024
2007	6,979.27	2,659.81	NO	4,319.46	NO	NO	0.00027
2008	7,329.07	2,546.82	NO	4,782.25	NO	NO	0.00018
2009	2,216.98	1,099.35	NO	1,117.63	NO	NO	0.00020
2010	1,237.40	1,031.73	NO	205.67	NO	NO	0.00011
2011	1,309.09	1,109.53	NO	199.56	NO	NO	NO
2012	1,336.82	1,146.00	NO	190.82	NO	NO	NO
2013	3,990.12	1,989.92	NO	2,000.21	NO	NO	NO
2014	3,770.45	1,453.84	NO	2,316.61	NO	NO	0.00003
2015	4,724.04	1,633.67	NO	3,090.37	NO	NO	0.00003
2016	4,453.37	1,728.65	NO	2,724.72	NO	NO	0.00003
2017	3,120.11	1,048.67	NO	2,071.45	NO	NO	0.00004
2018	2,957.84	409.89	NO	2,547.94	NO	NO	0.00010
2019	4,671.41	241.00	NO	4,430.41	NO	NO	0.00004
2020	4,024.84	536.41	NO	3,488.43	NO	NO	0.00004
Trend							
1990 - 2020	*-7.2%*	*-66.2%*	*NA*	*26.9%*	*NA*	*NA*	*NA*
2005 - 2020	*-9.3%*	*-77.4%*	*NA*	*69.1%*	*NA*	*NA*	*-83.8%*
2019 - 2020	*-13.8%*	*122.6%*	*NA*	*-21.3%*	*NA*	*NA*	*-1.6%*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 207 N_2O Emissions by fuels from IPCC category 1.A.2.m *Other (not-specified industry)*

N_2O	Total N_2O emissions	N_2O emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
1.A.2.m	kt	kt	kt	kt	kt	kt	kt
1990	0.018	0.013	NO	0.005	NO	NO	NO
1991	0.018	0.013	NO	0.005	NO	NO	2.73E-09
1992	0.019	0.013	NO	0.005	NO	NO	3.01E-09
1993	0.017	0.013	NO	0.005	NO	NO	5.09E-09
1994	0.017	0.012	NO	0.005	NO	NO	5.09E-09
1995	0.018	0.013	NO	0.005	NO	NO	5.09E-09
1996	0.018	0.013	NO	0.005	NO	NO	5.09E-09
1997	0.021	0.016	NO	0.005	NO	NO	6.78E-09
1998	0.019	0.015	NO	0.005	NO	NO	7.21E-09
1999	0.018	0.013	NO	0.005	NO	NO	7.21E-09
2000	0.019	0.014	NO	0.005	NO	NO	7.21E-09
2001	0.021	0.015	NO	0.005	NO	NO	7.21E-09
2002	0.022	0.016	NO	0.005	NO	NO	9.70E-09
2003	0.022	0.017	NO	0.005	NO	NO	7.91E-09
2004	0.023	0.017	NO	0.006	NO	NO	7.91E-09
2005	0.023	0.019	NO	0.004	NO	NO	9.61E-09
2006	0.026	0.019	NO	0.007	NO	NO	8.67E-09
2007	0.029	0.022	NO	0.008	NO	NO	9.61E-09
2008	0.029	0.021	NO	0.008	NO	NO	6.26E-09
2009	0.011	0.009	NO	0.002	NO	NO	7.22E-09
2010	0.008	0.007	NO	0.000	NO	NO	4.06E-09
2011	0.008	0.008	NO	0.000	NO	NO	NO
2012	0.007	0.007	NO	0.000	NO	NO	NO
2013	0.018	0.014	NO	0.004	NO	NO	NO
2014	0.015	0.011	NO	0.004	NO	NO	9.44E-10
2015	0.018	0.012	NO	0.005	NO	NO	9.46E-10
2016	0.018	0.013	NO	0.005	NO	NO	9.17E-10
2017	0.011	0.008	NO	0.004	NO	NO	1.58E-09
2018	0.007	0.002	NO	0.004	NO	NO	3.40E-09
2019	0.009	0.001	NO	0.008	NO	NO	1.58E-09
2020	0.009	0.003	NO	0.006	NO	NO	1.56E-09
Trend							
1990 - 2020	*-46.7%*	*-74.2%*	*NA*	*26.9%*	*NA*	*NA*	*NA*
2005 - 2020	*-58.7%*	*-82.7%*	*NA*	*69.1%*	*NA*	*NA*	*-83.8%*
2019 - 2020	*9.0%*	*273.2%*	*NA*	*-21.3%*	*NA*	*NA*	*-1.6%*

Table 208 CH_4 Emissions by fuels from IPCC category 1.A.2.m *Other (not-specified industry)*

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.2.m	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.112	0.064	NO	0.048	NO	NO	NO
1991	0.118	0.065	NO	0.053	NO	NO	2.05E-08
1992	0.121	0.066	NO	0.054	NO	NO	2.26E-08
1993	0.111	0.064	NO	0.047	NO	NO	3.81E-08
1994	0.108	0.060	NO	0.047	NO	NO	3.81E-08
1995	0.113	0.065	NO	0.047	NO	NO	3.81E-08
1996	0.114	0.067	NO	0.047	NO	NO	3.81E-08
1997	0.128	0.080	NO	0.047	NO	NO	5.09E-08
1998	0.122	0.073	NO	0.049	NO	NO	5.40E-08
1999	0.115	0.067	NO	0.048	NO	NO	5.40E-08
2000	0.119	0.072	NO	0.047	NO	NO	5.40E-08
2001	0.130	0.077	NO	0.052	NO	NO	5.40E-08
2002	0.136	0.082	NO	0.054	NO	NO	7.28E-08
2003	0.138	0.084	NO	0.054	NO	NO	5.93E-08
2004	0.148	0.086	NO	0.063	NO	NO	5.93E-08
2005	0.132	0.096	NO	0.036	NO	NO	7.20E-08
2006	0.164	0.096	NO	0.068	NO	NO	6.51E-08
2007	0.183	0.108	NO	0.076	NO	NO	7.20E-08
2008	0.187	0.103	NO	0.084	NO	NO	4.70E-08
2009	0.064	0.045	NO	0.020	NO	NO	5.41E-08
2010	0.041	0.038	NO	0.004	NO	NO	3.05E-08
2011	0.044	0.041	NO	0.003	NO	NO	NO
2012	0.041	0.038	NO	0.003	NO	NO	NO
2013	0.108	0.073	NO	0.035	NO	NO	NO
2014	0.095	0.055	NO	0.041	NO	NO	7.08E-09
2015	0.117	0.063	NO	0.054	NO	NO	7.10E-09
2016	0.115	0.068	NO	0.048	NO	NO	6.88E-09
2017	0.076	0.040	NO	0.036	NO	NO	1.18E-08
2018	0.058	0.013	NO	0.045	NO	NO	2.55E-08
2019	0.083	0.006	NO	0.078	NO	NO	1.19E-08
2020	0.079	0.018	NO	0.061	NO	NO	1.17E-08
Trend							
1990 - 2020	-29.8%	-72.2%	NA	26.9%	NA	NA	NA
2005 - 2020	-40.3%	-81.4%	NA	69.1%	NA	NA	-83.8%
2019 - 2020	-5.3%	210.5%	NA	-21.3%	NA	NA	-1.6%

3.2.4.15.2 Methodological issues

3.2.4.15.2.1 Choice of methods – TIER 1 for CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[230] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$	= emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$	= amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$	= default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG	= CO_2, CH_4, N_2O
Fuel	= liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.4.15.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:
- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil)
- Motor Gasoline* (only non-biogasoline)
- Liquefied Petroleum Gases
- Other Kerosene
- Other Oil - Other Petroleum Products

Gaseous fuels:
- Natural gas

Biomass
- Fuelwood

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[231] .
- 2010 – 2020 are taken from the National Energy balance provided by MEM[232].

Total fuel consumption decreased by 1.2% over the period 1990 – 2020, From 2005 to 2020, total fuel consumption increased by 0.8%. On the other hand, from 2019 to 2020, total fuel consumption decreased by 15.4%. The increase in GHG emissions from unspecified industries is explained by the increase in national demand due to the increase in population and the improvement in living standards since 2005 due to the increase in the price of a barrel of oil. The decrease in emissions between 2019 and 2020 is explained by the impact of the Covid 19 pandemic, which curbed production in the various industries in Algeria.

The most important fuel is natural gas. While natural gas accounted for 69% of total fuel consumption in 1991, this figure had already risen to 89% by 2020.

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[230] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[231] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[232] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

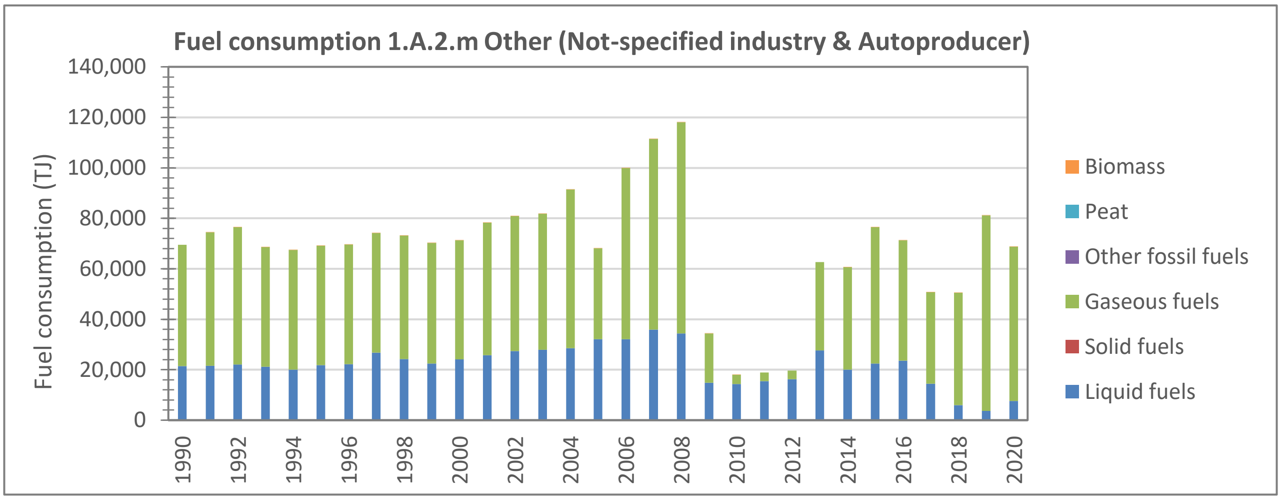

Figure 82 Activity data for IPCC category 1.A.2.m *Other (not-specified industry)*

Table 209 Activity data for IPCC category 1.A.2.m *Other (not-specified industry)*

Activity data 1.A.2.m	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	69,551.67	21,436.77	NO	48,114.90	NO	NO	NO
1991	74,469.50	21,599.21	NO	52,869.60	NO	NO	0.68
1992	76,523.50	22,094.35	NO	54,428.40	NO	NO	0.75
1993	68,618.87	21,186.70	NO	47,430.90	NO	NO	1.27
1994	67,503.37	20,071.20	NO	47,430.90	NO	NO	1.27
1995	69,192.74	21,760.57	NO	47,430.90	NO	NO	1.27
1996	69,645.82	22,213.65	NO	47,430.90	NO	NO	1.27
1997	74,220.39	26,787.79	NO	47,430.90	NO	NO	1.70
1998	73,182.66	24,273.96	NO	48,906.90	NO	NO	1.80
1999	70,295.79	22,419.39	NO	47,874.60	NO	NO	1.80
2000	71,345.73	24,067.83	NO	47,276.10	NO	NO	1.80
2001	78,213.90	25,757.40	NO	52,454.70	NO	NO	1.80
2002	80,917.64	27,405.72	NO	53,509.50	NO	NO	2.43
2003	81,796.85	27,900.17	NO	53,894.70	NO	NO	1.98
2004	91,413.05	28,518.17	NO	62,892.90	NO	NO	1.98
2005	68,145.05	32,021.15	NO	36,121.50	NO	NO	2.40
2006	99,934.20	32,103.53	NO	67,828.50	NO	NO	2.17
2007	111,523.36	35,894.86	NO	75,626.10	NO	NO	2.40
2008	118,100.38	34,370.01	NO	83,728.80	NO	NO	1.57
2009	34,405.60	14,836.00	NO	19,567.80	NO	NO	1.80
2010	17,965.77	14,363.91	NO	3,600.85	NO	NO	1.02
2011	18,910.03	15,416.02	NO	3,494.01	NO	NO	NO
2012	19,605.75	16,264.90	NO	3,340.86	NO	NO	NO
2013	62,612.04	27,591.97	NO	35,020.07	NO	NO	NO
2014	60,614.72	20,054.73	NO	40,559.76	NO	NO	0.24

Activity data 1.A.2.m	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
2015	76,489.20	22,381.99	NO	54,106.98	NO	NO	0.24
2016	71,279.28	23,574.03	NO	47,705.03	NO	NO	0.23
2017	50,706.55	14,438.81	NO	36,267.35	NO	NO	0.39
2018	50,500.24	5,889.42	NO	44,609.97	NO	NO	0.85
2019	81,225.42	3,656.34	NO	77,568.68	NO	NO	0.40
2020	68,713.69	7,637.08	NO	61,076.22	NO	NO	0.39
Trend							
1990 - 2020	-1.2%	-64.4%	NA	26.9%	NA	NA	NA
2005 - 2020	0.8%	-76.1%	NA	69.1%	NA	NA	-83.8%
2019 - 2020	-15.4%	108.9%	NA	-21.3%	NA	NA	-1.6%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table, the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.2.m Other are provided.

Table 210Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.2.m *Other (not-specified industry)*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Motor Gasoline* Essence automobile	TJ / Gg	44.75 * 0.95 = 42.51	44.3
	Residual Fuel Oil Fiouls résiduels	TJ / Gg	42.18 * 0.95 = 40.07	40.4
	Liquefied Petroleum Gas (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
	Other Kerosene Autres kérosènes	TJ / Gg	43.92 * 0.95 = 41.72	43.8
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	MEM/Sonatrach	40.2
biomass	Fuel Wood Bois/résidus de bois	TJ / Gg	MEM/Sonatrach	15.6
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
Conversion from weight in tons per m3 for fuelwood (general fuelwood)				
Fuelwood (general fuelwood)			Volume (m3) *0.707 = weight (tonnes)	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[233]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)		
	Conversion from GCV to NCV Conversion from weight in tons per m3 for fuelwood (general fuelwood)	International Recommendations for Energy Statistics (IRES) (2018) [234]: Table 4 Difference between net and gross calorific values for selected fuels Table 4.3 Conversion table for fuelwood (wood with 25 per cent moisture content)		
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

3.2.4.15.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas, liquid fuels and biomass were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 211 GHG Emission factor TIER 1 for IPCC category 1.A.2.m *Other (not-specified industry)*

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	1	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	3	D	0.6	D
	Motor Gasoline* Essence automobile	69,300	D	3	D	0.6	D
	Residual Fuel Oil Fiouls résiduels	77,400	D	3	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63,100	D	1	D	0.1	D
	Other Kerosene Autres kérosènes	71,900	D	3	D	0.6	D
	Other Petroleum Products Autres produits pétroliers	73,300	D	3	D	0.6	D
biomass	Fuelwood Bois/résidus de bois	112,000	D	30	D	4	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for						

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[233] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[234] https://unstats.un.org/unsd/energystats/methodology/ires/

Fuel type	**Fuel**	**CO₂ (kg/TJ)**		**CH₄ (kg/TJ)**		**N₂O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
	stationary combustion in the commercial/ institutional category						
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.4.15.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.4.a Commercial/ Institutional are presented in the following table.

Table 212Uncertainty for IPCC category 1.A.2.m *Other (not-specified industry).*

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	7%	7%	7%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	2%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			187%	based Table 2.14
Combined Uncertainty (U)	7%	150%	187%	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[235] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[236].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [237];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [238].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.4.15.4 Category-specific QA/QC and verification

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[235] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[236] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[237] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[238] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[239] and
    - international energy statistics of UN statistics[240] and International Energy Agency (IEA)[241]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.4.15.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.2.m Other*.

Table 213Recalculations done since NC in IPCC category 1.A.2.m *Other (not-specified industry)*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.2.g.viii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.2.g.viii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.2.g.viii	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.2.g.viii	Revision of CO_2 and CH_4 EF	EF	Accuracy Comparability
1.A.2.g.viii	Assumption of 100% oxidation	EF	Accuracy Comparability

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[239] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[240] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[241] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.4.15.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 214Planned improvements for IPCC category 1.A.2.m *Other (not-specified industry)*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.2.m	Energy balance • Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content)	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.2.m	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.2.m	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	medium

3.2.5 Transport (IPCC category 1.A.3)

This section describes GHG emissions resulting from fuel combustion in transport sector, which originate from the following subcategories.

IPCC code	Description	Occurrent			Not occurrent (NO)
		Estimated	Not estimated (NE)	Included elsewhere (IE)	
1.A.3.a.i	Domestic Aviation (Civil)	✓			
1.A.3.b	Road Transportation				
1.A.3.b.i	Cars	✓			
1.A.3.b.ii	Light-duty trucks			✓ (in 1.A.3.b.i)	
1.A.3.b.iii	Heavy-duty trucks and buses			✓ (in 1.A.3.b.i)	
1.A.3.b.iv	Motorcycles			✓ (in 1.A.3.b.i)	
1.A.3.b.v	Evaporative emissions from vehicles		✓		
1.A.3.b.vi	Urea-based catalysts		✓		
1.A.3.c	Railways	✓			
1.A.3.d	Domestic Water-borne Navigation	✓			
1.A.3.e	Other Transportation				
1.A.3.e.i	Pipeline transport	✓			
1.A.3.e.ii	Other				✓

An overview of the GHG emission from fuel combustion in IPCC category 1.A.3 *Transport* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020 and 2019 – 2020;

The greenhouse gas emissions from IPCC category 1.A.3 Transport amounted to 14,214.35 kt CO_2 equivalents in 1990, 15,111.41 kt CO_2 equivalents in 2005 and 39,366.94 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.3 Transport shows an increase by 177%from 1990 to 2020, 160.5% from 2005 to 2020 and a decrease of 12.3% from 2019 to 2020.

The increase in GHG emissions from the transport sector is due to the increase in the national vehicle fleet with the import of vehicles and trucks as result of the improvement of the country's economic situation, the increase in the number of buses (population increase) and the launch of infrastructure projects since 2005. It should also be noted that the Algerian car fleet is characterized by a high rate of diesel cars those are an important source of GHG emissions given that Algerian citizens make massive use of light vehicles for travel. The decrease in GHG emissions between 2019 and 2020 is explained by the decrease in human activities during the Covid 19 pandemic.

The most important fuels gas/diesel and motor gasoline.

In 2020, the share in IPCC category 1.A.3 *Transport* contribute with

- 94.7% the IPCC category 1.A.3.b *Road Transportation*
- 3.2% the IPCC category 1.A.3.e *Other Transportation – pipeline transport*
- 2.0% the IPCC category 1.A.3.a.i *Domestic Aviation (Civil)*
- 0.1% the IPCC category 1.A.3.c *Railways* and 1.A.3.d *Domestic Water-borne Navigation*.

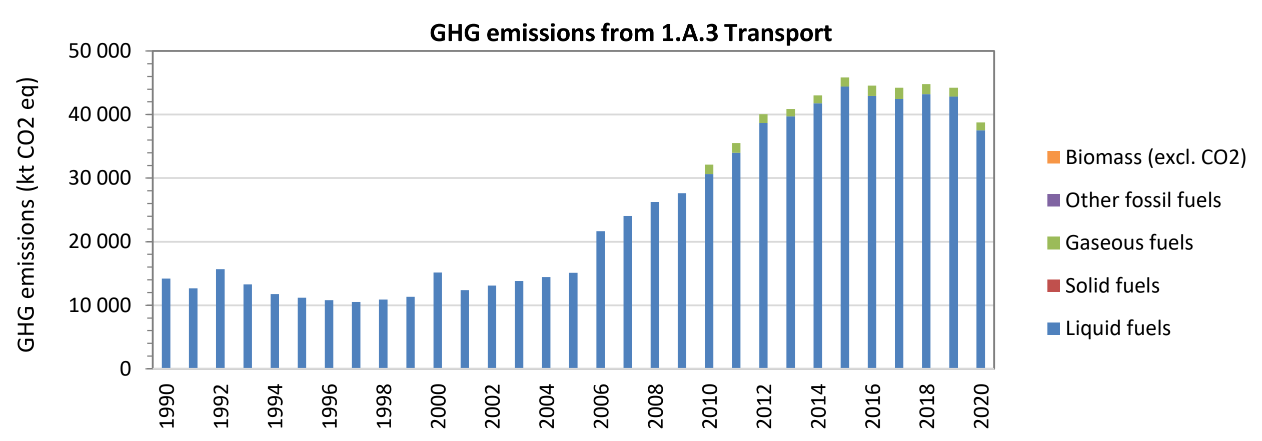

Figure 83 GHG Emissions from IPCC category 1.A.3 *Transport* by category

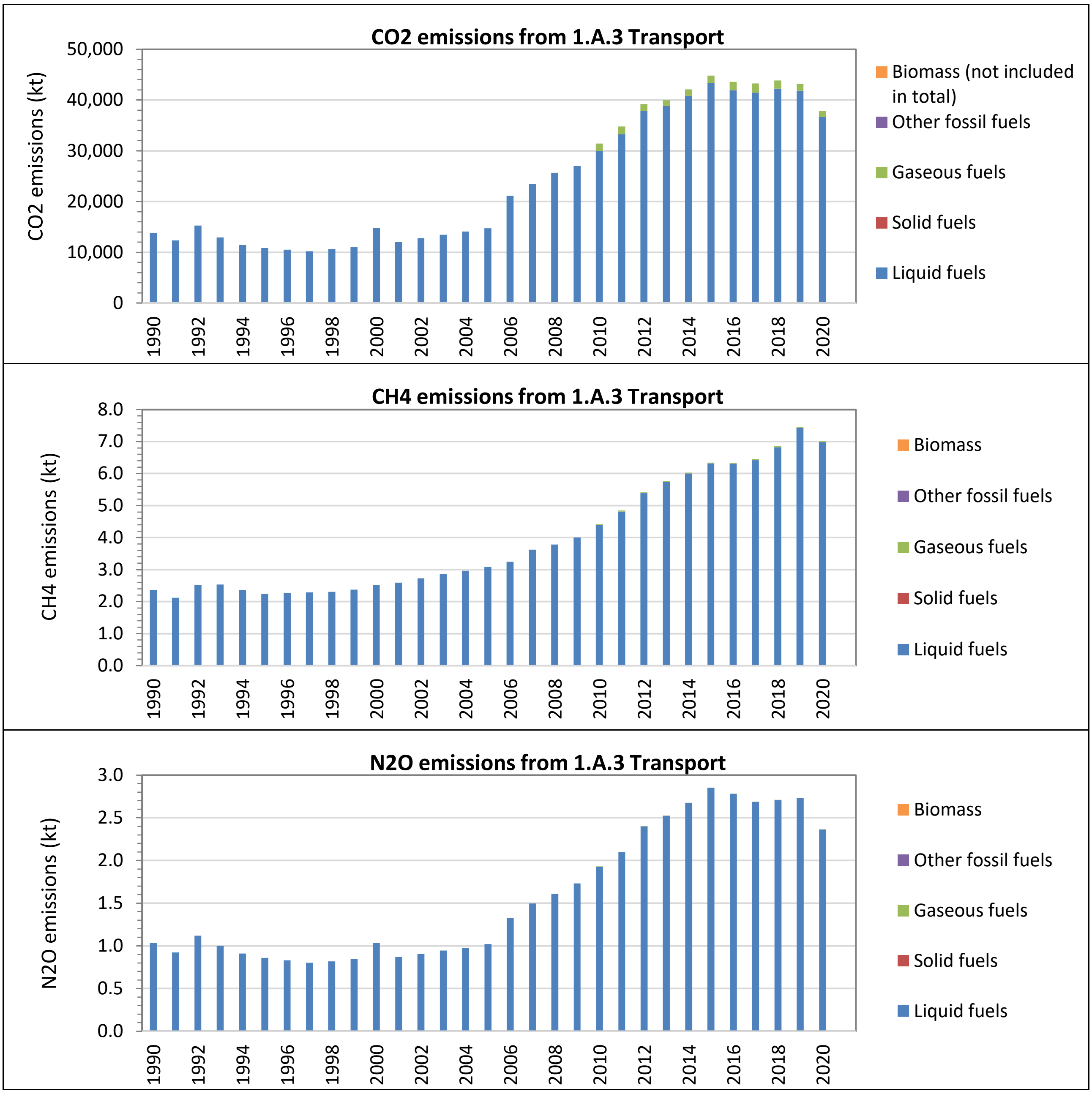

Figure 84 Emissions from IPCC category 1.A.3 *Transport*

Table 215 GHG Emissions by fuels from IPCC category 1.A.3 *Transport*

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.3	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	14,214.35	14,214.35	NO	NO	NO	NO	NO
1991	12,683.30	12,683.30	NO	NO	NO	NO	NO
1992	15,682.13	15,682.13	NO	NO	NO	NO	NO
1993	13,306.50	13,306.50	NO	NO	NO	NO	NO
1994	11,741.92	11,741.92	NO	NO	NO	NO	NO
1995	11,181.53	11,181.53	NO	NO	NO	NO	NO
1996	10,807.38	10,807.38	NO	NO	NO	NO	NO
1997	10,521.25	10,521.25	NO	NO	NO	NO	NO
1998	10,911.32	10,911.32	NO	NO	NO	NO	NO
1999	11,341.41	11,341.41	NO	NO	NO	NO	NO
2000	15,157.17	15,157.17	NO	NO	NO	NO	NO
2001	12,353.30	12,353.30	NO	NO	NO	NO	NO
2002	13,091.09	13,091.09	NO	NO	NO	NO	NO
2003	13,795.47	13,795.47	NO	NO	NO	NO	NO
2004	14,442.77	14,442.77	NO	NO	NO	NO	NO
2005	15,111.41	15,111.41	NO	NO	NO	NO	NO
2006	21,636.05	21,636.05	NO	NO	NO	NO	NO
2007	24,040.37	24,040.37	NO	NO	NO	NO	NO
2008	26,228.69	26,228.69	NO	NO	NO	NO	NO
2009	27,725.33	27,725.33	NO	NO	NO	NO	NO
2010	32,217.28	30,777.61	NO	1,439.66	NO	NO	NO
2011	35,541.07	33,968.83	NO	1,572.24	NO	NO	NO
2012	40,074.03	38,656.74	NO	1,417.30	NO	NO	NO
2013	40,879.96	39,741.04	NO	1,138.92	NO	NO	NO
2014	43,026.83	41,758.74	NO	1,268.09	NO	NO	NO
2015	45,834.85	44,389.51	NO	1,445.33	NO	NO	NO
2016	44,643.50	43,033.23	NO	1,610.27	NO	NO	NO
2017	44,208.48	42,432.32	NO	1,776.17	NO	NO	NO
2018	44,922.18	43,318.45	NO	1,603.73	NO	NO	NO
2019	44,903.97	43,527.92	NO	1,376.05	NO	NO	NO
2020	39,366.94	38,136.42	NO	1,230.52	NO	NO	NO
Trend							
1990 - 2020	177.0%	168.3%	NA	NA	NA	NA	NA
2005 - 2020	160.5%	152.4%	NA	NA	NA	NA	NA
2019 - 2020	-12.3%	-12.4%	NA	-10.6%	NA	NA	NA

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 216 CO_2 Emissions by fuels from IPCC category 1.A.3 *Transport*

CO_2	Total CO_2 emissions (excluding CO_2 from biomass)	CO_2 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass (1)
1.A.3	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	13,847.426	13,847.426	NO	IE	NO	NO	NO
1991	12,355.128	12,355.128	NO	IE	NO	NO	NO
1992	15,285.076	15,285.076	NO	IE	NO	NO	NO
1993	12,944.105	12,944.105	NO	IE	NO	NO	NO
1994	11,411.844	11,411.844	NO	IE	NO	NO	NO
1995	10,869.633	10,869.633	NO	IE	NO	NO	NO
1996	10,503.284	10,503.284	NO	IE	NO	NO	NO
1997	10,225.265	10,225.265	NO	IE	NO	NO	NO
1998	10,610.282	10,610.282	NO	IE	NO	NO	NO
1999	11,030.098	11,030.098	NO	IE	NO	NO	NO
2000	14,786.627	14,786.627	NO	IE	NO	NO	NO
2001	12,029.946	12,029.946	NO	IE	NO	NO	NO
2002	12,752.907	12,752.907	NO	IE	NO	NO	NO
2003	13,442.332	13,442.332	NO	IE	NO	NO	NO
2004	14,078.172	14,078.172	NO	IE	NO	NO	NO
2005	14,729.909	14,729.909	NO	IE	NO	NO	NO
2006	21,160.249	21,160.249	NO	IE	NO	NO	NO
2007	23,503.485	23,503.485	NO	IE	NO	NO	NO
2008	25,654.618	25,654.618	NO	IE	NO	NO	NO
2009	27,110.485	27,110.485	NO	IE	NO	NO	NO
2010	31,532.857	30,094.572	NO	1,438.284	NO	NO	NO
2011	34,794.782	33,224.051	NO	1,570.731	NO	NO	NO
2012	39,222.485	37,806.547	NO	1,415.938	NO	NO	NO
2013	39,983.000	38,845.173	NO	1,137.827	NO	NO	NO
2014	42,079.347	40,812.474	NO	1,266.873	NO	NO	NO
2015	44,826.022	43,382.075	NO	1,443.947	NO	NO	NO
2016	43,656.798	42,048.073	NO	1,608.725	NO	NO	NO
2017	43,245.990	41,471.525	NO	1,774.466	NO	NO	NO
2018	43,944.181	42,341.989	NO	1,602.192	NO	NO	NO
2019	43,904.254	42,529.527	NO	1,374.728	NO	NO	NO
2020	38,487.634	37,258.298	NO	1,229.336	NO	NO	NO
Trend							
1990 - 2020	177.9%	169.1%	NA	NA	*NA*	*NA*	*NA*
2005 - 2020	161.3%	152.9%	NA	NA	*NA*	*NA*	*NA*
2019 - 2020	-12.3%	-12.4%	NA	-10.6%	*NA*	*NA*	*NA*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 217 N_2O Emissions by fuels from IPCC category 1.A.3 *Transport*

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.3	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	1.03	1.03	NO	IE	NO	NO	NO
1991	0.92	0.92	NO	IE	NO	NO	NO
1992	1.12	1.12	NO	IE	NO	NO	NO
1993	1.00	1.00	NO	IE	NO	NO	NO
1994	0.91	0.91	NO	IE	NO	NO	NO
1995	0.86	0.86	NO	IE	NO	NO	NO
1996	0.83	0.83	NO	IE	NO	NO	NO
1997	0.80	0.80	NO	IE	NO	NO	NO
1998	0.82	0.82	NO	IE	NO	NO	NO
1999	0.85	0.85	NO	IE	NO	NO	NO
2000	1.03	1.03	NO	IE	NO	NO	NO
2001	0.87	0.87	NO	IE	NO	NO	NO
2002	0.91	0.91	NO	IE	NO	NO	NO
2003	0.94	0.94	NO	IE	NO	NO	NO
2004	0.97	0.97	NO	IE	NO	NO	NO
2005	1.02	1.02	NO	IE	NO	NO	NO
2006	1.32	1.32	NO	IE	NO	NO	NO
2007	1.50	1.50	NO	IE	NO	NO	NO
2008	1.61	1.61	NO	IE	NO	NO	NO
2009	1.73	1.73	NO	IE	NO	NO	NO
2010	1.93	1.93	NO	0.003	NO	NO	NO
2011	2.10	2.10	NO	0.003	NO	NO	NO
2012	2.40	2.40	NO	0.002	NO	NO	NO
2013	2.53	2.52	NO	0.002	NO	NO	NO
2014	2.67	2.67	NO	0.002	NO	NO	NO
2015	2.85	2.85	NO	0.003	NO	NO	NO
2016	2.78	2.78	NO	0.003	NO	NO	NO
2017	2.69	2.69	NO	0.003	NO	NO	NO
2018	2.71	2.71	NO	0.003	NO	NO	NO
2019	2.73	2.73	NO	0.002	NO	NO	NO
2020	2.37	2.36	NO	0.002	NO	NO	NO
Trend							
1990 - 2020	*129.0%*	*128.8%*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*131.6%*	*131.4%*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-13.5%*	*-13.5%*	*NA*	*-10.6%*	*NA*	*NA*	*NA*

Table 218 CH_4 Emissions by fuels from IPCC category 1.A.3 *Transport*

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.3	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	2.36	2.36	NO	IE	NO	NO	NO
1991	2.12	2.12	NO	IE	NO	NO	NO
1992	2.52	2.52	NO	IE	NO	NO	NO
1993	2.54	2.54	NO	IE	NO	NO	NO
1994	2.36	2.36	NO	IE	NO	NO	NO
1995	2.24	2.24	NO	IE	NO	NO	NO
1996	2.27	2.27	NO	IE	NO	NO	NO
1997	2.29	2.29	NO	IE	NO	NO	NO
1998	2.30	2.30	NO	IE	NO	NO	NO
1999	2.37	2.37	NO	IE	NO	NO	NO
2000	2.51	2.51	NO	IE	NO	NO	NO
2001	2.60	2.60	NO	IE	NO	NO	NO
2002	2.73	2.73	NO	IE	NO	NO	NO
2003	2.87	2.87	NO	IE	NO	NO	NO
2004	2.97	2.97	NO	IE	NO	NO	NO
2005	3.09	3.09	NO	IE	NO	NO	NO
2006	3.24	3.24	NO	IE	NO	NO	NO
2007	3.62	3.62	NO	IE	NO	NO	NO
2008	3.78	3.78	NO	IE	NO	NO	NO
2009	3.97	3.97	NO	IE	NO	NO	NO
2010	4.38	4.36	NO	0.03	NO	NO	NO
2011	4.84	4.82	NO	0.03	NO	NO	NO
2012	5.41	5.38	NO	0.02	NO	NO	NO
2013	5.76	5.74	NO	0.02	NO	NO	NO
2014	6.03	6.01	NO	0.02	NO	NO	NO
2015	6.34	6.32	NO	0.03	NO	NO	NO
2016	6.31	6.28	NO	0.03	NO	NO	NO
2017	6.45	6.42	NO	0.03	NO	NO	NO
2018	6.81	6.79	NO	0.03	NO	NO	NO
2019	7.41	7.38	NO	0.02	NO	NO	NO
2020	6.98	6.96	NO	0.02	NO	NO	NO
Trend							
1990 - 2020	195.2%	194.3%	NA	NA	*NA*	*NA*	*NA*
2005 - 2020	126.2%	125.5%	NA	NA	*NA*	*NA*	*NA*
2019 - 2020	-5.8%	-5.7%	NA	-10.6%	*NA*	*NA*	*NA*

3.2.5.1 Domestic aviation (IPCC category 1.A.3.a.ii)

3.2.5.1.1 Category description

As described in the 2006 IPCC Guidelines, the IPCC category 1.A.3.a.ii *Domestic Aviation includes* emissions from flights that depart in one country and arrive in the same country. Also, *Domestic Aviation* include IPCC category 1.A.3.a.ii take-offs and landings for these flight stages. It is *good practice*, that emissions from *Domestic Aviation* are reported separately from *Domestic aviation* and it is *good practice* to apply the definition presented in the following table.

Table 219 Criteria for defining international and domestic *Aviation.*

Criteria for defining international or domestic navigation (applies to individual legs of journeys with more than one take-off and landing)		
Journey type between two airports	**Domestic**	**International**
• Departs and arrives in same country	Yes	No
• Departs from one country and arrives in another	No	Yes
Source: 2006 IPCC Guidelines. Volume 2. Chapter 3: Mobile Combustion. 3.6.1.3 Choice of activity data. TABLE 3.6.		

This section describes GHG emissions resulting from fuel combustion in *Domestic Aviation* (IPCC category 1.A.3.a.ii).

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.3.a.ii	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO	✓	NA	NA	NA	NA	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

The greenhouse gas emissions from IPCC category 1.A.3.a.ii *Domestic aviation* amounted to 481.38 kt CO_2 equivalents in 1990, 155.45 kt CO_2 equivalents in 2005 and 762.25 kt CO_2 equivalents in 2020.
The overall trend of GHG emissions from IPCC category 1.A.3.a.ii of domestic aviation shows an increase of 59.4% from 1990 to 2020 and an increase of 390.4% from 2005 to 2020. In 2005, GHG emissions were about 30% of the 1990 level due to the political situation in Algeria. Due to the global COVID 19 pandemic and the lockdown, a decrease of 46.0% was observed between 2019 and 2020.

GHG emissions from domestic aviation increased between 1990 and 2009, mainly due to the increase in passenger and freight transport activities and the increase in the number of aircraft with the improvement of the country's economic situation. The emergence of new airlines such as Khalifa and Tassili has led to an increase in the number of take-offs and landings within the country, which has increased GHG emissions.

Figure 85 GHG emissions from IPCC category 1.A.3.a.ii Domestic aviation

Table 220 Activity data and Emissions from *IPCC category 1.A.3.a.ii Domestic aviation*

1.A.3.a.ii Domestic aviation	**Emissions**				**Activity data**	
	GHG	**CO_2**	**N_2O**	**CH_4**	**Jet Kerosene**	**Aviation fuel**
	Kt CO_2 equivalent	**kt**	**kt**	**kt**	**[TJ]**	**[TJ]**
1990	481.38	477.32	0.013	0.003	6.675.84	NO
1991	421.21	417.66	0.012	0.003	5.841.36	NO
1992	722.08	715.98	0.020	0.005	10,013.76	NO
1993	448.29	444.51	0.012	0.003	6,216.88	NO
1994	303.87	301.31	0.008	0.002	4,214.12	NO
1995	291.84	289.38	0.008	0.002	4,047.23	NO
1996	297.86	295.34	0.008	0.002	4,130.68	NO
1997	373.07	369.92	0.010	0.003	5,173.78	NO
1998	349.00	346.06	0.010	0.002	4,839.98	NO
1999	352.01	349.04	0.010	0.002	4,881.71	NO
2000	309.89	307.28	0.009	0.002	4,297.57	NO
2001	391.13	387.82	0.011	0.003	5,424.12	NO
2002	90.26	89.50	0.003	0.001	1,251.72	NO
2003	45.13	44.75	0.001	0.000	625.86	NO
2004	385.11	381.86	0.011	0.003	5,340.67	NO
2005	156.45	155.13	0.004	0.001	2,169.65	NO
2006	NE	NE	NE	NE	NE	NO
2007	NE	NE	NE	NE	NE	NO
2008	646.86	641.40	0.018	0.004	8,970.66	NO
2009	466.34	462.41	0.013	0.003	6,467.22	NO
2010	1,352.42	1,341.01	0.038	0.009	18,755.36	NO
2011	1,367.36	1,355.82	0.038	0.009	18,962.47	NO
2012	1,522.12	1,509.28	0.042	0.011	21,108.76	NO
2013	1,165.53	1,155.70	0.032	0.008	16,163.63	NO
2014	1,248.60	1,238.06	0.035	0.009	17,315.59	NO
2015	1,365.49	1,353.97	0.038	0.009	18,936.67	NO
2016	1,382.82	1,371.15	0.038	0.010	19,176.99	NO
2017	1,422.66	1,410.65	0.039	0.010	19,729.41	NO
2018	1,742.98	1,728.27	0.048	0.012	24,171.67	NO
2019	1,419.88	1,407.90	0.039	0.010	19,690.89	NO
2020	767.25	760.78	0.021	0.005	10,640.25	NO
Trend						
1990 - 2020	59.4%	59.4%	59.4%	59.4%	59.4%	NA
2005 - 2020	390.4%	390.4%	390.4%	390.4%	390.4%	NA
2019 - 2020	-46.0%	-46.0%	-46.0%	-46.0%	-46.0%	NA

3.2.5.1.2 Methodological issues

3.2.5.1.2.1 Choice of methods – TIER 1

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[242] has been applied:

Equation 3.6.1: Aviation equation (2006 IPCC GL. Vol. 3. Chap. 3.6.1.1)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., jet kerosene, aviation gasoline

3.2.5.1.2.2 Choice of activity data

The following fuels are used in *Domestic aviation*:

Liquid fuels:
- Jet Kerosene

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[243] ;
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[244].

Total fuel consumption increased by 59.4% over the period 1990-2020 due to the increased travel of a growing population. In general, during this period the mobility of the population has increased significantly. From 2005 to 2020, total fuel consumption increased by 390.4%. This increase is explained by the improvement of the country's revenues with the increase in oil prices which allowed the launch of several infrastructure projects. This improvement is accompanied by the change in the behaviour of state and public companies with the movement of their employees and executives using air transport.

From 2019 to 2020 total fuel consumption decreased by 46.0% due to the blockage caused by the covid 19 pandemic which led to the freezing of national air transport.

For the years 2006 and 2007 no activity data are provided in the energy balance. Therefore, the notation key not estimated was used.

In energy statistics production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units. e.g., in tones or cubic meters. To convert these data to energy units in this case terajoules requires calorific values. The emission calculations are based on net calorific values. In the following table, the applied net calorific values (NCVs) for conversion to energy units in IPCC category *Domestic aviation* are provided.

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[242] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.6.1.1 Methodological issues - Choice of method

[243] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[244] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 221 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category IPCC category 1.A.3.a.ii *Domestic aviation*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV ***
liquid	Jet Kerosene	TJ / Gg	43.92 * 0.95 = 41.72	44.1

Conversion from GCV to NCV	**Default**
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[245]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2

Note:

D	Default	CS	Country specific	PS	Plant specific
*	For comparision				

3.2.5.1.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Jet Kerosene were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 222 GHG Emission factors TIER 1 for IPCC category 1.A.3.a.ii *Domestic aviation*

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Jet Kerosene	71 500	D	0.5	D	2	D

Source	2006 IPCC Guidelines Vol. 2. Chap. 3 (3.6.1.2) Table 3.6.4 CO_2 emission factors and Table 3.6.5 NON-CO_2

Note:

D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.5.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category IPCC category 1.A.3.a.ii *Domestic aviation* are presented in the following table.

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[245] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

Table 223Uncertainty for IPCC category 1.A.3.a.ii *Domestic aviation.*

Uncertainty	**Jet Kerosene**			**Reference**
	CO_2	**CH_4**	**N_2O**	
Activity data (AD)	10%	10%	10%	2006 IPCC GL. Vol. 2. Chap. 3.6.1.7
Emission factor (EF)	5%	82%	133%	
Combined Uncertainty (U)	11%	83%	133%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2020 are taken from the Energy balance provided by MEM and UN statistics.
- 2010 - 2010 are taken from the National Energy balance prepared by MEM.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be done for future submissions.

3.2.5.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series),
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[246] and
    - international energy statistics of UN statistics[247] and International Energy Agency (IEA)[248]
- time series consistency - plausibility checks of dips and jumps.

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[246] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[247] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[248] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.5.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category IPCC category 1.A.3.a.ii *Domestic aviation.*

Table 224Recalculations done since NC in IPCC category 1.A.3.a.ii *Domestic aviation.*

Source category	Revisions of data	Type of revision	Type of improvement
1.3.1.a.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.3.1.a.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.3.1.a.ii	Revision of NCV: Default → country specific: jet kerosene	AD	Accuracy Comparability
1.3.1.a.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.5.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 225Planned improvements for IPCC category 1.A.3.a.ii *Domestic aviation*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.a.i 1.A.3.a.ii	Energy balance Revision of the energy balance (1990-2020) for all aviation related fuels • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all aviation related fuels ○ Jet kerosene ○ aviation gasoline • Investigation regarding fuel consumption of aviation gasoline used by small planes and helicopters.	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	• Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC GL. Vol. 2. Chap. 3: Mobile Combustion. 3.6.1.3 Choice of activity data. • Improvement of Energy balance: allocation of Jet kerosene used in *International* or *Domestic aviation* and Jet kerosene exported	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Collection of data on aircraft movement • international aviation • domestic aviation	AD	Accuracy Completeness Comparability Transparency	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.a.i 1.A.3.a.ii	Application of Tier 2 methodology • Estimate fuel consumption for LTO and cruise for ○ *International aviation* ○ domestic aviation • Estimate emissions from LTO and cruise phases for ○ *International aviation* ○ domestic *aviation*	M EF	Accuracy Completeness Comparability Transparency Consistency	high

3.2.5.2 Road transportation (IPCC category 1.A.3.b)

3.2.5.2.1 Category description

This section describes GHG emissions resulting from fuel combustion in Road Transport (IPCC category 1.A.3.b). The mobile *Road Transportation* includes all types of vehicles such as light-duty vehicles such as automobiles and light trucks, and heavy-duty vehicles such as tractor trailers and buses, and on-road motorcycles (including mopeds, scooters and three-wheelers).

IPCC category	description
1.A.3.b	Road Transportation
1.A.3.b.i	Cars
1.A.3.b.i.1	Passenger cars with 3-way catalysts
1.A.3.b.i.2	Passenger cars without 3-way catalysts
1.A.3.b.ii	Light-duty trucks
1.A.3.b.ii.1	Light-duty trucks with 3-way catalysts
1.A.3.b.ii.2	Light-duty trucks without 3-way catalysts
1.A.3.b.iii	Heavy-duty trucks and buses
1.A.3.b.iv	Motorcycles
1.A.3.b.v	Evaporative emissions from vehicles
1.A.3.b.vi	Urea-based catalysts

Estimated	**CO_2**							**CH_4**							**N_2O**						
	Gasoline	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Biomass**	**Other fossil fuels**	**Gasoline**	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Biomass**	**Other fossil fuels**	**Gasoline**	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Biomass**	**Other fossil fuels**
1.A.3.b (i-iv)	✓	✓	✓	NO	NO	NO	NO	✓	✓	✓	NO	NO	NO	NO	✓	✓	✓	NO	NO	NO	NO
1.A.3.b.v	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.A.3.b.vi	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Key category																					
1.A.3.b (i-iv)	LA 1990 & 2020 TA	LA 1990 & 2020 TA	LA 2020																		
1.A.3.b.v																					
1.A.3.b.vi																					

A '✓' indicates: emissions from this sub-category have been estimated.
Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential

Key Category: LA – Level Assessment (in year); TA – Trend Assessment

An overview of the GHG emission from fuel combustion in IPCC category 1.A.3.b *Road transport* is provided in the following figures and tables:

- annual GHG emissions;
- Trend of the periods 2010 – 2020. 2019 – 2020.

The IPCC category 1.A.3.b *Road transport* is for CO_2 and Diesel oil, Gasoline and LPG key source.

Greenhouse gas emissions from road transport in IPCC category 1.A.3.b have increased by 167.5% from 13,732.96 kt CO_2 equivalent in 1990 to 36,739.08 kt CO_2 equivalent in 2020. In addition, GHG emissions have increased by 145.7% over the period 2005-2020. The significant increase in GHG emissions is the result of the growing mobility within cities but also between cities, the increase in freight transport due to the increase in domestic production but also to imports and exports. This evolution is also reflected in the transport fleet as shown in the following figure following the improvement of the country's economic situation and the citizen's standard of living from 2005 onwards.

In the period 2019 to 2020 GHG emissions from the IPCC category 1.A.3.b *Road transport* decreased by 1.2% from 41,369.74 kt CO_2 equivalent in 2019 to 36,739.08 kt CO_2 equivalent in 2020 as a result of nationwide lockdown due to the covid pandemic.

About 66% of the GHG emissions from IPCC category 1.A.3.b *Road transport* are from vehicles fulling up Gas/Diesel Oil.

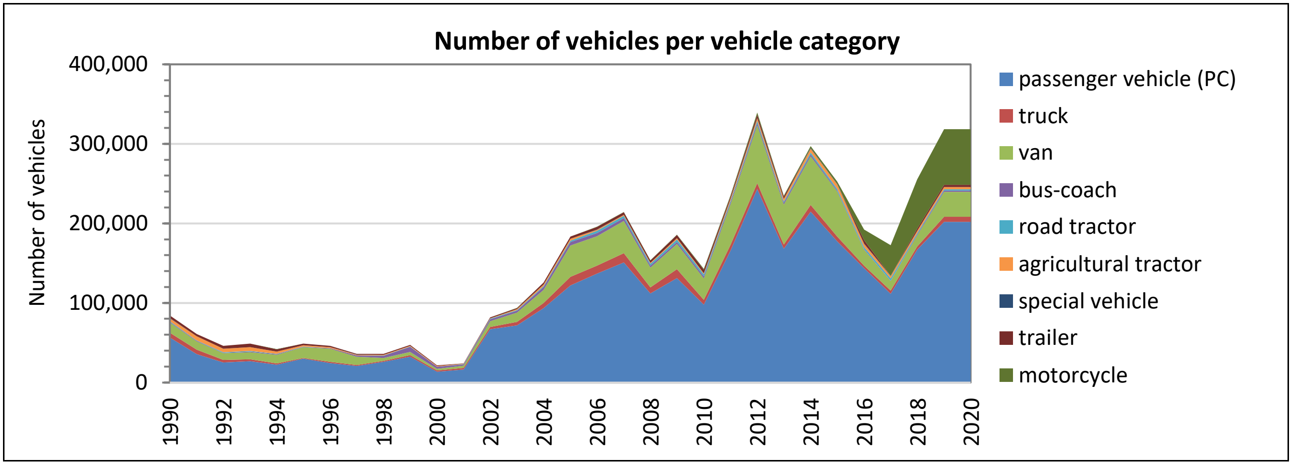

Figure 86 Number of vehicles by vehicle category

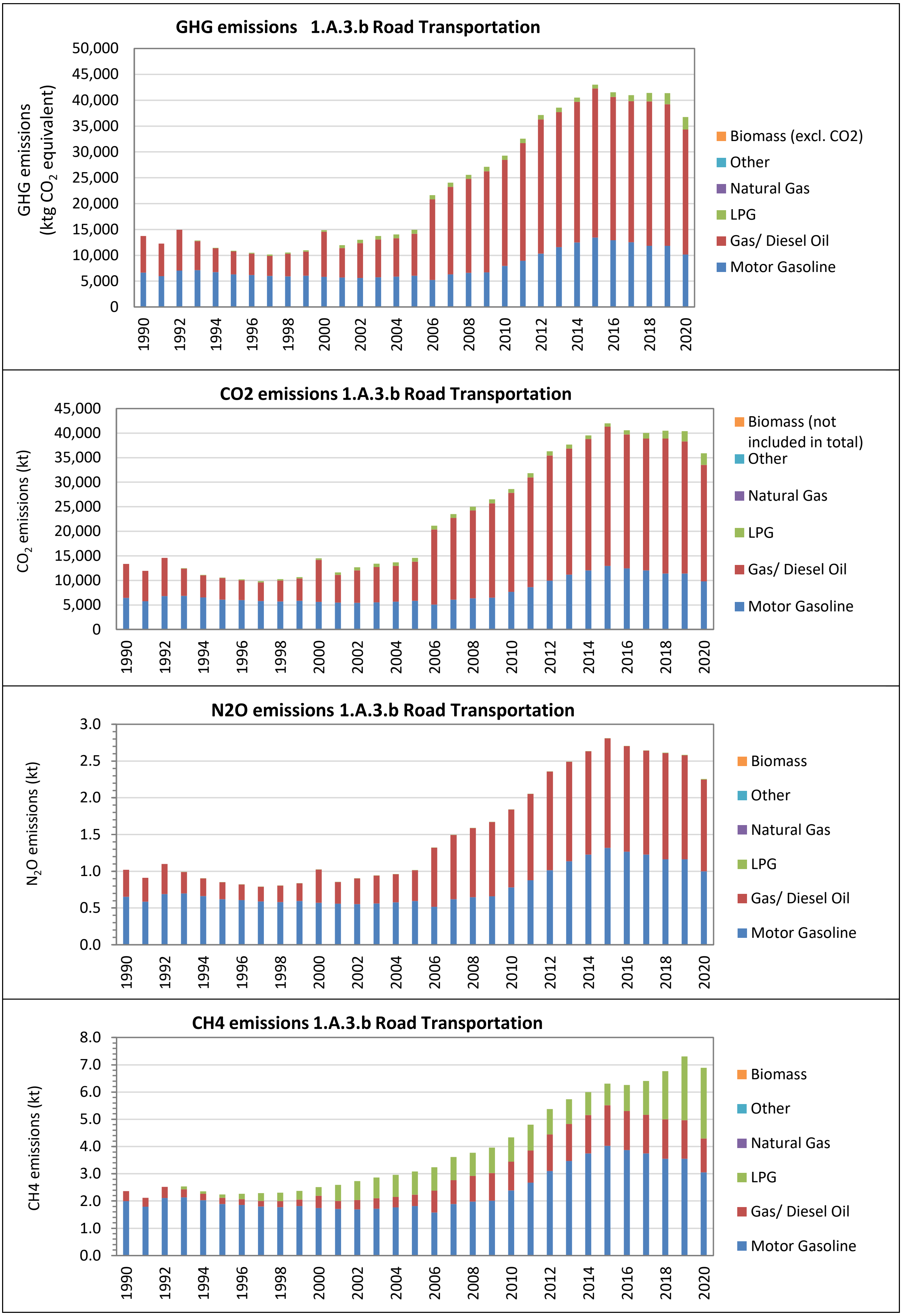

Figure 87 GHG emissions from IPCC category 1.A.3.b Road transportation

Table 226 GHG Emissions by fuels from IPCC category 1.A.3.b Road transportation

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**						
		Gasoline	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Biomass**
	kt CO_2 equivalent							
1990	13,732.96	6,658.29	7,074.67	NE	NO	NO	NO	NO
1991	12,262.09	5,976.25	6,285.83	NE	NO	NO	NO	NO
1992	14,960.05	7,037.54	7,922.51	NE	NO	NO	NO	NO
1993	12,858.21	7,120.12	5,636.75	101.34	NO	NO	NO	NO
1994	11,438.04	6,759.22	4,590.15	88.67	NO	NO	NO	NO
1995	10,889.70	6,300.45	4,475.24	114.00	NO	NO	NO	NO
1996	10,509.52	6,187.29	4,139.83	182.41	NO	NO	NO	NO
1997	10,148.17	6,003.78	3,875.85	268.54	NO	NO	NO	NO
1998	10,562.31	5,912.03	4,366.54	283.74	NO	NO	NO	NO
1999	10,989.40	6,061.89	4,633.63	293.88	NO	NO	NO	NO
2000	14,847.28	5,817.21	8,736.19	293.88	NO	NO	NO	NO
2001	11,962.17	5,691.82	5,720.60	549.75	NO	NO	NO	NO
2002	13,000.83	5,639.82	6,717.52	643.49	NO	NO	NO	NO
2003	13,750.35	5,740.75	7,295.17	714.43	NO	NO	NO	NO
2004	14,057.66	5,887.56	7,410.08	760.03	NO	NO	NO	NO
2005	14,954.96	6,061.89	8,102.64	790.43	NO	NO	NO	NO
2006	21,636.05	5,254.45	15,581.04	800.56	NO	NO	NO	NO
2007	24,040.37	6,300.45	16,944.42	795.49	NO	NO	NO	NO
2008	25,581.83	6,597.12	18,186.68	798.03	NO	NO	NO	NO
2009	27,132.85	6,719.46	19,546.95	866.43	NO	NO	NO	NO
2010	29,276.04	7,965.15	20,480.76	830.12	NO	NO	NO	NO
2011	32,570.64	8,930.76	22,754.72	885.16	NO	NO	NO	NO
2012	37,122.82	10,342.63	25,911.50	868.69	NO	NO	NO	NO
2013	38,560.14	11,587.34	26,128.32	844.49	NO	NO	NO	NO
2014	40,484.31	12,493.28	27,203.90	787.13	NO	NO	NO	NO
2015	42,997.61	13,429.49	28,831.97	736.15	NO	NO	NO	NO
2016	41,525.30	12,917.46	27,717.34	890.50	NO	NO	NO	NO
2017	40,990.89	12,516.79	27,316.38	1,157.72	NO	NO	NO	NO
2018	41,426.43	11,856.63	27,923.13	1,646.67	NO	NO	NO	NO
2019	41,368.74	11,849.06	27,343.79	2,175.89	NO	NO	NO	NO
2020	36,739.08	10,169.48	24,153.61	2,415.99	NO	NO	NO	NO
Trend								
1990 - 2020	*167.5%*	*52.7%*	*241.4%*	*NA*	NA	NA	NA	NA
2005 - 2020	*145.7%*	*67.8%*	*198.1%*	*205.7%*	NA	NA	NA	NA
2019 - 2020	*-11.2%*	*-14.2%*	*-11.7%*	*11.0%*	NA	NA	NA	NA

(1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 227 CO_2 Emissions by fuels from IPCC category 1.A.3.b Road transportation

CO_2	**Total GHG emissions** (excluding CO_2 from biomass)	**CO_2 emission from**						
		Gasoline	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Biomass (1)**
	kt							
1990	13,370.10	6,413.70	6,956.41	NE	NO	NO	NO	NO
1991	11,937.47	5,756.71	6,180.76	NE	NO	NO	NO	NO
1992	14,569.09	6,779.01	7,790.08	NE	NO	NO	NO	NO
1993	12,499.60	6,858.56	5,542.53	98.51	NO	NO	NO	NO
1994	11,110.53	6,510.92	4,513.42	86.20	NO	NO	NO	NO
1995	10,580.26	6,069.00	4,400.43	110.82	NO	NO	NO	NO
1996	10,207.94	5,959.99	4,070.63	177.32	NO	NO	NO	NO
1997	9,855.34	5,783.23	3,811.06	261.05	NO	NO	NO	NO
1998	10,264.22	5,694.84	4,293.55	275.83	NO	NO	NO	NO
1999	10,681.06	5,839.20	4,556.17	285.68	NO	NO	NO	NO
2000	14,479.35	5,603.51	8,590.16	285.68	NO	NO	NO	NO
2001	11,642.12	5,482.72	5,624.98	534.42	NO	NO	NO	NO
2002	12,663.41	5,432.64	6,605.23	625.54	NO	NO	NO	NO
2003	13,397.58	5,529.86	7,173.22	694.50	NO	NO	NO	NO
2004	13,696.31	5,671.27	7,286.21	738.83	NO	NO	NO	NO
2005	14,574.78	5,839.20	7,967.19	768.38	NO	NO	NO	NO
2006	21,160.25	5,061.43	15,320.59	778.23	NO	NO	NO	NO
2007	23,503.49	6,069.00	16,661.18	773.31	NO	NO	NO	NO
2008	25,013.22	6,354.77	17,882.67	775.77	NO	NO	NO	NO
2009	26,535.09	6,472.62	19,220.21	842.26	NO	NO	NO	NO
2010	28,617.92	7,672.54	20,138.41	806.97	NO	NO	NO	NO
2011	31,837.51	8,602.68	22,374.36	860.47	NO	NO	NO	NO
2012	36,285.51	9,962.69	25,478.37	844.46	NO	NO	NO	NO
2013	37,674.16	11,161.66	25,691.56	820.93	NO	NO	NO	NO
2014	39,548.67	12,034.33	26,749.17	765.18	NO	NO	NO	NO
2015	42,001.78	12,936.14	28,350.02	715.62	NO	NO	NO	NO
2016	40,562.61	12,442.92	27,254.02	865.66	NO	NO	NO	NO
2017	40,042.17	12,056.97	26,859.77	1,125.43	NO	NO	NO	NO
2018	40,478.18	11,421.07	27,456.37	1,600.74	NO	NO	NO	NO
2019	40,415.70	11,413.78	26,886.71	2,115.20	NO	NO	NO	NO
2020	35,894.36	9,795.89	23,749.86	2,348.61	NO	NO	NO	NO
Trend								
1990 - 2020	*168.5%*	*52.7%*	*241.4%*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*146.3%*	*67.8%*	*198.1%*	*205.7%*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-11.2%*	*-14.2%*	*-11.7%*	*11.0%*	*NA*	*NA*	*NA*	*NA*

(1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 228 N_2O Emissions by fuels from IPCC category 1.A.3.b Road transportation

N_2O	**Total GHG emissions**	**N_2O emissions from**						
		Gasoline	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Biomass**
	kt							
1990	1.02	0.65	0.37	NE	NO	NO	NO	NO
1991	0.91	0.59	0.33	NE	NO	NO	NO	NO
1992	1.10	0.69	0.41	NE	NO	NO	NO	NO
1993	0.99	0.70	0.29	0.000	NO	NO	NO	NO
1994	0.90	0.66	0.24	0.000	NO	NO	NO	NO
1995	0.85	0.62	0.23	0.000	NO	NO	NO	NO
1996	0.82	0.61	0.21	0.001	NO	NO	NO	NO
1997	0.79	0.59	0.20	0.001	NO	NO	NO	NO
1998	0.81	0.58	0.23	0.001	NO	NO	NO	NO
1999	0.84	0.59	0.24	0.001	NO	NO	NO	NO
2000	1.02	0.57	0.45	0.001	NO	NO	NO	NO
2001	0.86	0.56	0.30	0.002	NO	NO	NO	NO
2002	0.90	0.55	0.35	0.002	NO	NO	NO	NO
2003	0.94	0.56	0.38	0.002	NO	NO	NO	NO
2004	0.96	0.58	0.38	0.003	NO	NO	NO	NO
2005	1.02	0.59	0.42	0.003	NO	NO	NO	NO
2006	1.32	0.52	0.81	0.003	NO	NO	NO	NO
2007	1.50	0.62	0.88	0.003	NO	NO	NO	NO
2008	1.59	0.65	0.94	0.003	NO	NO	NO	NO
2009	1.67	0.66	1.01	0.003	NO	NO	NO	NO
2010	1.84	0.78	1.06	0.003	NO	NO	NO	NO
2011	2.06	0.88	1.18	0.003	NO	NO	NO	NO
2012	2.36	1.01	1.34	0.003	NO	NO	NO	NO
2013	2.49	1.14	1.35	0.003	NO	NO	NO	NO
2014	2.64	1.23	1.41	0.003	NO	NO	NO	NO
2015	2.81	1.32	1.49	0.003	NO	NO	NO	NO
2016	2.71	1.27	1.43	0.003	NO	NO	NO	NO
2017	2.65	1.23	1.41	0.004	NO	NO	NO	NO
2018	2.61	1.16	1.45	0.006	NO	NO	NO	NO
2019	2.59	1.16	1.42	0.008	NO	NO	NO	NO
2020	2.26	1.00	1.25	0.008	NO	NO	NO	NO
Trend								
1990 - 2020	*121.3%*	*52.7%*	*241.4%*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*121.9%*	*67.8%*	*198.1%*	*205.7%*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-12.7%*	*-14.2%*	*-11.7%*	*11.0%*	*NA*	*NA*	*NA*	*NA*

Table 229 CH_4 Emissions by fuels from IPCC category 1.A.3.b Road transportation

CH_4	**Total GHG emissions**	**CH_4 emissions from**						
		Gasoline	**Diesel oil**	**LPG**	**Other liquid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Biomass**
	kt							
1990	2.36	2.00	0.37	NE	NO	NO	NO	NO
1991	2.12	1.79	0.33	NE	NO	NO	NO	NO
1992	2.52	2.11	0.41	NE	NO	NO	NO	NO
1993	2.53	2.13	0.29	0.109	NO	NO	NO	NO
1994	2.36	2.03	0.24	0.095	NO	NO	NO	NO
1995	2.24	1.89	0.23	0.122	NO	NO	NO	NO
1996	2.26	1.85	0.21	0.196	NO	NO	NO	NO
1997	2.29	1.80	0.20	0.289	NO	NO	NO	NO
1998	2.30	1.77	0.23	0.305	NO	NO	NO	NO
1999	2.37	1.82	0.24	0.316	NO	NO	NO	NO
2000	2.51	1.74	0.45	0.316	NO	NO	NO	NO
2001	2.59	1.71	0.30	0.591	NO	NO	NO	NO
2002	2.73	1.69	0.35	0.691	NO	NO	NO	NO
2003	2.87	1.72	0.38	0.768	NO	NO	NO	NO
2004	2.96	1.76	0.38	0.817	NO	NO	NO	NO
2005	3.09	1.82	0.42	0.849	NO	NO	NO	NO
2006	3.24	1.57	0.81	0.860	NO	NO	NO	NO
2007	3.62	1.89	0.88	0.855	NO	NO	NO	NO
2008	3.78	1.98	0.94	0.857	NO	NO	NO	NO
2009	3.96	2.01	1.01	0.931	NO	NO	NO	NO
2010	4.34	2.39	1.06	0.892	NO	NO	NO	NO
2011	4.80	2.68	1.18	0.951	NO	NO	NO	NO
2012	5.37	3.10	1.34	0.933	NO	NO	NO	NO
2013	5.73	3.47	1.35	0.907	NO	NO	NO	NO
2014	6.00	3.74	1.41	0.846	NO	NO	NO	NO
2015	6.31	4.02	1.49	0.791	NO	NO	NO	NO
2016	6.26	3.87	1.43	0.957	NO	NO	NO	NO
2017	6.41	3.75	1.41	1.244	NO	NO	NO	NO
2018	6.77	3.55	1.45	1.769	NO	NO	NO	NO
2019	7.30	3.55	1.42	2.338	NO	NO	NO	NO
2020	6.89	3.05	1.25	2.596	NO	NO	NO	NO
Trend								
1990 - 2020	191.9%	52.7%	241.4%	NA	NA	NA	NA	NA
2005 - 2020	123.4%	67.8%	198.1%	205.7%	NA	NA	NA	NA
2019 - 2020	-5.6%	-14.2%	-11.7%	11.0%	NA	NA	NA	NA

3.2.5.2.2 Methodological issues

3.2.5.2.2.1 Choice of methods

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[249] has been applied:

Equation 3.2.1: CO_2 from road transport (2006 IPCC GL. Vol. 2. Chap. 3.2.1.1)

Equation 3.2.3: Emissions of CH_4 and N_2O (2006 IPCC GL. Vol. 2. Chap. 3.2.1.1)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 3.2.1: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$	= emissions of a given GHG by type of fuel (Gg GHG)
Fuel consumption $_{\text{fuel}}$	= amount of fuel combusted (TJ) (as represented by fuel sold)
Emission factor $_{\text{GHG. fuel}}$	= default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG	= CO_2, CH_4, N_2O
Fuel	= liquid fuels, e.g., Gas/Diesel Oil, Motor Gasoline, LPG

3.2.5.2.2.2 Choice of activity data

The following fuels are used in Road transportation:

Liquid fuels:

- Gas/Diesel Oil* (only non- Gas/Diesel Oil)
- Motor Gasoline* (only non-biogasoline)
- Liquefied Petroleum Gases (LPG)

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[250];
- 2010 – 2020 are taken from the National Energy balance provided by MEM[251].

The total fuel consumption increased by 170.2% during the period 1990 – 2020 and from 2005 to 2020, the total fuel consumption increased by 145.2%. The significant increase of fuel consumption was a result of growing mobility within cities but also between cities, growing freight transport due to increased national production but also due to imports and exports.

From 2019 to 2020 the total fuel consumption decreased by 10.9% because of nationwide lockdown due to the covid pandemic.

Until 2005 around half of the fuel consumed was motor gasoline. In the period 1990 – 2020, the fuel consumption of motor gasoline increased by 52.7% to 141,354.87 TJ in 2020. After 2005, the use of gas/diesel oil increased significant which was a result of growing freight transport. along the period 1990 – 2020, the fuel consumption of gas/diesel oil increased by 241.4% to 320,510.97 TJ in 2020. Since 1993 vehicle fulling up with LPG increased by 2.284% significantly from 1,755.98 TJ in 1993 to 41.864.63 TJ in 2020.

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[249] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.6.1.1 Methodological issues - Choice of method

[250] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[251] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

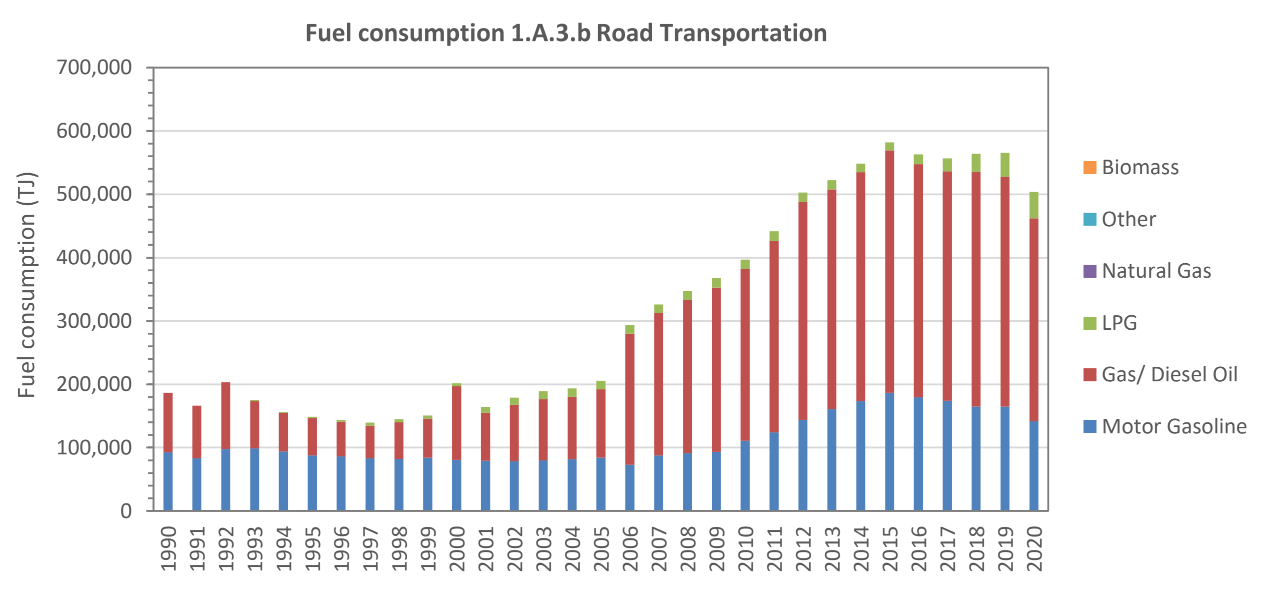

Figure 88 Activity data for IPCC category 1.A.3.b Road transportation

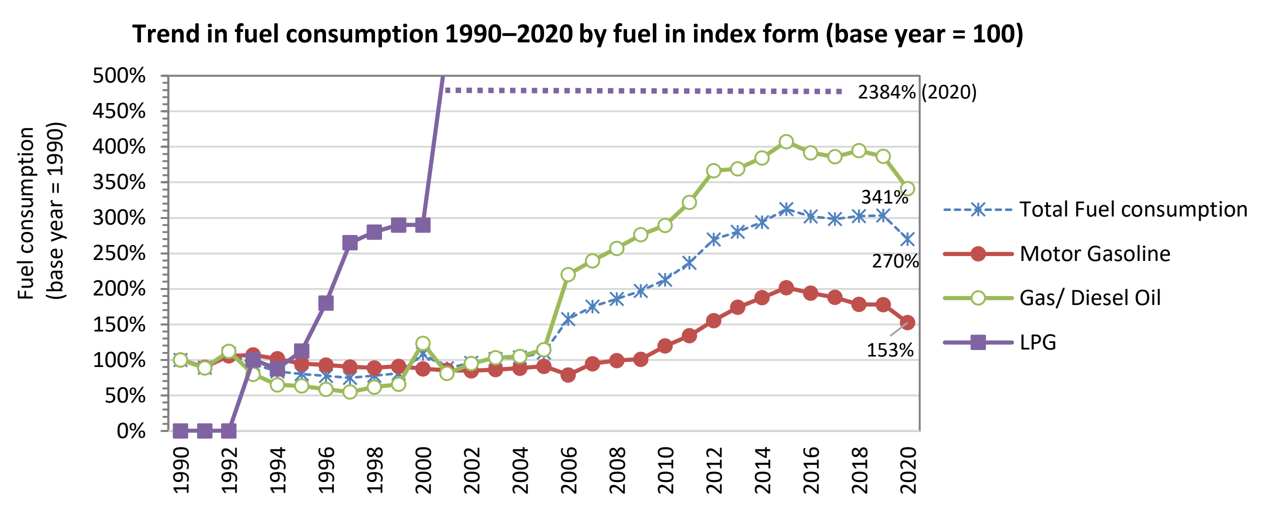

Figure 89 Trend in fuel consumption 1990–2020 by fuel type in index form (base year = 100)

Table 230 Activity data for IPCC category 1.A.3.b Road transportation

Activity data 1.A.3.b	Total Fuel consumption	Fuel consumption of						
		Gasoline	Diesel oil	LPG	Other liquid fuels	Gaseous fuels	Other fossil fuels	Biomass
	TJ							
1990	186,428.37	92,549.71	93,878.66	NE	NO	NO	NO	NO
1991	166,480.49	83,069.43	83,411.06	NE	NO	NO	NO	NO
1992	202,950.52	97,821.26	105,129.26	NE	NO	NO	NO	NO
1993	175,523.05	98,969.10	74,797.97	1,755.98	NO	NO	NO	NO
1994	156,398.97	93,952.63	60,909.86	1,536.48	NO	NO	NO	NO
1995	148,936.28	87,575.75	59,385.05	1,975.48	NO	NO	NO	NO
1996	144,097.81	86,002.79	54,934.26	3,160.76	NO	NO	NO	NO
1997	139,536.71	83,452.04	51,431.33	4,653.35	NO	NO	NO	NO
1998	145,036.07	82,176.66	57,942.67	4,916.74	NO	NO	NO	NO
1999	150,838.93	84,259.78	61,486.81	5,092.34	NO	NO	NO	NO
2000	201,877.66	80,858.78	115,926.54	5,092.34	NO	NO	NO	NO
2001	164,552.62	79,115.76	75,910.66	9,526.19	NO	NO	NO	NO
2002	178,682.92	78,393.05	89,139.39	11,150.47	NO	NO	NO	NO
2003	188,980.26	79,795.96	96,804.64	12,379.66	NO	NO	NO	NO
2004	193,335.86	81,836.56	98,329.45	13,169.85	NO	NO	NO	NO
2005	205,475.92	84,259.78	107,519.50	13,696.64	NO	NO	NO	NO
2006	293,664.30	73,036.48	206,755.59	13,872.24	NO	NO	NO	NO
2007	326,207.41	87,575.75	224,847.22	13,784.44	NO	NO	NO	NO
2008	346,859.42	91,699.46	241,331.62	13,828.34	NO	NO	NO	NO
2009	367,795.63	93,399.96	259,382.03	15,013.63	NO	NO	NO	NO
2010	396,872.80	110,714.90	271,773.44	14,384.46	NO	NO	NO	NO
2011	441,423.18	124,136.79	301,948.16	15,338.22	NO	NO	NO	NO
2012	502,652.04	143,761.76	343,837.58	15,052.70	NO	NO	NO	NO
2013	522,411.16	161,062.99	346,714.76	14,633.42	NO	NO	NO	NO
2014	548,282.40	173,655.49	360,987.43	13,639.49	NO	NO	NO	NO
2015	582,016.20	186,668.73	382,591.33	12,756.14	NO	NO	NO	NO
2016	562,782.82	179,551.59	367,800.56	15,430.67	NO	NO	NO	NO
2017	556,523.36	173,982.28	362,479.98	20,061.11	NO	NO	NO	NO
2018	563,871.21	164,806.17	370,531.37	28,533.67	NO	NO	NO	NO
2019	565,248.78	164,700.99	362,843.65	37,704.14	NO	NO	NO	NO
2020	503,730.47	141,354.87	320,510.97	41,864.63	NO	NO	NO	NO
Trend								
1990 - 2020	*170.2%*	*52.7%*	*241.4%*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*145.2%*	*67.8%*	*198.1%*	*205.7%*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-10.9%*	*-14.2%*	*-11.7%*	*11.0%*	*NA*	*NA*	*NA*	*NA*

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category *Domestic aviation* are provided.

Table 231Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.3.b Road transportation.

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV (D)**
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Motor Gasoline* Essence automobile	TJ / Gg	44.75 * 0.95 = 42.51	44.3
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.21 * 0.95 = 43.90	47.3

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[252]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [253]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

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[252] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[253] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.5.2.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 232 GHG Emission factor TIER 1 for IPCC IPCC category 1.A.3.b Road transportation

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Gas / Diesel Oil* Gasoil / Diesel	74.100	D	3	D	0.6	D
	Motor Gasoline* Essence automobile	69.300	D	3	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	63.100	D	1	D	0.1	D
Source	2006 IPCC Guidelines Vol. 2. Chap. 3 (3.2.1.2) Table 3.2.1 CO_2 emission factors and Table 3.2.2 NON-CO_2						
Note:							
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor	

3.2.5.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category IPCC category 1.A.3.b *Road transportation* are presented in the following table.

Table 233Uncertainty for IPCC category 1.A.3.b Road transportation.

Uncertainty	**Road transportation, Diesel oil**			**Road transportation, Motor gasoline**			**Road transportation, LPG**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	
Activity data (AD)	7%	7%	7%	7%	7%	7%	7%	7%	7%	**based on** 2006 IPCC GL. Vol. 2. Chap. 3.6.1.7
Emission factor (EF)	3%			3%			3%			
		150%			150%			150%		
			200%			200%			200%	
Combined Uncertainty (U)	8%	150%	200%	8%	150%	200%	8%	150%	200%	

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2020 are taken from the Energy balance provided by MEM and UN statistics.
- 2010 - 2010 are taken from the National Energy balance provided by MEM.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.5.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series),
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
  - national statistic published by MEM and Office National des Statistics (ONS)[254] and
  - international energy statistics of UN statistics[255] and International Energy Agency (IEA)[256]
- time series consistency - plausibility checks of dips and jumps.

3.2.5.2.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.3.b *Road transportation.*

Table 234Recalculations done since NC in IPCC category 1.A.3.b Road transportation.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.3.b	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.b	Revision of NCV - Default → country specific: motor gasoline, gasoil/diesel, LPG	AD	Accuracy Comparability
1.A.3.b	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.5.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

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[254] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[255] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[256] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

Table 235Planned improvements for IPCC category 1.A.3.b Road transportation

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.b	Application of Tier 2 (or higher) using the COPERT model[257]	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Collection of road transport related data for 1990 - 2020 Vehicle fleet: • Collect data on vehicle fleet in operation per category ○ Passenger transport ○ Freight transport • Collect or estimate data on vehicle fleet split per ○ fuel (energy) type ○ segment subcategories ○ technology/Euro standard • Collect or estimate data on vehicle fleet split per age distributions • Mileage: Collect or assume typical values for average annual distance driven for each vehicle (sub)category • Speeds: Estimate average travelling speeds in urban areas, rural areas and highways; Activity shares: Estimate share of activity (mileage) in urban areas (35%), rural areas (35%) and highways (30%);	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Fuel (energy) consumption - Energy balance Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content)	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Transparency	Medium
1.A.3.b	Information about imported secondhand vehicles	AD	Accuracy Transparency	Medium

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[257] COPERT is the EU standard vehicle emissions calculator. It uses vehicle population, mileage, speed and other data such as ambient temperature and calculates emissions and energy consumption for a specific country or region.
https://www.emisia.com/utilities/copert/

3.2.5.3 Railways (IPCC category 1.A.c)

3.2.5.3.1 Category description

As described in the 2006 IPCC Guidelines, the IPCC category 1.A.c *Railways* includes emissions from railway transport for both freight and passenger traffic routes.

This section describes GHG emissions resulting from fuel combustion in IPCC category 1.A.c *Railways*.

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.3.c	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

Emissions for the period 1990-2008, 2012-2015, 2017:
it is assumed, that the fuel combusted in IPCC category 1.A.c *Railways* is included in IPCC category *1.A.3 Road transport.*

The Algerian railway network comprises a total of 3.995 km (2018). Over the period 1998-2018, tonne-kilometres decreased by 53% but passenger-kilometres increased by 38%. These results can be explained by the increase in the use of road freight transport (following the completion of the East-West motorway and other national roads) leading to a decrease in tonne-kilometres in rail transport. In the case of the increase in passenger-kilometres, it can be explained by the increase in the number of trains since the improvement of the economic situation of the country. The number of locomotives, mainly diesel-powered, has increased by 38% over the period 1998-2018.

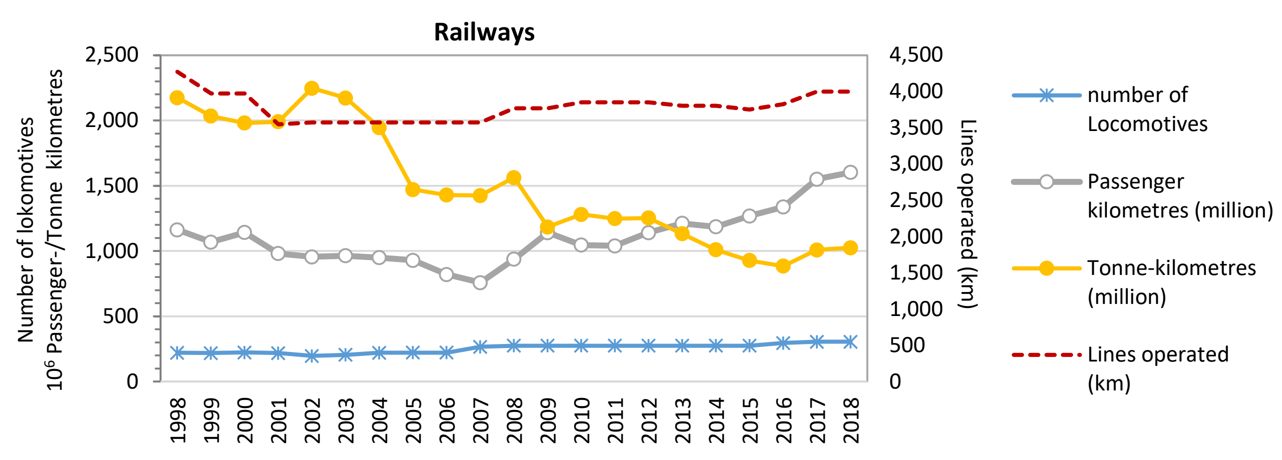

Figure 90 Railway: number of locomotives. lines operated. passenger-km and tone-kilometer

Source : Office National des Statistiques (ONS) : L'Algérie en quelques chiffres : résultats. Several years.[258]

The greenhouse gas emissions of the railways in IPCC category 1.A.c amount to 126.14 kt of CO_2 equivalents in 2009 ,119.61 kt of CO_2 equivalents in 2019 and 62.93 kt of CO_2 equivalents in 2020. The decrease in GHG emissions from rail transport despite the increase in the number of trains can be explained by the acquisition

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[258] available (20.09.2022) on https://www.ons.dz/spip.php?rubrique127

of electrified trains that are not polluting compared to the old diesel trains. The decrease in GHG emissions in 2020 is due to the impact of the Covid 19 pandemic on the different activities including rail transport.

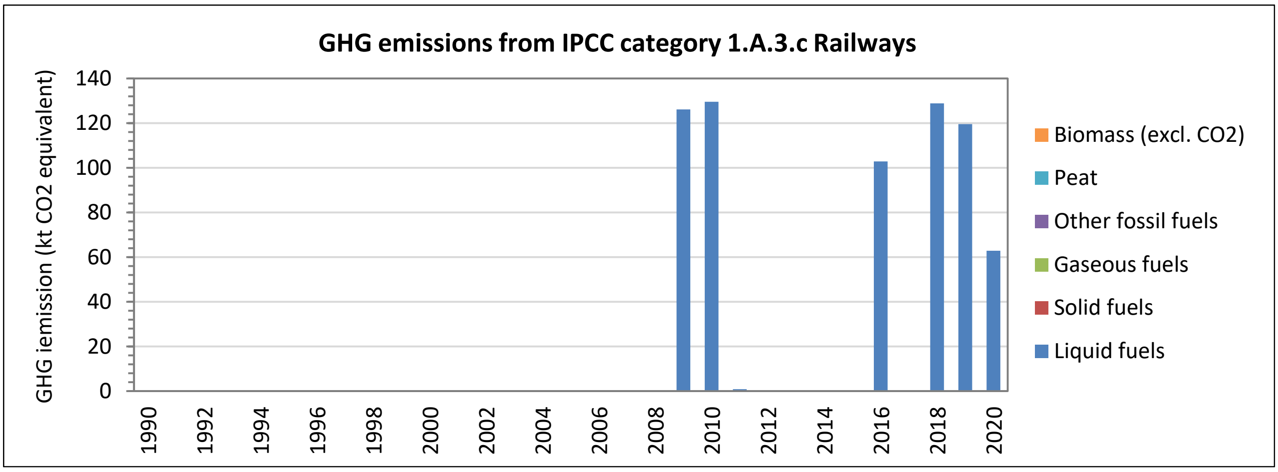

Figure 91 GHG emissions from IPCC category 1.A.c Railways

Table 236 GHG emissions and Activity data from IPCC category 1.A.3.c Railways

IPCC category 1.A.3.c	**Emission**				**Fuel consumption**			
	GHG	**CO_2**	**N_2O**	**CH_4**	**Total**	**Gas/ Diesel Oil**	**Fuel oil**	**Other**
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**[TJ]**	**[TJ]**	**[TJ]**	**[TJ]**
1990	NE	NE	NE	NE	IE	IE	NO	NO
1991	NE	NE	NE	NE	IE	IE	NO	NO
1992	NE	NE	NE	NE	IE	IE	NO	NO
1993	NE	NE	NE	NE	IE	IE	NO	NO
1994	NE	NE	NE	NE	IE	IE	NO	NO
1995	NE	NE	NE	NE	IE	IE	NO	NO
1996	NE	NE	NE	NE	IE	IE	NO	NO
1997	NE	NE	NE	NE	IE	IE	NO	NO
1998	NE	NE	NE	NE	IE	IE	NO	NO
1999	NE	NE	NE	NE	IE	IE	NO	NO
2000	NE	NE	NE	NE	IE	IE	NO	NO
2001	NE	NE	NE	NE	IE	IE	NO	NO
2002	NE	NE	NE	NE	IE	IE	NO	NO
2003	NE	NE	NE	NE	IE	IE	NO	NO
2004	NE	NE	NE	NE	IE	IE	NO	NO
2005	NE	NE	NE	NE	IE	IE	NO	NO
2006	NE	NE	NE	NE	IE	IE	NO	NO
2007	NE	NE	NE	NE	IE	IE	NO	NO
2008	NE	NE	NE	NE	IE	IE	NO	NO
2009	126.14	112.99	0.04	0.006	1,524.81	1,524.81	NO	NO
2010	129.54	116.09	0.04	0.007	1,567.25	1,567.25	NO	NO
2011	0.90	0.89	IE	0.0004	12.85	12.85	NO	NO

IPCC category 1.A.3.c	**Emission**				**Fuel consumption**			
	GHG	**CO_2**	**N_2O**	**CH_4**	**Total**	**Gas/ Diesel Oil**	**Fuel oil**	**Other**
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**[TJ]**	**[TJ]**	**[TJ]**	**[TJ]**
2012	IE	IE	IE	IE	IE	IE	NO	NO
2013	IE	IE	IE	IE	IE	IE	NO	NO
2014	IE	IE	IE	IE	IE	IE	NO	NO
2015	IE	IE	IE	IE	IE	IE	NO	NO
2016	102.85	92.12	0.04	0.005	1,243.21	1,243.21	NO	NO
2017	IE	IE	IE	IE	IE	IE	NO	NO
2018	128.86	115.42	0.04	0.006	1,557.61	1,557.61	NO	NO
2019	119.61	107.14	0.04	0.006	1,445.85	1,445.85	NO	NO
2020	62.93	56.37	0.02	0.003	760.71	760.71	NO	NO
Trend								
1990 - 2020	NA	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-47.39%	-47.39%	-47.39%	-47.39%	-47.39%%	-47.39%	NA	NA

3.2.5.3.2 Methodological issues

3.2.5.3.2.1 Choice of methods – TIER 1

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[259] has been applied:

Equation 3.4.1: General method for emissions from LOCOMOTIVES
(2006 IPCC GL. Vol.2. Chap. 3.4.1.2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 3.4.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap.3)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., gas/diesel oil, motor gasoline

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[259] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.4.1.1 Methodological issues - Choice of method

3.2.5.3.2.2 Choice of activity data

The following fuels are used in IPCC category 1.A.c *Railways*:

Liquid fuels:
- gas/diesel oil.
- motor gasoline

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[260] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[261].

It is assumed that the activity data from 1.A.c *Railways* for the period 1990 – 2008, 2012-2015 and 2017 are included in 1.A.3.b. as the energy balance does not provide information for in this period.

The activities data are provided in Table 236.

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units. in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category *Domestic aviation* are provided.

Table 237Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.c *Railways.*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV ***
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0

Conversion from GCV to NCV	**Default**
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[262]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2

Note:

D	Default	CS	Country specific	PS	Plant specific

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[260] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[261] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[262] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière de reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

3.2.5.3.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 238 GHG Emission factor TIER 1 for IPCC category IPCC category 1.A.c *Railways*

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	4.15	D	28.6	D
Source	2006 IPCC Guidelines Vol. 2. Chap. 3 (3.4.1.2) Table 3.4.1 CO_2 EF and NON-CO_2 EF						
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.5.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category IPCC category 1.A.c *Railways* are presented in the following table.

Table 239Uncertainty for IPCC category 1.A.c *Railways.*

Uncertainty	**Jet Kerosene**			**Reference**
	CO_2	**CH_4**	**N_2O**	
Activity data (AD)	7%	7%	7%	2006 IPCC GL. Vol. 2. Chap. 3.4.1.6
Emission factor (EF)	2%	90%	100%	
Combined Uncertainty (U)	7%	90%	100%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[263] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[264].

For the IPCC category 1.A.c *Railways* only data for the recent data were available. Further improvement of the energy balance will be made for future submissions.

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [265];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [266].

A revision of the years 1990-2009 is still pending.
Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

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[263] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[264] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[265] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[266] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

3.2.5.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[267] and
    - international energy statistics of UN statistics[268] and International Energy Agency (IEA)[269]
- time series consistency - plausibility checks of dips and jumps.

3.2.5.3.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.c *Railways.*

Table 240Recalculations done since NC in IPCC category 1.A.c *Railways.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.3.c	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.c	Revision of NCV Default → country specific: Gasoil/diesel. motor gasoline	AD	Accuracy Comparability
1.A.3.c	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.5.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

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[267] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[268] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[269] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

Table 241Planned improvements for IPCC category 1.A.c *Railways*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.c	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all railway related fuels ○ motor gasoline. ○ gas/diesel oil ○ fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.c	Application of Tier 2 methodology (or higher) and development of country-specific emission factors for locomotives = collection of information regarding engine types	M EF	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.c	Collection of activity data related to locomotives. • number of locomotives by type • annual hours of use of locomotive • average rated power of locomotive	M EF	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.c	Collection of activity data related to emission standards	AD	Transparency	medium

3.2.5.4 Domestic navigation (IPCC category 1.A.3.d.ii)

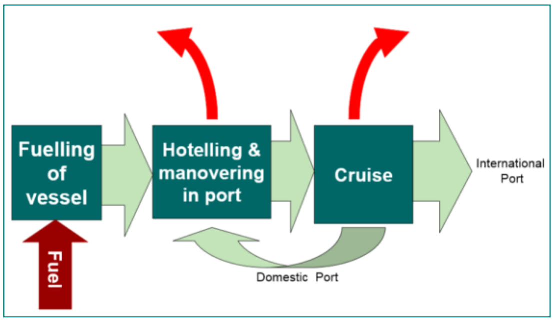
3.2.5.4.1 Category description

As described in the 2006 IPCC Guidelines, the IPCC category A.3.d.ii *Domestic Water-borne Navigation (International bunkers)* includes emissions from fuels used by vessels of all flags that are engaged in international water-borne navigation. The Domestic navigation may take place at sea on inland lakes and waterways and in coastal waters. This category includes emissions from journeys that depart in one country and arrive in the same country. The category exclude consumption by fishing vessels (see here Other Sector - Fishing). It is *good practice* that emissions from domestic navigation are reported separately from international navigation, and it is *good practice* to apply the definition presented in the following table.

Table 242 Criteria for defining international or domestic water-borne navigation.

Criteria for defining international or domestic water-borne navigation (applies to each segment of a voyage calling at more than two ports)		
Journey type between two ports	**Domestic**	**International**
• Departs and arrives in same country	Yes	No
• Departs from one country and arrives in another	No	Yes

Source: 2006 IPCC Guidelines. Volume 2. Chapter 3: Mobile Combustion. 3.5.1.3 Choice of activity data. TABLE 3.5.4.[270]



Source: EMEP/EEA air pollutant emission inventory guidebook 2019. Chapter 1.A.3.d Navigation (shipping) 2019. Figure 2 – 1 Flow diagram for the contribution from navigation to mobile sources combustion emissions [271]

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
Estimated	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**Other fossil fuel**	**Peat**	**biomass**
1.A.3.d.ii	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this sub-category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

Emissions for the period 1990-2020:

It is assumed, that the fuel combusted in IPCC category 1.A.3.d.ii *Domestic navigation* is included in IPCC category *1.A.3 Road transport.*

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[270] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf

[271] Source: EMEP/EEA air pollutant emission inventory guidebook 2016, Part B: sectoral guidance chapters, 1. Energy , 1.A Combustion, Chapter 1.A.3.d Navigation (shipping) 2016 https://www.eea.europa.eu/publications/emep-eea-guidebook-2016/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/1-a-3-d-navigation/view

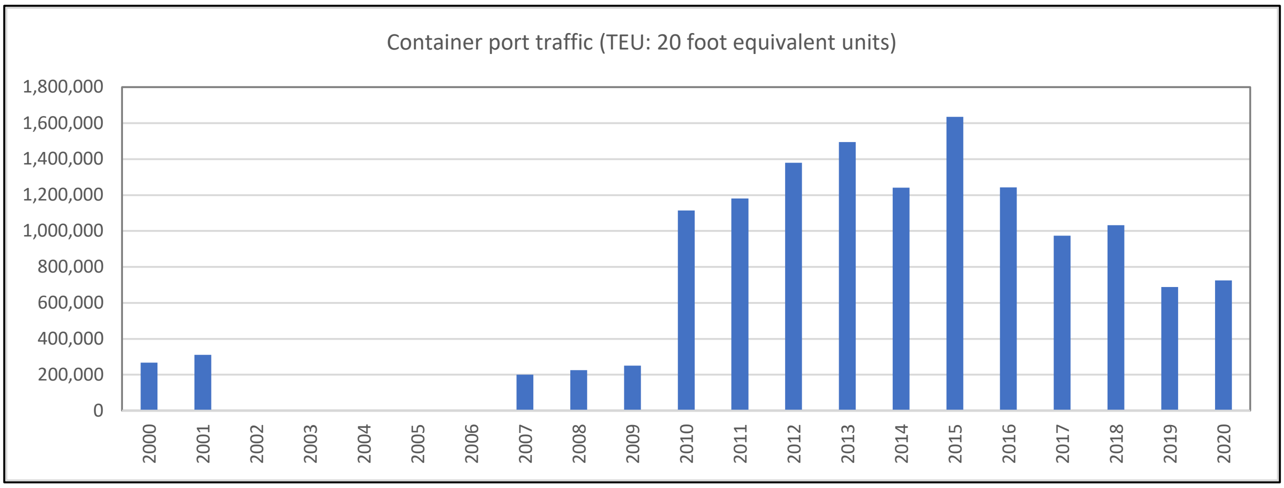

Figure 92 Container port traffic of Algerian ports in TEU (20-foot equivalent units)[272]

GHG emissions from combustion of fuel in Domestic navigation amounted to

- 598.73 kt CO_2 equivalent in the year 2019.
- 553.55 kt CO_2 equivalent in the year 2020.

However, the energy balance provides activity data only for the years 2019 and 2020.

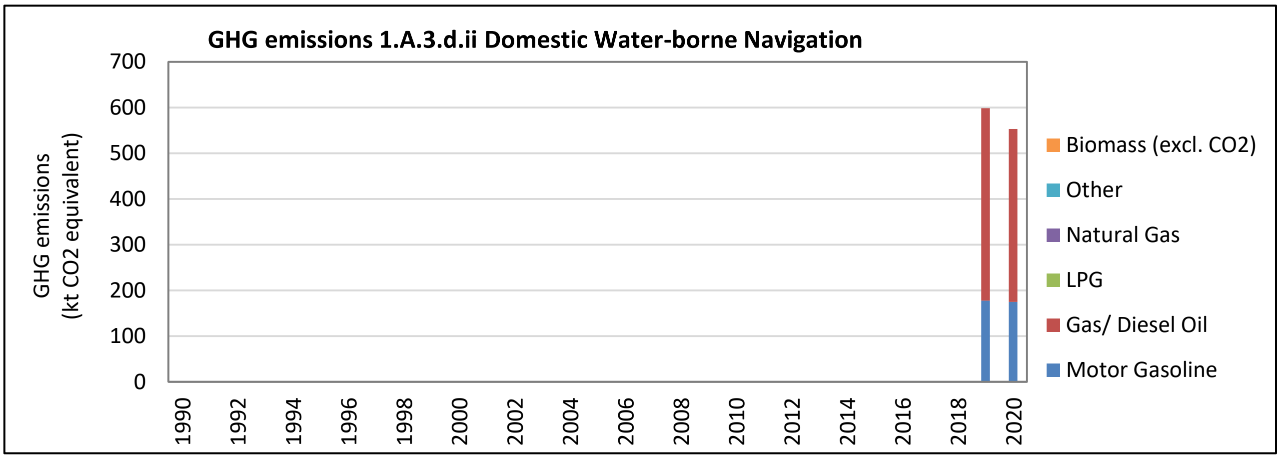

Figure 93 GHG emissions from IPCC category 1.A.3.d.ii *Domestic navigation*

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[272] Source: Worldbank (2022): available on 02.10.2022 on https://data.worldbank.org/indicator/IS.SHP.GOOD.TU?view=chart

Table 243 GHG emissions and Activity data from IPCC category 1.A.3.d.ii *Domestic navigation*

IPCC category 1.A.3.a.ii Domestic aviation	**Emission**				**Fuel consumption**			
	GHG	**CO_2**	**N_2O**	**CH_4**	**Total**	**Motor Gasoline**	**Gas/ Diesel Oil**	**Other**
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**[TJ]**	**[TJ]**	**[TJ]**	**[TJ]**
1990	IE	IE	IE	IE	IE	IE	IE	NO
1991	IE	IE	IE	IE	IE	IE	IE	NO
1992	IE	IE	IE	IE	IE	IE	IE	NO
1993	IE	IE	IE	IE	IE	IE	IE	NO
1994	IE	IE	IE	IE	IE	IE	IE	NO
1995	IE	IE	IE	IE	IE	IE	IE	NO
1996	IE	IE	IE	IE	IE	IE	IE	NO
1997	IE	IE	IE	IE	IE	IE	IE	NO
1998	IE	IE	IE	IE	IE	IE	IE	NO
1999	IE	IE	IE	IE	IE	IE	IE	NO
2000	IE	IE	IE	IE	IE	IE	IE	NO
2001	IE	IE	IE	IE	IE	IE	IE	NO
2002	IE	IE	IE	IE	IE	IE	IE	NO
2003	IE	IE	IE	IE	IE	IE	IE	NO
2004	IE	IE	IE	IE	IE	IE	IE	NO
2005	IE	IE	IE	IE	IE	IE	IE	NO
2006	IE	IE	IE	IE	IE	IE	IE	NO
2007	IE	IE	IE	IE	IE	IE	IE	NO
2008	IE	IE	IE	IE	IE	IE	IE	NO
2009	IE	IE	IE	IE	IE	IE	IE	NO
2010	IE	IE	IE	IE	IE	IE	IE	NO
2011	IE	IE	IE	IE	IE	IE	IE	NO
2012	IE	IE	IE	IE	IE	IE	IE	NO
2013	IE	IE	IE	IE	IE	IE	IE	NO
2014	IE	IE	IE	IE	IE	IE	IE	NO
2015	IE	IE	IE	IE	IE	IE	IE	NO
2016	IE	IE	IE	IE	IE	IE	IE	NO
2017	IE	IE	IE	IE	IE	IE	IE	NO
2018	IE	IE	IE	IE	IE	IE	IE	NO
2019	598.73	577.91	0.065	0.063	7,557.96	2,144.17	5,413.79	NO
2020	553.55	533.23	0.063	0.057	6,979.38	2,113.79	4,865.58	NO
Trend								
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*-7.55%*	*-7.73%*	*-1.85%*	*-8.90%*	*-7.66%*	*-1.42%*	*-10.13%*	*NA*

3.2.5.4.2 Methodological issues

3.2.5.4.2.1 Choice of methods

For estimating the CO_2, CH_4 and N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach[273] has been applied:

Equation 3.5.1: Water-borne navigation equation (2006 IPCC GL. Vol. 3. Chap. 3.5.1.1)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., Gas/diesel oil, motor gasoline

3.2.5.4.2.2 Choice of activity data

The following fuels are used in IPCC category 1.A.3.a.ii *Domestic navigation*:

Liquid fuels:

- Gas/Diesel Oil
- Motor gasoline

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[274] ;
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[275].

It is assumed that the activity data from 1.A.3.a.ii *Domestic navigation* for the period 1990 – 2018 are included in 1.A.3.b. as the energy balance does not provide information for in this period.

The activities data are provided in Table 243. However, the energy balance provides activity data only for the years 2019 and 2020, see chapter planned improvements.

From 2019 to 2020, the total fuel consumption decreased by 7.7% because of the lockdown due to the covid 19 pandemic.

In energy statistics production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units in this case terajoules requires calorific values. The emission calculations are based on net calorific values. In the following table, the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.3.a.ii *Domestic navigation* are provided.

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[273] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 3: Mobile Combustion - 3.5.1.1 Methodological issues - Choice of method

[274] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[275] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 244 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units IPCC category 1.A.3.d.ii *Domestic navigation.*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV***
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Residual fuel Oil *	TJ / Gg	42.18 * 0.95 = 40.07	40.4
Conversion from GCV to NCV			**Default**	
Petroleum products			1 NCV = 0.95 x GCV	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[276]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2		
Note:				
D	Default	CS	Country specific	PS Plant specific
*	For comparison			

3.2.5.4.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for liquid fuels were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 245 GHG Emission factor TIER 1 for IPCC category 1.A.3.d.ii *Domestic navigation*

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	4.15	D	28.6	D
	Residual fuel Oil*	77,400	D	10	D	0.6	D
Source	2006 IPCC Guidelines Vol. 2. Chap. 3 (3.5.1.2) Table 3.5.2 CO_2 EF and Table 3.5.3 NON-CO_2 EF						
Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.5.4.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.3.d.ii *Domestic navigation* are presented in the following table.

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[276] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

Table 246Uncertainty for IPCC category 1.A.3.d.ii *Domestic navigation.*

Uncertainty	**Gas/Diesel Oil**			**Residual Fuel Oil**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	
Activity data (AD)	15%	15%	15%	15%	15%	15%	2006 IPCC GL. Vol. 2. Chap. 3.5.1.7
Emission factor (EF)	1.5%	+/-50%	-40% to 140%	3.0%	+/-50%	-40% to 140%	
Combined Uncertainty (U)	15%	72%	135%	15%	72%	135%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by UN statistics[277] for and from Algeria
- 2010 - 2020 are taken from the National Energy balance prepared by MEM[278].

For the IPCC category 1.A.3.d.ii *Domestic navigation* only data for the recent data were available. Further improvement of the energy balance will be made for future submissions.

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [279];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [280].

A revision of the years 1990-2009 is still pending.
Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.5.4.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series),
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources (e.g., 1.A.3.d.i International navigation):

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[277] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[278] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[279] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[280] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

  - national statistic published by MEM and Office National des Statistics (ONS)[281] and
  - international energy statistics of UN statistics[282] and International Energy Agency (IEA)[283]
- time series consistency - plausibility checks of dips and jumps.

3.2.5.4.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.A.3.a.ii *Domestic navigation*.

Table 247Recalculations done since NC in IPCC category 1.A.3.d.ii *Domestic navigation.*

GHG source & sink category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.A.3.d.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.d.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.d.ii	Revision of NCV - Default → country specific: Motor gasoline. Gasoil/diesel	AD	Accuracy Comparability
1.A.3.d.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

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[281] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[282] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[283] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.5.4.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 248Planned improvements for IPCC category 1.A.3.d.ii *Domestic navigation*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.A.3.d.i 1.A.3.d.ii	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all navigation related fuels ○ motor gasoline. ○ gas/diesel oil ○ fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC Guidelines. Volume 2. Chapter 3: Mobile Combustion. 3.5.1.3 Choice of activity data.	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Data on fuel consumption by fuel type and engine type • Surveys of shipping companies (including ferry and freight) • Surveys of individual port and marine authorities	AD	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.d.i 1.A.3.d.ii	• Ship movement data and standard passenger and freight ferry schedules • Fischery boot movements	AD	Transparency	medium
1.A.3.d.i 1.A.3.d.ii	Application of Tier 2 methodology • Estimate fuel consumption for hotelling & movements and cruise for navigation. • Estimate emissions from hotelling & movements and cruise for navigation.	M EF	Accuracy Completeness Comparability Transparency Consistency	medium

3.2.5.5 Other transportation (IPCC category 1.A.3.e)

3.2.5.5.1 Category description

As described in the 2006 IPCC Guidelines, the IPCC category 1.A.3.e O*ther transportation* includes GHG emissions from

IPCC code		**Description**
1.A.3.e.i	Pipeline transport	which include fuel combustion related emissions from the operation of pump stations and maintenance of pipelines. Transport via pipelines includes transport of gases. liquids. slurry and other commodities via pipelines. ⇒ Distribution of natural or manufactured gas. water or steam from the distributor to final users is excluded and should be reported in 1.A.1.c.ii or 1.A.4.a.
1.A.3.e.ii	Other	which include fuel combustion emissions from Other Transportation excluding Pipeline Transport.

GHG emissions/ removals estimated	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.3.e.i	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO	NO	NO	✓	NO	NO	NO
1.A.3.e.ii	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Key Category																		
1.A.3.e.i	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.A.3.e.i	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this sub-category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

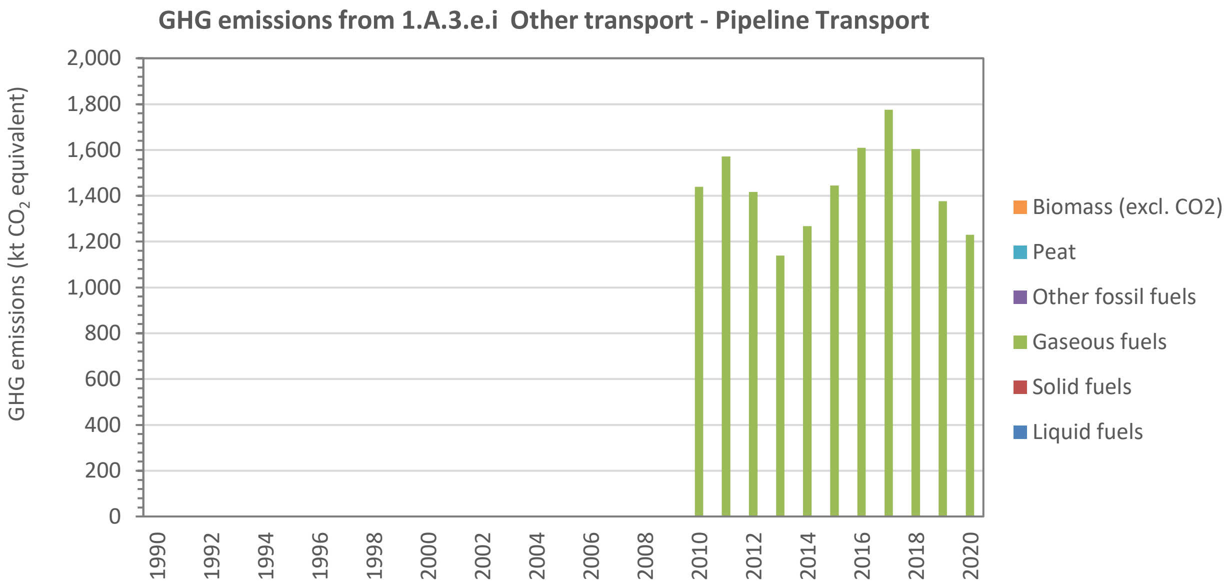
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

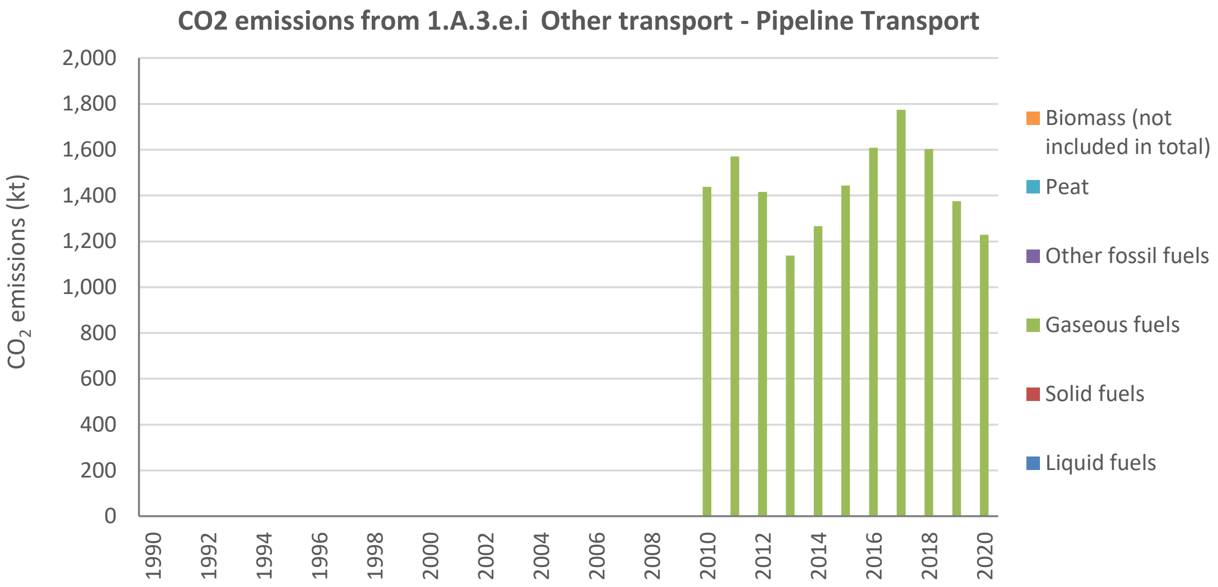
Emissions for the period 1990-2020:

It is assumed, that the fuel combusted in IPCC category 1.A.3.e.i other *transportation - Pipeline transport* is included in IPCC category *1.A.1.c or 1.A.1 or 1.A.3.b.* during the period 1990-2009.

Greenhouse gas emissions from fuel combustion in IPCC category 1.A.3.e.i "Other transport - Pipeline transport" decreased by 14.5 % from 1,439.66 kt CO_2 equivalent in 2010 to 1,230.52 kt CO_2 equivalent in 2020. From 2019 to 2020, emissions decreased by 10.6 %. This decline can be attributed to the decrease of quantities of gas transported by pipeline.

No bio-gasoline or bio-gas/diesel oil was consumed.
No CO_2 emission were captured.


GHG emissions from 1.A.3.e.i Other transport - Pipeline Transport
GHG emissions (kt CO_2 equivalent)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions from 1.A.3.e.i Other transport - Pipeline Transport
CO_2 emissions (kt)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

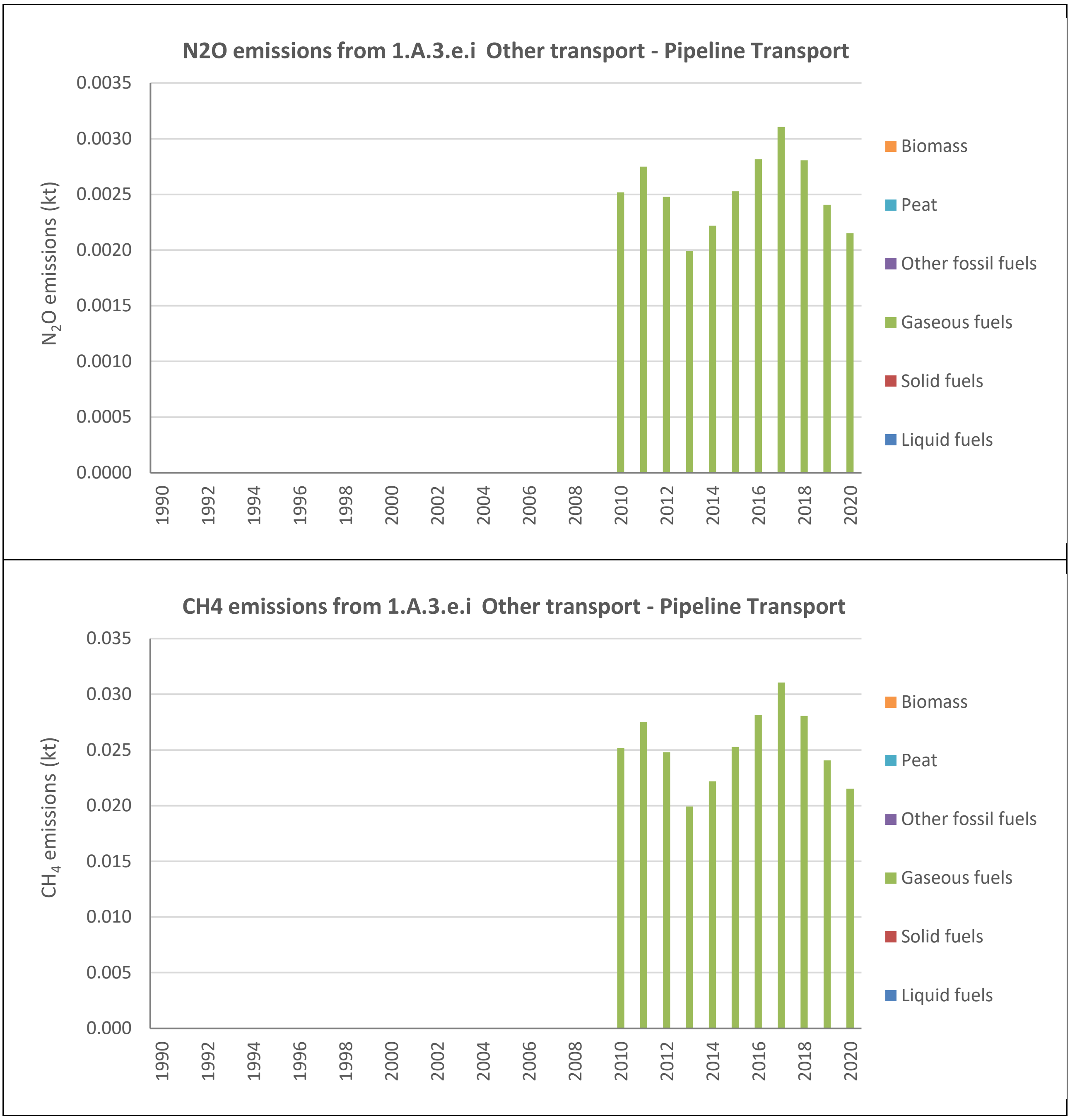


Figure 94 Emissions from IPCC category 1.A.3.e.i other *transportation- Pipeline transport*

Table 249 GHG Emissions by fuels from IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport*

	Total GHG emissions (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	NO	NO	IE	NO	NO	NO
1991	IE	NO	NO	IE	NO	NO	NO
1992	IE	NO	NO	IE	NO	NO	NO
1993	IE	NO	NO	IE	NO	NO	NO
1994	IE	NO	NO	IE	NO	NO	NO
1995	IE	NO	NO	IE	NO	NO	NO
1996	IE	NO	NO	IE	NO	NO	NO
1997	IE	NO	NO	IE	NO	NO	NO
1998	IE	NO	NO	IE	NO	NO	NO
1999	IE	NO	NO	IE	NO	NO	NO
2000	IE	NO	NO	IE	NO	NO	NO
2001	IE	NO	NO	IE	NO	NO	NO
2002	IE	NO	NO	IE	NO	NO	NO
2003	IE	NO	NO	IE	NO	NO	NO
2004	IE	NO	NO	IE	NO	NO	NO
2005	IE	NO	NO	IE	NO	NO	NO
2006	IE	NO	NO	IE	NO	NO	NO
2007	IE	NO	NO	IE	NO	NO	NO
2008	IE	NO	NO	IE	NO	NO	NO
2009	IE	NO	NO	IE	NO	NO	NO
2010	1,439.66	NO	NO	1,439.66	NO	NO	NO
2011	1,572.24	NO	NO	1,572.24	NO	NO	NO
2012	1,417.30	NO	NO	1,417.30	NO	NO	NO
2013	1,138.92	NO	NO	1,138.92	NO	NO	NO
2014	1,268.09	NO	NO	1,268.09	NO	NO	NO
2015	1,445.33	NO	NO	1,445.33	NO	NO	NO
2016	1,610.27	NO	NO	1,610.27	NO	NO	NO
2017	1,776.17	NO	NO	1,776.17	NO	NO	NO
2018	1,603.73	NO	NO	1,603.73	NO	NO	NO
2019	1,376.05	NO	NO	1,376.05	NO	NO	NO
2020	1,230.52	NO	NO	1,230.52	NO	NO	NO
Trend							
1990-2020	NA	NA	NA	NA	NA	NA	NA
20**10**-2020	-14.53%	NA	NA	-14.53%	NA	NA	NA
2019-2020	-10.6%	NA	NA	-10.6%	NA	NA	NA

3.2.5.5.2 Methodological issues

3.2.5.5.2.1 Choice of methods – TIER 1 CO_2, CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[284] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, e.g., motor gasoline, gas/diesel oil, LPG

3.2.5.5.2.2 Choice of activity data

The following fuels are used for combustion of fuel used for operation of pump stations and maintenance of pipelines.

Gaseous fuels:
- Natural gas

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years.

- 2010 – 2020 are taken from the National Energy balance provided by MEM[285].

The total fuel consumption decreased by 14.5% in the period 2010 – 2020 due to the decrease of diesel use. From 2019 to 2020, the total fuel consumption decreased by 10.6% due to the Covid 19 pandemic which led to a decrease in fuel consumption.

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[284] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[285] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

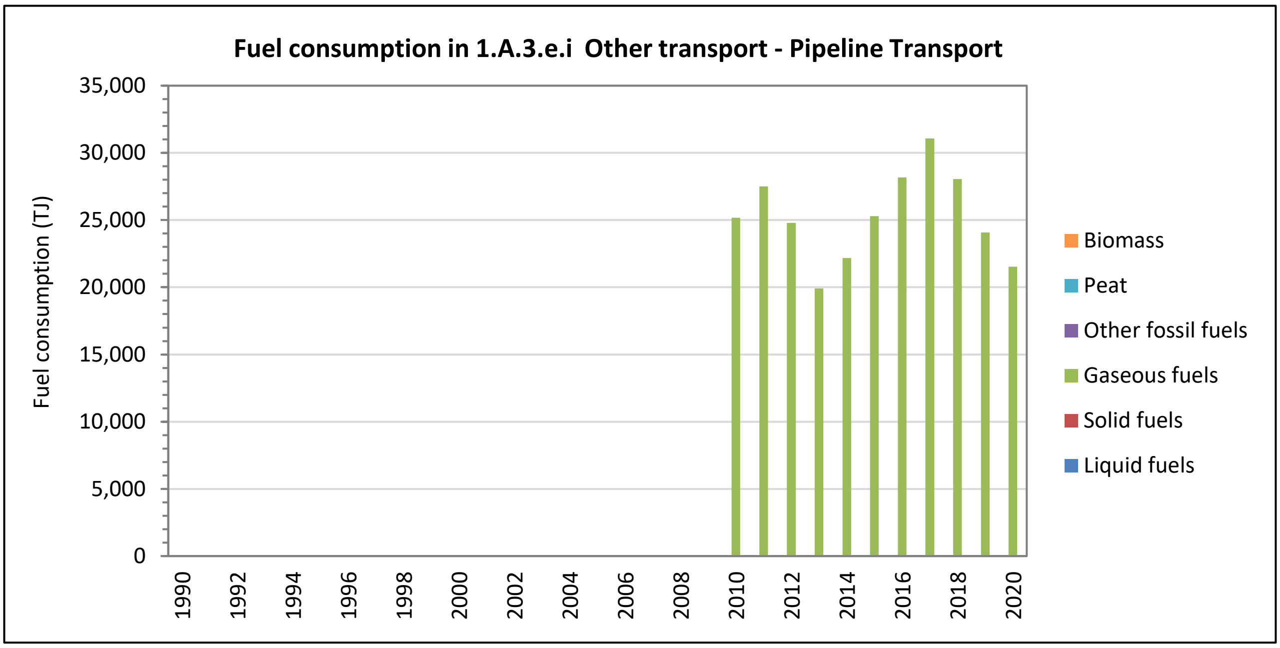

Figure 95 Activity data for IPCC category 1.A.3.e.i other *transportation- Pipeline transport*

Table 250 Activity data for IPCC category 1.A.3.e.i *other transportation- Pipeline transport*

Activity data 1.A.3.e.i	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	NO	NO	IE	NO	NO	NO
1991	IE	NO	NO	IE	NO	NO	NO
1992	IE	NO	NO	IE	NO	NO	NO
1993	IE	NO	NO	IE	NO	NO	NO
1994	IE	NO	NO	IE	NO	NO	NO
1995	IE	NO	NO	IE	NO	NO	NO
1996	IE	NO	NO	IE	NO	NO	NO
1997	IE	NO	NO	IE	NO	NO	NO
1998	IE	NO	NO	IE	NO	NO	NO
1999	IE	NO	NO	IE	NO	NO	NO
2000	IE	NO	NO	IE	NO	NO	NO
2001	IE	NO	NO	IE	NO	NO	NO
2002	IE	NO	NO	IE	NO	NO	NO
2003	IE	NO	NO	IE	NO	NO	NO
2004	IE	NO	NO	IE	NO	NO	NO
2005	IE	NO	NO	IE	NO	NO	NO
2006	IE	NO	NO	IE	NO	NO	NO
2007	IE	NO	NO	IE	NO	NO	NO
2008	IE	NO	NO	IE	NO	NO	NO
2009	IE	NO	NO	IE	NO	NO	NO
2010	25,181.81	NO	NO	25,181.81	NO	NO	NO
2011	27,500.71	NO	NO	27,500.71	NO	NO	NO
2012	24,790.57	NO	NO	24,790.57	NO	NO	NO
2013	19,921.34	NO	NO	19,921.34	NO	NO	NO
2014	22,180.70	NO	NO	22,180.70	NO	NO	NO
2015	25,280.96	NO	NO	25,280.96	NO	NO	NO
2016	28,165.93	NO	NO	28,165.93	NO	NO	NO
2017	31,067.75	NO	NO	31,067.75	NO	NO	NO
2018	28,051.54	NO	NO	28,051.54	NO	NO	NO
2019	24,069.05	NO	NO	24,069.05	NO	NO	NO
2020	21,523.50	NO	NO	21,523.50	NO	NO	NO
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 - 2020	-14.5%	NA	NA	-14.5%	NA	NA	NA
2019 - 2020	-10.6%	NA	NA	-10.6%	NA	NA	NA

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tons or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.3.e.i *Other transportation- Pipeline transport* are provided.

Table 251 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.3.e.i *Other transportation- Pipeline transport*

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific (CS) NCV (GVC * Conversion factor)	**2006 IPCC default NCV (D)**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3	39.57 * 0.9 = 35.61	39.02*

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[286]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [287]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

3.2.5.5.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 252 GHG Emission factor TIER 1 for IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport*

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56 100	D	1	D	0.1	D

Source	CS – country specific EF -	Ministry of Energy and Mines (2021): Development of Country specific emission factor.
	D – Default EF -	2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category

Note:

D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.5.5.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport* are presented in the following table.

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[286] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[287] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 253Uncertainty for IPCC category 1.A.3.e.i other *transportation- Pipeline transport.*

Uncertainty	**Gaseous fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2 (2.4.2)
Activity data (AD)	5%	5%	5%	Table 2.15 and Table 3.1
Emission factor (EF)	2%			Table 2.13
		150%		Table 2.12
			187%	Table 2.14
Combined Uncertainty (U)	7%	150%	187%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 2010 - 2020 are taken from the National Energy balance provided by MEM[288].

For the IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport* only data for the recent data were available. Further improvement of the energy balance will be made for future submissions.

3.2.5.5.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[289] and
    - international energy statistics of UN statistics[290]. International Energy Agency (IEA)[291]
    - Sonelgaz: Chiffres Clés (different years)[292]
    - Sonatrach: Rapport Annuel (different years)[293]
- cross checks with other relevant sectors are performed to avoid double counting or omissions.
- time series consistency - plausibility checks of dips and jumps.

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[288] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[289] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[290] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[291] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

[292] https://www.sonelgaz.dz/fr

[293] https://sonatrach.com/rapports

3.2.5.5.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC sub-category 1.A.3.e.i O*ther transportation- Pipeline transport*.

Table 254Recalculations done since NC in IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.3.e.i	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.e.i	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.e.i	Revision of NCV Default → country specific: Natural gas,	AD	Accuracy Comparability
1.A.3.e.i	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability

3.2.5.5.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 255Planned improvements for IPCC category 1.A.3.e.i O*ther transportation- Pipeline transport*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.e.i	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption, NCV, carbon content) • for all used fuels ○ natural gas	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.e.i 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low

3.2.6 Other sectors (IPCC category 1.A.4)

The IPCC category 1.A.4 category *Other sectors* comprise emissions from fuel combustion in agriculture, forestry, fishing and fishing industries such as fish farms. Activities included in ISIC[294] Divisions 01, 02 and 05.

IPCC category	description	
1.A.4	**Other Sectors**	Emissions from combustion activities as described below, including combustion for the generation of electricity and/or heat for own use in these sectors.
1.A.4.a 1.A.4.a.i 1.A.4.a.ii	**Commercial/institutional** Stationary combustion Off-road vehicles and other machinery	▪ activities of public administration (governmental) ○ executive and legislative administration of central, regional and local level ○ activities of providing health care, education, cultural services and other social services ○ Public order and safety activities, foreign affairs ▪ Financial sector ▪ NGOs ▪ Commercial activites: wholesale and retail trade, repair of motor vehicles and motorbikes, transport and storage, accommodation and food service activities, information and communication, private scientific and technical activities, other business activities.
1.A.4.b 1.A.4.b.i 1.A.4.b.ii	**Residential** Stationary combustion Off-road vehicles and other machinery	▪ private households
1.A.4.c 1.A.4.c.i 1.A.4.c.ii 1.A.4.c.iii	**Agriculture/forestry/fishing** Stationary Off-road vehicles and other machinery Fishing	▪ includes the exploitation of vegetal and animal natural resources. ▪ activities of growing of crops, raising and breeding of animals. harvesting of timber and other plants, animals or animal products from a farm or their natural habitats.
Source: 2006 IPCC Guidelines. Volume 2: Energy. Chapter 2: Stationary Combustion - 2.2 Description of sources		

An overview of the GHG emission from fuel combustion in IPCC category 1.A.4 *Other sectors* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020 and 2019 – 2020.

The greenhouse gas emissions from IPCC category 1.A.4 *Other sectors* amounted to 7,481.62 kt CO_2 equivalents in 1990, 19,293.43 kt CO_2 equivalents in 2005 and 31,520.46 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 1.A.4 *Other sectors* shows an increase by 321.3% from 1990 to 2020, 63.4% from 2005 to 2020 and by 1.4% from 2019 to 2020.

While liquid fuels accounted for 67% of total fuel consumption in 1990, natural gas accounted for 77.3% of total fuel consumption in 2020. In 2006 many households, commercial and institutional buildings were connected to the natural gas grid.[295]

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[294] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

The GHG emissions of IPCC category 1.A.4 *Other sectors* comprise of:

IPCC category	share in 1990	share in 2020
1.A.4.a Commercial/institutional	NA (included in 1.A.4.b)	10.6% from liquid fuel
		7.0% from gaseous fuels
		<0.1% from biomass
1.A.4.b Residential	65.9% from liquid fuel	11.7% from liquid fuel
	34.1% from gaseous fuels	70.2% from gaseous fuels
	<0.1% from biomass	<0.1% from biomass
1.A.4.c. Agriculture/Forestry/Fishing	NA (included in 1.A.4.b)	0.3% from liquid fuel
		0.2% from gaseous fuels
		<0.1% from biomass

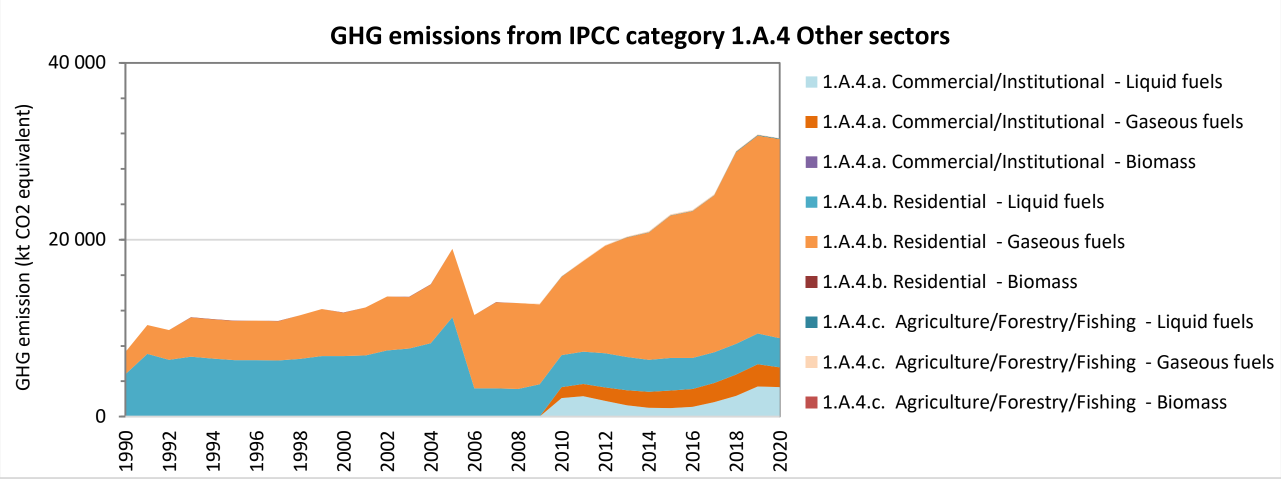

Figure 96 GHG Emissions from IPCC category 1.A.4 *Other sectors* by category

GHG emissions from the other sectors category increased due to the increase in national consumption of natural gas and other liquid fuels by the different sectors (population increase and development of other sectors). However, 2006 saw a decrease in GHG emissions. This decrease is explained by the decrease in national production of natural gas by 1%, condensates by 2.9% and LPG in the field by 6% (2006 energy balance).

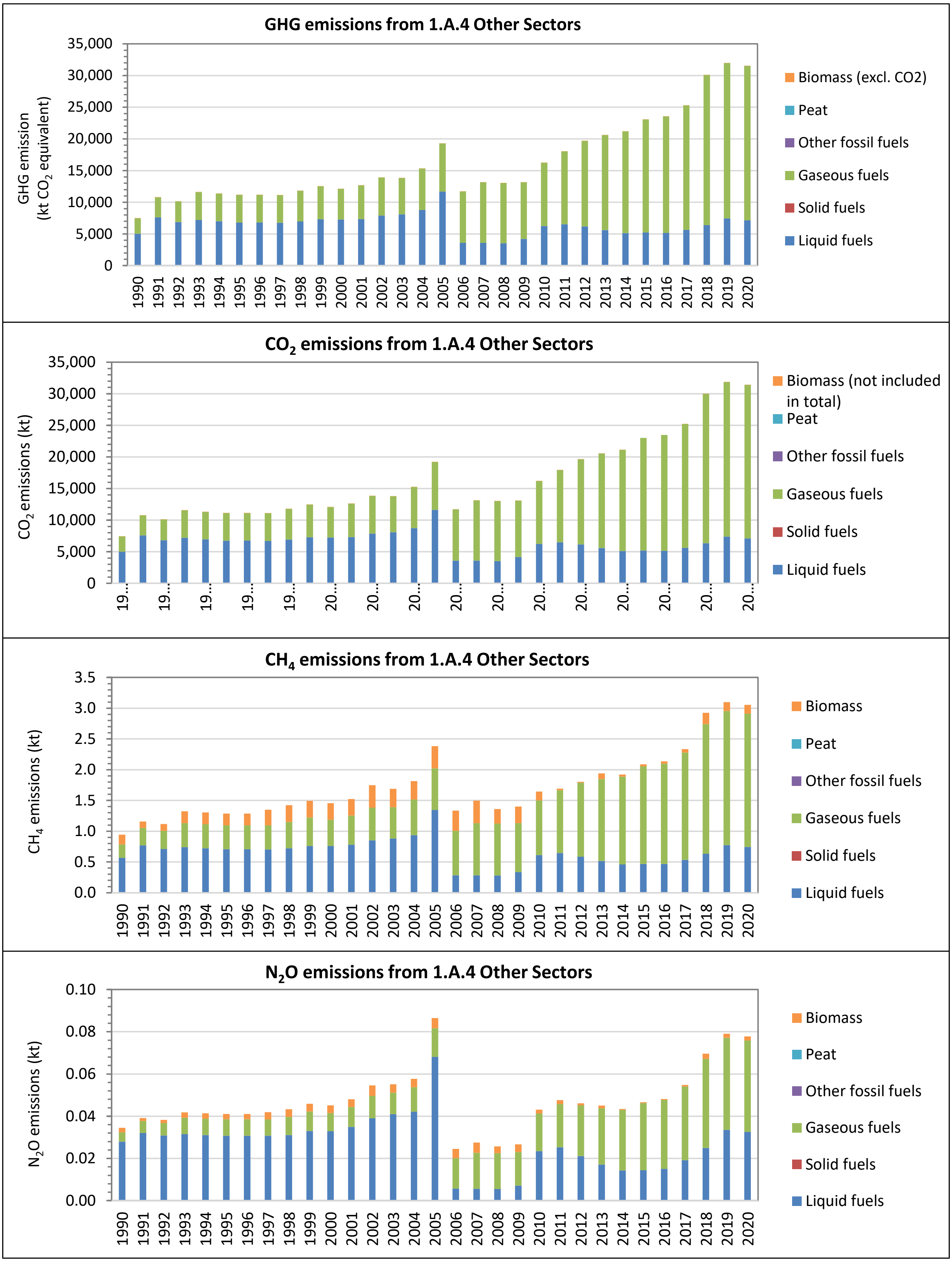

Figure 97 Emissions from IPCC category 1.A.4 *Other sectors*

Table 256 GHG Emissions by fuels from IPCC category 1.A.4 *Other sectors*

GHG	**Total GHG emissions** (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.4	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	7,481.62	5,015.19	NO	2,461.75	NO	NO	4.68
1991	10,798.68	7,603.64	NO	3,192.03	NO	NO	3.02
1992	10,149.54	6,856.97	NO	3,289.24	NO	NO	3.34
1993	11,607.80	7,227.54	NO	4,374.63	NO	NO	5.63
1994	11,369.97	6,989.71	NO	4,374.63	NO	NO	5.63
1995	11,170.86	6,790.60	NO	4,374.63	NO	NO	5.63
1996	11,173.63	6,793.37	NO	4,374.63	NO	NO	5.63
1997	11,134.02	6,751.88	NO	4,374.63	NO	NO	7.50
1998	11,813.99	6,962.06	NO	4,843.96	NO	NO	7.97
1999	12,524.48	7,305.18	NO	5,211.33	NO	NO	7.97
2000	12,117.72	7,295.36	NO	4,814.39	NO	NO	7.97
2001	12,670.20	7,347.47	NO	5,314.76	NO	NO	7.97
2002	13,889.04	7,900.65	NO	5,977.65	NO	NO	10.74
2003	13,843.05	8,104.27	NO	5,730.02	NO	NO	8.76
2004	15,320.27	8,787.01	NO	6,524.50	NO	NO	8.76
2005	19,293.43	11,688.40	NO	7,594.40	NO	NO	10.63
2006	11,738.84	3,600.60	NO	8,128.64	NO	NO	9.60
2007	13,162.76	3,592.30	NO	9,559.83	NO	NO	10.63
2008	13,057.05	3,517.64	NO	9,532.49	NO	NO	6.93
2009	13,139.35	4,195.13	NO	8,936.23	NO	NO	7.99
2010	16,256.25	6,259.07	NO	9,992.98	NO	NO	4.21
2011	18,007.77	6,518.17	NO	11,488.32	NO	NO	1.29
2012	19,706.25	6,187.20	NO	13,518.36	NO	NO	0.69
2013	20,617.70	5,616.33	NO	14,998.65	NO	NO	2.72
2014	21,204.77	5,121.76	NO	16,082.01	NO	NO	1.00
2015	23,078.04	5,220.98	NO	17,856.06	NO	NO	1.00
2016	23,533.95	5,153.29	NO	18,379.66	NO	NO	1.00
2017	25,282.00	5,632.30	NO	19,648.03	NO	NO	1.67
2018	30,103.96	6,378.64	NO	23,719.86	NO	NO	5.47
2019	31,964.27	7,443.12	NO	24,516.85	NO	NO	4.30
2020	31,520.46	7,138.98	NO	24,377.30	NO	NO	4.19
Trend							
1990 - 2020	321.3%	42.3%	NA	890.2%	NA	NA	-10.4%
2005 - 2020	63.4%	-38.9%	NA	221.0%	NA	NA	-60.6%
2019 - 2020	-1.4%	-4.1%	NA	-0.6%	NA	NA	-2.5%

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 257 CO_2 Emissions by fuels from IPCC category 1.A.4 *Other sectors*

CO_2	**Total CO_2 emissions** (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
1.A.4	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	7,447.72	4,992.68	NO	2,454.98	NO	NO	0.06
1991	10,758.08	7,574.80	NO	3,183.24	NO	NO	0.04
1992	10,110.18	6,829.95	NO	3,280.18	NO	NO	0.04
1993	11,562.28	7,199.62	NO	4,362.59	NO	NO	0.07
1994	11,325.03	6,962.37	NO	4,362.59	NO	NO	0.07
1995	11,126.41	6,763.75	NO	4,362.59	NO	NO	0.07
1996	11,129.17	6,766.51	NO	4,362.59	NO	NO	0.07
1997	11,087.81	6,725.13	NO	4,362.59	NO	NO	0.10
1998	11,765.52	6,934.78	NO	4,830.63	NO	NO	0.10
1999	12,473.42	7,276.33	NO	5,196.99	NO	NO	0.10
2000	12,067.82	7,266.58	NO	4,801.14	NO	NO	0.10
2001	12,617.80	7,317.56	NO	5,300.14	NO	NO	0.10
2002	13,829.08	7,867.74	NO	5,961.20	NO	NO	0.14
2003	13,784.43	8,070.07	NO	5,714.26	NO	NO	0.11
2004	15,257.72	8,751.06	NO	6,506.55	NO	NO	0.11
2005	19,208.04	11,634.41	NO	7,573.50	NO	NO	0.14
2006	11,698.18	3,591.79	NO	8,106.27	NO	NO	0.12
2007	13,117.17	3,583.51	NO	9,533.52	NO	NO	0.14
2008	13,015.37	3,509.03	NO	9,506.26	NO	NO	0.09
2009	13,096.33	4,184.59	NO	8,911.64	NO	NO	0.10
2010	16,202.32	6,236.79	NO	9,965.48	NO	NO	0.05
2011	17,951.26	6,494.50	NO	11,456.70	NO	NO	0.05
2012	19,647.47	6,166.27	NO	13,481.17	NO	NO	0.03
2013	20,555.79	5,598.38	NO	14,957.38	NO	NO	0.03
2014	21,143.77	5,106.01	NO	16,037.75	NO	NO	0.01
2015	23,011.96	5,205.02	NO	17,806.92	NO	NO	0.01
2016	23,466.23	5,137.14	NO	18,329.08	NO	NO	0.01
2017	25,207.26	5,613.28	NO	19,593.97	NO	NO	0.02
2018	30,010.05	6,355.40	NO	23,654.59	NO	NO	0.07
2019	31,863.18	7,413.74	NO	24,449.38	NO	NO	0.05
2020	31,420.91	7,110.64	NO	24,310.22	NO	NO	0.05
Trend							
1990 - 2020	321.9%	42.4%	NA	890.2%	NA	NA	-10.4%
2005 - 2020	63.6%	-38.9%	NA	221.0%	NA	NA	-60.6%
2019 - 2020	-1.4%	-4.1%	NA	-0.6%	NA	NA	-2.5%

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 258 N_2O Emissions by fuels from IPCC category 1.A.4 *Other sectors*

N_2O	**Total N_2O emissions**	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.4	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.034	0.028	NO	0.004	NO	NO	0.002
1991	0.039	0.032	NO	0.006	NO	NO	0.001
1992	0.038	0.031	NO	0.006	NO	NO	0.002
1993	0.042	0.031	NO	0.008	NO	NO	0.003
1994	0.041	0.031	NO	0.008	NO	NO	0.003
1995	0.041	0.031	NO	0.008	NO	NO	0.003
1996	0.041	0.031	NO	0.008	NO	NO	0.003
1997	0.042	0.031	NO	0.008	NO	NO	0.003
1998	0.043	0.031	NO	0.009	NO	NO	0.004
1999	0.046	0.033	NO	0.009	NO	NO	0.004
2000	0.045	0.033	NO	0.009	NO	NO	0.004
2001	0.048	0.035	NO	0.009	NO	NO	0.004
2002	0.055	0.039	NO	0.011	NO	NO	0.005
2003	0.055	0.041	NO	0.010	NO	NO	0.004
2004	0.058	0.042	NO	0.012	NO	NO	0.004
2005	0.086	0.068	NO	0.014	NO	NO	0.005
2006	0.025	0.006	NO	0.014	NO	NO	0.004
2007	0.028	0.006	NO	0.017	NO	NO	0.005
2008	0.026	0.006	NO	0.017	NO	NO	0.003
2009	0.027	0.007	NO	0.016	NO	NO	0.004
2010	0.043	0.023	NO	0.018	NO	NO	0.002
2011	0.048	0.025	NO	0.020	NO	NO	0.002
2012	0.046	0.021	NO	0.024	NO	NO	0.001
2013	0.045	0.017	NO	0.027	NO	NO	0.001
2014	0.043	0.014	NO	0.029	NO	NO	0.000
2015	0.047	0.014	NO	0.032	NO	NO	0.000
2016	0.048	0.015	NO	0.033	NO	NO	0.000
2017	0.055	0.019	NO	0.035	NO	NO	0.001
2018	0.070	0.025	NO	0.042	NO	NO	0.002
2019	0.079	0.034	NO	0.044	NO	NO	0.002
2020	0.078	0.033	NO	0.043	NO	NO	0.002
Trend							
1990 - 2020	125.7%	16.3%	NA	890.2%	NA	NA	-10.4%
2005 - 2020	-10.1%	-52.3%	NA	221.0%	NA	NA	-60.6%
019 - 2020	-1.7%	-3.1%	NA	-0.6%	NA	NA	-2.5%

Table 259 CH_4 Emissions by fuels from IPCC category 1.A.4 *Other sectors*

CH_4	**Total CH_4 emissions**	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
1.A.4	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.945	0.567	NO	0.219	NO	NO	0.159
1991	1.158	0.772	NO	0.284	NO	NO	0.103
1992	1.119	0.713	NO	0.292	NO	NO	0.114
1993	1.323	0.742	NO	0.389	NO	NO	0.192
1994	1.304	0.723	NO	0.389	NO	NO	0.192
1995	1.288	0.707	NO	0.389	NO	NO	0.192
1996	1.288	0.708	NO	0.389	NO	NO	0.192
1997	1.349	0.704	NO	0.389	NO	NO	0.256
1998	1.423	0.721	NO	0.431	NO	NO	0.272
1999	1.495	0.760	NO	0.463	NO	NO	0.272
2000	1.458	0.759	NO	0.428	NO	NO	0.272
2001	1.524	0.780	NO	0.472	NO	NO	0.272
2002	1.748	0.851	NO	0.531	NO	NO	0.366
2003	1.688	0.880	NO	0.509	NO	NO	0.298
2004	1.814	0.936	NO	0.580	NO	NO	0.298
2005	2.384	1.347	NO	0.675	NO	NO	0.362
2006	1.334	0.285	NO	0.722	NO	NO	0.327
2007	1.496	0.284	NO	0.850	NO	NO	0.362
2008	1.361	0.278	NO	0.847	NO	NO	0.236
2009	1.403	0.336	NO	0.794	NO	NO	0.272
2010	1.643	0.612	NO	0.888	NO	NO	0.143
2011	1.693	0.645	NO	1.021	NO	NO	0.028
2012	1.802	0.586	NO	1.202	NO	NO	0.015
2013	1.940	0.514	NO	1.333	NO	NO	0.093
2014	1.922	0.459	NO	1.429	NO	NO	0.034
2015	2.087	0.466	NO	1.587	NO	NO	0.034
2016	2.135	0.467	NO	1.634	NO	NO	0.034
2017	2.336	0.533	NO	1.746	NO	NO	0.057
2018	2.926	0.632	NO	2.108	NO	NO	0.186
2019	3.100	0.775	NO	2.179	NO	NO	0.146
2020	3.055	0.746	NO	2.167	NO	NO	0.143
Trend							
1990 - 2020	223.2%	31.5%	NA	890.2%	NA	NA	-10.4%
2005 - 2020	28.1%	-44.6%	NA	221.0%	NA	NA	-60.6%
2019 - 2020	-1.5%	-3.7%	NA	-0.6%	NA	NA	-2.5%

3.2.6.1 Commercial/institutional (IPCC category 1.A.4.a)

3.2.6.1.1 Category description

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.4.a																		
1.A.4.a.i	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓
1.A.4.a.ii	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO
Key Category	LA 2020	-	LA 2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

Emissions included elsewhere (IE):

It is assumed that the fuel combusted in IPCC category 1.A.4.a.ii *Off-road vehicles and other machinery* is included either in IPCC category 1.A.4.b *Residential or* IPCC category *1.A.3 Road transport.*

Furthermore, the greenhouse gas emissions from IPCC category 1.A.4.a *Commercial/institutional* for the period 1990 – 2009 are included in IPCC category 1.A.4.b *Residential* as the energy balance was not disaggregated in this period. The IPCC category 1.A.4.a *Commercial/institutional* is for CO_2, gaseous and liquids fuels key category.

An overview of the GHG emission from fuel combustion in IPCC category 1.A.4.a *Commercial/institutional* is provided in the following figures and tables:

- annual GHG emissions;
- Trend of the periods 2010 – 2020. 2019 – 2020;

The greenhouse gas emissions from IPCC category 1.A.4.a *Commercial/institutional* amounted to 3,319.80 kt CO_2 equivalents in 2010 and 5,561.75 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the 1.A.4.a *Commercial/institutional* shows an increase by 67.5% from 2010 to 2020 and a decrease by 5.6% from 2019 to 2020 due to the national lockdown due to the COVID pandemic (2020).

The overall increasing trend of emissions is result of rising heat and electricity production due to increased demand by households, commercial and public and private institutions. The dips and jumps from year to year are mainly due to:

- the weather circumstances in the corresponding years
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning
- the economic situation as reflected in the gross domestic product (GDP).

No bio-gasoline or bio-gas/diesel oil was consumed.

Emissions from the combustion of wood charcoal, used for e.g., barbeque were not estimated due to lack of data.

No CO_2 emission were captured.

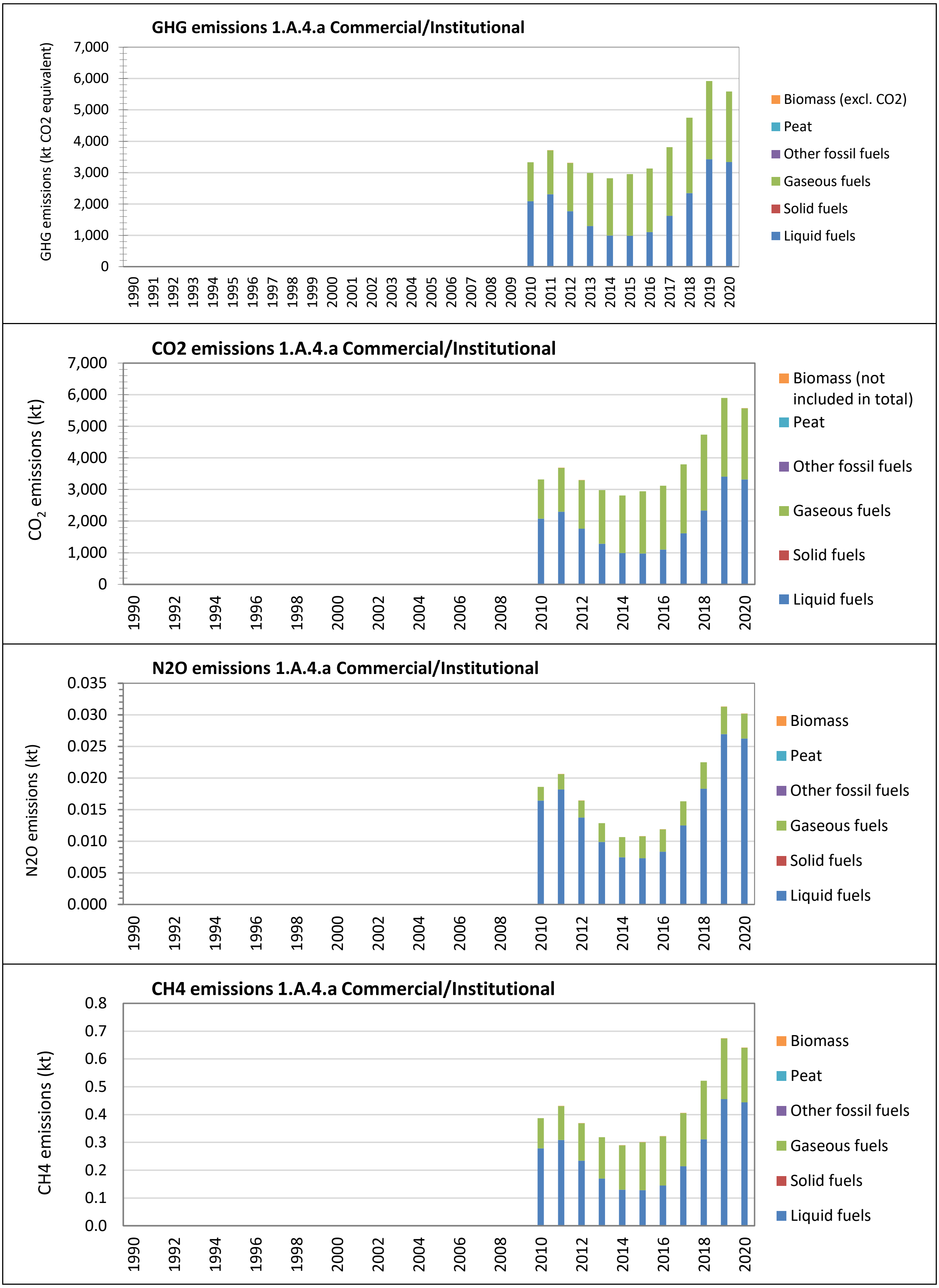

Figure 98 Emissions from IPCC category 1.A.4.a Commercial/Institutional

Table 260 GHG Emissions by fuels from IPCC category 1.A.4.a Commercial/Institutional

	Total GHG emissions (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt CO_2 eq	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	12.20	IE	NO	12.20	NO	NO	IE
2010	3,319.80	2,098.52	NO	1,221.28	NO	NO	IE
2011	3,691.76	2,319.99	NO	1,371.34	NO	NO	0.44
2012	3,295.40	1,782.98	NO	1,512.18	NO	NO	0.24
2013	2,974.47	1,304.85	NO	1,669.62	NO	NO	0.00
2014	2,802.15	1,004.08	NO	1,798.06	NO	NO	0.02
2015	2,928.94	995.59	NO	1,933.34	NO	NO	0.02
2016	3,106.36	1,117.41	NO	1,988.90	NO	NO	0.04
2017	3,782.87	1,637.38	NO	2,145.46	NO	NO	0.02
2018	4,725.32	2,358.97	NO	2,366.35	NO	NO	0.00
2019	5,892.23	3,439.23	NO	2,452.74	NO	NO	0.26
2020	5,561.75	3,353.53	NO	2,208.02	NO	NO	0.19
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-5.6%	-2.5%	NA	-10.0%	NA	NA	-24.7%

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 261 CO_2 Emissions by fuels from IPCC category 1.A.4.a Commercial/Institutional

	Total CO_2 emissions (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	12.17	IE	NO	12.17	NO	NO	IE
2010	3,304.57	2,086.65	NO	1,217.92	NO	NO	IE
2011	3,674.41	2,306.85	NO	1,367.56	NO	NO	0.04
2012	3,281.05	1,773.03	NO	1,508.01	NO	NO	0.02
2013	2,962.67	1,297.64	NO	1,665.03	NO	NO	0.00
2014	2,791.72	998.61	NO	1,793.11	NO	NO	0.00
2015	2,918.21	990.20	NO	1,928.02	NO	NO	0.00
2016	3,094.74	1,111.31	NO	1,983.43	NO	NO	0.00
2017	3,767.85	1,628.29	NO	2,139.56	NO	NO	0.00
2018	4,705.57	2,345.74	NO	2,359.83	NO	NO	0.00
2019	5,865.81	3,419.81	NO	2,446.00	NO	NO	0.00
2020	5,536.55	3,334.61	NO	2,201.94	NO	NO	0.00
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-5.6%	-2.5%	NA	-10.0%	NA	NA	-24.7%

Table 262 N_2O Emissions by fuels from IPCC category 1.A.4.a Commercial/Institutional

	Total N_2O emissions	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	0.00002	IE	NO	0.00002	NO	NO	IE
2010	0.01861	0.01644	NO	0.00217	NO	NO	IE
2011	0.02210	0.01820	NO	0.00244	NO	NO	0.00147
2012	0.01720	0.01373	NO	0.00269	NO	NO	0.00079
2013	0.01286	0.00989	NO	0.00297	NO	NO	0.00000
2014	0.01066	0.00745	NO	0.00320	NO	NO	0.00001
2015	0.01077	0.00733	NO	0.00344	NO	NO	0.00001
2016	0.01189	0.00833	NO	0.00354	NO	NO	0.00002
2017	0.01632	0.01250	NO	0.00381	NO	NO	0.00001
2018	0.02249	0.01829	NO	0.00421	NO	NO	0.00000
2019	0.03141	0.02693	NO	0.00436	NO	NO	0.00012
2020	0.03026	0.02625	NO	0.00393	NO	NO	0.00009
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-3.7%	-2.5%	NA	-10.0%	NA	NA	-24.7%

Table 263 CH₄ Emissions by fuels from IPCC category 1.A.4.a Commercial/Institutional

	Total CH_4 emissions	**CH_4 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	0.001	IE	NO	0.001	NO	NO	IE
2010	0.387	0.279	NO	0.109	NO	NO	IE
2011	0.431	0.309	NO	0.122	NO	NO	1.10E-04
2012	0.369	0.234	NO	0.134	NO	NO	5.89E-05
2013	0.319	0.170	NO	0.148	NO	NO	1.30E-07
2014	0.290	0.130	NO	0.160	NO	NO	5.64E-07
2015	0.301	0.128	NO	0.172	NO	NO	5.64E-07
2016	0.323	0.145	NO	0.177	NO	NO	1.46E-06
2017	0.406	0.215	NO	0.191	NO	NO	8.37E-07
2018	0.522	0.311	NO	0.210	NO	NO	2.84E-08
2019	0.683	0.456	NO	0.218	NO	NO	8.93E-06
2020	0.647	0.444	NO	0.196	NO	NO	6.73E-06
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-5.2%	-2.5%	NA	-10.0%	NA	NA	-24.7%

3.2.6.1.2 Methodological issues

3.2.6.1.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[296] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\mathrm{GHG.\,fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\mathrm{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\mathrm{GHG.\,fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.6.1.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use (and which are not delivered by public electricity power plants):

Liquid fuels
- Gas/Diesel Oil* (only non-bio Gas/Diesel Oil)
- Motor Gasoline* (only non-biogasoline)
- Liquefied Petroleum Gases
- Other Petroleum Products

Gasous fuels
- Natural gas

Biomass
- Fuelwood

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Emissions from the combustion of wood charcoal, used for e.g for barbeque, were not estimated due to lack of data.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[297] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[298].

Activity data from 1.A.4.a for the period 1990 – 2009 are included in 1.A.4.b as the energy balance was not disaggregated in this period.

The total fuel consumption increased by 67.5% in the period 2010 – 2020. From 2019 to 2020 the total fuel consumption decreased by 5.6% due to corona pandemic.

The increased consumption is the result of increased heat and electricity demand per building of the

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[296] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[297] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[298] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

commercial and institutions sectors but also due growing number of buildings of the commercial and institutions sectors. The dips and jumps from year to year are mainly due to:

- the weather circumstances in the corresponding years
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning.

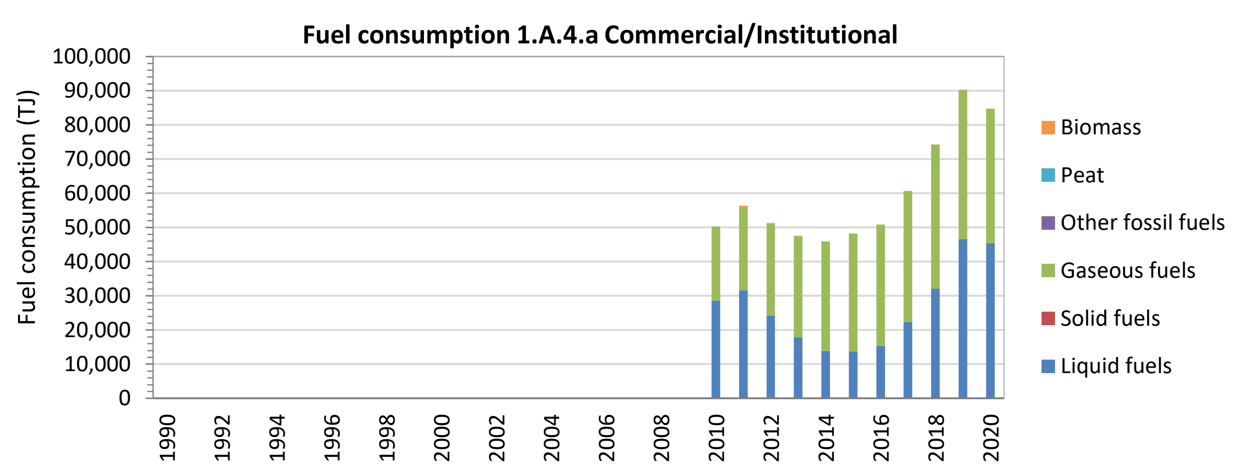

Figure 99 Emissions from IPCC category 1.A.4.a Commercial/Institutional

Table 264 Activity data for IPCC category 1.A.4.a Commercial/Institutional

Activity data 1.A.4.a	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	216.90	IE	NO	216.90	NO	NO	IE
2010	50,324.90	28,615.11	NO	21,709.79	NO	NO	IE
2011	56,375.01	31,631.44	NO	24,377.24	NO	NO	366.33
2012	51,344.58	24,267.36	NO	26,880.83	NO	NO	196.38
2013	47,528.49	17,848.41	NO	29,679.65	NO	NO	0.43
2014	45,821.21	13,856.52	NO	31,962.80	NO	NO	1.88
2015	48,121.19	13,751.82	NO	34,367.49	NO	NO	1.88
2016	50,763.46	15,403.36	NO	35,355.23	NO	NO	4.87
2017	60,557.33	22,416.22	NO	38,138.32	NO	NO	2.79
2018	74,189.33	32,124.44	NO	42,064.79	NO	NO	0.09
2019	90,212.39	46,581.98	NO	43,600.63	NO	NO	29.77
2020	84,686.27	45,413.56	NO	39,250.29	NO	NO	22.42
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	68.28%	58.70%	NA	80.80%	NA	NA	NA
2019 - 2020	-6.1%	-2.5%	NA	-10.0%	NA	NA	-24.7%

In energy statistics production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tons or cubic meters. To convert these data to energy units in this case terajoules requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.4.a Commercial/Institutional are provided.

Table 265 Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.4.a Commercial/Institutional

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Motor Gasoline* Essence automobile	TJ / Gg	44.75 * 0.95 = 42.51	44.3
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	MEM/Sonatrach	40.2
biomass	Fuel Wood Bois/résidus de bois	TJ / Gg	MEM/Sonatrach	15.6
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	
Conversion from weight in tons per m3 for fuelwood (general fuelwood)				
Fuelwood (general fuelwood)			Volume (m3) *0.707 = weight (tonnes)	
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[299]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)		
	Conversion from GCV to NCV Conversion from weight in tons per m3 for fuelwood (general fuelwood)	International Recommendations for Energy Statistics (IRES) (2018) [300]: Table 4 Difference between net and gross calorific values for selected fuels Table 4.3 Conversion table for fuelwood (wood with 25 per cent moisture content)		
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

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[299] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[300] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.6.1.2.3 Choice of emission factors

Default emission factors for CO_2. CH_4 and N_2O for Natural gas , liquid fuels and biomass, were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 266 GHG Emission factor TIER 1 for IPCC category 1.A.4.a Commercial/Institutional

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	5	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	10	D	0.6	D
	Motor Gasoline* Essence automobile	69,300	D	10	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	56,100	D	5	D	0.1	D
	Other Petroleum Products Autres produits pétroliers	73,300	D	10	D	0.6	D
biomass	Fuelwood Bois/résidus de bois	112,000	D	300	D	4	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						

Note:

D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

3.2.6.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.4.a Commercial/ Institutional are presented in the following table.

Table 267Uncertainty for IPCC category 1.A.4.a Commercial/Institutional.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Biomass**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	10%	10%	10%	15%	15%	15%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	5%			2%			10%			based Table 2.13
		150%			150%			20%		based Table 2.12
			187%			200%			250%	based Table 2.14
Combined Uncertainty (U)	9%	150%	187%	10%	150%	200%	18%	201%	250%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[301] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[302].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC)[303];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities[304].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

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[301] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[302] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[303] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[304] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

3.2.6.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- Cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[305] and
    - international energy statistics of UN statistics[306] and International Energy Agency (IEA)[307]
- Cross checks with other relevant sectors (e.g., 1.4.b and 1.4.c) are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.6.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.4.a Commercial/Institutional*.

Table 268Recalculations done since NC in IPCC category 1.A.4.a Commercial/Institutional

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.4.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.4.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.a	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.4.a	Revision of CO_2 and CH_4 EF	EF	Accuracy Comparability
1.A.4.a	Assumption of 100% oxidation	EF	Accuracy Comparability

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[305] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[306] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[307] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.6.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 269Planned improvements for IPCC category 1.A.4.a Commercial/Institutional

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a. 1.A.4.b. 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.a.i 1.A.4.a.ii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Completeness Comparability	low
1.A.4.a	Energy balance - Use of other biomass than fuel wood ▪ bio-gasoline or bio-gas/diesel oil including MTBE, AddBlue, etc. Wood charcoal	AD	Completeness	medium
1.A.4.a	Determination ▪ CS NCV for biomass considering moisture content Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.a	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air conditioning. etc.) energy-saving devices and technologies	AD EF	Transparency	Medium / low

3.2.6.2 Residential (IPCC category 1.A.4.b)

3.2.6.2.1 Category description

GHG emissions/ removals	CO_2						CH_4						N_2O					
	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass	liquid	solid	gaseous	other fossil fuel	Peat	biomass
1.A.4.b																		
1.A.4.b.i	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓
1.A.4.b.ii	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO	IE	NO	IE	NO	NO	NO
Key Category	LA 1990 & 2020 TA	-	LA 1990 & 2020 TA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

Emissions included elsewhere (IE):

It is assumed. that the fuel combusted in IPCC category 1.A.4.b.ii *Off-road vehicles and other machinery* is included either in IPCC category 1.A.4.b.i *Residential or* IPCC category *1.A.3 Road transport.*

Furthermore. for the period 1990 – 2009 the greenhouse gas emissions from IPCC category 1.A.4.b *Residential* include emissions from IPCC category 1.A.4.a *Commercial/institutional* and 1.A.4.c Agriculture/ Forestry/ Fishing as the energy balance was not disaggregated in this period.

An overview of the GHG emission from fuel combustion in IPCC category 1.A.4.b *Residential* is provided in the following figures and tables:

- annual GHG emissions;
- Trend of the periods 1990 – 2019. 2005 – 2020. 2019 – 2020.

IPCC category 1.A.4.b *Residential is for CO_2 and, gaseous and liquid fuels key category.*

The greenhouse gas emissions from IPCC category 11.A.4.b *Residential* amounted to 7,481.62 kt CO_2 equivalents in 1990, 19,293.43 kt CO_2 equivalents in 2005. and 25,806.34 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the 1.A.4.b *Residential* shows an increase by 244.9% from 1990 to 2020 and an increase by 33.8% from 2005 to 2020 which was a result of rising heat production due to increased demand by households. The dips and jumps from year to year are mainly due to:

- increased population which leads in general to higher consumption of fuel for cooking and heating
- increasing number of households with a trend to smaller households
- increasing size of living area
- the weather circumstances in the corresponding years
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning.

No bio-gasoline or bio-gas/diesel oil was consumed.

Emissions from the combustion of wood charcoal. used in barbeque for e.g., were not estimated due to lack of data.

No CO_2 emission were captured.

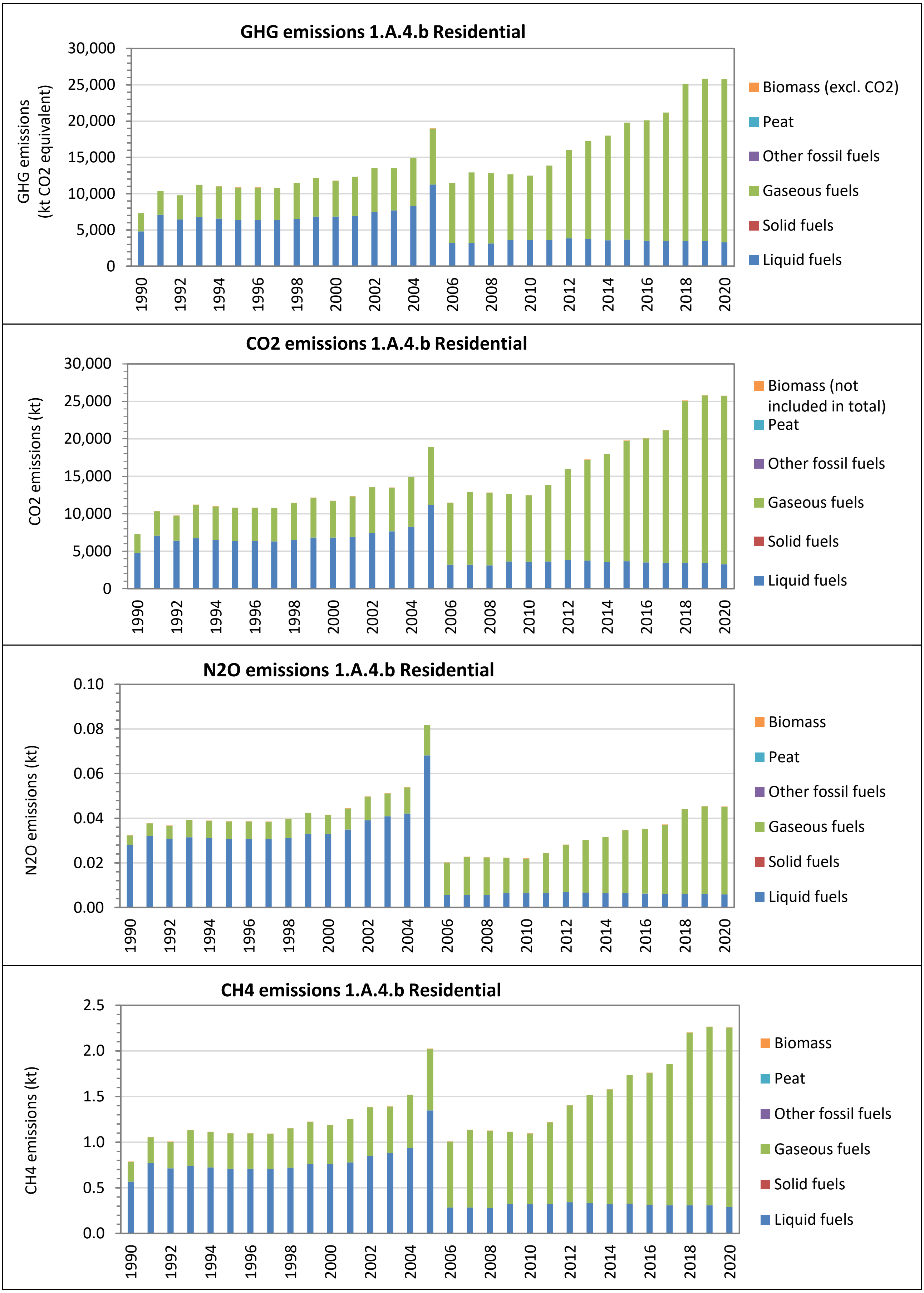

Figure 100 Emissions from IPCC category 1.A.4.b Residential

Table 270 GHG Emissions by fuels from IPCC category 1.A.4.b Residential

	Total GHG emissions (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt CO_2 eq	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	7,481.62	5,015.19	NO	2,461.75	NO	NO	4.62
1991	10,798.68	7,603.64	NO	3,192.03	NO	NO	2.98
1992	10,149.54	6,856.97	NO	3,289.24	NO	NO	3.30
1993	11,607.80	7,227.54	NO	4,374.63	NO	NO	5.56
1994	11,369.97	6,989.71	NO	4,374.63	NO	NO	5.56
1995	11,170.86	6,790.60	NO	4,374.63	NO	NO	5.56
1996	11,173.63	6,793.37	NO	4,374.63	NO	NO	5.56
1997	11,134.02	6,751.88	NO	4,374.63	NO	NO	7.41
1998	11,813.99	6,962.06	NO	4,843.96	NO	NO	7.87
1999	12,524.48	7,305.18	NO	5,211.33	NO	NO	7.87
2000	12,117.72	7,295.36	NO	4,814.39	NO	NO	7.87
2001	12,670.20	7,347.47	NO	5,314.76	NO	NO	7.87
2002	13,889.04	7,900.65	NO	5,977.65	NO	NO	10.60
2003	13,843.05	8,104.27	NO	5,730.02	NO	NO	8.65
2004	15,320.27	8,787.01	NO	6,524.50	NO	NO	8.65
2005	19,293.43	11,688.40	NO	7,594.40	NO	NO	10.49
2006	11,738.84	3,600.60	NO	8,128.64	NO	NO	9.48
2007	13,162.76	3,592.30	NO	9,559.83	NO	NO	10.49
2008	13,057.05	3,517.64	NO	9,532.49	NO	NO	6.84
2009	12,972.39	4,095.61	NO	8,868.79	NO	NO	7.89
2010	12,782.01	4,071.42	NO	8,706.39	NO	NO	4.15
2011	14,155.01	4,106.54	NO	10,047.66	NO	NO	0.80
2012	16,266.55	4,330.04	NO	11,936.07	NO	NO	0.43
2013	17,486.42	4,231.21	NO	13,252.49	NO	NO	2.68
2014	18,197.04	4,030.07	NO	14,165.99	NO	NO	0.97
2015	19,961.41	4,130.77	NO	15,829.65	NO	NO	0.97
2016	20,245.10	3,949.00	NO	16,295.14	NO	NO	0.95
2017	21,308.18	3,909.36	NO	17,397.18	NO	NO	1.62
2018	25,200.84	3,919.49	NO	21,277.83	NO	NO	3.48
2019	25,889.35	3,902.41	NO	21,985.24	NO	NO	1.68
2020	25,806.34	3,682.88	NO	22,121.80	NO	NO	1.64
Trend							
1990 - 2020	244.9%	-26.6%	NA	798.6%	*NA*	*NA*	*-64.5%*
2005 - 2020	33.8%	-68.5%	NA	191.3%	*NA*	*NA*	*-84.4%*
2019 - 2020	-0.3%	-5.6%	NA	0.6%	*NA*	*NA*	*-2.5%*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 271 CO_2 Emissions by fuels from IPCC category 1.A.4.b Residential

	Total CO_2 emissions (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	7,447.66	4,992.68	NO	2,454.98	NO	NO	0.06
1991	10,758.04	7,574.80	NO	3,183.24	NO	NO	0.04
1992	10,110.14	6,829.95	NO	3,280.18	NO	NO	0.04
1993	11,562.20	7,199.62	NO	4,362.59	NO	NO	0.07
1994	11,324.96	6,962.37	NO	4,362.59	NO	NO	0.07
1995	11,126.34	6,763.75	NO	4,362.59	NO	NO	0.07
1996	11,129.09	6,766.51	NO	4,362.59	NO	NO	0.07
1997	11,087.71	6,725.13	NO	4,362.59	NO	NO	0.10
1998	11,765.41	6,934.78	NO	4,830.63	NO	NO	0.10
1999	12,473.32	7,276.33	NO	5,196.99	NO	NO	0.10
2000	12,067.72	7,266.58	NO	4,801.14	NO	NO	0.10
2001	12,617.70	7,317.56	NO	5,300.14	NO	NO	0.10
2002	13,828.94	7,867.74	NO	5,961.20	NO	NO	0.14
2003	13,784.32	8,070.07	NO	5,714.26	NO	NO	0.11
2004	15,257.60	8,751.06	NO	6,506.55	NO	NO	0.11
2005	19,207.91	11,634.41	NO	7,573.50	NO	NO	0.14
2006	11,698.06	3,591.79	NO	8,106.27	NO	NO	0.12
2007	13,117.03	3,583.51	NO	9,533.52	NO	NO	0.14
2008	13,015.28	3,509.03	NO	9,506.26	NO	NO	0.09
2009	12,929.97	4,085.59	NO	8,844.38	NO	NO	0.10
2010	12,743.89	4,061.46	NO	8,682.43	NO	NO	0.05
2011	14,116.50	4,096.49	NO	10,020.01	NO	NO	0.01
2012	16,222.67	4,319.45	NO	11,903.22	NO	NO	0.01
2013	17,436.88	4,220.86	NO	13,216.03	NO	NO	0.03
2014	18,147.21	4,020.21	NO	14,127.01	NO	NO	0.01
2015	19,906.76	4,120.67	NO	15,786.10	NO	NO	0.01
2016	20,189.64	3,939.33	NO	16,250.30	NO	NO	0.01
2017	21,249.10	3,899.79	NO	17,349.31	NO	NO	0.02
2018	25,129.17	3,909.89	NO	21,219.28	NO	NO	0.04
2019	25,817.60	3,892.86	NO	21,924.74	NO	NO	0.02
2020	25,734.80	3,673.87	NO	22,060.93	NO	NO	0.02
Trend							
1990 - 2020	245.5%	-26.4%	NA	798.6%	NA	NA	-64.5%
2005 - 2020	34.0%	-68.4%	NA	191.3%	NA	NA	-84.4%
2019 - 2020	-0.3%	-5.6%	NA	0.6%	NA	NA	-2.5%

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector. Therefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or national totals** to avoid double counting.

Table 272 N_2O Emissions by fuels from IPCC category 1.A.4.b Residential

	Total N_2O emissions	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.034	0.028	NO	0.004	NO	NO	2.12E-06
1991	0.039	0.032	NO	0.006	NO	NO	1.37E-06
1992	0.038	0.031	NO	0.006	NO	NO	1.52E-06
1993	0.042	0.031	NO	0.008	NO	NO	2.56E-06
1994	0.041	0.031	NO	0.008	NO	NO	2.56E-06
1995	0.041	0.031	NO	0.008	NO	NO	2.56E-06
1996	0.041	0.031	NO	0.008	NO	NO	2.56E-06
1997	0.042	0.031	NO	0.008	NO	NO	3.41E-06
1998	0.043	0.031	NO	0.009	NO	NO	3.62E-06
1999	0.046	0.033	NO	0.009	NO	NO	3.62E-06
2000	0.045	0.033	NO	0.009	NO	NO	3.62E-06
2001	0.048	0.035	NO	0.009	NO	NO	3.62E-06
2002	0.055	0.039	NO	0.011	NO	NO	4.88E-06
2003	0.055	0.041	NO	0.010	NO	NO	3.98E-06
2004	0.058	0.042	NO	0.012	NO	NO	3.98E-06
2005	0.086	0.068	NO	0.014	NO	NO	4.83E-06
2006	0.025	0.006	NO	0.014	NO	NO	4.36E-06
2007	0.028	0.006	NO	0.017	NO	NO	4.83E-06
2008	0.026	0.006	NO	0.017	NO	NO	3.15E-06
2009	0.026	0.006	NO	0.016	NO	NO	3.63E-06
2010	0.024	0.006	NO	0.015	NO	NO	1.91E-06
2011	0.025	0.006	NO	0.018	NO	NO	3.66E-07
2012	0.028	0.007	NO	0.021	NO	NO	1.96E-07
2013	0.031	0.007	NO	0.024	NO	NO	1.23E-06
2014	0.032	0.006	NO	0.025	NO	NO	4.46E-07
2015	0.035	0.007	NO	0.028	NO	NO	4.47E-07
2016	0.036	0.006	NO	0.029	NO	NO	4.36E-07
2017	0.038	0.006	NO	0.031	NO	NO	7.46E-07
2018	0.046	0.006	NO	0.038	NO	NO	1.60E-06
2019	0.046	0.006	NO	0.039	NO	NO	7.74E-07
2020	0.046	0.006	NO	0.039	NO	NO	7.55E-07
Trend							
1990 - 2020	33.2%	*-79.2%*	*NA*	*798.6%*	*NA*	*NA*	*-64.5%*
2005 - 2020	-46.9%	*-91.5%*	*NA*	*191.3%*	*NA*	*NA*	*-84.4%*
2019 - 2020	-0.3%	*-5.6%*	*NA*	*0.6%*	*NA*	*NA*	*-2.5%*

Table 273 CH_4 Emissions by fuels from IPCC category 1.A.4.b Residential

	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	kt	kt	kt	kt	kt	kt	kt
1990	0.95	0.57	NO	0.22	NO	NO	0.16
1991	1.16	0.77	NO	0.28	NO	NO	0.10
1992	1.12	0.71	NO	0.29	NO	NO	0.11
1993	1.32	0.74	NO	0.39	NO	NO	0.19
1994	1.30	0.72	NO	0.39	NO	NO	0.19
1995	1.29	0.71	NO	0.39	NO	NO	0.19
1996	1.29	0.71	NO	0.39	NO	NO	0.19
1997	1.35	0.70	NO	0.39	NO	NO	0.26
1998	1.42	0.72	NO	0.43	NO	NO	0.27
1999	1.50	0.76	NO	0.46	NO	NO	0.27
2000	1.46	0.76	NO	0.43	NO	NO	0.27
2001	1.52	0.78	NO	0.47	NO	NO	0.27
2002	1.75	0.85	NO	0.53	NO	NO	0.37
2003	1.69	0.88	NO	0.51	NO	NO	0.30
2004	1.81	0.94	NO	0.58	NO	NO	0.30
2005	2.38	1.35	NO	0.68	NO	NO	0.36
2006	1.33	0.28	NO	0.72	NO	NO	0.33
2007	1.50	0.28	NO	0.85	NO	NO	0.36
2008	1.36	0.28	NO	0.85	NO	NO	0.24
2009	1.38	0.32	NO	0.79	NO	NO	0.27
2010	1.24	0.32	NO	0.77	NO	NO	0.14
2011	1.25	0.32	NO	0.89	NO	NO	0.03
2012	1.42	0.34	NO	1.06	NO	NO	0.01
2013	1.60	0.33	NO	1.18	NO	NO	0.09
2014	1.61	0.32	NO	1.26	NO	NO	0.03
2015	1.77	0.33	NO	1.41	NO	NO	0.03
2016	1.79	0.31	NO	1.45	NO	NO	0.03
2017	1.91	0.31	NO	1.55	NO	NO	0.06
2018	2.32	0.31	NO	1.89	NO	NO	0.12
2019	2.32	0.31	NO	1.95	NO	NO	0.06
2020	2.31	0.29	NO	1.97	NO	NO	0.06
Trend							
1990 - 2020	144.8%	*-48.7%*	*NA*	*798.6%*	*NA*	*NA*	*-64.5%*
2005 - 2020	-3.0%	*-78.4%*	*NA*	*191.3%*	*NA*	*NA*	*-84.4%*
2019 - 2020	-0.3%	*-5.6%*	*NA*	*0.6%*	*NA*	*NA*	*-2.5%*

3.2.6.2.2 Methodological issues

3.2.6.2.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[308] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathrm{GHG.\,fuel}}}$$

Where:

Emissions $_{\text{GHG. fuel}}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{\text{fuel}}$ = amount of fuel combusted (TJ)
Emission factor $_{\text{GHG. fuel}}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.6.2.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:	• Gas/Diesel Oil* (only non-bio Gas/Diesel Oil) • Liquefied Petroleum Gases
Gaseous fuels:	• Natural gas
Biomass	• Fuelwood

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Emissions from the combustion of wood charcoal, used for e.g., barbeque were not estimated due to lack of data.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[309] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[310].

The total fuel consumption increased by 288.8%% in the period 1990 – 2020. From 2005 to 2020 the total fuel consumption increased by 49.2%. From 2019 to 2020 the total fuel consumption decreased by 0.2% due to the corona pandemic all activities are shut down. In general, the share of natural gas as a fuel has become larger and larger.

The dips and jumps from year to year are mainly due to:

- the weather circumstances in the corresponding years
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning

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[308] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[309] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[310] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

The rising fuel consumption is the result of increased heat and electricity demand and households per building but also due growing number of buildings and population increase.

The high fuel consumption in 2005 is a result of the coldest year in the last 30 years in Algeria.[311]

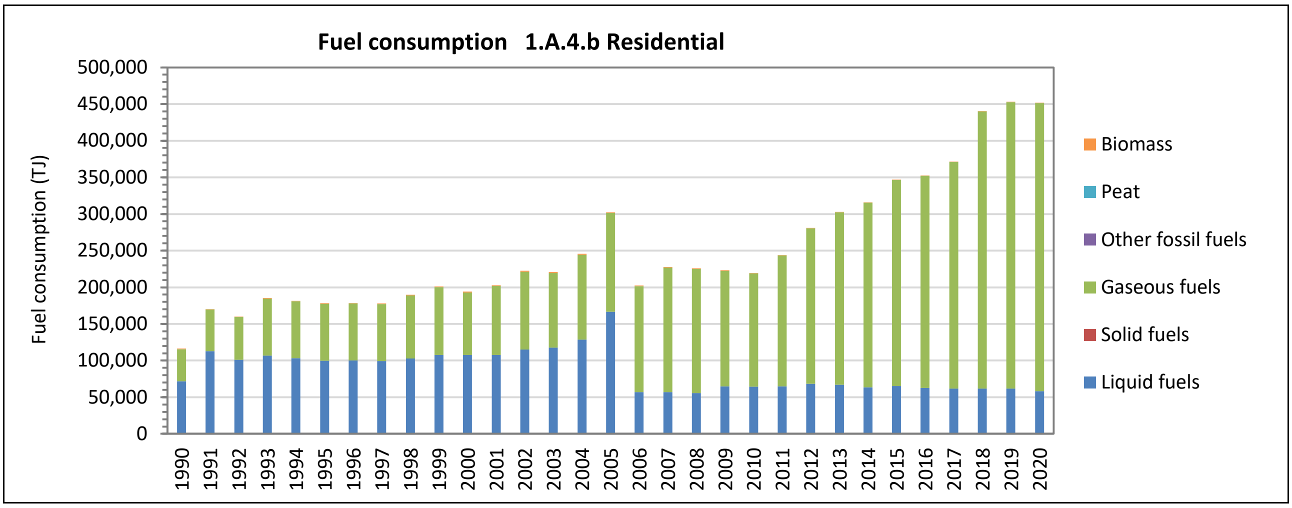

Figure 33 Activity data for IPCC category 1.A.4.b Residential

Table 274 Activity data for IPCC category 1.A.4.b Residential

Activity data 1.A.4.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	116,173.61	71,881.67	NO	43,760.70	NO	NO	531.24
1991	169,887.85	112,802.66	NO	56,742.30	NO	NO	342.89
1992	159,847.94	100,998.53	NO	58,470.30	NO	NO	379.11
1993	185,261.27	106,856.87	NO	77,764.50	NO	NO	639.90
1994	181,501.44	103,097.04	NO	77,764.50	NO	NO	639.90
1995	178,353.67	99,949.27	NO	77,764.50	NO	NO	639.90
1996	178,397.39	99,992.99	NO	77,764.50	NO	NO	639.90
1997	177,954.10	99,337.21	NO	77,764.50	NO	NO	852.39
1998	189,672.87	102,659.85	NO	86,107.50	NO	NO	905.52
1999	201,091.59	107,548.17	NO	92,637.90	NO	NO	905.52
2000	193,916.97	107,429.55	NO	85,581.90	NO	NO	905.52
2001	202,915.64	107,533.52	NO	94,476.60	NO	NO	905.52
2002	222,561.30	115,081.58	NO	106,260.30	NO	NO	1,219.43
2003	220,580.95	117,727.69	NO	101,858.40	NO	NO	994.86
2004	245,438.56	128,462.50	NO	115,981.20	NO	NO	994.86
2005	302,627.41	166,420.05	NO	135,000.00	NO	NO	1,207.36
2006	202,509.18	56,922.14	NO	144,496.80	NO	NO	1,090.24
2007	227,936.34	56,790.98	NO	169,938.00	NO	NO	1,207.36
2008	225,849.76	55,610.57	NO	169,452.00	NO	NO	787.20

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[311] available (25.09.2022) on https://onm-blog.meteo.dz/wp-content/uploads/2021/07/Les-signes-meteorologiques-extremes-signes-d-un.pdf

Activity data 1.A.4.b	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
2009	223,309.67	64,747.84	NO	157,653.90	NO	NO	907.93
2010	219,610.19	64,365.43	NO	154,766.98	NO	NO	477.79
2011	243,622.03	64,920.57	NO	178,609.88	NO	NO	91.58
2012	280,681.77	68,453.99	NO	212,178.69	NO	NO	49.10
2013	302,779.74	66,891.56	NO	235,579.81	NO	NO	308.37
2014	315,641.48	63,711.65	NO	251,818.30	NO	NO	111.52
2015	346,807.57	65,303.73	NO	281,392.07	NO	NO	111.78
2016	352,205.83	62,429.99	NO	289,666.72	NO	NO	109.12
2017	371,246.70	61,803.32	NO	309,256.89	NO	NO	186.50
2018	440,603.91	61,963.46	NO	378,240.21	NO	NO	400.24
2019	452,702.41	61,693.45	NO	390,815.36	NO	NO	193.59
2020	451,654.57	58,223.00	NO	393,242.87	NO	NO	188.70
Trend							
1990 - 2020	288.8%	-19.0%	NA	798.6%	NA	NA	-64.5%
2005 - 2020	49.2%	-65.0%	NA	191.3%	NA	NA	-84.4%
2019 - 2020	-0.2%	-5.6%	NA	0.6%	NA	NA	-2.5%

In energy statistics, production, transformation, and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units. e.g., in tones or cubic metres. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.4.b Residential are provided.

Table 275Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.4.b Residential

Fuel type	Fuel	Unit	Net calorific value (NCV)	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	default NCV for comparison
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m^3 TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
biomass	Fuelwood Bois/résidus de bois	TJ / Gg	MEM/Sonatrach	15.6
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Petroleum products			1 NCV = 0.95 x GCV	
Conversion from weight in tons per m3 for fuelwood (general fuelwood)				
Fuelwood (general fuelwood)			Volume (m3) *0.707 = weight (tonnes)	

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[312]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)		
	Conversion from GCV to NCV Conversion from weight in tons per m3 for fuelwood (general fuelwood)	International Recommendations for Energy Statistics (IRES) (2018)[313]: Table 4 Difference between net and gross calorific values for selected fuels Table 4.3 Conversion table for fuelwood (wood with 25 per cent moisture content)		
Note:				
D Default		CS Country specific		PS Plant specific
* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.				

3.2.6.2.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas , liquid fuels and biomass were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 276 GHG Emission factor TIER 1 for IPCC category 1.A.4.b Residential

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	5	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	10	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	56,100	D	5	D	0.1	D
biomass	Fuelwood Bois/résidus de bois	112,000	D	300	D	4	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor	

3.2.6.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.4.a Commercial/ Institutional are presented in the following table.

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[312] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[313] https://unstats.un.org/unsd/energystats/methodology/ires/

Table 277Uncertainty for IPCC category 1.A.4.b Residential.

Uncertainty	Gaseous fuels			Liquid fuels			Biomass			Reference
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	10%	10%	10%	15%	15%	15%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	5%			2%			10%			based Table 2.13
		150%			150%			20%		based Table 2.12
			187%			200%			250%	based Table 2.14
Combined Uncertainty (U)	9%	150%	187%	10%	150%	200%	18%	201%	250%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[314] ;
- 2010 - 2020 are taken from the National Energy balance provided by MEM[315].

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [316];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [317].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.6.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series) ,
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:

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[314] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[315] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[316] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[317] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

  - national statistic published by MEM and Office National des Statistics (ONS)[318] and
  - international energy statistics of UN statistics[319] and International Energy Agency (IEA)[320]
- cross checks with other relevant sectors (e.g., 1.4.a and 1.4.c) are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

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[318] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[319] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[320] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

3.2.6.2.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.4.b Residential*.

Table 278Recalculations done since NC in IPCC category 1.A.4.b Residential

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.4.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.4.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.b	Revision of NCV Default → country specific: Natural gas. Gasoil/diesel	AD	Accuracy Comparability
1.A.4.b	Revision of CO_2 and CH_4 EF	EF	Accuracy Comparability
1.A.4.b	Assumption of 100% oxidation	EF	Accuracy Comparability

3.2.6.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 279Planned improvements for IPCC category 1.A.4.b Residential

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a. 1.A.4.b. 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.b.i 1.A.4.b.ii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Completeness Comparability	low
1.A.4.b	Energy balance - Use of other biomass than fuel wood ▪ bio-gasoline or bio-gas/diesel oil including MTBE, AdBlue, etc. ▪ Wood charcoal	AD	Completeness	medium
1.A.4.b	Determination ▪ CS NCV for biomass considering moisture content Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.b	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air condidtioning. etc.) ▪ energy-saving devices and technologies	AD EF	Transparency	Medium / low

3.2.6.3 Agriculture/forestry/fishing (IPCC category 1.A.4.c)

3.2.6.3.1 Category description

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.4.c.																		
1.A.4.c.i.	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓	✓	NO	✓	NO	NO	✓
1.A.4.c.ii.	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO
1.A.4.c.iii.	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO	IE	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

A '✓' indicates: emissions from this category have been estimated.
Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

Emissions included elsewhere (IE):

It is assumed, that the fuel combusted in IPCC category 1.A.4.c.ii *Off-road vehicles and other machinery* and IPCC category 1.A.4.c.iii *Fishing* is included either in IPCC category 1.A.4.c.i *Stationary combustion.* IPCC category 1.A.4.b *Residential or* IPCC category *1.A.3 Road transport.*
Furthermore, the greenhouse gas emissions from IPCC category 1.A.4.c *Agriculture/Forestry/Fishing* for the period 1990 – 2008 are included in emissions from IPCC category 1.A.4.b *Residential* as the energy balance was not disaggregated in this period.

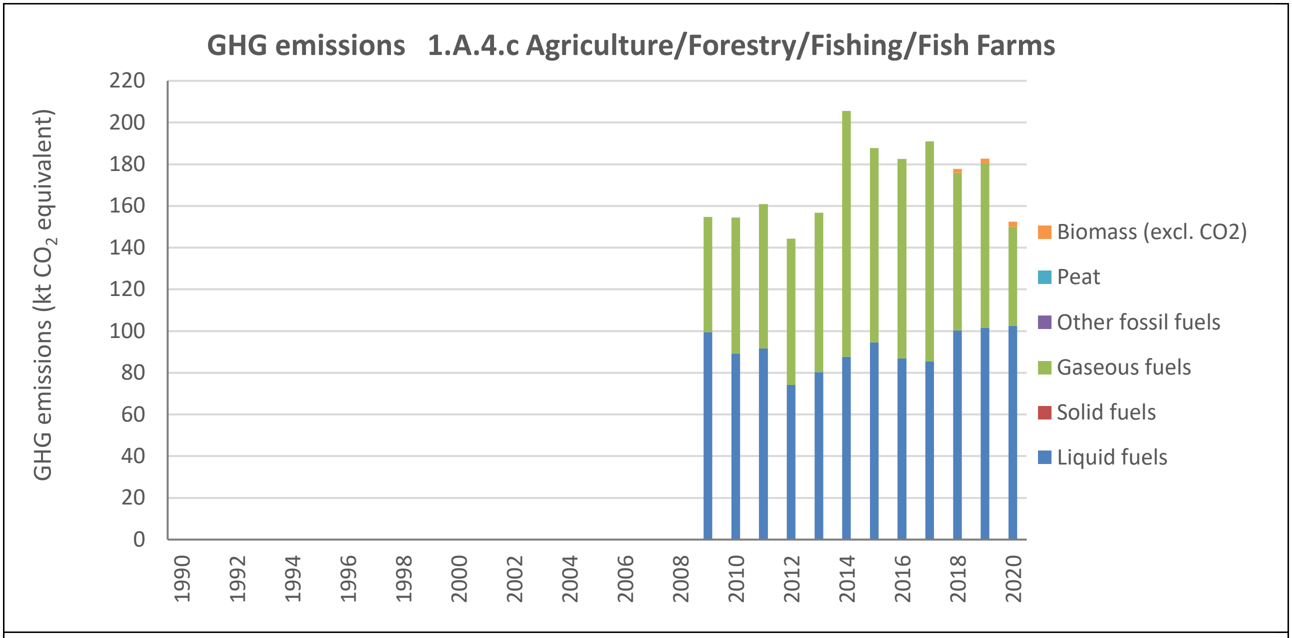
An overview of the GHG emissions from fuel combustion in IPCC category 1.A.4c *Agriculture/Forestry/Fishing* is provided in the following figures and tables:

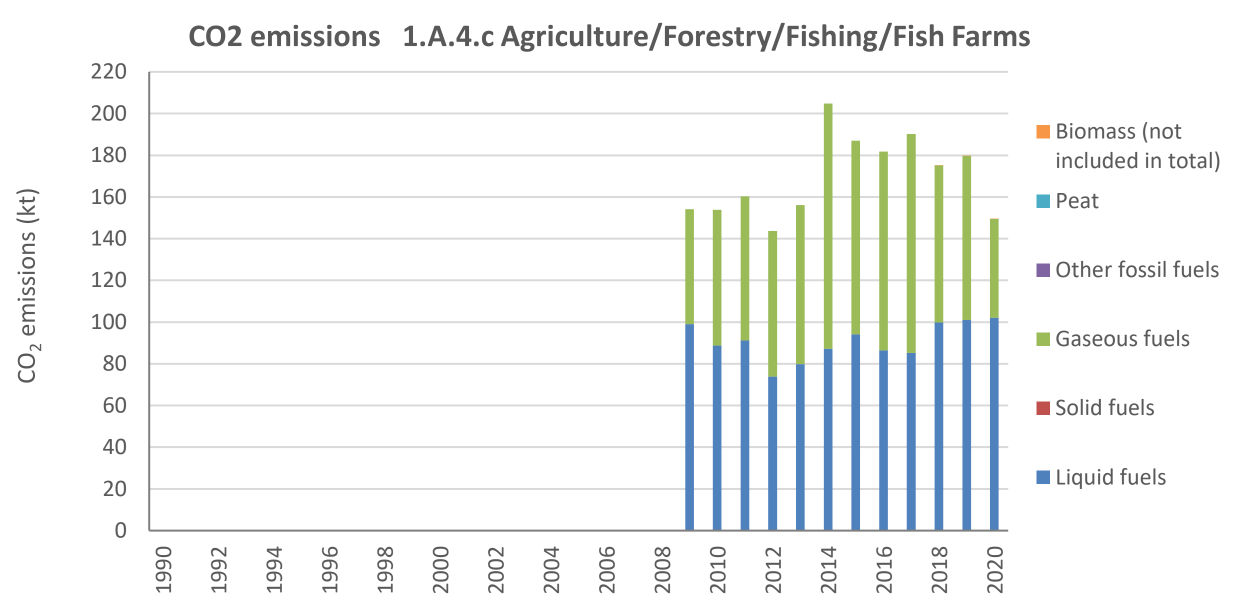
- annual GHG emissions;
- Trend of the periods 2009 – 2020, 2019 – 2020;

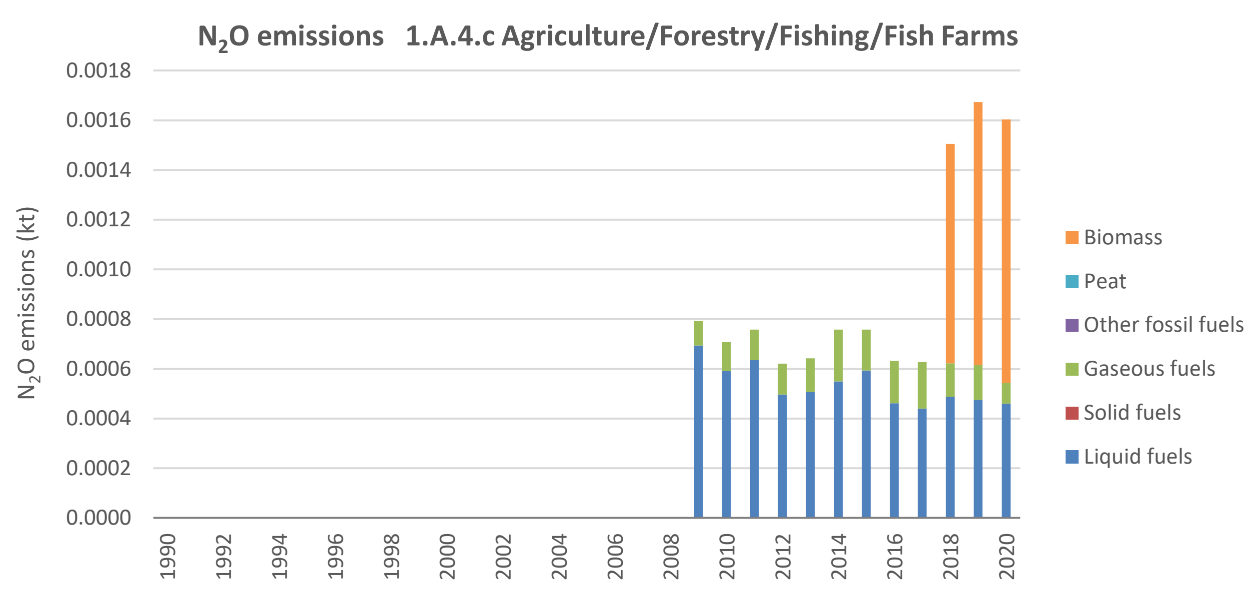
The greenhouse gas emissions from IPCC category 1.A.4.c *Agriculture/Forestry/Fishing* amounted to 154.76kt CO_2 equivalents in 2010. and 152.37 kt CO_2 equivalents in 2020.
The overall trend in GHG emissions from the 1.A.4.c *Agriculture/Forestry/Fishing* shows an decrease by 1.34% from 2010 to 2020 and a decrease by 16.6% from 2019 to 2020 due to the national lockdown due to the COVID pandemic (2020).
The overall increasing trend of emissions is result of rising heat and electricity production due to increased demand by farms and (industrial) agricultural holdings. The dips and jumps from year to year are mainly due to:

- Increased agricultural production
    - cold or mild winters: affecting the heating demand
    - hot summers: affecting the electricity demand for air conditioning the economic situation as reflected in the gross domestic product (GDP).

No bio-gasoline or bio-gas/diesel oil was consumed. No CO_2 emission were captured.


GHG emissions 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms
GHG emissions (kt CO₂ equivalent)
0
20
40
60
80
100
120
140
160
180
200
220
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (excl. CO2)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


CO2 emissions 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms
CO₂ emissions (kt)
0
20
40
60
80
100
120
140
160
180
200
220
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass (not included in total)
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels


N₂O emissions 1.A.4.c Agriculture/Forestry/Fishing/Fish Farms
N₂O emissions (kt)
0.0000
0.0002
0.0004
0.0006
0.0008
0.0010
0.0012
0.0014
0.0016
0.0018
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Biomass
Peat
Other fossil fuels
Gaseous fuels
Solid fuels
Liquid fuels

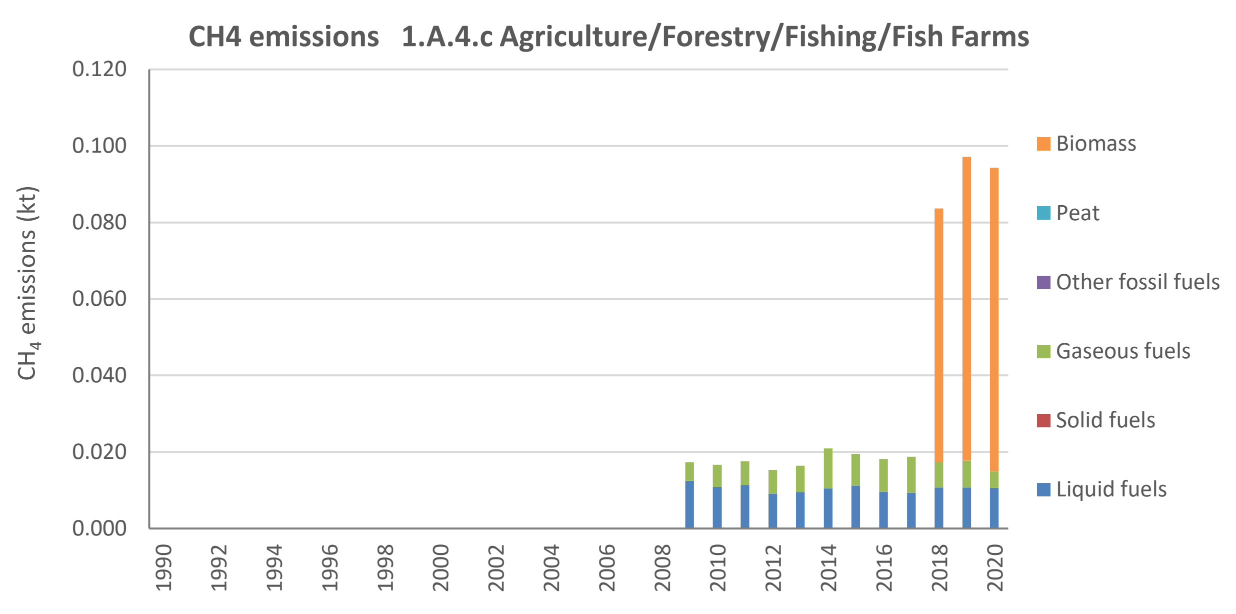


Figure 101 Emissions from IPCC category 1.A.4.c Agriculture/forestry/fishing

Table 280 GHG Emissions by fuels from IPCC category 1.A.4.a Commercial/Institutional

	Total GHG emissions (excluding CO_2 from biomass)	**GHG emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt CO_2 eq	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**	**kt CO_2 eq**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	154.76	99.52	NO	55.24	NO	NO	IE
2010	154.44	89.13	NO	65.31	NO	NO	IE
2011	160.96	91.64	NO	69.32	NO	NO	IE
2012	144.29	74.17	NO	70.12	NO	NO	IE
2013	156.80	80.27	NO	76.53	NO	NO	IE
2014	205.58	87.62	NO	117.96	NO	NO	IE
2015	187.69	94.62	NO	93.07	NO	NO	IE
2016	182.49	86.88	NO	95.61	NO	NO	IE
2017	190.95	85.56	NO	105.39	NO	NO	IE
2018	177.81	100.18	NO	75.68	NO	NO	1.94
2019	182.68	101.48	NO	78.86	NO	NO	2.33
2020	*152.37*	*102.56*	*NO*	*47.48*	*NO*	*NO*	*2.33*
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2010 - 2020	*-1.5%*	*15.1%*	*NA*	*-27.3%*	*NA*	*NA*	*NA*
2019 - 2020	*-16.6%*	*1.1%*	*NA*	*-39.8%*	*NA*	*NA*	*0.0%*

Note: (1) Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sectorTherefore, emissions from combustion of biofuels are reported as **information items** but **not included in the sectoral or**

national totals to avoid double counting.

Table 281 CO₂ Emissions by fuels from IPCC category 1.A.4.c Agriculture/forestry/fishing

	Total CO_2 emissions (excluding CO_2 from biomass)	**CO_2 emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass (1)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	154	99	NO	55	NO	NO	IE
2010	154	89	NO	65	NO	NO	IE
2011	160	91	NO	69	NO	NO	IE
2012	144	74	NO	70	NO	NO	IE
2013	156	80	NO	76	NO	NO	IE
2014	205	87	NO	118	NO	NO	IE
2015	187	94	NO	93	NO	NO	IE
2016	182	86	NO	95	NO	NO	IE
2017	190	85	NO	105	NO	NO	IE
2018	175	100	NO	75	NO	NO	0.02
2019	180	101	NO	79	NO	NO	0.03
2020	150	102	NO	47	NO	NO	0.03
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 - 2020	-2.8%	15.2%	NA	-27.30%	NA	NA	NA
2019 - 2020	-16.8%	1.1%	NA	-39.8%	NA	NA	0.0%

Table 282 N_2O Emissions by fuels from IPCC category 1.A.4.c Agriculture/forestry/fishing

	Total N_2O emissions	**N_2O emission from**					
		Liquid fuels	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	0.0008	0.00069	NO	0.00010	NO	NO	IE
2010	0.0007	0.00059	NO	0.00012	NO	NO	IE
2011	0.0008	0.00063	NO	0.00012	NO	NO	IE
2012	0.0006	0.00050	NO	0.00012	NO	NO	IE
2013	0.0006	0.00051	NO	0.00014	NO	NO	IE
2014	0.0008	0.00055	NO	0.00021	NO	NO	IE
2015	0.0008	0.00059	NO	0.00017	NO	NO	IE
2016	0.0006	0.00046	NO	0.00017	NO	NO	IE
2017	0.0006	0.00044	NO	0.00019	NO	NO	IE
2018	0.0015	0.00049	NO	0.00013	NO	NO	0.0009
2019	0.0017	0.00047	NO	0.00014	NO	NO	0.0011
2020	0.0016	0.00046	NO	0.00008	NO	NO	0.0011
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 - 2020	126.7%	-22.2%	NA	-27.30%	NA	NA	NA
2019 - 2020	-4.2%	-3.2%	NA	-39.8%	NA	NA	0.0%

Table 283 CH_4 Emissions by fuels from IPCC category 1.A.4.c Agriculture/forestry/fishing

	Total CH_4 emissions	CH_4 emission from					
		Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	kt	kt	kt	kt	kt	kt	kt
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	0.017	0.012	NO	0.005	NO	NO	IE
2010	0.017	0.011	NO	0.006	NO	NO	IE
2011	0.018	0.011	NO	0.006	NO	NO	IE
2012	0.015	0.009	NO	0.006	NO	NO	IE
2013	0.016	0.010	NO	0.007	NO	NO	IE
2014	0.021	0.010	NO	0.010	NO	NO	IE
2015	0.020	0.011	NO	0.008	NO	NO	IE
2016	0.018	0.010	NO	0.008	NO	NO	IE
2017	0.019	0.009	NO	0.009	NO	NO	IE
2018	0.084	0.011	NO	0.007	NO	NO	0.066
2019	0.097	0.011	NO	0.007	NO	NO	0.079
2020	0.094	0.011	NO	0.004	NO	NO	0.079
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
2010 - 2020	465.0%	-2.2%	NA	-27.30%	NA	NA	NA
2019 - 2020	-2.9%	-0.6%	NA	-39.79%	NA	NA	0.00%

3.2.6.3.2 Methodological issues

3.2.6.3.2.1 Choice of methods – TIER 1 for CO_2. CH_4 and N_2O

For estimating the CO_2, CH_4 and N_2O emissions the 2006 IPCC Guidelines Tier 1 approach[321] has been applied:

Equation 2.1: GHG emissions from stationary combustion (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG.\,fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.\,fuel}}$$

Equation 2.2: Total emissions by greenhouse gas (2006 IPCC GL. Vol. 2. Chap. 2)

$$\boldsymbol{Emissions_{GHG} = \sum_{fuel} emissions_{\mathbf{GHG.\,fuel}}}$$

Where:

Emissions $_{GHG.\ fuel}$ = emissions of a given GHG by type of fuel (kg GHG)
Fuel consumption $_{fuel}$ = amount of fuel combusted (TJ)
Emission factor $_{GHG.\ fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)
GHG = CO_2, CH_4, N_2O
Fuel = liquid fuels, solid fuels, other fossil fuel, biomass, peat

3.2.6.3.2.2 Choice of activity data

The following fuels are used for combustion for the generation of electricity and/or heat for own use:

Liquid fuels:
- Gas/Diesel Oil (Non-bio gas/diesel oil)
- Liquefied Petroleum Gases
- Other Oil - Other Petroleum Products

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

Fuel consumption used for estimating the GHG and non-GHG emissions for the years

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[322] ;
- 2010 – 2020 are taken from the National Energy balance provided by MEM[323].

  Activity data from 1.A.4.c for the period 1990 – 2009 are included in 1.A.4.b as the energy balance was not disaggregated in this period.

From 2010 to 2020 the total fuel consumption increased by 20.76%. From 2019 to 2020 the total fuel consumption decreased by 21.9% due to Covid19.

In 2014 the fuel consumption increased by 47% due to the evolution of continental fishery (aqua culture) and development of irrigated land.

The dips and jumps from year to year are mainly due to:

- the weather circumstances in the corresponding years
  - cold or mild winters: affecting the heating demand
  - hot summers: affecting the electricity demand for air conditioning.

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[321] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.3.1 Methodological issues - Choice of method

[322] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[323] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

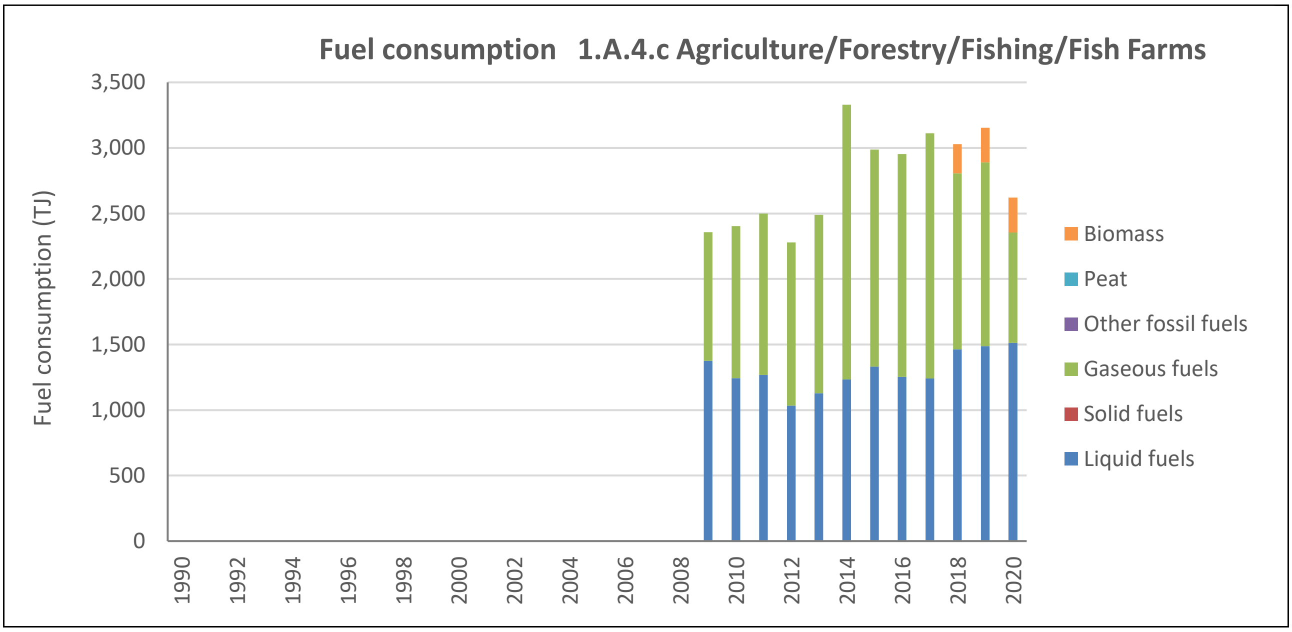

Figure 102 Activity data for IPCC category 1.A.4.c Agriculture/forestry/fishing

Table 284 Activity data for IPCC category 1.A.4.c Agriculture/forestry/fishing

Activity data 1.A.4.c	Total fuels (incl. biomass)	Liquid fuels	Solid fuels	Gaseous fuels	Other fossil fuels	Peat	Biomass
	TJ						
1990	IE	IE	NO	IE	NO	NO	IE
1991	IE	IE	NO	IE	NO	NO	IE
1992	IE	IE	NO	IE	NO	NO	IE
1993	IE	IE	NO	IE	NO	NO	IE
1994	IE	IE	NO	IE	NO	NO	IE
1995	IE	IE	NO	IE	NO	NO	IE
1996	IE	IE	NO	IE	NO	NO	IE
1997	IE	IE	NO	IE	NO	NO	IE
1998	IE	IE	NO	IE	NO	NO	IE
1999	IE	IE	NO	IE	NO	NO	IE
2000	IE	IE	NO	IE	NO	NO	IE
2001	IE	IE	NO	IE	NO	NO	IE
2002	IE	IE	NO	IE	NO	NO	IE
2003	IE	IE	NO	IE	NO	NO	IE
2004	IE	IE	NO	IE	NO	NO	IE
2005	IE	IE	NO	IE	NO	NO	IE
2006	IE	IE	NO	IE	NO	NO	IE
2007	IE	IE	NO	IE	NO	NO	IE
2008	IE	IE	NO	IE	NO	NO	IE
2009	2,356.91	1,375.01	NO	981.90	NO	NO	IE
2010	2,403.70	1,242.71	NO	1,160.98	NO	NO	IE
2011	2,500.06	1,267.85	NO	1,232.21	NO	NO	IE
2012	2,278.99	1,032.54	NO	1,246.46	NO	NO	IE

Activity data 1.A.4.c	**Total fuels** (incl. biomass)	**Liquid fuels**	**Solid fuels**	**Gaseous fuels**	**Other fossil fuels**	**Peat**	**Biomass**
	TJ						
2013	2,489.07	1,128.62	NO	1,360.45	NO	NO	IE
2014	3,330.67	1,233.84	NO	2,096.83	NO	NO	IE
2015	2,986.72	1,332.31	NO	1,654.40	NO	NO	IE
2016	2,953.33	1,253.70	NO	1,699.63	NO	NO	IE
2017	3,113.43	1,240.07	NO	1,873.36	NO	NO	IE
2018	3,028.30	1,462.34	NO	1,345.38	NO	NO	220.58
2019	3,154.90	1,488.30	NO	1,401.89	NO	NO	264.70
2020	2,620.35	1,511.62	NO	844.03	NO	NO	264.70
Trend							
1990 - 2020	NA	NA	NA	NA	NA	NA	NA
201 - 2020	9.0%	21.6%	NA	-27.30%	NA	NA	NA
2019 - 2020	-16.9%	1.6%	NA	-39.8%	NA	NA	0.0%

In energy statistics, production, transformation and consumption of solid, liquid, gaseous and renewable fuels are specified in physical units, e.g., in tones or cubic meters. To convert these data to energy units, in this case terajoules, requires calorific values. The emission calculations are based on net calorific values. In the following table the applied net calorific values (NCVs) for conversion to energy units in IPCC category 1.A.4.c Agriculture/forestry/fishing are provided.

Table 285Net calorific values (NCVs) and Conversion factors applied for conversion to energy units in IPCC category 1.A.4.c Agriculture/forestry/fishing

Fuel type	**Fuel**	**Unit**	**Net calorific value (NCV)**	
			Country specific NCV (CS NCV) (GVC * Conversion factor)	**default NCV for comparison**
gaseous	Natural Gas Gaz naturel	TJ / 10^6 m³ TJ /Gg	39.57 * 0.9 = 35.61	39.02 UN default 48.0 2006 IPCC default
liquid	Gas / Diesel Oil* Gasoil / Diesel	TJ / Gg	43.38 * 0.95 = 41.21	43.0
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	TJ / Gg	46.02 * 0.95 = 43.72	47.3
	Other Petroleum Products Autres produits pétroliers	TJ / Gg	-	40.2
biomass	Solid Biofuels - Wood / Wood Waste/ Fuelwood. Wood residues and by-products	TJ / Gg	-	29.5

Conversion from GCV to NCV	**Default**
Natural gas	1 NCV = 0.9 x GCV
Petroleum products	1 NCV = 0.95 x GCV

Conversion from weight in tons per m3 for fuelwood (general fuelwood)	
Solid Biofuels - Wood / Wood Waste/ Fuelwood, Wood residues and by-products	Volume (m3) *0.707 = weight (tonnes)

Source	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[324]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2 International Recommendations for Energy Statistics (IRES) (2018): Table 4.1 Default net calorific values for energy products (only English version)
	Conversion from GCV to NCV Conversion from weight in tons per m3 for fuelwood (general fuelwood)	International Recommendations for Energy Statistics (IRES) (2018) [325]: Table 4 Difference between net and gross calorific values for selected fuels Table 4.3 Conversion table for fuelwood (wood with 25 per cent moisture content)

Note:

D Default	CS Country specific	PS Plant specific

* no bio-gas/diesel oil or biogasoline is not consumed in Algeria.

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[324] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[325] https://unstats.un.org/unsd/energystats/methodology/ires/

3.2.6.3.2.3 Choice of emission factors

Default emission factors for CO_2, CH_4 and N_2O for Natural gas ,liquid fuels and biomass, were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 286 GHG Emission factor TIER 1 for IPCC category 1.A.4.c Agriculture/forestry/fishing

Fuel type	**Fuel**	**CO_2 (kg/TJ)**		**CH_4 (kg/TJ)**		**N_2O (kg/TJ)**	
		EF	**type**	**EF**	**type**	**EF**	**type**
gaseous	Natural Gas Gaz naturel	56,100	D	5	D	0.1	D
liquid	Gas / Diesel Oil* Gasoil / Diesel	74,100	D	10	D	0.6	D
	Liquefied Petroleum Gases (LPG) Gaz de pétrole liquéfiés (GPL)	56,100	D	5	D	0.1	D
	Other Petroleum Products Autres produits pétroliers	73,300	D	10	D	0.6	D
biomass	Fuelwood Bois/résidus de bois	112,000	D	300	D	4	D
Source	CS – country specific EF - Ministry of Energy and Mines (2021): Development of Country specific emission factor. D – Default EF - 2006 IPCC Guidelines Vol. 2. Chap. 2 (2.3.2.1) Table 2.4 Default emission factors for stationary combustion in the commercial/ institutional category						
Note:							
D Default	CS Country specific		PS Plant specific		IEF Implied emission factor		

3.2.6.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.A.4.a Commercial/ Institutional are presented in the following table.

Table 287Uncertainty for IPCC category 1.A.4.c Agriculture/forestry/fishing.

Uncertainty	**Gaseous fuels**			**Liquid fuels**			**Reference**
	CO_2	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**	2006 IPCC GL. Vol. 2. Chap. 2
Activity data (AD)	7%	7%	7%	10%	10%	10%	based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	5%			2%			based Table 2.13
		150%			150%		based Table 2.12
			187%			200%	based Table 2.14
Combined Uncertainty (U)	9%	150%	187%	10%	150%	200%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[326] ;
- 2010 - 2020 are taken from the National Energy balance prepared by MEM[327].

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[326] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[327] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

In 2009, the energy balance was improved by applying International Recommendations for Energy Statistics (IRES) based on Standard International Energy Product Classification (SIEC) which is harmonized with the

- International Standard Industrial Classification of all Economic Activities (ISIC) [328];
- 2006 IPCC Guidelines - Sectoral Approach, where emissions from stationary combustion are specified for a number of societal and economic activities and as defined within the IPCC sector 1.A Fuel Combustion Activities [329].

A revision of the years 1990-2009 is still pending.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.2.6.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistics (ONS)[330] and
    - international energy statistics of UN statistics[331] and International Energy Agency (IEA)[332]
- cross checks with other relevant sectors (e.g., 1.4.b and 1.4.c) are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.2.6.3.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.A.4.c Agriculture/forestry/fishing*.

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[328] (ISIC) - International Standard Industrial Classification of All Economic Activities is the international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. https://unstats.un.org/unsd/classifications/Econ/isic

[329] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 2: Stationary Combustion - 2.2 Description of sources

[330] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[331] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[332] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

Table 288Recalculations done since NC in IPCC category 1.A.4.c Agriculture/forestry/fishing

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.4.c	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.4.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.c	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.4.c	Revision of CO_2 and CH_4 EF	EF	Accuracy Comparability
1.A.4.c	Assumption of 100% oxidation	EF	Accuracy Comparability

3.2.6.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 289Planned improvements for IPCC category 1.A.4.c Agriculture/forestry/fishing

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a. 1.A.4.b. 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.c.i 1.A.4.c.ii 1.A.4.c.iii	Energy balance - Survey on use of fuels in • Stationary • Off-road vehicles and other machinery • Fishing	AD	Completeness Comparability	Medium
1.A.4.b	Energy balance - Use of other biomass than fuel wood ▪ Wood charcoal	AD	Completeness	medium
1.A.4.b	Determination ▪ CS NCV for biomass considering moisture content Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.b	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air condidtioning, etc.) ▪ energy-saving devices and technologies	AD EF	Transparency	Medium / low

3.2.7 Other - Non-Specified (IPCC category 1.A.5)

The IPCC category 1.A.5 *Other – Non specified* comprise all remaining emissions from fuel combustion that are not specified elsewhere. This category should also include emissions from fuel delivered to the military in the country and delivered to the military of other countries that are not engaged in multilateral operations. The fuel consumption of the military is included in the energy balance. Activity data of fuels used by military are confidential. Emissions of military mobile sources are aggregated and included under category 1.A.3b

IPCC category	**Description**	
1.A.5.a	**Stationary**	Emissions from fuel combustion in stationary sources that are not specified elsewhere.
1.A.5.b	**Mobile**	Emissions from vehicles and other machinery, marine and aviation (not included in 1.A.4.c.ii or elsewhere).
1.A.5.b.i	Mobile - aviation component	All remaining aviation emissions from fuel combustion that are not specified elsewhere. Include emissions from fuel delivered to the country's military as well as fuel delivered within that country but used by the militaries of other countries that are not engaged in multilateral operations.
1.A.5.b.ii	Mobile - waterborne component	All remaining water-borne emissions from fuel combustion that are not specified elsewhere. Include emissions from fuel delivered to the country's military as well as fuel delivered within that country but used by the militaries of other countries that are not engaged in multilateral operations.
1.A.5.b.iii	Mobile - other	All remaining emissions from mobile sources not included elsewhere.
Source: 2006 IPCC Guidelines. Volume 2: Energy. Chapter 2: Stationary Combustion - 2.2 Description of sources		

GHG emissions/ removals	**CO_2**						**CH_4**						**N_2O**					
	liquid	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**	**liquid**	**solid**	**gaseous**	**other fossil fuel**	**Peat**	**biomass**
1.A.5.a	NE	NO	NE	NO	NO	NE	NE	NO	NE	NO	NO	NE	NE	NO	NE	NO	NO	NE
1.A.5.b.i	NE	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO
1.A.5.b.ii	NE	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO	NE	NO	NO	NO	NO	NO
1.A.5.b.iii	IE,C	NO	NO	NO	NO	NO	IE,C	NO	NO	NO	NO	NO	IE,C	NO	NO	NO	NO	NO
Key Category	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential																		
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF																		

Emissions from IPCC category 1.A.5 *Other - Non-Specified* were not estimated due lack of information.

3.2.8 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 290Planned improvements for IPCC category 1.A.5

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.5	- Survey on fuels combustion not included in IPCC categories 1.A.1-1.A.4;	AD	Transparency	Medium

3.3 Fugitive emissions from fuels (IPCC category 1.B)

The following figures and tables provide an overview of the fugitive emissions in IPCC category 1B.
The fugitive GHG emissions of IPCC category 1.B *Fugitive emissions from fuels* amounted to 19,631.55kt CO_2 in 1990, 33,048.93kt CO_2 in 2005 and 30,424.51kt CO_2 in 2020.

The overall trend of greenhouse gas emissions in category 1.B

Fugitive emissions from fuels show a significant increase of 55% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, resulting in a downward trend of 7.9% in GHG emissions from 2005 to 2020. During the period 2019-2020, GHG emissions decreased by 0.3%.
These trends can be explained by the increase in hydrocarbon production from the year 1999 onwards, particularly the increase in CH_4 emissions resulting from natural gas production, transformation and transport activities, as well as the losts by venting. However, in the case of coke, the decrease is due to the cessation of its production at the national level and to the import of the quantities necessary to ensure the needs of the industrial sector.

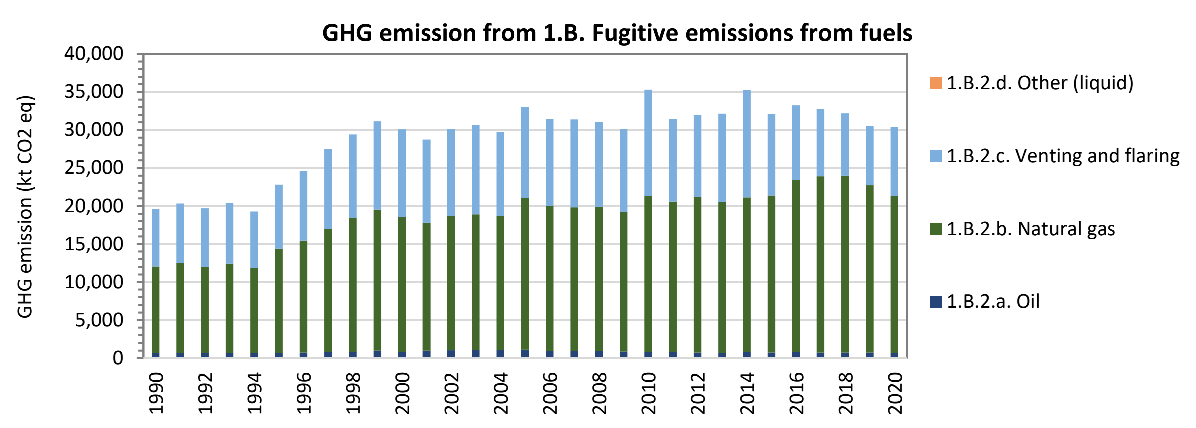


Figure 103 GHG Emissions from IPCC category 1.B *Fugitive emissions from fuels*

The most important gas in IPCC category 1.B Fugitive emissions from fuels is CH_4 with a part of 72.43% of total emissions in 2020, CH_4 emissions are mainly the result of natural gas production, transformation and transport activities, as well as the losts by venting.

In IPCC category 1.B Fugitive emissions from fuels, CO_2 emissions have a part of 27.49% in the 2020 emissions. CO_2 emissions are mainly the result of venting and flaring from natural gas production, processing and transport activities.

N_2O is only a minor source in category 1.B Fugitive emissions from fuels, with a part of 0.09% in 2020 emissions. These emissions are only due to flaring in natural gas production, processing and transportation activities, including a small amount of nitrogen that is emitted as N_2O.

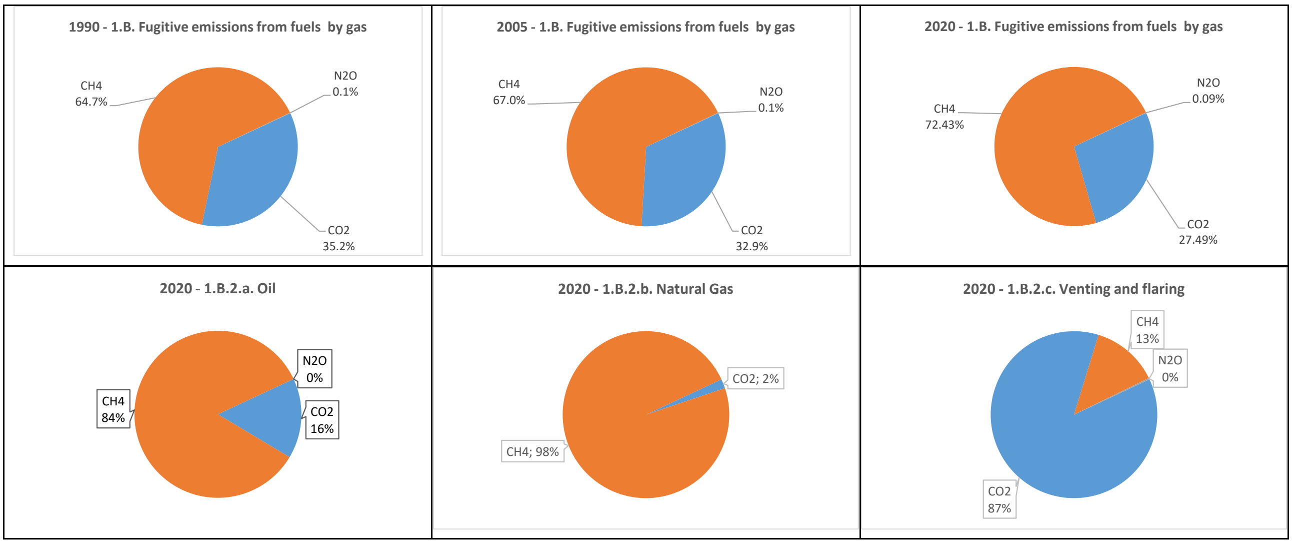


Figure 104 Share by gas and fuels in IPCC Category 1.B fugitive GHG emissions

The general trend of CO_2 emissions from category 1.B

The Fugitive emissions of CO2 from fuels show an increase of 21% over the period 1990-2020. However, the peak of CO2 emissions from this category was reached in 2014, during the period 2014-2020, the CO2 emissions decreased by 34.28%. In the period 2019-2020, fugitives CO_2 emissions have increased by 15.2%.

This significant decrease in fugitive CO_2 emissions from 2014 to 2020 is due to the investments undertaken by Sonatrach and Sonelgaz in the improvement of the quality of natural gas transport pipelines, and to the reduction of flaring as part of the national efforts in GHG mitigation.

For the year 2020, it was also impacted by the Covid 19 pandemic which was characterized by a decrease in human activities (industry, air transport...) on a global scale and a decrease in demand for hydrocarbons.

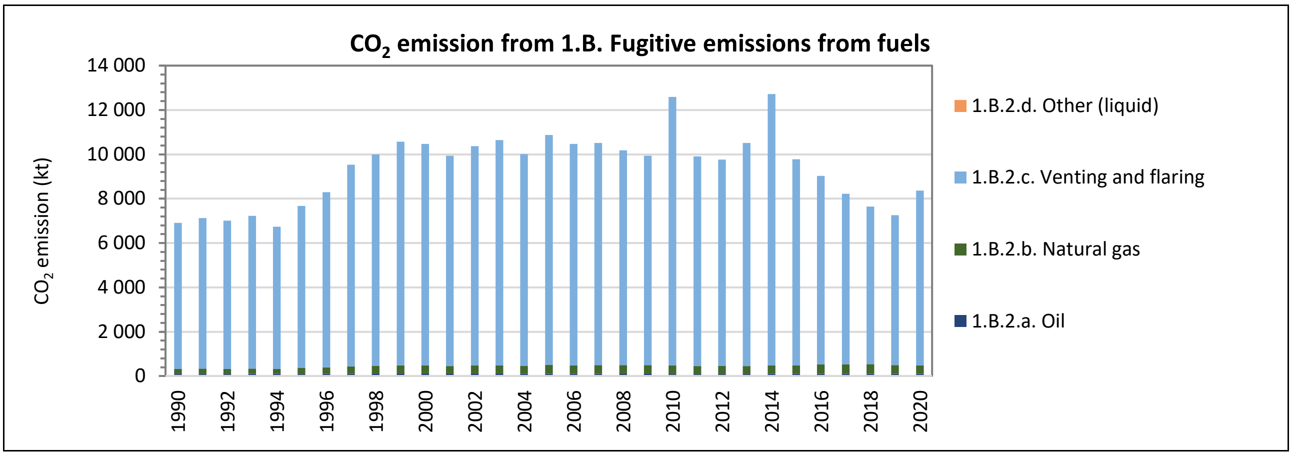


Figure 105 CO_2 Emissions from IPCC category 1.B *Fugitive emissions from fuels*

Fugitive CH_4 emissions in IPCC category 1.B

Fugitive emissions of CH4 from fuels amounted to 507.86 kt in 1990, 885.76 kt in 2005 and 881.41 kt in 2020.

The overall trend of CH_4 emissions in category 1.B of fugitive emissions from fuels shows a significant increase of 73.6% over the period 1990-2020. However, the peak of CH4 fugitive emissions was reached in 2017, were the emissions accounted to 981.45 Kt. Since 2017, total emissions of CH4 decreased by 10.19% and since 2019, Fugitive emissions of CH4 from fuels decreased by 5.2%

These trends are explained by the increase in investments in production, transport and distribution of natural gas between 1990 and 2014, which led to significant fugitive emissions of CH_4, followed by a decrease due to the flaring of CH_4 into CO_2 on the one hand, and the improvement of the control of CH_4 leaks in the various stages on the other.

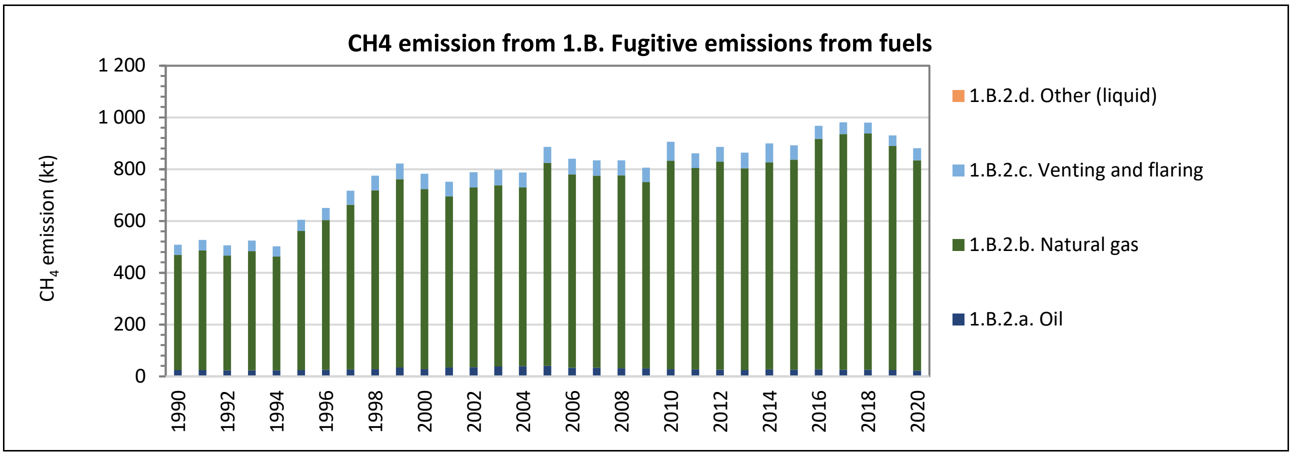


Figure 106 CH_4 Emissions from IPCC category 1.B *Fugitive emissions from fuels*

IPCC Category 1.B fugitive N_2O emissions

Fugitive N_2O emissions from fuels amounted to 0.076 kt in 1990, 0.119 kt in 2005 and 0.091 kt in 2020.

The general trend of N_2O emissions in category 1.B

Fugitive emissions from fuels increased by 19.6 % over the period 1990-2020. However, However, the peak of N_2O fugitive emissions was reached in 2014, were the emissions accounted to 0.141 Kt. Since 2014, total emissions of N_2O decreased by 35.6% and since 2019, Fugitive emissions of N_2O from fuels increased by 16.7%.

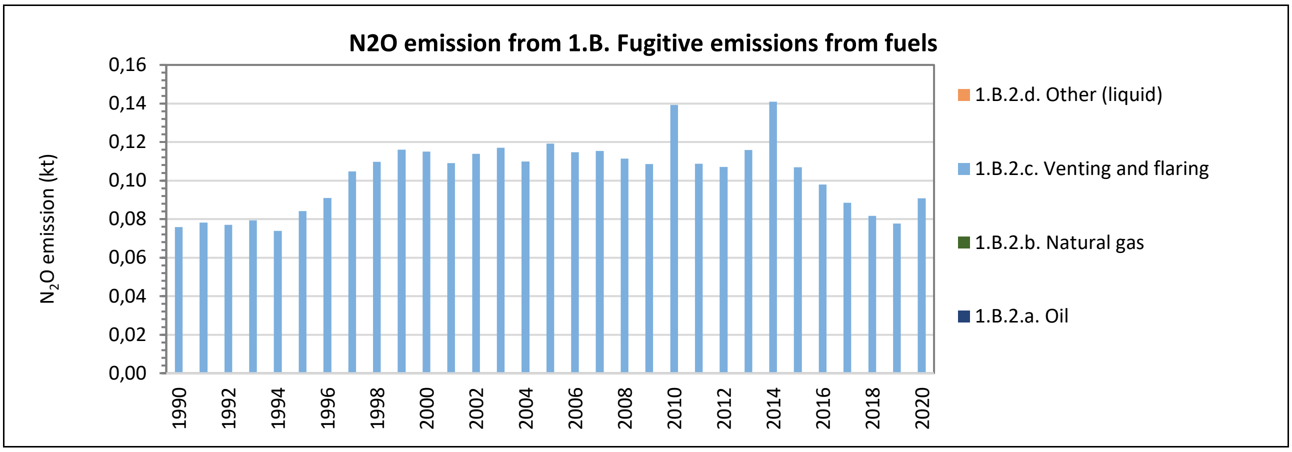


Figure 107 N_2O Emissions from IPCC category 1.B *Fugitive emissions from fuels*

Table 291 GHG Emissions from IPCC category 1.B. Fugitive emissions from fuels

GHG	1.B	1.B.1	1. B. 1.a	1. B.1.b	1.B.1.c	1.B.2	1.B.2.a	1.B.2.b.	1.B.2.c.	1.B.2.d
	Fugitive emissions from fuels	**1.B.1. Solid fuels**	**Coal mining and handling**	**Fuel trans-formation**	**Other**	**Oil and natural gas***	**Oil**	**Natural gas**	**Venting and flaring**	**Other**
	kt CO_2 equivalent									
1990	**19 631,55**	0.77	NO	0.77	NO	19 630,79	696.21	11 328,85	7,605.73	NO
1991	**20 323,91**	0.89	NO	0.89	NO	20 323,03	700.54	11 785,39	7,837.09	NO
1992	**19 688,23**	1.06	NO	1.06	NO	19 687,17	671.03	11 298,80	7,717.33	NO
1993	**20 365,76**	0.82	NO	0.82	NO	20 364,94	683.96	11 721,99	7,958.99	NO
1994	**19 296,03**	0.78	NO	0.78	NO	19 295,25	685.07	11 204,54	7,405.64	NO
1995	**22 815,32**	0.78	NO	0.78	NO	22 814,54	698.42	13 683,52	8,432.60	NO
1996	**24 577,28**	0.32	NO	0.32	NO	24 576,95	726.37	14 734,44	9,116.14	NO
1997	**27 476,46**	0.56	NO	0.56	NO	27 475,90	762.99	16 214,83	10,498.08	NO
1998	**29 404,80**	0.64	NO	0.64	NO	29 404,16	797.72	17 611,97	10,994.47	NO
1999	**31 145,15**	0.65	NO	0.65	NO	31 144,50	975.17	18 533,88	11,635.45	NO
2000	**30 066,17**	0.50	NO	0.50	NO	30 065,68	800.74	17 731,60	11,533.33	NO
2001	**28 760,81**	0.56	NO	0.56	NO	28 760,25	968.64	16 849,27	10,942.35	NO
2002	**30 111,85**	0.91	NO	0.91	NO	30 110,93	1,012.34	17 685,20	11,413.39	NO
2003	**30 645,69**	0.81	NO	0.81	NO	30 644,88	1,065.59	17 850,80	11,728.49	NO
2004	**29 709,55**	0.93	NO	0.93	NO	29 708,62	1,073.37	17 620,79	11,014.47	NO
2005	**33 048,93**	0.70	NO	0.70	NO	33 048,23	1,101.41	19 995,01	11,951.81	NO
2006	**31 490,88**	0.83	NO	0.83	NO	31 490,05	914.67	19 067,66	11,507.71	NO
2007	**31 405,76**	0.69	NO	0.69	NO	31 405,06	921.16	18 922,62	11,561.28	NO
2008	**31 066,02**	0.69	NO	0.69	NO	31 065,33	913.33	18 978,67	11,173.33	NO
2009	**30 119,07**	0.14	NO	0.14	NO	30 118,93	867.46	18 360,03	10,891.45	NO
2010	**35 281,68**	NE	NO	NE	NO	35 281,68	791.78	20 516,49	13,973.42	NO
2011	**31 487,83**	NE	NO	NE	NO	31 487,83	764.16	19 816,47	10,907.20	NO
2012	**31 930,24**	NE	NO	NE	NO	31 930,24	712.03	20 487,43	10,730.78	NO
2013	**32 130,66**	NE	NO	NE	NO	32 130,66	692.24	19 821,61	11,616.81	NO
2014	**35 262,21**	0.02	NO	0.02	NO	35 262,19	766.04	20 369,51	14,126.65	NO
2015	**32 107,14**	NE	NO	NE	NO	32 107,14	747.45	20 637,15	10,722.55	NO
2016	**33 257,01**	NE	NO	NE	NO	33 257,01	755.00	22 682,65	9,819.37	NO
2017	**32 779,51**	NE	NO	NE	NO	32 779,51	737.83	23 172,54	8,869.13	NO
2018	**32 172,49**	0.01	NO	0.01	NO	32 172,48	734.27	23 242,14	8,196.07	NO
2019	**30 531,18**	0.01	NO	0.01	NO	30 531,17	711.71	22 022,99	7,796.46	NO
2020	**30 424,51**	NE	NO	NE	NO	30 424,51	654.53	20 673,46	9,096.52	NO
Trend										
1990 - 2020	**55.0%**	NA	NA	NA	NA	55.0%	-6.0%	82.5%	19.6%	NA
2005 - 2020	**-7.9%**	NA	NA	NA	NA	-7.9%	-40.6%	3.4%	-23.9%	NA
2019 - 2020	**-0.3%**	NA	NA	NA	NA	-0.3%	-8.0%	-6.1%	16.7%	NA

Table 292 CO_2 Emissions from IPCC category 1.B. Fugitive emissions from fuels

CO_2	1.B	1.B.1	1. B. 1.a	1. B.1.b	1.B.1.c	1.B.2	1.B.2.a	1.B.2.b.	1.B.2.c.	1.B.2.d
	Fugitive emissions from fuels	1.B.1. Solid fuels	Coal mining and handling	Fuel trans-formation	Other	Oil and natural gas*	Oil	Natural gas	Venting and flaring	Other
	kt									
1990	6,912.49	NE	NO	NE	NO	6,912.5	95.90	222.56	6,594.0	NO
1991	7,124.51	NE	NO	NE	NO	7,124.5	97.45	232.44	6,794.6	NO
1992	7,013.61	NE	NO	NE	NO	7,013.6	97.73	225.09	6,690.8	NO
1993	7,230.78	NE	NO	NE	NO	7,230.8	98.33	232.16	6,900.3	NO
1994	6,740.70	NE	NO	NE	NO	6,740.7	99.52	220.62	6,420.6	NO
1995	7,675.96	NE	NO	NE	NO	7,676.0	96.44	268.61	7,310.9	NO
1996	8,292.02	NE	NO	NE	NO	8,292.0	98.90	289.60	7,903.5	NO
1997	9,534.61	NE	NO	NE	NO	9,534.6	106.81	326.15	9,101.6	NO
1998	9,995.48	NE	NO	NE	NO	9,995.5	114.86	348.62	9,532.0	NO
1999	10,574.48	NE	NO	NE	NO	10,574.5	116.96	369.81	10,087.7	NO
2000	10,472.87	NE	NO	NE	NO	10,472.9	115.23	358.45	9,999.2	NO
2001	9,938.98	NE	NO	NE	NO	9,939.0	113.51	338.66	9,486.8	NO
2002	10,368.99	NE	NO	NE	NO	10,369.0	119.09	354.70	9,895.2	NO
2003	10,649.60	NE	NO	NE	NO	10,649.6	122.73	358.48	10,168.4	NO
2004	10,013.19	NE	NO	NE	NO	10,013.2	108.69	355.17	9,549.3	NO
2005	10,869.41	NE	NO	NE	NO	10,869.4	111.08	396.33	10,362.0	NO
2006	10,464.32	NE	NO	NE	NO	10,464.3	105.24	382.11	9,977.0	NO
2007	10,511.54	NE	NO	NE	NO	10,511.5	109.88	378.24	10,023.4	NO
2008	10,184.27	NE	NO	NE	NO	10,184.3	117.99	379.21	9,687.1	NO
2009	9,930.49	NE	NO	NE	NO	9,930.5	122.93	364.88	9,442.7	NO
2010	12,587.82	NE	NO	NE	NO	12,587.8	96.97	376.15	12,114.7	NO
2011	9,912.37	NE	NO	NE	NO	9,912.4	92.03	364.00	9,456.3	NO
2012	9,766.21	NE	NO	NE	NO	9,766.2	84.29	378.53	9,303.4	NO
2013	10,519.41	NE	NO	NE	NO	10,519.4	84.97	362.89	10,071.6	NO
2014	12,725.31	NE	NO	NE	NO	12,725.3	110.37	367.40	12,247.5	NO
2015	9,774.28	NE	NO	NE	NO	9,774.3	105.03	372.99	9,296.3	NO
2016	9,034.91	NE	NO	NE	NO	9,034.9	103.79	417.91	8,513.2	NO
2017	8,216.86	NE	NO	NE	NO	8,216.9	102.25	425.24	7,689.4	NO
2018	7,644.03	NE	NO	NE	NO	7,644.0	109.32	428.87	7,105.8	NO
2019	7,256.79	NE	NO	NE	NO	7,256.8	100.62	396.78	6,759.4	NO
2020	8,362.22	NE	NO	NE	NO	8,362.2	101.69	374.02	7,886.5	NO
Trend										
1990 - 2020	21.0%	NA	NA	NA	NA	21.0%	6.0%	68.0%	19.6%	NA
2005 - 2020	-23.1%	NA	NA	NA	NA	-23.1%	-8.5%	-5.6%	-23.9%	NA
2019 - 2020	15.2%	NA	NA	NA	NA	15.2%	1.1%	-5.7%	16.7%	NA

Table 293 CH_4 Emissions from IPCC category 1.B. Fugitive emissions from fuels

CH_4	1.B	1.B.1	1. B. 1.a	1. B.1.b	1.B.1.c	1.B.2	1.B.2.a	1.B.2.b.	1.B.2.c.	1.B.2.d
	Fugitive emissions from fuels	1.B.1. Solid fuels	Coal mining and handling	Fuel trans-formation	Other	Oil and natural gas*	Oil	Natural gas	Venting and flaring	Other
	kt									
1990	507.86	0.031	NO	0.031	NO	507.83	24.01	444.25	39.56	NO
1991	527.04	0.035	NO	0.035	NO	527.01	24.12	462.12	40.77	NO
1992	506.07	0.042	NO	0.042	NO	506.02	22.93	442.95	40.14	NO
1993	524.45	0.033	NO	0.033	NO	524.42	23.42	459.59	41.40	NO
1994	501.33	0.031	NO	0.031	NO	501.30	23.42	439.36	38.52	NO
1995	604.57	0.031	NO	0.031	NO	604.54	24.08	536.60	43.87	NO
1996	650.33	0.013	NO	0.013	NO	650.31	25.10	577.79	47.42	NO
1997	716.43	0.023	NO	0.023	NO	716.40	26.25	635.55	54.61	NO
1998	775.07	0.026	NO	0.026	NO	775.04	27.31	690.53	57.19	NO
1999	821.44	0.026	NO	0.026	NO	821.42	34.33	726.56	60.53	NO
2000	782.36	0.020	NO	0.020	NO	782.34	27.42	694.93	60.00	NO
2001	751.57	0.022	NO	0.022	NO	751.55	34.20	660.42	56.92	NO
2002	788.36	0.037	NO	0.037	NO	788.32	35.73	693.22	59.37	NO
2003	798.45	0.032	NO	0.032	NO	798.42	37.71	699.69	61.01	NO
2004	786.54	0.037	NO	0.037	NO	786.51	38.59	690.62	57.30	NO
2005	885.76	0.028	NO	0.028	NO	885.73	39.61	783.95	62.17	NO
2006	839.69	0.033	NO	0.033	NO	839.66	32.38	747.42	59.86	NO
2007	834.39	0.028	NO	0.028	NO	834.37	32.45	741.78	60.14	NO
2008	833.94	0.028	NO	0.028	NO	833.91	31.81	743.98	58.12	NO
2009	806.25	0.006	NO	0.006	NO	806.24	29.78	719.81	56.66	NO
2010	906.09	NE	NO	NE	NO	906.09	27.79	805.61	72.69	NO
2011	861.72	NE	NO	NE	NO	861.72	26.88	778.10	56.74	NO
2012	885.29	NE	NO	NE	NO	885.29	25.11	804.36	55.82	NO
2013	863.07	NE	NO	NE	NO	863.07	24.29	778.35	60.43	NO
2014	899.80	0.001	NO	0.001	NO	899.80	26.23	800.08	73.49	NO
2015	892.04	NE	NO	NE	NO	892.04	25.70	810.57	55.78	NO
2016	967.72	NE	NO	NE	NO	967.72	26.05	890.59	51.08	NO
2017	981.45	NE	NO	NE	NO	981.45	25.42	909.89	46.14	NO
2018	980.16	0.000	NO	0.000	NO	980.16	25.00	912.53	42.64	NO
2019	930.05	0.000	NO	0.000	NO	930.05	24.44	865.05	40.56	NO
2020	881.41	NE	NO	NE	NO	881.41	22.11	811.98	47.32	NO
Trend										
1990 - 2020	73.6%	NA	NA	NA	NA	73.6%	-7.9%	82.8%	19.6%	NA
2005 - 2020	-0.5%	NA	NA	NA	NA	-0.5%	-44.2%	3.6%	-23.9%	NA
2019 - 2020	-5.2%	NA	NA	NA	NA	-5.2%	-9.5%	-6.1%	16.7%	NA

Table 294 N_2O Emissions from IPCC category 1.B. Fugitive emissions from fuels

N_2O	1.B	1.B.1	1. B. 1.a	1. B.1.b	1.B.1.c	1.B.2	1.B.2.a	1.B.2.b.	1.B.2.c.	1.B.2.d
	Fugitive emissions from fuels	1.B.1. Solid fuels	Coal mining and handling	Fuel trans-formation	Other	Oil and natural gas*	Oil	Natural gas	Venting and flaring	Other
	kt									
1990	0.076	NA	NA	NA	NO	0.076	0.00003	NA	0.076	NO
1991	0.078	NA	NA	NA	NO	0.078	0.00003	NA	0.078	NO
1992	0.077	NA	NA	NA	NO	0.077	0.00003	NA	0.077	NO
1993	0.079	NA	NA	NA	NO	0.079	0.00003	NA	0.079	NO
1994	0.074	NA	NA	NA	NO	0.074	0.00003	NA	0.074	NO
1995	0.084	NA	NA	NA	NO	0.084	0.00003	NA	0.084	NO
1996	0.091	NA	NA	NA	NO	0.091	0.00003	NA	0.091	NO
1997	0.105	NA	NA	NA	NO	0.105	0.00004	NA	0.105	NO
1998	0.110	NA	NA	NA	NO	0.110	0.00004	NA	0.110	NO
1999	0.116	NA	NA	NA	NO	0.116	0.00004	NA	0.116	NO
2000	0.115	NA	NA	NA	NO	0.115	0.00004	NA	0.115	NO
2001	0.109	NA	NA	NA	NO	0.109	0.00004	NA	0.109	NO
2002	0.114	NA	NA	NA	NO	0.114	0.00004	NA	0.114	NO
2003	0.117	NA	NA	NA	NO	0.117	0.00004	NA	0.117	NO
2004	0.110	NA	NA	NA	NO	0.110	0.00004	NA	0.110	NO
2005	0.119	NA	NA	NA	NO	0.119	0.00004	NA	0.119	NO
2006	0.115	NA	NA	NA	NO	0.115	0.00004	NA	0.115	NO
2007	0.115	NA	NA	NA	NO	0.115	0.00004	NA	0.115	NO
2008	0.111	NA	NA	NA	NO	0.111	0.00004	NA	0.111	NO
2009	0.109	NA	NA	NA	NO	0.109	0.00004	NA	0.109	NO
2010	0.139	NA	NA	NA	NO	0.139	0.00003	NA	0.139	NO
2011	0.109	NA	NA	NA	NO	0.109	0.00003	NA	0.109	NO
2012	0.107	NA	NA	NA	NO	0.107	0.00003	NA	0.107	NO
2013	0.116	NA	NA	NA	NO	0.116	0.00003	NA	0.116	NO
2014	0.141	NA	NA	NA	NO	0.141	0.00004	NA	0.141	NO
2015	0.107	NA	NA	NA	NO	0.107	0.00003	NA	0.107	NO
2016	0.098	NA	NA	NA	NO	0.098	0.00003	NA	0.098	NO
2017	0.088	NA	NA	NA	NO	0.088	0.00003	NA	0.088	NO
2018	0.082	NA	NA	NA	NO	0.082	0.00004	NA	0.082	NO
2019	0.078	NA	NA	NA	NO	0.078	0.00003	NA	0.078	NO
2020	0.091	NA	NA	NA	NO	0.091	0.00003	NA	0.091	NO
Trend										
1990 - 2020	19.6%	NA	NA	NA	NA	19.6%	6.0%	NA	19.6%	NA
2005 - 2020	-23.9%	NA	NA	NA	NA	-23.9%	-8.4%	NA	-23.9%	NA
2019 - 2020	16.7%	NA	NA	NA	NA	16.7%	1.1%	NA	16.7%	NA

3.3.1 Solid fuels (IPCC category 1.B.1)

In the following table is provided the status of reporting of sources of IPCC category 1.B.1 *Solid fuels.*

Table 295 Status of reporting and key category of IPCC category 1.B.1 *Solid fuels*

IPCC code	Description	CH_4		CO_2		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.1.a	**Coal mining and handling**						
1.B.1.a.i	Underground mines	NO	-	NO	-	NA	-
1.B.1.a.i.1	Mining activities	NO	-	NO	-	NA	-
1.B.1.a.i.2	Post-mining activities	NO	-	NO	-	NA	-
1.B.1.a.i.3	Abandoned underground mines	NO	-	NO	-	NA	-
1.B.1.a.i.4	Flaring of drained methane or conversion of methane to CO_2	NO	-	NO	-	NA	-
1.B.1.a.i.5	Other	NO	-	NO	-	NA	-
1.B.1.a.ii	Surface mines	NO	-	NO	-	NA	-
1.B.1.a.ii.1	Mining activities	NO	-	NO	-	NA	-
1.B.1.a.ii.2	Post-mining activities	NO	-	NO	-	NA	-
1.B.1.a.ii.3	Other	NO	-	NO	-	NA	-
1.B.1.b	**Fuel transformation**						
1.B.1.b.i	Charcoal and biochar production	NE	-	NA	-	NA	-
1.B.1.b.ii	Coke production	✓	-	✓	-	NA	-
1.B.1.b.iii	Coal to liquids	NO	-	NO	-	NA	-
1.B.1.b.iv	Gas to liquids	✓	-	✓	-	NA	-
1.B.1.b.v	Other	NO	-	NO	-	NA	-
1.B.1.c	**Other**						
1.B.1.c	Other	NO	-	NO	-	NA	-

A '✓' indicates: emissions from this category have been estimated.

Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

3.3.1.1 Fugitive emissions from Coal mining and handling (IPCC category 1.B.1.a)

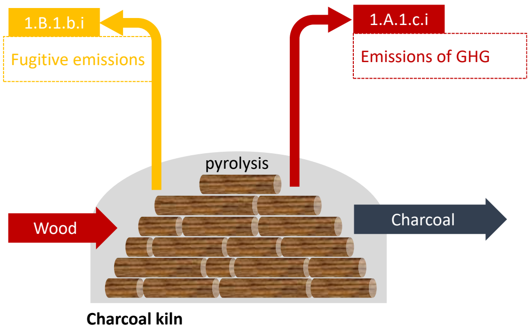
The IPCC subcategory 1.B.1.a Coal mining and handling does not exist in Algeria.

3.3.1.2 Fugitive emissions from Fuel transformation (IPCC category 1.B.1.b)

This section describes the estimation of fugitive emissions arising during the manufacture of secondary and tertiary products from fuels.

3.3.1.2.1 Charcoal and biochar production (IPCC category 1.B.1.b.i)

Charcoal is produced by the carbonization of wood. Carbonization of fuel is the thermal decomposition in the absence of oxygen at a temperature above 300°C. According to the 2019 IPCC Refinements to the 2006 IPCC GL[333], the carbonization of wood produces charcoal, volatile compounds and a range of gases. The gases produced include direct greenhouse gases (CO_2. CH_4 and N_2O) , indirect greenhouse gases (CO) and other gases, including H_2.



This category has not been estimated due to lack of activity data and resources.

3.3.1.2.1.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 296Planned improvements for IPCC category 1.B.1.b.i *Charcoal and biochar production*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.1.b.i	Estimation of fugitive emissions from wood charcoal and biochar production	M	Completeness	medium
1.B.1.b.i	Collection of activity data: • Fuel wood used for charcoal production • wood used for charcoal production	AD	Completeness	medium

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*	

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[333] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.3.2.3, page 4.99

3.3.1.2.2 Coke production (IPCC category 1.B.1.b.ii)

This section describes the fugitive emissions arising during the production of coke. As described in the 2019 IPCC Refinements to the 2006 IPCC GL[334]

- the coke is produced by the pyrolysis of coal. This is a managed thermal treatment of the coal which limits combustion or oxidation of the coal or coke product. Coal pyrolysis at high temperature is called carbonisation. The process produces coke, volatile compounds and a range of other gases. In the coke production process, the coal is heated indirectly up to 1 000 – 1 100°C for 14 – 28 hours.
- Coke is the most important reducing agent used in primary metal production. Other uses of coke include as a heating fuel and feedstock.
- Fugitive emissions can occur during coking operations from leakages at the battery, for example. because of leakage from vessels, oven doors, flanges, or at the by-product plant.
- Fugitive emissions occur also from the ascension pipe and charging hole sealings. The magnitude of these emissions will depend on the coke oven technology and the level of maintenance. The variability in the magnitude of fugitive emissions will be large.

3.3.1.2.2.1 Category description

IPCC code	Description		CH_4		CO_2		N_2O	
			Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
1.B.1.b	**Fuel transformation**							
1.B.1.b.ii	Coke production							
1.B.1.b.ii.1	Coal handling and preparation		IE	-	IE	-	NA	-
1.B.1.b.ii.2	Battery operation (coal charging. heating/firing. coking. coke pushing. coke quenching)		✓	-	✓	-	NA	-
1.B.1.b.ii.3	Flaring of coke oven gas (COG) emissions							
	coke oven gas (COG) treatment with recovery and treatment of by-products in the case of a conventional coking plant		NE	-	NE	-	NA	-
	coke oven gas (COG) treatment with recovery of the heat of the coking and treatment of the flue gas in the case of a heat recovery coking plant.		NE	-	NE	-	NA	-
	IE: it is assumed that the CH_4 emissions of coal handling and preparation are included in battery operation							
	A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential							
	LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

An overview of the fugitive emissions from coke production is provided in the following figures and tables.

The fugitive emissions of CH_4 from IPCC category 1.B.1.b.ii Coke production amounted to 0.77kt CO_2 equivalents in 1990. 0.70 kt CO_2 equivalents in 2005, and 0.01 kt CO_2 equivalents in 2019, In 2020 no coke was produced.

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[334] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.3.2 Methodological issues, page 4.104

The overall trend in GHG emissions from the IPCC category 1.B.1.b.ii Coke production shows a significant decrease in the period 1990-2008. The overall decreasing trend of emissions is result of import of coke instead of coke production.

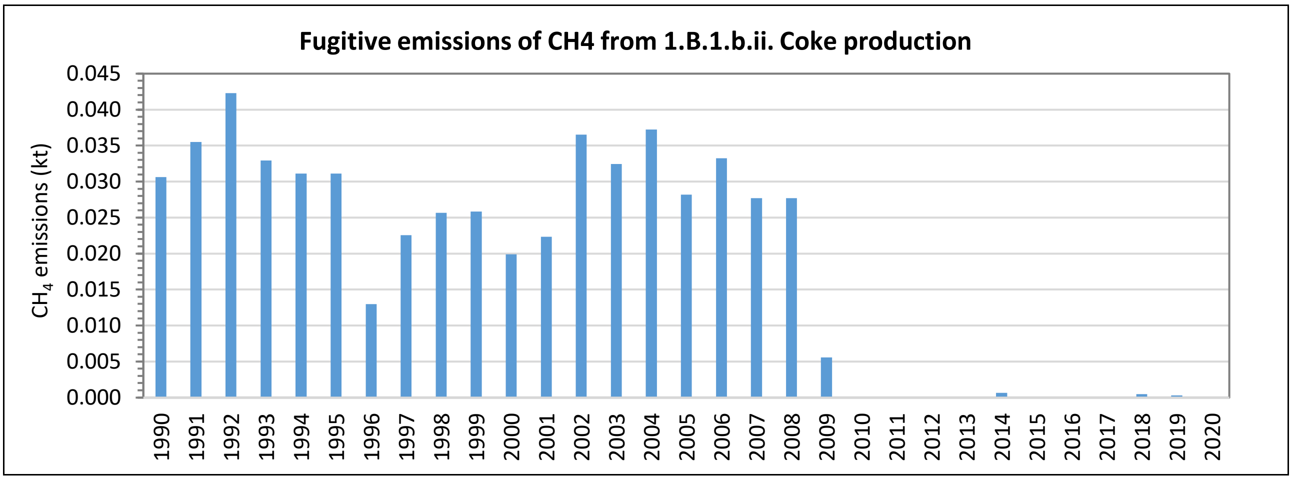

Figure 108 Emissions from IPCC category 1.B.1.b.ii Coke production

Table 297 Activity data and GHG Emissions from IPCC category 1.B.1.b.ii Coke production

	Fugitive emissions from Coke production				Amount of coke produced
	TOTAL GHG	CH_4	CO_2	N_2O	
	kt $_{CO_2\ equivalent}$	Gg	kt	kt	kt
1990	0.77	0.0306	NE	NA	625.28
1991	0.89	0.0355	NE	NA	724.30
1992	1.06	0.0423	NE	NA	863.37
1993	0.82	0.0329	NE	NA	672.01
1994	0.78	0.0311	NE	NA	635.29
1995	0.78	0.0311	NE	NA	635.29
1996	0.32	0.0130	NE	NA	264.80
1997	0.56	0.0226	NE	NA	460.61
1998	0.64	0.0257	NE	NA	524.03
1999	0.65	0.0258	NE	NA	527.37
2000	0.50	0.0199	NE	NA	406.10
2001	0.56	0.0224	NE	NA	456.16
2002	0.91	0.0365	NE	NA	745.44
2003	0.81	0.0324	NE	NA	661.99
2004	0.93	0.0372	NE	NA	759.90
2005	0.70	0.0282	NE	NA	575.21
2006	0.83	0.0333	NE	NA	678.68
2007	0.69	0.0277	NE	NA	565.20
2008	0.69	0.0277	NE	NA	565.20
2009	0.14	0.0056	NE	NA	113.48
2010	NE	NE	NE	NA	NE
2011	NE	NE	NE	NA	NE
2012	NE	NE	NE	NA	NE

	Fugitive emissions from Coke production				Amount of coke produced
	TOTAL GHG	CH_4	CO_2	N_2O	
	kt $_{CO_2\ equivalent}$	Gg	kt	kt	kt
2013	NE	NE	NE	NA	NE
2014	0.02	0.0006	NE	NA	12.79
2015	NE	NE	NE	NA	NE
2016	NE	NE	NE	NA	NE
2017	NE	NE	NE	NA	NE
2018	0.01	0.0005	NE	NA	9.70
2019	0.01	0.0003	NE	NA	5.86
2020	NE	NE	NE	NA	NE
Trend					
1990 - 2020	NA	NA	*NA*	*NA*	*—100 %*
2005 - 2020	NA	NA	*NA*	*NA*	*—100 %*
2019 - 2020	NA	NA	*NA*	*NA*	*—100 %*

3.3.1.2.2.2 Methodological issues

3.3.1.2.2.2.1 Choice of methods

For estimating the CO_2 and CH_4 emissions the 2019 Refinments to the 2006 IPCC Guidelines Tier 1 approach[335] has been applied:

Equation 4.3.2 (new) Fugitive GHG emission from coke production
(2019 to the 2006 IPCC GL. Vol. 2. Chap. 4.3.2)

$$Emissions_{GHG} = Activity\ data_{coke\ production} \times Emission\ Factor_{GHG}$$

Where:

Emissions $_{GHG}$ = emissions of a given GHG (kg GHG)
GHG = CH_4
Activity data $_{coke\ production}$ = amount of coke produced (tonnes)
Emission factor $_{GHG.\ fuel}$ = default emission factor for each GHG (kg GHG/tonne of coke produced)

3.3.1.2.2.2.2 Choice of activity data

The coke production data was taken for the years

- 1990 - 2009 are taken from the Energy balance provided by UN statistics[336] for and from Algeria
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[337].

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[335] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.3.2 Methodological issues, page 4.111

[336] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[337] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

3.3.1.2.2.2.3 Choice of emission factors

The default emission factor for CH_4 was taken from 2019 Refinements to the IPCC 2006 Guidelines and are presented in the following table.

Table 298 GHG Emission factor TIER 1 for IPCC category 1.B.1.b.ii Coke production

	Unit	CH_4 EF	Type	Source
Hard coal / coking coal (Using horizontal coke batteries. Non-heat recovery ovens)	kg / ton	0.049	D	TABLE 4.3.5 (NEW); 2019 Refinement to the 2006 IPCC Guidelines. Volume 2. Chapter 4.3.2 Methodological issues. page 4.111
Note:				
D Default	CS	Country specific	PS	Plant specific IEF Implied emission factor

3.3.1.2.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 1.B.1.b.ii Coke production are presented in the following table.

Table 299Uncertainty for IPCC category 1.B.1.b.ii Coke production.

Uncertainty		**Reference**
	CH_4	
Activity data (AD)	10%	2006 IPCC GL. Vol. 2. Chap. 2 based Table 2.15 and Chap. 2.4.2
Emission factor (EF)	-90% to +900%	2019 Refinement of the 2006 IPCC GL. Vol. 2. Chap. 4 based TABLE 4.3.6 (NEW)
Combined Uncertainty (U)	900%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period. The activity data is considered almost consistent even though two different data sets were used:

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics;
- 2010 - 2020 are taken from the National Energy balance prepared by MEM.

Several checks and reallocation have been performed in order to ensure time series consistency. Further improvement of the energy balance will be made for future submissions.

3.3.1.2.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.

- cross-checked from different sources:
    - national statistic published by MEM and Office National des Statistiques (ONS)[338] and
    - International energy statistics of UN statistics[339]. International Energy Agency (IEA)[340]
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency - plausibility checks of dips and jumps.

3.3.1.2.2.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.B.1.b.ii *Coke production*.

Table 300Recalculations done since NC in IPCC category 1.B.1.b.ii *Coke production*

source category	Revisions of data	Type of revision	Type of improvement
1.B.1.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.1.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.1.b.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance Use of data from UN statistics	AD	Accuracy Completeness

3.3.1.2.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 301Planned improvements for IPCC category 1.B.1.b.ii *Coke production*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.1.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness	medium
1.B.1.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency	medium
1.B.1.b.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: • Consumption of hard coal and/or cocking coal	AD	Accuracy Completeness Transparency Consistency	high

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[338] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[339] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[340] Data and statistics - Data tools - Data tables Energy data by category, indicator, country or region https://www.iea.org/data-and-statistics/data-browser?country=WORLD&fuel=Energy%20supply&indicator=TESbySource

GHG source & sink category	Planned improvement	Type of improvement		Priority
	- Production of coke oven coke - Production, consumption and flaring coke oven coke gas (COG)			
1.B.1.b.ii	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.B.1.b.ii	Investigation of the coke oven technology applied and the level of maintenance	AD	Transparency	High

3.3.1.2.3 Coal to liquids (IPCC category 1.B.1.b.iii)

IPCC code	Description	CH_4		CO_2		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.1.b	**Fuel transformation**						
1.B.1.b.iii	Coal to liquids	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC subcategory 1.B.1.b.iii *Other* does not exist in Algeria.

3.3.1.2.4 Gas to liquids (IPCC category 1.B.1.b.iv)

This section describes the estimation of fugitive emissions arising from the transformation of natural gas into syngas, composed by H_2, CO, CO_2 and CH_4, and, then, into a liquid hydrocarbons fuel.[341]

IPCC code	Description	CH_4		CO_2		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.1.b	**Fuel transformation**						
1.B.1.b.iv	Gas to liquids	NE	-	NE	-	NA	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE - included elsewhere. NO – not occurrent. NE - not estimated. NA - not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This category has not been estimated due to lack of activity data and resources.

3.3.1.2.4.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

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[341] Is this approach applied in Algeria for LNG, LPG (GPL) and …

Table 302Planned improvements for IPCC category 1.B.1.b.iv *Gas to liquids*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.1.b.iv	Estimation of fugitive emissions from Gas to liquids	M	Completeness	high
1.B.1.b.iv	Collection of activity data: • Natural gas used • Liquefied Fuel produced	AD	Completeness	high
1.B.1.b.iv	Investigation on • number of plants • technology applied • abatements technology applied	AD	Transparency	medium

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.1.2.5 Other (IPCC category 1.B.1.b.v)

IPCC code	Description	CH_4		CO_2		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
1.B.1.b	**Fuel transformation**						
1.B.1.b.v	Other	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC subcategory 1.B.1.b.v *Other* does not exist in Algeria.

3.3.1.3 Other (IPCC category 1.B.1.c)

IPCC code	Description	CH_4		CO_2		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
1.B.1.c	**Other**						
1.B.1.c	Other	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC subcategory 1.B.1.c *Other* does not exist in Algeria.

3.3.2 Oil and Natural Gas (IPCC category 1.B.2)

This section describes the fugitive GHG emissions from oil and gas systems except contributions from fuel combustion. Oil and natural gas systems consists of infrastructure required to produce, collect, process, or refine and deliver natural gas and petroleum products to market. As described in the 2019 Refinement to the 2006 IPCC GL, the sources of fugitive emissions on oil and gas systems include, but are not limited to, equipment leaks, evaporation and flashing losses, venting, flaring and accidental releases (e.g., pipeline dig-ins. well blow-outs and spills). Venting and flaring emission sources are engineered or intentional (e.g., vents from tanks. seal and process vents and flare systems), while leak emissions (e.g., working losses from tanks, and leaks from other equipment) are unintentional (or uncontrolled). The scope of the inventory includes all relevant processes from the well head, or oil and gas source, to the final sales point to the consumer.

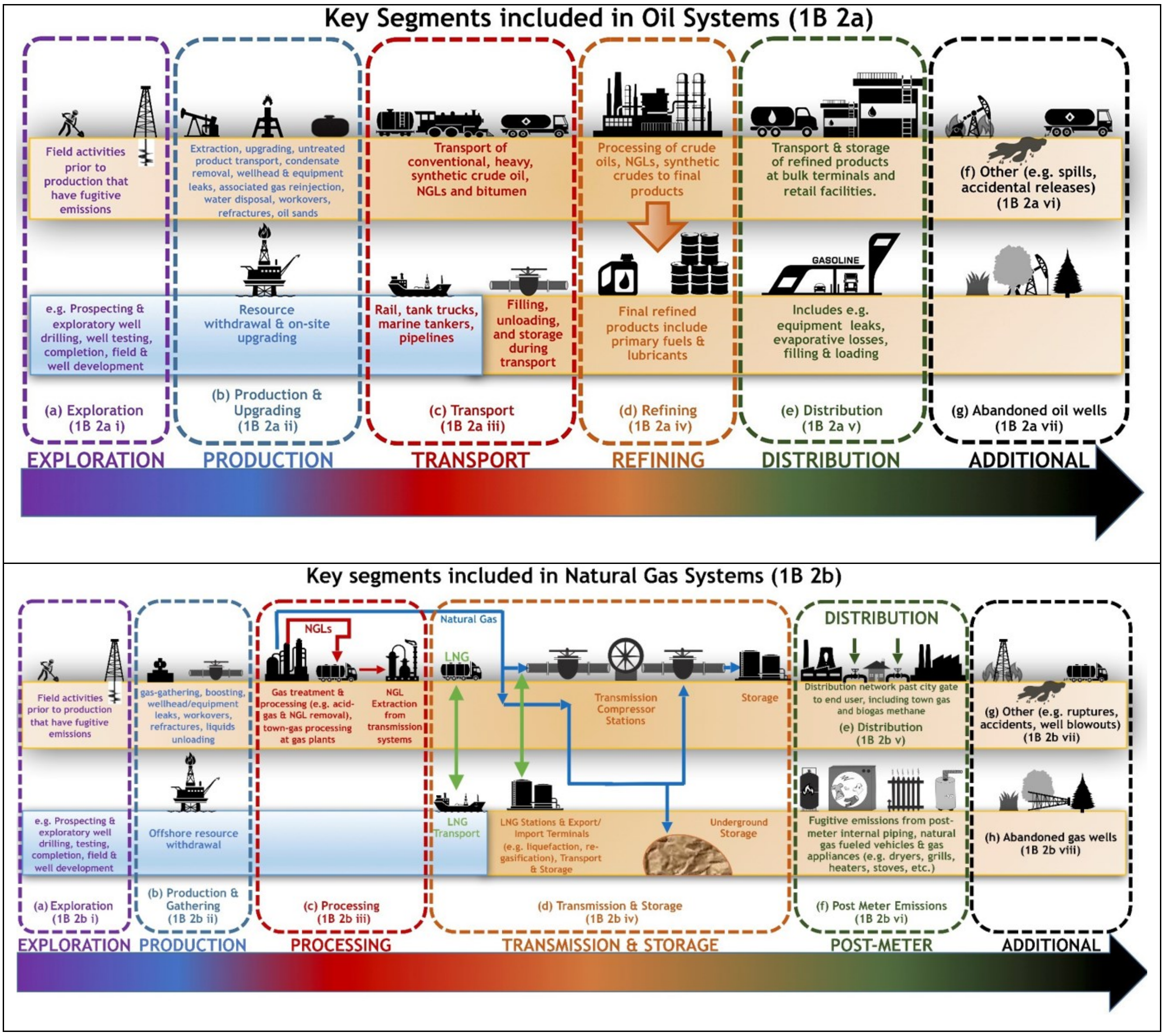

Figure 109 Key segments included in oil and natural gas systems.

Source: 2019 Refinement to the 2006 IPCC GL. Chapter 4: Fugitive Emissions. Figure 4.2.0. page 4.36[342]

In the following table is the status of reporting of sources of IPCC category 1.B.2 Oil and natural gas provided.

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[342] https://www.ipcc-nggip.iges.or.jp/public/2006gl/french/pdf/2_Volume2/V2_4_CH#4#_Fugitive_Emissions.pdf

Table 303Status of reporting and key category of IPCC category 1.B.2

IPCC code	Description		CH_4		CO_2		NMVOC		N_2O	
			Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.2.a	**Oil**									
1.B.2.a.i	Exploration	Leaks	NA		NA		NA		NA	
		Venting	IE in 1.B.2.c.i.1							
		Flaring	IE in 1.B.2.c.ii.1							
1.B.2.a.ii	Production and upgrading	Leaks	✓		NA		✓		NA	
		Venting	IE in 1.B.2.c.ii							
		Flaring	✓		✓		NA		✓	
1.B.2.a.iii	Transport	All	✓		✓		✓		NA	
1.B.2.a.iv	Refining/storage	Leaks	✓		✓		✓		✓	
		Venting	IE in 1.B.2.c.i.1							
		Flaring	IE in 1.B.2.c.ii.1							
1.B.2.a.v	Distribution of oil products	All	NA		NA		✓		NA	
1.B.2.a.vi	Other									
1.B.2.a.vi.1	Abandoned wells	All	NE		NE		NE		NE	
1.B.2.a.vi.2	Other	All	NE		NE		NE		NE	
1.B.2.b	**Natural gas**									
1.B.2.b.i	Exploration	Leaks	NA		NA		NA		NA	
		Venting	1.B.2.c.i.2							
		Flaring	1.B.2.c.ii.2							
1.B.2.b.ii	Production and gathering	All	✓		✓		✓		✓	
1.B.2.b.iii	Processing	All	✓		✓		✓		✓	
1.B.2.b.iv	Transmission and storage	All	✓		✓		✓		NA	
1.B.2.b.v	Distribution	All	✓		✓		✓		NA	
1.B.2.b.vi	Other									
1.B.2.b.vi.1	Gas post-meter	All	NE		NE		NE		NE	
1.B.2.b.vi.2	Abandoned wells	All	NE		NE		NE		NE	
1.B.2.b.vi.3	Other	All	NE		NE		NE		NE	
1.B.2.c.	**Venting and flaring**									
1.B.2.c.i.	Venting									
1.B.2.c.i.1.	Oil		✓		✓		✓		✓	
1.B.2.c.i.2.	Gas		✓		✓		✓		✓	
1.B.2.c.i.3.	Combined		NO		NO		NO		NO	
1.B.2.c.ii.	Flaring									
1.B.2.c.ii.1.	Oil		✓		✓		✓		✓	
1.B.2.c.ii.2.	Gas		✓		✓		✓		✓	
1.B.2.c.ii.3.	Combined		NO		NO		NO		NO	
1.B.2.d.	**Other**									
1.B.2.d.	Other	All	NO		NO		NO		NO	
All: sum of leak. venting and flaring	A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF										

This section describes the emissions resulting from IPCC category 1.B.2. Oil and Natural Gas.

The following figures and tables provide an overview of oil and gas and other emissions from energy production, as well as an overview of fugitive emissions.

Fugitive GHG emissions in IPCC category 1.B.2.

Oil and natural gas and other emissions from energy production amounted to 19,630.78 kt CO_2 equivalent in 1990, 33,048.23 kt CO_2 equivalent in 2005 and 30,424.51kt CO_2 equivalent in 2020.

The overall trend of GHG emissions in IPCC category 1.B.2.

Oil and natural gas and other emissions from energy production show a significant increase of 55.0% over the period 1990-2020. However, the peak in GHG emissions of this category was reached in 2010 where the emissions were estimated at 35,281.68 kt. During the period 2010-2020, the GHG emissions from IPCC category 1.B.2 decreased by 13.77%.

This variation is explained by the increase in national demand for gas and oil (electricity production, heating, transport and the realization of mega infrastructure projects) and international demand leading to an increase in their production during the years 1990 to 2005.the period from 2005 to 2020 was characterized by fluctuating GHG emissions due particularly to the variation of CH_4 emissions generating from natural gas production and transmission.

In the period 2019-2020. GHG emissions decreased by 0.3%.

The most important gas in IPCC category 1.B.2.

The most important emissions from oil and natural gas and other gases from fuel-based energy production are due to CH_4, with a part of 72.4% of total emissions in 2020. The CH_4 emissions result mainly from the production, transformation, and transport of natural gas, and to the fact that Algeria is a gas country.

In IPCC category 1.B.2. oil and natural gas emissions and other emissions from energy production, CO_2 emissions present 27.4% of the 2020 emissions, CO_2 emissions are mainly the result of flaring in the different phases of oil and gas production, processing and transport.

N_2O is only a minor source in IPCC category 1.B.2 Oil and natural gas emissions and other emissions from energy production, with a part of 0.04% in 2020 emissions.

Fugitive CO_2 emissions from IPCC category 1.B.2.

CO_2 emissions from Oil and natural gas and other from energy production amounted to 6,912.49 kt in 1990, 10,869.41kt in 2005 and 8,362.22 kt in 2020.

The overall trend in CO_2 emissions in IPCC category 1.B.2.

CO_2 Emissions resulting from oil and natural gas and other emissions from fuel-based energy production show an increase of 21% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2010, since 2010, CO_2 emissions have decreased by 13.8%.

During the period 2019-2020, CO_2 emissions have increased by 15.2%.

Fugitive CH_4 emissions from IPCC category 1.B.2.

Fugitive CH_4 emissions from Oil and natural gas and other emissions from energy production were estimated to be 507.83 kt in 1990, 885.73 kt in 2005 and 881.41kt in 2020.

The overall trend of CH_4 emissions in IPCC category 1.B.2.

Fugitive CH_4 emissions from IPCC category 1.B.2. oil and gas show a significant increase of 73.6% over the period 1990-2020. These trends due to the increase of production, transport, processing activities of oil and natural gas resulting of the increase of demand and consumption of fuels by different sectors.

However, between 2005 and 2020, CH_4 emissions were decreased by 0.5%. Fugitives CH_4 emissions from IPCC category 1.B.2. marked by a decrease of 5.2% between 2019 and 2020.

Fugitive N_2O emissions from IPCC category 1.B.2.

Fugitive N_2O emissions of Oil and natural gas and other emissions from energy production were estimated be to 0.076kt in 1990, 0.119kt in 2005 and 0.091kt in 2020.

The overall trend in N_2O emissions from IPCC category 1.B.2.

Fugitive N_2O emissions from IPCC category 1.B.2. oil and gas show an increase of up to 19.6% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2010, since 2010, N_2O emissions have decreased by 34.9%. during the period 2019-2020, N_2O emissions decreased by 16.7%.

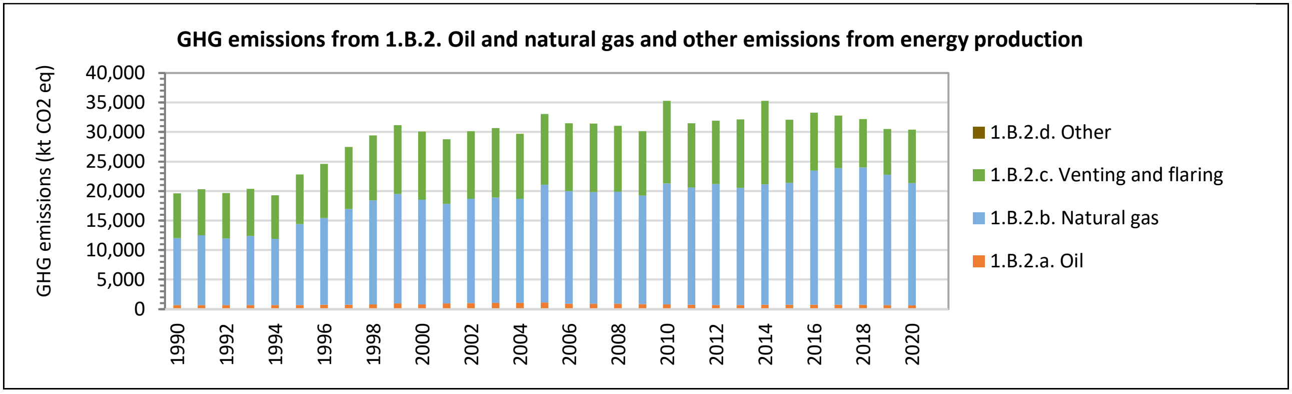

Figure 110 GHG emissions from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production

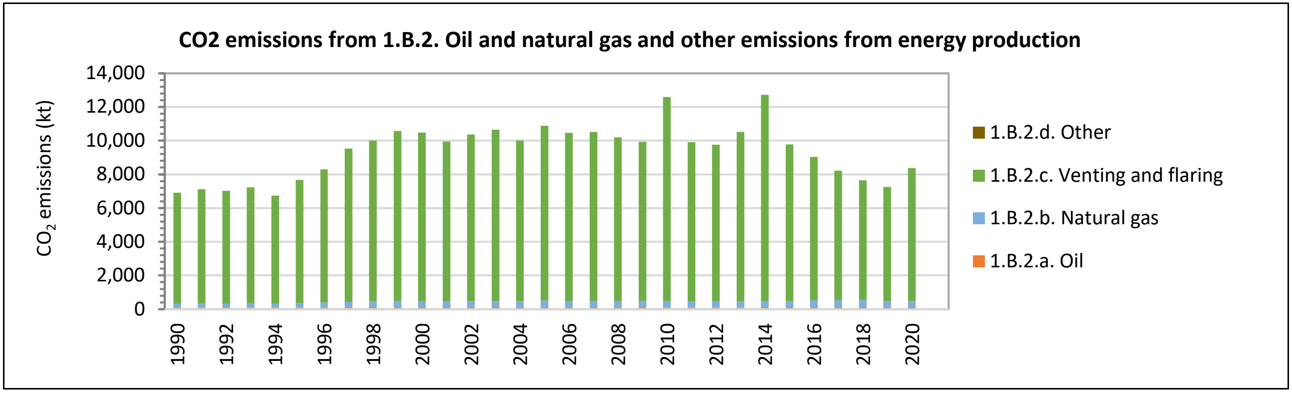

Figure 111 CO_2 emissions from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production

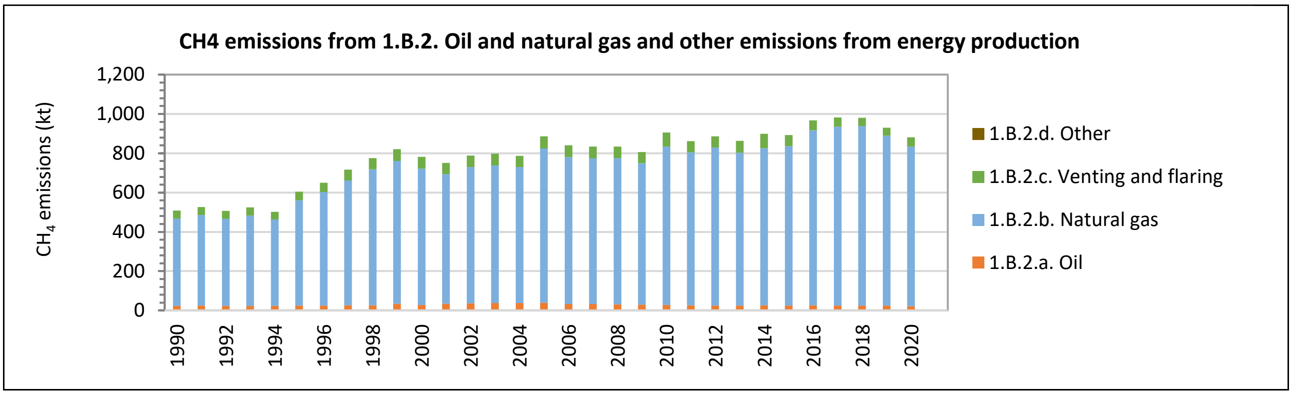

Figure 112 CH_4 emissions from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production

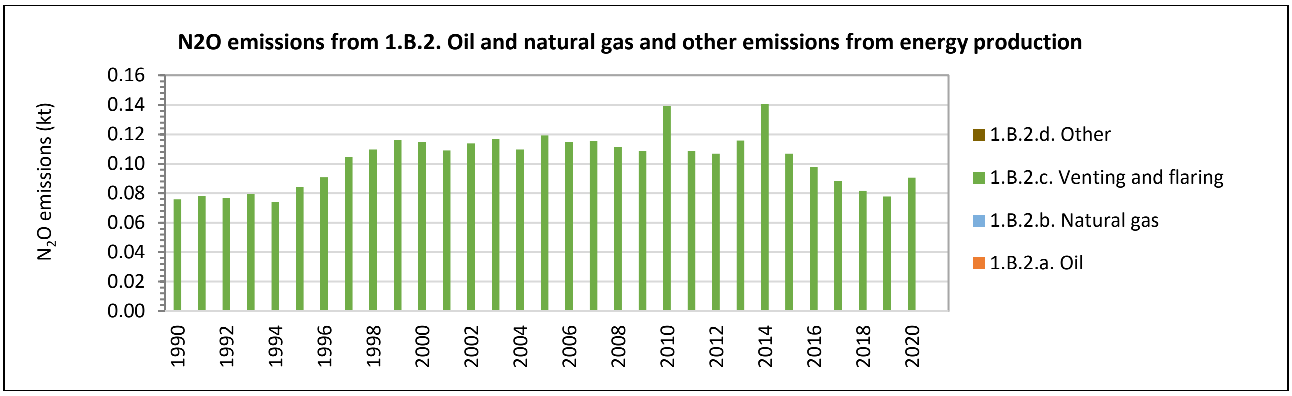

Figure 113 N_2O emissions from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production

Table 304 Fugitive emissions of GHG from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production GHG from Oil and gas

GHG	1.B.2	1.B.2.a	1.B.2.b	1.B.2.c	1.B.2.d
	Oil and natural gas	Oil	Natural gas	Venting and flaring	Other
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	19,630.78	696.20	11,328.85	7,605.73	NO
1991	20,323.03	700.54	11,785.39	7,837.09	NO
1992	19,687.17	671.03	11,298.80	7,717.33	NO
1993	20,364.94	683.96	11,721.99	7,958.99	NO
1994	19,295.25	685.07	11,204.54	7,405.64	NO
1995	22,814.54	698.42	13,683.52	8,432.60	NO
1996	24,576.95	726.37	14,734.44	9,116.14	NO
1997	27,475.90	762.99	16,214.83	10,498.08	NO
1998	29,404.16	797.72	17,611.97	10,994.47	NO
1999	31,144.50	975.17	18,533.88	11,635.45	NO
2000	30,065.68	800.74	17,731.60	11,533.33	NO
2001	28,760.25	968.64	16,849.27	10,942.35	NO
2002	30,110.93	1,012.34	17,685.20	11,413.39	NO
2003	30,644.88	1,065.59	17,850.80	11,728.49	NO
2004	29,708.62	1,073.37	17,620.79	11,014.47	NO
2005	33,048.23	1,101.41	19,995.01	11,951.81	NO
2006	31,490.05	914.67	19,067.66	11,507.71	NO
2007	31,405.06	921.16	18,922.62	11,561.28	NO
2008	31,065.33	913.33	18,978.67	11,173.33	NO
2009	30,118.93	867.46	18,360.03	10,891.45	NO
2010	35,281.68	791.78	20,516.49	13,973.42	NO
2011	31,487.83	764.16	19,816.47	10,907.20	NO
2012	31,930.24	712.03	20,487.43	10,730.78	NO
2013	32,130.66	692.24	19,821.61	11,616.81	NO
2014	35,262.19	766.04	20,369.51	14,126.65	NO
2015	32,107.14	747.45	20,637.15	10,722.55	NO
2016	33,257.01	755.00	22,682.65	9,819.37	NO
2017	32,779.51	737.83	23,172.54	8,869.13	NO
2018	32,172.48	734.27	23,242.14	8,196.07	NO
2019	30,531.17	711.71	22,022.99	7,796.46	NO
2020	30,424.51	654.53	20,673.46	9,096.52	NO
Trend					
1990 – 2020	55.0%	- 6.0 %	83.2 %	19.6%	*NA*
2005 – 2020	-7.9%	-40.6 %	3.4 %	-23.9%	*NA*
2019 - 2020	-0.3%	8.0 %	- 6.1 %	16.7%	*NA*

Table 305Fugitive emissions of CO_2 from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production GHG from Oil and gas

CO_2	1.B.2	1.B.2.a	1.B.2.b	1.B.2.c	1.B.2.d
	Oil and natural gas	**Oil**	**Natural gas**	**Venting and flaring**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**
1990	6,912.49	95.90	222.56	6,594.03	NO
1991	7,124.51	97.45	232.44	6,794.61	NO
1992	7,013.61	97.73	225.09	6,690.79	NO
1993	7,230.78	98.33	232.16	6,900.30	NO
1994	6,740.70	99.52	220.62	6,420.56	NO
1995	7,675.96	96.44	268.61	7,310.91	NO
1996	8,292.02	98.90	289.60	7,903.52	NO
1997	9,534.61	106.81	326.15	9,101.65	NO
1998	9,995.48	114.86	348.62	9,532.00	NO
1999	10,574.48	116.96	369.81	10,087.72	NO
2000	10,472.87	115.23	358.45	9,999.19	NO
2001	9,938.98	113.51	338.66	9,486.81	NO
2002	10,368.99	119.09	354.70	9,895.20	NO
2003	10,649.60	122.73	358.48	10,168.39	NO
2004	10,013.19	108.69	355.17	9,549.34	NO
2005	10,869.41	111.08	396.33	10,362.00	NO
2006	10,464.32	105.24	382.11	9,976.97	NO
2007	10,511.54	109.88	378.24	10,023.42	NO
2008	10,184.27	117.99	379.21	9,687.07	NO
2009	9,930.49	122.93	364.88	9,442.68	NO
2010	12,587.82	96.97	376.15	12,114.70	NO
2011	9,912.37	92.03	364.00	9,456.34	NO
2012	9,766.21	84.29	378.53	9,303.39	NO
2013	10,519.41	84.97	362.89	10,071.56	NO
2014	12,725.31	110.37	367.40	12,247.54	NO
2015	9,774.28	105.03	372.99	9,296.25	NO
2016	9,034.91	103.79	417.91	8,513.21	NO
2017	8,216.86	102.25	425.24	7,689.38	NO
2018	7,644.03	109.32	428.87	7,105.85	NO
2019	7,256.79	100.62	396.78	6,759.39	NO
2020	8,362.22	101.69	374.02	7,886.52	NO
Trend					
1990 – 2020	21.0%	6.0 %	68.0 %	19.6%	*NA*
2005 – 2020	-23.1%	-8.5 %	-5.6 %	-23.9%	*NA*
2019 - 2020	15.2%	1.1 %	-5.7 %	16.7%	*NA*

Table 306Fugitive emissions of CH_4 from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production GHG from Oil and gas

CH_4	1.B.2	1.B.2.a	1.B.2.b	1.B.2.c	1.B.2.d
	Oil and natural gas	Oil	Natural gas	Venting and flaring	Other
	kt	kt	kt	kt	kt
1990	507.83	24.01	444.25	39.56	NO
1991	527.01	24.12	462.12	40.77	NO
1992	506.02	22.93	442.95	40.14	NO
1993	524.42	23.42	459.59	41.40	NO
1994	501.30	23.42	439.36	38.52	NO
1995	604.54	24.08	536.60	43.87	NO
1996	650.31	25.10	577.79	47.42	NO
1997	716.40	26.25	635.55	54.61	NO
1998	775.04	27.31	690.53	57.19	NO
1999	821.42	34.33	726.56	60.53	NO
2000	782.34	27.42	694.93	60.00	NO
2001	751.55	34.20	660.42	56.92	NO
2002	788.32	35.73	693.22	59.37	NO
2003	798.42	37.71	699.69	61.01	NO
2004	786.51	38.59	690.62	57.30	NO
2005	885.73	39.61	783.95	62.17	NO
2006	839.66	32.38	747.42	59.86	NO
2007	834.37	32.45	741.78	60.14	NO
2008	833.91	31.81	743.98	58.12	NO
2009	806.24	29.78	719.81	56.66	NO
2010	906.09	27.79	805.61	72.69	NO
2011	861.72	26.88	778.10	56.74	NO
2012	885.29	25.11	804.36	55.82	NO
2013	863.07	24.29	778.35	60.43	NO
2014	899.80	26.23	800.08	73.49	NO
2015	892.04	25.70	810.57	55.78	NO
2016	967.72	26.05	890.59	51.08	NO
2017	981.45	25.42	909.89	46.14	NO
2018	980.16	25.00	912.53	42.64	NO
2019	930.05	24.44	865.05	40.56	NO
2020	881.41	22.11	811.98	47.32	NO
Trend					
1990 – 2020	73.6%	- 7.9 %	82.8%	19.6%	NA
2005 – 2020	-0.5%	- 44.2 %	3.6%	-23.9%	NA
2019 - 2020	-5.2%	- 9.5 %	-6.1%	16.7%	NA

Table 307Fugitive emissions of N_2O from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production GHG from Oil and gas

N_2O	1.B.2	1.B.2.a	1.B.2.b	1.B.2.c	1.B.2.d
	Oil and natural gas	Oil	Natural gas	Venting and flaring	Other
	kt	kt	kt	kt	kt
1990	0.076	0.000032	NA	0.076	NE
1991	0.078	0.000032	NA	0.078	NE
1992	0.077	0.000033	NA	0.077	NE
1993	0.079	0.000033	NA	0.079	NE
1994	0.074	0.000033	NA	0.074	NE
1995	0.084	0.000032	NA	0.084	NE
1996	0.091	0.000033	NA	0.091	NE
1997	0.105	0.000036	NA	0.105	NE
1998	0.110	0.000038	NA	0.110	NE
1999	0.116	0.000039	NA	0.116	NE
2000	0.115	0.000038	NA	0.115	NE
2001	0.109	0.000038	NA	0.109	NE
2002	0.114	0.000040	NA	0.114	NE
2003	0.117	0.000041	NA	0.117	NE
2004	0.110	0.000036	NA	0.110	NE
2005	0.119	0.000037	NA	0.119	NE
2006	0.115	0.000035	NA	0.115	NE
2007	0.115	0.000037	NA	0.115	NE
2008	0.111	0.000039	NA	0.111	NE
2009	0.109	0.000041	NA	0.109	NE
2010	0.139	0.000032	NA	0.139	NE
2011	0.109	0.000031	NA	0.109	NE
2012	0.107	0.000028	NA	0.107	NE
2013	0.116	0.000028	NA	0.116	NE
2014	0.141	0.000037	NA	0.141	NE
2015	0.107	0.000035	NA	0.107	NE
2016	0.098	0.000035	NA	0.098	NE
2017	0.088	0.000034	NA	0.088	NE
2018	0.082	0.000036	NA	0.082	NE
2019	0.078	0.000034	NA	0.078	NE
2020	0.091	0.000034	NA	0.091	NE
Trend					
1990 – 2020	19.6%	6.0 %	NA	19.6%	*NA*
2005 – 2020	-23.9%	-8.4 %	NA	-23.9%	*NA*
2019 - 2020	16.7%	1.1 %	NA	16.7%	*NA*

Table 308Fugitive emissions of NMVOC from IPCC category 1.B.2. Oil and natural gas and other emissions from energy production GHG from Oil and gas

NMVOC	1.B.2	1.B.2.a	1.B.2.b	1.B.2.c	1.B.2.d
	Oil and natural gas	**Oil**	**Natural gas**	**Venting and flaring**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**
1990	7,485.42	7,437.80	51.309	0.76	NO
1991	6,756.75	6,707.10	53.514	0.78	NO
1992	7,927.85	7,879.90	51.693	0.76	NO
1993	7,863.32	7,813.01	54.188	0.77	NO
1994	7,431.79	7,383.24	52.213	0.75	NO
1995	6,975.57	6,917.02	63.077	0.84	NO
1996	6,851.88	6,788.89	67.883	0.90	NO
1997	6,666.29	6,595.95	75.886	0.99	NO
1998	6,622.10	6,547.57	80.464	1.05	NO
1999	6,805.97	6,727.84	84.455	1.08	NO
2000	6,816.66	6,740.43	82.325	1.08	NO
2001	6,543.07	6,470.53	78.283	1.03	NO
2002	6,580.70	6,505.12	81.589	1.09	NO
2003	6,750.50	6,673.32	83.218	1.14	NO
2004	6,936.05	6,859.88	82.156	1.12	NO
2005	7,356.82	7,272.72	90.818	1.22	NO
2006	6,525.27	6,443.95	87.782	1.18	NO
2007	7,671.23	7,590.93	86.680	1.19	NO
2008	8,069.10	7,988.41	87.076	1.19	NO
2009	8,776.00	8,698.34	83.794	1.16	NO
2010	9,951.32	9,870.69	86.978	1.12	NO
2011	11,096.87	11,018.95	84.071	1.08	NO
2012	12,420.65	12,339.91	87.181	1.09	NO
2013	13,619.33	13,541.43	84.051	1.05	NO
2014	14,598.55	14,518.75	85.979	1.11	NO
2015	15,642.80	15,561.80	87.297	1.11	NO
2016	15,116.37	15,026.73	96.739	1.20	NO
2017	14,734.01	14,643.61	97.644	1.21	NO
2018	14,152.17	14,061.57	97.907	1.22	NO
2019	14,096.28	14,019.34	83.660	1.14	NO
2020	12,120.80	12,048.32	78.813	1.08	NO
Trend					
1990 – 2020	*61.9 %*	*62.0 %*	*52.4 %*	*42.7 %*	*NA*
2005 – 2020	*64.8 %*	*65.7 %*	*-13.9 %*	*-11.4 %*	*NA*
2019 - 2020	*-14.0 %*	*14.1 %*	*- 5.8 %*	*-5.5 %*	*NA*

3.3.2.1 Characteristics of the Algerian oil and gas sector in Algeria

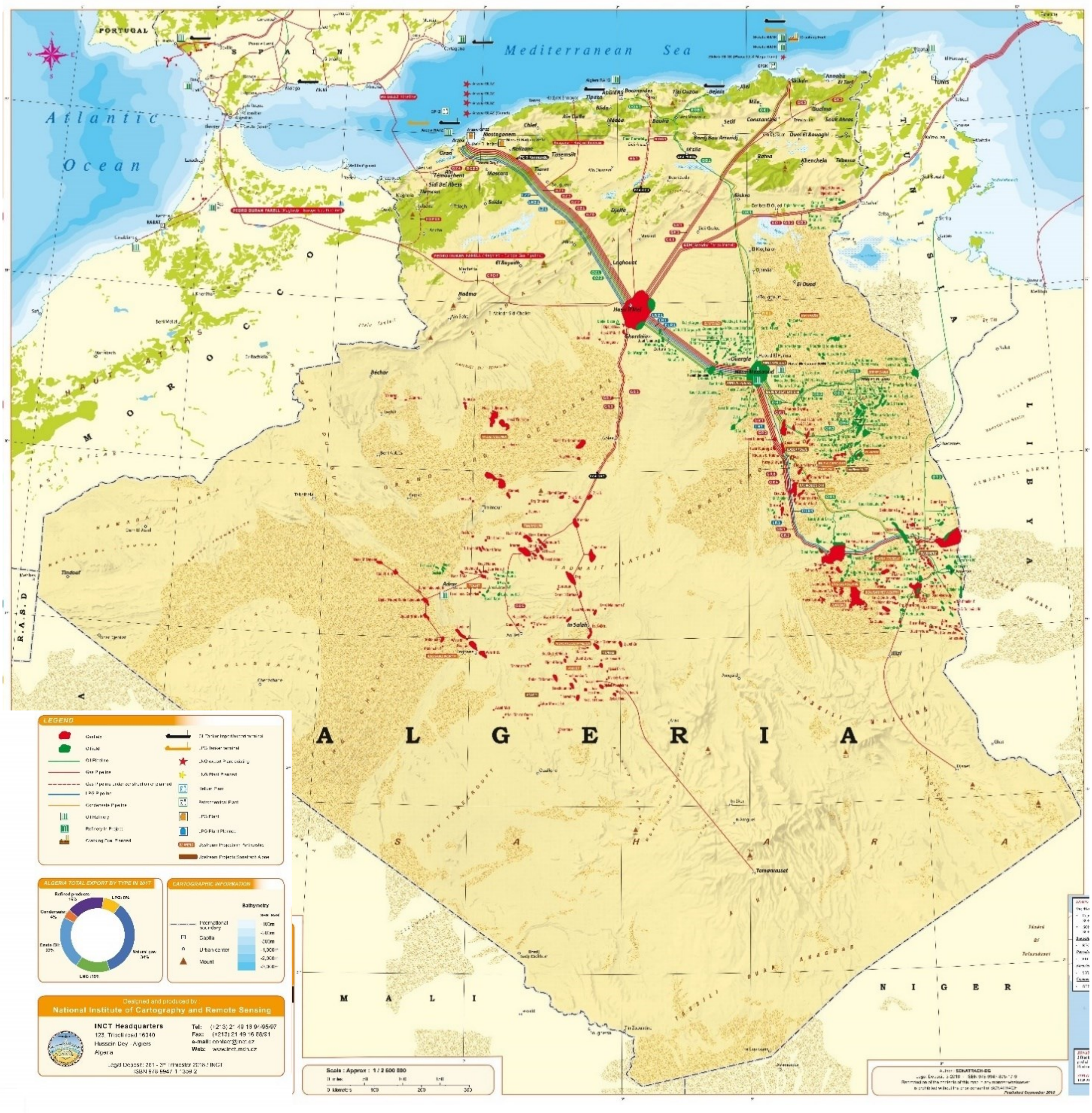

Figure 114 Oil and gas map of Algeria[343]

The previous figure shows the characteristics of the oil and gas sector in Algeria, with the various oil production sites, mainly in Hassi Messaoud, Ain Amenas and Adrar, and the natural gas production sites, mainly in Hassi R'mel and Adrar. The figure illustrates the enormous length of the gas and oil pipelines that transport hydrocarbons to refineries, distribution and processing stations and to the export ports at Arzew, Skikda, Bejaia and Annaba.

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[343] Source: SONATRACH (2018): Map of Algeria. (modified);
available (12 August 2022) on https://sonatrach.com/wp-content/uploads/2018/12/Oil__Gas_map_of_Algeria_2018.jpg

3.3.2.2 Methodological issues

In the following figure is provided the decision tree and the decision (highlighted) for Tier 1 or Tier 2 method for estimating fugitive emissions of CO_2, CH_4, N_2O, and NMVOC from IPCC category 1.B.1.a oil systems.

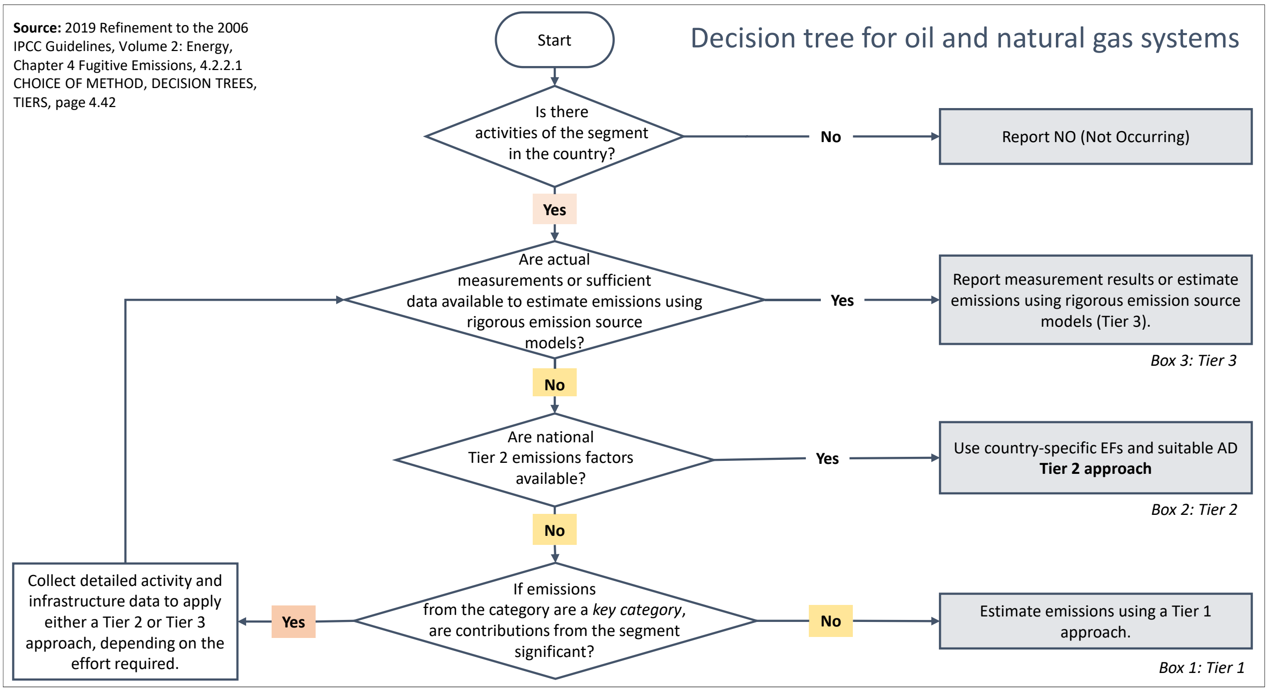


Figure 115 Decision tree for oil and natural gas systems

Source: 2019 Refinement to the 2006 IPCC Guidelines. Vol. 2: Energy. Chapter 4: Fugitive Emissions. sub-chap. 4.2.2.1 Choice of method, decision trees. TIERS. Figure 4.2. p. 4.42. (modified)

3.3.2.2.1 Choice of methods for estimating fugitive emissions from oil and natural gas systems

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from oil and natural gas systems the Tier 1 method according to 2019 Refinements to 2006 IPCC GL has been applied. Fugitive emissions include emissions from venting, flaring and leaks.

Equation 4.2.1 TIER 1 Estimating fugitive emissions from an industry segment

(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\boldsymbol{Emissions_{gas,\ industry\ segment} = AD_{industry\ segment} * EF_{gas,\ industry\ segment}}$$

Equation 4.2.1 TIER 1 Estimating fugitive emissions from an industry segment

(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\boldsymbol{Emissions_{NMVOC,\ industry\ segment} = AD_{industry\ segment} * EF_{NMVOC,\ industry\ segment}}$$

Equation 4.2.2 Total fugitive emissions from industry segments

(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\boldsymbol{Emissions_{gas} = \sum_{industry\ segments} emissions_{gas,industry\ segments}}$$

Where:

Gas = CH_4, CO_2, N_2O, NMVOC

$Emissions_{gas.industry\ segment}$ = emissions of CH_4, CO_2, NMVOC, and N_2O from different industry segments

$AD_{industry\ segment}$ = activity data of different industry segments

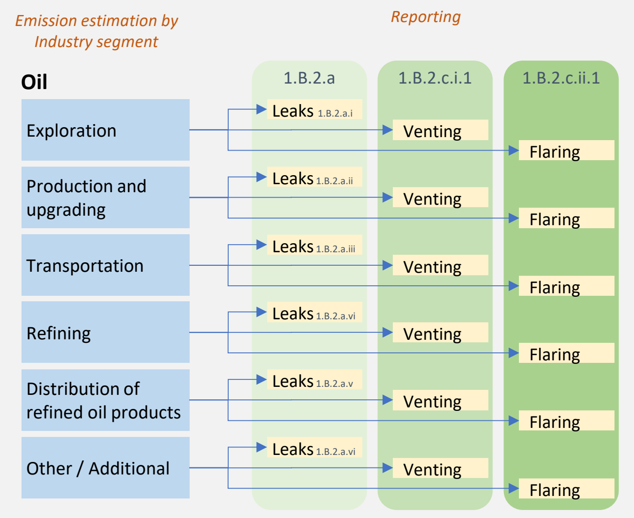
$EF_{gas.industry\ segment}$ = default emission factor of CH_4, CO_2, N_2O and NMVOC for different industry segments

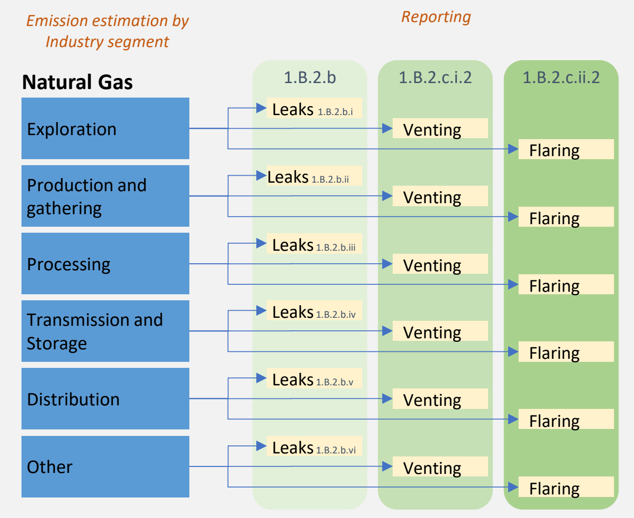
3.3.2.3 Fugitive emissions from Oil systems (IPCC category 1.B.2.a)

In the following table is the status of reporting of sources of IPCC category 1.B.2 Oil and natural gas provided.

Table 309Status of reporting and key category of IPCC category 1.B.2

IPCC code	**Description**		**CH_4**		**CO_2**		**NMVOC**		**N_2O**	
			Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.2.a	**Oil**	LA 1990								
1.B.2.a.i	Exploration	Leaks	NA		NA		NA		NA	
		Venting	IE in 1.B.2.c.i.1							
		Flaring	IE in 1.B.2.c.ii.1							
1.B.2.a.ii	Production and upgrading	Leaks	✓		NA		✓		NA	
		Venting	IE in 1.B.2.c.i.1							
		Flaring	IE in 1.B.2.c.ii.1							
1.B.2.a.iii	Transport	All	✓		✓		✓		NA	
1.B.2.a.iv	Refining/storage	Leaks	✓		✓		✓		✓	
		Venting	IE in 1.B.2.c.i.1							
		Flaring	IE in 1.B.2.c.ii.1							
1.B.2.a.v	Distribution of oil products	All	NA		NA		✓		NA	
1.B.2.a.vi	Other									
1.B.2.a.vi.1	Abandoned wells	All	NE		NE		NE		NE	
1.B.2.a.vi.2	Other	All	NE		NE		NE		NE	
1.B.2. c.	**Venting and flaring**	LA 1990 & 2020								
1.B.2.c.i.	Venting									
1.B.2.c.i.1.	Oil		✓		✓		✓		✓	
1.B.2.c.i.2.	Gas		✓		✓		✓		✓	
1.B.2.c.i.3.	Combined		NO		NO		NO		NO	
1.B.2.c.ii.	Flaring									
1.B.2.c.ii.1.	Oil		✓		✓		✓		✓	
1.B.2.c.ii.2.	Gas		✓		✓		✓		✓	
1.B.2.c.ii.3.	Combined		NO		NO		NO		NO	
All: sum of leak. venting and flaring	A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF										





This section describes the emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting.

The following figures show the fugitive emissions of CH_4, CO_2, N_2O and NMVOCs from the Oil (IPCC category 1.B.2.a) and Oil Flaring and Venting (IPCC category 1.B.2.C) segments.

The IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting are for CH_4 key category.

Fugitive GHG emissions from IPCC category 1.B.2.a Oil. 1.B.2.C Flaring and venting amounted to 5,784.23kt CO_2 equivalent in 1990, 9,822.76 kt CO_2 equivalent in 2005 and 8,337.40 kt CO_2 equivalent in 2020.

The overall trend of greenhouse gas emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting shows a decrease of 6.0% for 1.B.2.a, and an increase of 51.0% for venting and flaring, over the period 1990-2020. However, the peak in GHG emissions was reached in 2010. Since 2010, GHG emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting have decreased by 17.3% and 36.6%, respectively.

In the period 2019-2020, GHG emissions from IPCC category 1.B.2.a Oil decreased by 8.0%, however emissions from IPCC category 1.B.2.C Oil flaring and venting increased by 15.9% .

The most important gas in the IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting is CH_4 with a part of 84.4% for 1.B.2.a. 13% for flaring and venting of the 2020 emissions respectively. The CH_4 emissions result mainly from leakage, venting and flaring in the different oil production stages.

In the IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting of oil, CO_2 emissions have respective parts of 15.5% for 1.B.2.a. 86.7% for venting and flaring in the 2020 emissions. The CO_2 emissions result mainly from oil refining and storage activities as well as from flaring.

N_2O is only a minor source in the IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting of oil, with a part of 0.002% for 1.B.2.a and 0.3% for venting and flaring in the 2020 emissions.

Fugitive CO_2 emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting amounted to 4,507.12 kt in 1990, 7,672.34 kt in 2005 and 6,762.59 kt in 2020.

The overall trend of CO_2 emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting shows a decrease of 6.0% for 1.B.2.a, and an increase of 51.0% for venting and flaring, over the period 1990-2020. However, the peak in GHG emissions was reached in 2010. Since 2010, CO_2 emissions from IPCC category 1.B.2.C Oil flaring and venting have decreased by 36.6%.

Fugitive CH_4 emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Flaring and venting of oil amounted to 1,261.99 kt CO_2 eq in 1990 2,124.50 kt CO_2 eq in 2005 and 1,551.97 kt CO_2 eq in 2020.

The overall trend of CH_4 emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting shows a decrease of 7.9% for 1.B.2.a, and an increase of 51.0% for venting and flaring, over the period 1990-2020. However, the peak in GHG emissions was reached in 2010. Since 2010, CH_4 emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting have decreased by 20.4% and 36.6%, respectively.

Fugitive N_2O emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting amounted to 15.13 kt in 1990. 25.92 kt in 2005 and 22.84 kt in 2020.

The overall trend of N_2O emissions from IPCC category 1.B.2.a Oil and category 1.B.2.C Oil flaring and venting shows a decrease of 6.0% for 1.B.2.a, and an increase of 51.0% for venting and flaring, over the period 1990-2020. However, the peak in GHG emissions was reached in 2010. Since 2010, N_2O emissions from IPCC category 1.B.2.C Oil flaring and venting have decreased by 36.5%.

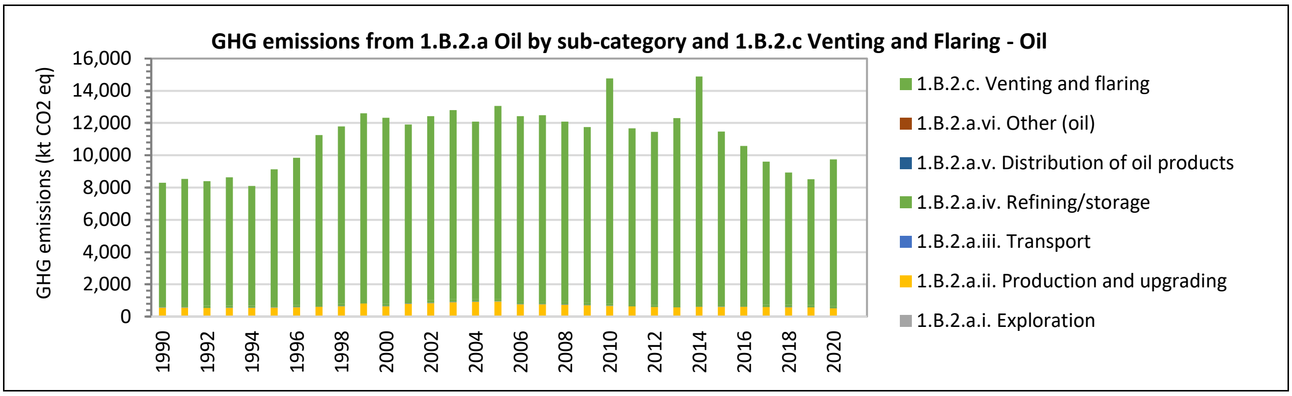


Figure 116 GHG emissions from IPCC category 1.B.2.a Oil

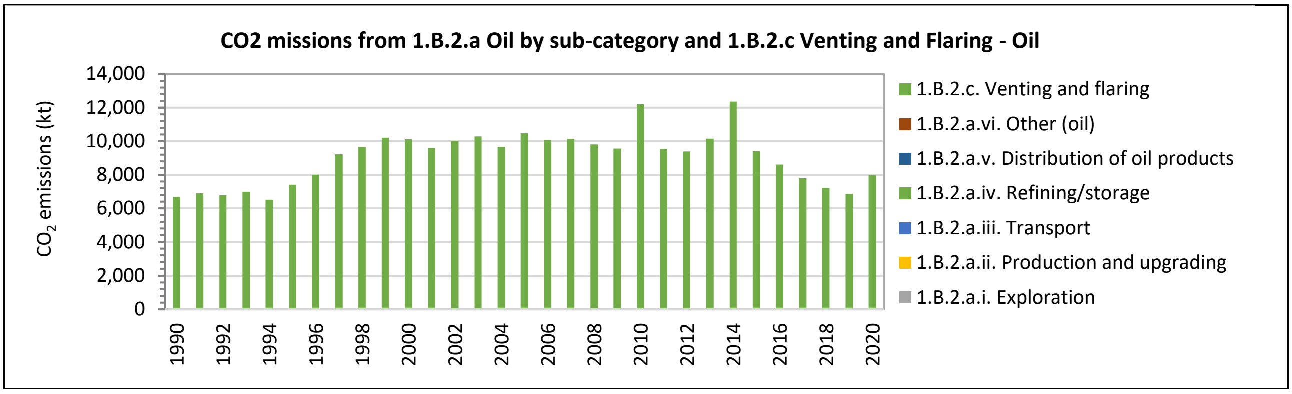


Figure 117 CO_2 emissions from IPCC category 1.B.2.a Oil

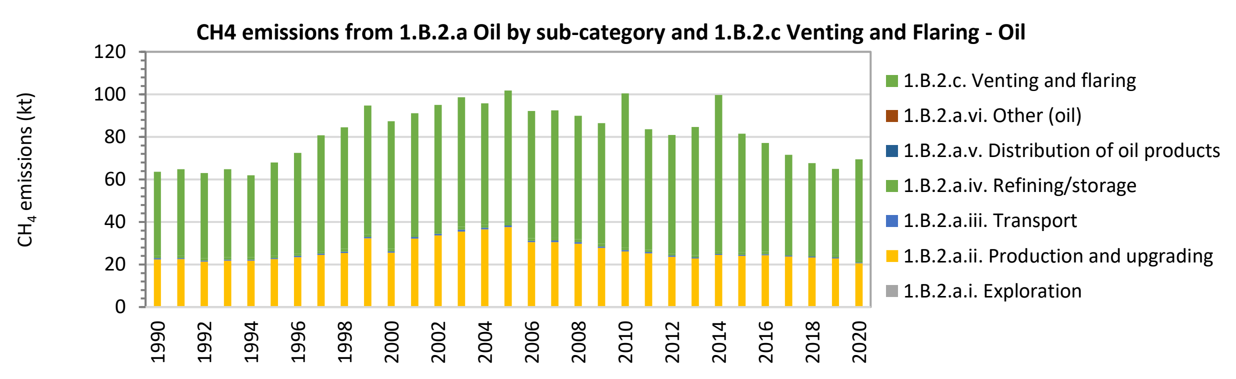


Figure 118 CH_4 emissions from IPCC category 1.B.2.a Oil

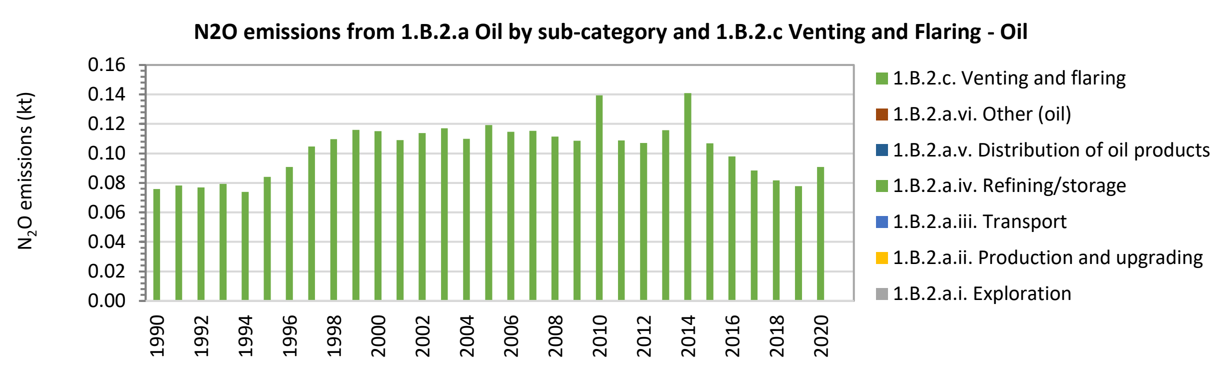


Figure 119 N_2O emissions from IPCC category 1.B.2.a Oil

Table 310Fugitive emissions of GHG from IPCC category 1.B.2.a Oil

GHG	1.B.2.a.	1.B.2.a.i.	1.B.2.a.ii.	1.B.2.a.iii.	1.B.2.a.iv.	1.B.2.a.v.	1.B.2.a.vi.	1.B.2.c.i.1 .	1.B.2.c.ii. 1.
	Oil	Exploration	Production and upgrading	Transport	Refining/ storage	Distribution of oil products	Other	Venting - Oil	Flaring - Oil
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	696.20	NA	561.19	12.12	122.90	NA	NE	IE	5,088.03
1991	700.54	NA	563.48	12.17	124.89	NA	NE	IE	5,288.56
1992	671.03	NA	534.24	11.54	125.26	NA	NE	IE	5,130.52
1993	683.96	NA	546.15	11.79	126.02	NA	NE	IE	5,278.03
1994	685.07	NA	545.74	11.78	127.54	NA	NE	IE	5,014.85
1995	698.42	NA	562.68	12.15	123.60	NA	NE	IE	6,042.44
1996	726.37	NA	586.95	12.67	126.75	NA	NE	IE	6,484.37
1997	762.99	NA	612.87	13.23	136.88	NA	NE	IE	7,258.37
1998	797.72	NA	636.78	13.75	147.20	NA	NE	IE	7,726.88
1999	975.17	NA	807.86	17.44	149.87	NA	NE	IE	8,145.13
2000	800.74	NA	639.26	13.80	147.67	NA	NE	IE	7,952.98
2001	968.64	NA	805.79	17.40	145.45	NA	NE	IE	7,527.44
2002	1,012.34	NA	841.56	18.17	152.61	NA	NE	IE	7,859.88
2003	1,065.59	NA	889.12	19.20	157.27	NA	NE	IE	7,967.03
2004	1,073.37	NA	914.37	19.74	139.26	NA	NE	IE	7,828.83
2005	1,101.41	NA	938.80	20.27	142.33	NA	NE	IE	8,721.35
2006	914.67	NA	763.33	16.48	134.86	NA	NE	IE	8,427.66
2007	921.16	NA	763.86	16.49	140.81	NA	NE	IE	8,357.80
2008	913.33	NA	746.02	16.11	151.21	NA	NE	IE	8,416.72
2009	867.46	NA	694.91	15.00	157.54	NA	NE	IE	8,103.36
2010	791.78	NA	653.40	14.11	124.27	NA	NE	IE	12,109.47
2011	764.16	NA	632.57	13.66	117.93	NA	NE	IE	8,871.98
2012	712.03	NA	591.25	12.77	108.01	NA	NE	IE	8,551.77
2013	692.24	NA	571.03	12.33	108.88	NA	NE	IE	8,921.81
2014	766.04	NA	611.39	13.20	141.45	NA	NE	IE	9,432.44
2015	747.45	NA	599.89	12.95	134.61	NA	NE	IE	8,459.15
2016	755.00	NA	608.84	13.15	133.01	NA	NE	IE	7,820.52
2017	737.83	NA	593.97	12.83	131.04	NA	NE	IE	7,825.71
2018	734.27	NA	581.61	12.56	140.10	NA	NE	IE	6,930.41
2019	711.71	NA	570.44	12.32	128.96	NA	NE	IE	6,627.59
2020	654.53	NA	513.12	11.08	130.33	NA	NE	IE	7,682.86
Trend									
1990 – 2020	-6.0%	*NA*	-8.6%	-8.6%	6.0%	*NA*	*NA*	NA	51.0%
2005 – 2020	-40.6%	*NA*	-45.3%	-45.3%	-8.4%	*NA*	*NA*	NA	-11.9%
2019 - 2020	-8.0%	*NA*	-10.0%	-10.0%	1.1%	*NA*	*NA*	NA	15.9%

Table 311Fugitive emissions of CO_2 from IPCC category 1.B.2.a Oil

CO_2	1.B.2.a.	1.B.2.a.i.	1.B.2.a.ii.	1.B.2.a.iii.	1.B.2.a.iv.	1.B.2.a.v.	1.B.2.a.vi.	1.B.2.c.i.1.	1.B.2.c.ii.1.
	Oil	Exploration	Production and upgrading	Transport	Refining/ storage	Distribution of oil products	Other	Venting - Oil	Flaring - Oil
	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	95.90	NA	NA	0.04	95.85	NA	NE	IE	4,411.22
1991	97.45	NA	NA	0.04	97.41	NA	NE	IE	4,585.08
1992	97.73	NA	NA	0.04	97.69	NA	NE	IE	4,448.07
1993	98.33	NA	NA	0.04	98.29	NA	NE	IE	4,575.95
1994	99.52	NA	NA	0.04	99.48	NA	NE	IE	4,347.78
1995	96.44	NA	NA	0.04	96.40	NA	NE	IE	5,238.69
1996	98.90	NA	NA	0.05	98.86	NA	NE	IE	5,621.83
1997	106.81	NA	NA	0.05	106.76	NA	NE	IE	6,292.88
1998	114.86	NA	NA	0.05	114.81	NA	NE	IE	6,699.07
1999	116.96	NA	NA	0.06	116.89	NA	NE	IE	7,061.68
2000	115.23	NA	NA	0.05	115.18	NA	NE	IE	6,895.09
2001	113.51	NA	NA	0.06	113.44	NA	NE	IE	6,526.15
2002	119.09	NA	NA	0.07	119.03	NA	NE	IE	6,814.37
2003	122.73	NA	NA	0.07	122.66	NA	NE	IE	6,907.27
2004	108.69	NA	NA	0.07	108.61	NA	NE	IE	6,787.45
2005	111.08	NA	NA	0.07	111.01	NA	NE	IE	7,561.25
2006	105.24	NA	NA	0.06	105.18	NA	NE	IE	7,306.63
2007	109.88	NA	NA	0.06	109.82	NA	NE	IE	7,246.05
2008	117.99	NA	NA	0.06	117.93	NA	NE	IE	7,297.14
2009	122.93	NA	NA	0.05	122.87	NA	NE	IE	7,025.46
2010	96.97	NA	NA	0.05	96.92	NA	NE	IE	10,498.68
2011	92.03	NA	NA	0.05	91.98	NA	NE	IE	7,691.84
2012	84.29	NA	NA	0.05	84.24	NA	NE	IE	7,414.23
2013	84.97	NA	NA	0.04	84.92	NA	NE	IE	7,735.04
2014	110.37	NA	NA	0.05	110.32	NA	NE	IE	8,177.75
2015	105.03	NA	NA	0.05	104.99	NA	NE	IE	7,333.93
2016	103.79	NA	NA	0.05	103.74	NA	NE	IE	6,780.25
2017	102.25	NA	NA	0.05	102.20	NA	NE	IE	6,784.75
2018	109.32	NA	NA	0.05	109.27	NA	NE	IE	6,008.54
2019	100.62	NA	NA	0.04	100.58	NA	NE	IE	5,745.99
2020	101.69	NA	NA	0.04	101.65	NA	NE	IE	6,660.90
Trend									
1990 – 2020	6.0%	*NA*	*NA*	-8.6%	6.0%	*NA*	*NA*	NA	51.0%
2005 – 2020	-8.5%	*NA*	*NA*	-45.3%	-8.4%	*NA*	*NA*	NA	-11.9%
2019 - 2020	1.1%	*NA*	*NA*	-10.0%	1.1%	*NA*	*NA*	NA	15.9%

Table 312Fugitive emissions of CH_4 from IPCC category 1.B.2.a Oil

CH_4	1.B.2.a.	1.B.2.a.i.	1.B.2.a.ii.	1.B.2.a.iii.	1.B.2.a.iv.	1.B.2.a.v.	1.B.2.a.vi.	1.B.2.c.i.1.	1.B.2.c.ii.1.
	Oil	**Exploration**	**Production and upgrading**	**Transport**	**Refining/ storage**	**Distribution of oil products**	**Other**	**Venting - Oil**	**Flaring - Oil**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	24.01	NA	22.45	0.48	1.08	NA	NE	IE	26.47
1991	24.12	NA	22.54	0.48	1.10	NA	NE	IE	27.51
1992	22.93	NA	21.37	0.46	1.10	NA	NE	IE	26.69
1993	23.42	NA	21.85	0.47	1.11	NA	NE	IE	27.46
1994	23.42	NA	21.83	0.47	1.12	NA	NE	IE	26.09
1995	24.08	NA	22.51	0.48	1.09	NA	NE	IE	31.43
1996	25.10	NA	23.48	0.51	1.12	NA	NE	IE	33.73
1997	26.25	NA	24.51	0.53	1.20	NA	NE	IE	37.76
1998	27.31	NA	25.47	0.55	1.30	NA	NE	IE	40.19
1999	34.33	NA	32.31	0.70	1.32	NA	NE	IE	42.37
2000	27.42	NA	25.57	0.55	1.30	NA	NE	IE	41.37
2001	34.20	NA	32.23	0.69	1.28	NA	NE	IE	39.16
2002	35.73	NA	33.66	0.72	1.34	NA	NE	IE	40.89
2003	37.71	NA	35.56	0.77	1.38	NA	NE	IE	41.44
2004	38.59	NA	36.57	0.79	1.23	NA	NE	IE	40.72
2005	39.61	NA	37.55	0.81	1.25	NA	NE	IE	45.37
2006	32.38	NA	30.53	0.66	1.19	NA	NE	IE	43.84
2007	32.45	NA	30.55	0.66	1.24	NA	NE	IE	43.48
2008	31.81	NA	29.84	0.64	1.33	NA	NE	IE	43.78
2009	29.78	NA	27.80	0.60	1.39	NA	NE	IE	42.15
2010	27.79	NA	26.14	0.56	1.09	NA	NE	IE	62.99
2011	26.88	NA	25.30	0.54	1.04	NA	NE	IE	46.15
2012	25.11	NA	23.65	0.51	0.95	NA	NE	IE	44.49
2013	24.29	NA	22.84	0.49	0.96	NA	NE	IE	46.41
2014	26.23	NA	24.46	0.53	1.24	NA	NE	IE	49.07
2015	25.70	NA	24.00	0.52	1.18	NA	NE	IE	44.00
2016	26.05	NA	24.35	0.52	1.17	NA	NE	IE	40.68
2017	25.42	NA	23.76	0.51	1.15	NA	NE	IE	40.71
2018	25.00	NA	23.26	0.50	1.23	NA	NE	IE	36.05
2019	24.44	NA	22.82	0.49	1.13	NA	NE	IE	34.48
2020	22.11	NA	20.52	0.44	1.15	NA	NE	IE	39.97
Trend									
1990 – 2020	*-7.9%*	*NA*	*-8.6%*	*-8.6%*	*6.0%*	*NA*	*NA*	*NA*	51.0%
2005 – 2020	*-44.2%*	*NA*	*-45.3%*	*-45.3%*	*-8.4%*	*NA*	*NA*	*NA*	-11.9%
2019 - 2020	*-9.5%*	*NA*	*-10.0%*	*-10.0%*	*1.1%*	*NA*	*NA*	*NA*	15.9%

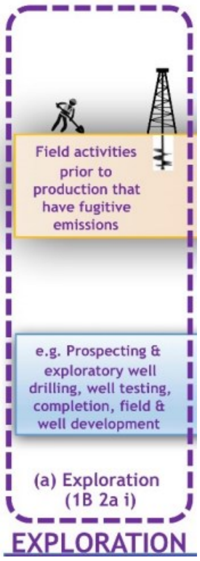
Table 313Fugitive emissions of N_2O from IPCC category 1.B.2.a Oil

N_2O	1.B.2.a.	1.B.2.a.i.	1.B.2.a.ii.	1.B.2.a.iii.	1.B.2.a.iv.	1.B.2.a.v.	1.B.2.a.vi.	1.B.2.c.i.1.	1.B.2.c.ii.1.
	Oil	Exploration	Production and upgrading	Transport	Refining/ storage	Distribution of oil products	Other	Venting - Oil	Flaring - Oil
	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	0.000032	NA	NA	NA	0.000032	NA	NA	NA	0.051
1991	0.000032	NA	NA	NA	0.000032	NA	NA	NA	0.053
1992	0.000033	NA	NA	NA	0.000033	NA	NA	NA	0.051
1993	0.000033	NA	NA	NA	0.000033	NA	NA	NA	0.053
1994	0.000033	NA	NA	NA	0.000033	NA	NA	NA	0.050
1995	0.000032	NA	NA	NA	0.000032	NA	NA	NA	0.060
1996	0.000033	NA	NA	NA	0.000033	NA	NA	NA	0.065
1997	0.000036	NA	NA	NA	0.000036	NA	NA	NA	0.072
1998	0.000038	NA	NA	NA	0.000038	NA	NA	NA	0.077
1999	0.000039	NA	NA	NA	0.000039	NA	NA	NA	0.081
2000	0.000038	NA	NA	NA	0.000038	NA	NA	NA	0.079
2001	0.000038	NA	NA	NA	0.000038	NA	NA	NA	0.075
2002	0.000040	NA	NA	NA	0.000040	NA	NA	NA	0.078
2003	0.000041	NA	NA	NA	0.000041	NA	NA	NA	0.079
2004	0.000036	NA	NA	NA	0.000036	NA	NA	NA	0.078
2005	0.000037	NA	NA	NA	0.000037	NA	NA	NA	0.087
2006	0.000035	NA	NA	NA	0.000035	NA	NA	NA	0.084
2007	0.000037	NA	NA	NA	0.000037	NA	NA	NA	0.083
2008	0.000039	NA	NA	NA	0.000039	NA	NA	NA	0.084
2009	0.000041	NA	NA	NA	0.000041	NA	NA	NA	0.081
2010	0.000032	NA	NA	NA	0.000032	NA	NA	NA	0.121
2011	0.000031	NA	NA	NA	0.000031	NA	NA	NA	0.088
2012	0.000028	NA	NA	NA	0.000028	NA	NA	NA	0.085
2013	0.000028	NA	NA	NA	0.000028	NA	NA	NA	0.089
2014	0.000037	NA	NA	NA	0.000037	NA	NA	NA	0.094
2015	0.000035	NA	NA	NA	0.000035	NA	NA	NA	0.084
2016	0.000035	NA	NA	NA	0.000035	NA	NA	NA	0.078
2017	0.000034	NA	NA	NA	0.000034	NA	NA	NA	0.078
2018	0.000036	NA	NA	NA	0.000036	NA	NA	NA	0.069
2019	0.000034	NA	NA	NA	0.000034	NA	NA	NA	0.066
2020	0.000034	NA	NA	NA	0.000034	NA	NA	NA	0.077
Trend									
1990 – 2020	6.0%	*NA*	*NA*	*NA*	6.0%	*NA*	*NA*	*NA*	51.0%
2005 – 2020	-8.4%	*NA*	*NA*	*NA*	-8.4%	*NA*	*NA*	*NA*	-11.9%
2019 - 2020	1.1%	*NA*	*NA*	*NA*	1.1%	*NA*	*NA*	*NA*	15.9%

Table 314Fugitive emissions of NMVOC from IPCC category 1.B.2.a Oil

NMVOC	1.B.2.a.	1.B.2.a.i.	1.B.2.a.ii.	1.B.2.a.iii.	1.B.2.a.iv.	1.B.2.a.v.	1.B.2.a.vi.	1.B.2.c.i.1.	1.B.2.c.ii.1.
	Oil	**Exploration**	**Production and upgrading**	**Transport**	**Refining/ storage**	**Distribution of oil products**	**Other**	**Venting - Oil**	**Flaring - Oil**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	7,437.80	NA	63.23	4.83	9.28	7,360.46	NE	0.10	0.22
1991	6,707.10	NA	64.39	4.85	9.43	6,628.44	NE	0.10	0.22
1992	7,879.90	NA	62.06	4.60	9.46	7,803.79	NE	0.10	0.22
1993	7,813.01	NA	60.09	4.70	9.51	7,738.70	NE	0.10	0.22
1994	7,383.24	NA	60.56	4.70	9.63	7,308.35	NE	0.10	0.22
1995	6,917.02	NA	61.33	4.84	9.33	6,841.52	NE	0.10	0.22
1996	6,788.89	NA	64.92	5.05	9.57	6,709.35	NE	0.11	0.22
1997	6,595.95	NA	65.23	5.27	10.33	6,515.11	NE	0.11	0.24
1998	6,547.57	NA	66.79	5.48	11.11	6,464.19	NE	0.11	0.26
1999	6,727.84	NA	60.79	6.95	11.31	6,648.78	NE	0.10	0.26
2000	6,740.43	NA	72.27	5.50	11.15	6,651.51	NE	0.12	0.26
2001	6,470.53	NA	69.36	6.93	10.98	6,383.26	NE	0.11	0.25
2002	6,505.12	NA	77.88	7.24	11.52	6,408.47	NE	0.13	0.27
2003	6,673.32	NA	93.71	7.65	11.87	6,560.08	NE	0.15	0.28
2004	6,859.88	NA	101.35	7.87	10.51	6,740.14	NE	0.16	0.26
2005	7,272.72	NA	106.82	8.08	10.74	7,147.07	NE	0.17	0.27
2006	6,443.95	NA	109.08	6.57	10.18	6,318.12	NE	0.18	0.25
2007	7,590.93	NA	109.45	6.57	10.63	7,464.28	NE	0.18	0.26
2008	7,988.41	NA	105.18	6.42	11.41	7,865.39	NE	0.17	0.28
2009	8,698.34	NA	97.54	5.98	11.89	8,582.92	NE	0.16	0.28
2010	9,870.69	NA	95.12	5.62	9.38	9,760.57	NE	0.15	0.23
2011	11,018.95	NA	93.15	5.44	8.90	10,911.45	NE	0.15	0.22
2012	12,339.91	NA	87.21	5.09	8.15	12,239.46	NE	0.14	0.20
2013	13,541.43	NA	84.67	4.91	8.22	13,443.63	NE	0.14	0.20
2014	14,518.75	NA	86.77	5.26	10.68	14,416.03	NE	0.14	0.26
2015	15,561.80	NA	84.00	5.16	10.16	15,462.47	NE	0.14	0.24
2016	15,026.73	NA	87.01	5.24	10.04	14,924.44	NE	0.14	0.24
2017	14,643.61	NA	84.49	5.11	9.89	14,544.12	NE	0.14	0.24
2018	14,061.57	NA	82.99	5.01	10.58	13,963.00	NE	0.13	0.25
2019	14,019.34	NA	82.66	4.91	9.73	13,922.04	NE	0.13	0.23
2020	12,048.32	NA	72.70	4.42	9.84	11,961.37	NE	0.12	0.23
Trend									
1990 – 2020	62.0%	*NA*	*15.0 %*	*— 8.6 %*	*6.0 %*	*62.5 %*	*NA*	*15.0 %*	*7.2 %*
2005 – 2020	65.7%	*NA*	*—31.9 %*	*—45.3 %*	*— 8.4 %*	*67.4 %*	*NA*	*—31.9 %*	*—12.5 %*
2019 - 2020	-14.1%	*NA*	*—12.0 %*	*—10.0 %*	*1.1 %*	*14.1 %*	*NA*	*—12.0 %*	*—0.9 %*

3.3.2.3.1 Fugitive emissions from oil exploration (IPCC category 1.B.2.a.i)



According to the 2019 IPCC Refinements to the 2006 IPCC GL[344] the segment *Oil Exploration* includes fugitive emissions, including equipment leaks, venting and flaring, from oil field activities prior to production.

- geological and geophysical surveys and tests.
- prospecting and exploratory well drilling.
- well/drill stem testing.
- field development and well development
    - construction/drilling.
    - testing, well completion.
    - any fracture stimulation

In the following figure an overview of the active rigs and completed well in Algeria is provided.

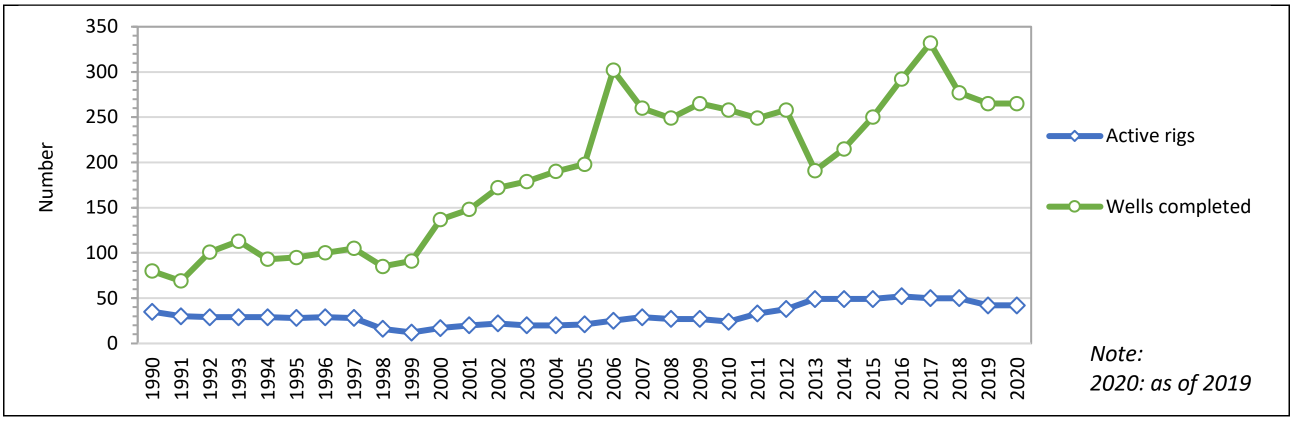


Figure 120 Active rigs and completed wells

Source: Organization of the Petroleum Exporting Countries (OPEC)(2022): Data download. Section 3 — Oil data: upstream. Table 3.2 and Table 3.3.[345]

The following table provides an overview of occurring activities in Algeria.

Table 315 Activities of segment Oil Exploration occurring in Algeria.

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
Onshore				
• Exploration of unconventional oil <u>without</u> flaring or recover				x
• Exploration of unconventional oil <u>with</u> flaring or recover				x
• Exploration of conventional oil		X		
Offshore				X
Note: Unconventional oil exploration refers to exploration that includes well completions with hydraulic fracturing. Conventional oil exploration emission factors refers to exploration where hydraulic fracturing well completion practices are not used.				

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[344] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.48

[345] Available on 05. June 2022: https://asb.opec.org/data/ASB_Data.php

It must be noted that GHG emissions from oil exploration (category 1.B.2.a.i) were included in Oil production and upgrading (category 1.B.2.a.ii) for the whole time period (1990 – 2020).

3.3.2.3.2 Fugitive emissions from Oil production and upgrading (IPCC category 1.B.2.a.ii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[346] the segment *Oil production and upgrading* includes fugitive emissions from onshore production, including equipment leaks, venting and flaring, from activities during production

- extraction
- on-site crude oil processing (i.e, removing water and gases contained in crude oil)
- wells, e.g., wellhead leaks, from well workovers and refractures
- well-site equipment, e.g., pneumatic controllers, dehydrators and separators.
- untreated transport.
- condensate removal.
- upgrading facilities.
- water disposal.
- upgrading.

The following table provides an overview of occurring activities in Algeria.

Table 316 Activities of segment Oil production and upgrading occurring in Algeria.

	Occurring			**Not occurring (NO)**
	Estimated	**Included elsewhere (IE)**	**Not estimated (NE)**	
Onshore oil production				
• Oil production	x			
• Oil Sands Mining and Ore Processing				x
• Oil Sands Upgrading				x
Offshore oil production				x

In the following figures and table, the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Oil production and upgrading* (IPCC category 1.B.2.a.ii) are provided.

This section describes the emissions from IPCC category 1.B.2.a.ii Oil Production and Upgrading. 1.B.2.c.i.1 Venting - Oil Production and Upgrading and 1.B.2.c.ii.1 Flaring - Oil Production and Upgrading and provides an overview of fugitive emissions in the following figures and tables.

Fugitive GHG emissions from IPCC category, 1.B.2.a.ii oil production and upgrading amounted to 5,279.09kt CO_2 equivalent in 1990, 9,342.18kt CO_2 equivalent in 2005 and 7,861.28 kt CO_2 equivalent in 2020.

fugitive emissions from venting and flaring accounted to 4,717.90kt CO_2 equivalent in 1990, 8,403.38kt CO_2 equivalent in 2005 and 7,348.16kt CO_2 equivalent in 2020.

The overall trend of greenhouse gas emissions in IPCC category, 1.B.2.a.ii oil production and upgrading shows a increase of 48.9% over the period 1990-2020. However, the GHG emissions for this category were decreased by 15.9 % between 2005 and 2020.

In the period 2019-2020, GHG emissions have increased by 14.2%.

The IPCC's overall trend in GHG emissions from venting and flaring in oil production and upgrading shows a increase of 55.8% for CH_4, 55.8% for CO_2 and 55.8% for N_2O over the period 1990-2020. the GHG emissions for this category were decreased by 12.6%, 12.6% and 12.6% decrease in GHG emissions for CH_4, CO_2 and N_2O between 2005 and 2020.

In the period 2019-2020, GHG emissions increased by 16.4% for CH_4, 16.4% for CO_2 and 16.4% for N_2O.

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[346] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.52

The most important gas in the IPCC category 1.B.2.a.ii Oil production and upgrading is CO_2 with 81.0% of 2020 emissions. The share of CH_4 in emissions resulting from this category is about 18.7%, CH_4 emission provided mainly from losses in oil production and upgrading.

In the case of venting and flaring, the most important gas is CO_2 with a part of 81.0% of 2020 emissions, which shows that venting and flaring emits mostly CO_2 due to complete combustion.

Fugitive CH_4 emissions from IPCC category, 1.B.2.a.ii oil production and upgrading amounted to 46.99kt in 1990, 81.27kt in 2005 and 58.75kt in 2020.

The overall trend of CH_4 emissions from IPCC category 1.B.2.a.ii oil production and upgrading shows an increase of 25.0% over the period 1990-2020. However, the GHG emissions for this category were decreased by 27.7 % between 2005 and 2020. This decrease in CH_4 emissions can be attributed to improved oil production and upgrading operations. In the period 2019-2020, CH_4 emissions increased by 5.6%.

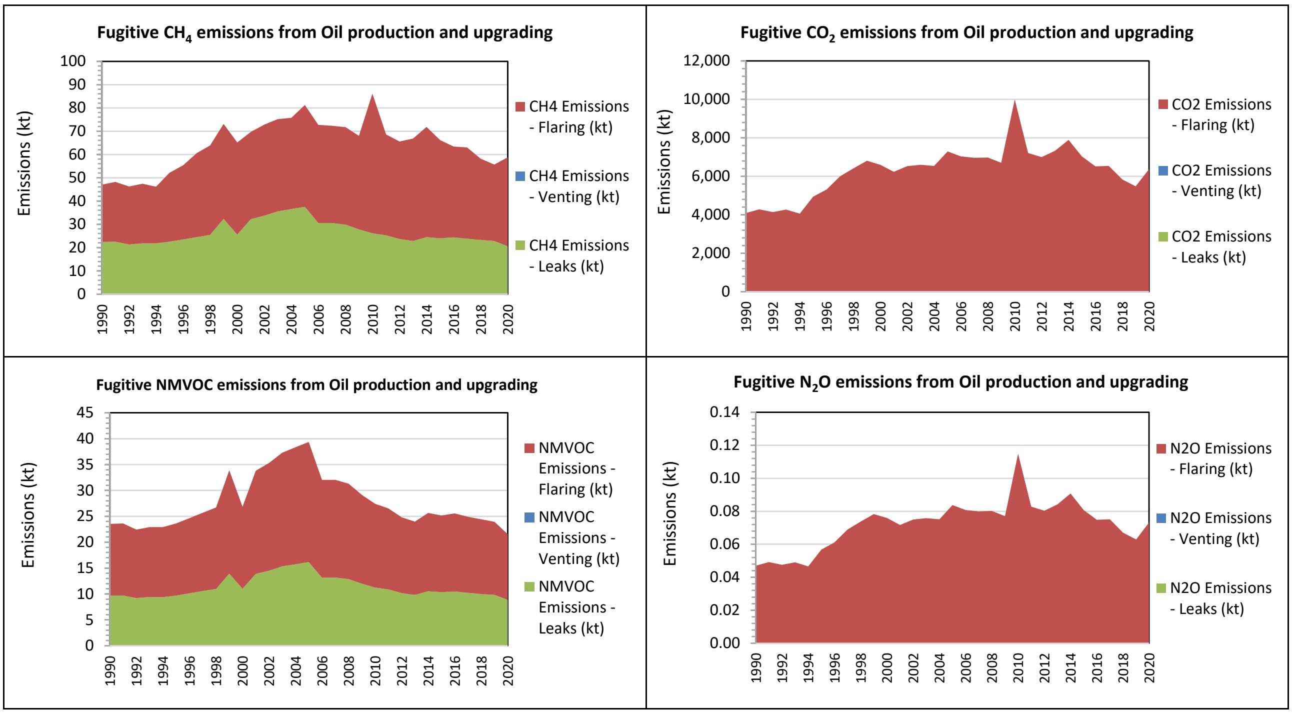

Figure 121 Fugitive emission of CH_4, CO_2, N_2O and NMVOC from IPCC category 1.B.2.a.ii Oil production and upgrading

Table 317 Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from Oil production and upgrading (IPCC category 1.B.2.a.ii)

	Fugitive emissions from IPCC category (according to reporting rules)												
	1.B.2.a.ii Oil production and upgrading					1.B.2.c.i.1 Venting - Oil production and upgrading				1.B.2.c.ii.1 Flaring - Oil production and upgrading			
	GHG	CH_4	CO_2	NMVOC	N_2O	CH_4	CO_2	NMVOC	N_2O	CH_4	CO_2	NMVOC	N_2O
	kt CO_2 eq	kt				kt				kt			
1990	561.19	22.45	NA	9.66	NA	IE	IE	IE	NA	24.54	4090.33	13.88	0.05
1991	563.48	22.54	NA	9.70	NA	IE	IE	IE	NA	25.64	4273.44	13.94	0.05
1992	534.24	21.37	NA	9.20	NA	IE	IE	IE	NA	24.84	4140.78	13.22	0.05
1993	546.15	21.85	NA	9.40	NA	IE	IE	IE	NA	25.62	4269.21	13.51	0.05
1994	545.74	21.83	NA	9.40	NA	IE	IE	IE	NA	24.33	4055.40	13.50	0.05
1995	562.68	22.51	NA	9.69	NA	IE	IE	IE	NA	29.63	4937.75	13.92	0.06
1996	586.95	23.48	NA	10.11	NA	IE	IE	IE	NA	31.91	5319.13	14.52	0.06

	Fugitive emissions from IPCC category (according to reporting rules)												
	1.B.2.a.ii Oil production and upgrading					**1.B.2.c.i.1 Venting - Oil production and upgrading**				**1.B.2.c.ii.1 Flaring - Oil production and upgrading**			
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**				**kt**				**kt**			
1997	612.87	24.51	NA	10.55	NA	IE	IE	IE	NA	36.01	6001.73	15.16	0.07
1998	636.78	25.47	NA	10.96	NA	IE	IE	IE	NA	38.46	6409.57	15.75	0.07
1999	807.86	32.31	NA	13.91	NA	IE	IE	IE	NA	40.82	6803.42	19.99	0.08
2000	639.26	25.57	NA	11.01	NA	IE	IE	IE	NA	39.60	6600.13	15.82	0.08
2001	805.79	32.23	NA	13.87	NA	IE	IE	IE	NA	37.39	6232.44	19.94	0.07
2002	841.56	33.66	NA	14.49	NA	IE	IE	IE	NA	39.17	6528.00	20.82	0.08
2003	889.12	35.56	NA	15.31	NA	IE	IE	IE	NA	39.60	6599.26	22.00	0.08
2004	914.37	36.57	NA	15.74	NA	IE	IE	IE	NA	39.21	6534.41	22.62	0.08
2005	938.80	37.55	NA	16.17	NA	IE	IE	IE	NA	43.71	7285.57	23.23	0.08
2006	763.33	30.53	NA	13.14	NA	IE	IE	IE	NA	42.17	7028.67	18.89	0.08
2007	763.86	30.55	NA	13.15	NA	IE	IE	IE	NA	41.74	6956.22	18.90	0.08
2008	746.02	29.84	NA	12.85	NA	IE	IE	IE	NA	41.84	6973.67	18.46	0.08
2009	694.91	27.80	NA	11.97	NA	IE	IE	IE	NA	40.21	6701.22	17.19	0.08
2010	653.40	26.14	NA	11.25	NA	IE	IE	IE	NA	59.97	9994.97	16.17	0.11
2011	632.57	25.30	NA	10.89	NA	IE	IE	IE	NA	43.25	7207.71	15.65	0.08
2012	591.25	23.65	NA	10.18	NA	IE	IE	IE	NA	41.95	6990.85	14.63	0.08
2013	571.03	22.84	NA	9.83	NA	IE	IE	IE	NA	43.94	7322.80	14.13	0.08
2014	611.39	24.46	NA	10.53	NA	IE	IE	IE	NA	47.37	7895.62	15.13	0.09
2015	599.89	24.00	NA	10.33	NA	IE	IE	IE	NA	42.17	7028.40	14.84	0.08
2016	608.84	24.35	NA	10.48	NA	IE	IE	IE	NA	39.08	6514.11	15.06	0.07
2017	593.97	23.76	NA	10.23	NA	IE	IE	IE	NA	39.23	6537.80	14.70	0.08
2018	581.61	23.26	NA	10.01	NA	IE	IE	IE	NA	34.96	5826.60	14.39	0.07
2019	570.44	22.82	NA	9.82	NA	IE	IE	IE	NA	32.84	5473.52	14.11	0.06
2020	513.12	20.52	NA	8.84	NA	IE	IE	IE	NA	38.22	6370.72	12.70	0.07
Trend													
1990 – 2020	-8.6%	-8.6%	-8.6%	-8.6%	NA	NA	NA	NA	NA	55.8%	55.8%	-8.6%	55.8%
2005 – 2020	-45.3%	-45.3%	-45.3%	-45.3%	NA	NA	NA	NA	NA	-12.6%	-12.6%	-45.3%	-12.6%
2019 - 2020	-10.0%	-10.0%	-10.0%	-10.0%	NA	NA	NA	NA	NA	16.4%	16.4%	-10.0%	16.4%
Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.													

3.3.2.3.2.1 Choice of method

For estimating fugitive emissions (leaks) of CH_4, CO2, N_2O and NMVOC from oil production and upgrading activities the Tier 1 method according to 2019 Refinements to 2006 IPCC GL[347] has been applied.

For estimating emissions from venting and flaring of CH_4, CO2 and N_2O from oil production and upgrading activities the Tier 1 method according to 2006 IPCC GL[348] has been applied.

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[347] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method

[348] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method

Equation 4.2.10 (new) General equation for estimating fugitive emissions from oil production and upgrading (2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\boldsymbol{Emissions}_{\boldsymbol{oil\ production}} = \boldsymbol{AD}_{\boldsymbol{oil\ production}} * \boldsymbol{EF}_{\boldsymbol{leaks}} + \boldsymbol{AD}_{\boldsymbol{oil\ production}} * \boldsymbol{EF}_{\boldsymbol{venting}} + \boldsymbol{AD}_{\boldsymbol{oil\ production}} * \boldsymbol{EF}_{\boldsymbol{flaring}}$$

Where:

Emissions$_{\text{oil production}}$ = emissions of CH_4, CO_2, NMVOC and N_2O from oil production and upgrading activities

Activity data$_{\text{oil production}}$ = activity data on exploration of conventional oil

EF$_{\text{leaks/venting/flaringl}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from leaks, venting and flaring from oil production and updgrading

Note: *In Algeria*, there are no activities of oil sands processing, sands upgrading, or offshore oil production. *Therefore*, *this part of the formula is omitted.*

3.3.2.3.2.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of thousand cubic meters onshore oil production. Production data of crude oil, natural gas liquids (NGL)/condensate and GPL aux champ were used for estimating the fugitive emissions of CH_4, CO_2, N_2O and NMVOC for the years.

- 1990 - 2020 are taken from the Energy balance provided by MEM and UN statistics[349] .
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[350].

It is necessary to clarify that Activity data used to estimate emissions of venting and flaring from oil production and upgrading were provided by the MEM for the period between 2010-2020.

For the period 1990 – 2009, missing data of venting and flaring volumes have been completed by using a ratio of flaring and venting volumes to oil production of the times series 2010 -2020 applied to the period 1990 -2009 to generate flaring and venting volumes based on annual oil production.

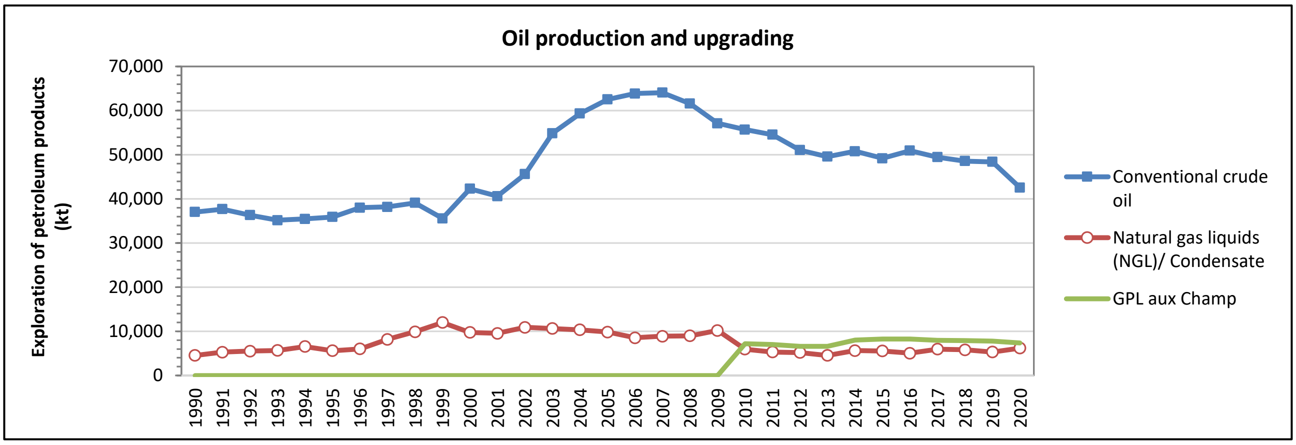

Figure 122 Activity data for Oil production and upgrading (IPCC category 1.B.2.a.ii)

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[349] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[350] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 318Activity data for Oil production and upgrading (IPCC category 1.B.2.a.ii)

Activity data	**Total**	**Crude Oil**			**Natural Gas Liquids (NGL) / Condensate**			**GPL aux Champs**		
	PJ	**Kt**	**PJ**	***10³ m³***	**kt**	**PJ**	***10³ m³***	**kt**	**PJ**	***10³ m³***
1990	2,644.02	37,021	*1,625*	*46,323*	*4,533*	*204*	*8,634*	*IE*	*IE*	*IE*
1991	2,585.80	37,698	*1,655*	*47,170*	*5,280*	*220*	*10,057*	*IE*	*IE*	*IE*
1992	2,461.39	36,333	*1,595*	*45,462*	*5,530*	*230*	*10,533*	*IE*	*IE*	*IE*
1993	2,483.82	35,184	*1,544*	*44,024*	*5,681*	*236*	*10,821*	*IE*	*IE*	*IE*
1994	2,497.52	35,455	*1,556*	*44,363*	*6,569*	*276*	*12,512*	*IE*	*IE*	*IE*
1995	2,553.34	35,907	*1,576*	*44,929*	*5,609*	*233*	*10,684*	*IE*	*IE*	*IE*
1996	2,672.64	38,009	*1,668*	*47,559*	*6,039*	*251*	*11,503*	*IE*	*IE*	*IE*
1997	2,765.93	38,194	*1,676*	*47,790*	*8,186*	*341*	*15,592*	*IE*	*IE*	*IE*
1998	2,864.21	39,103	*1,716*	*48,928*	*9,889*	*411*	*18,836*	*IE*	*IE*	*IE*
1999	3,401.67	35,592	*1,562*	*44,535*	*11,999*	*499*	*22,855*	*IE*	*IE*	*IE*
2000	2,926.04	42,315	*1,857*	*52,947*	*9,767*	*406*	*18,604*	*IE*	*IE*	*IE*
2001	3,477.52	40,609	*1,782*	*50,812*	*9,534*	*397*	*18,160*	*IE*	*IE*	*IE*
2002	3,684.72	45,601	*2,001*	*57,058*	*10,911*	*454*	*20,783*	*IE*	*IE*	*IE*
2003	4,003.74	54,869	*2,408*	*68,655*	*10,641*	*443*	*20,269*	*IE*	*IE*	*IE*
2004	4,165.64	59,340	*2,604*	*74,249*	*10,354*	*431*	*19,722*	*IE*	*IE*	*IE*
2005	4,303.77	62,545	*2,745*	*78,260*	*9,837*	*409*	*18,737*	*IE*	*IE*	*IE*
2006	3,714.75	63,865	*2,803*	*79,911*	*8,547*	*356*	*16,280*	*IE*	*IE*	*IE*
2007	3,720.25	64,085	*2,813*	*80,186*	*8,909*	*371*	*16,970*	*IE*	*IE*	*IE*
2008	3,616.72	61,585	*2,703*	*77,058*	*8,976*	*373*	*17,097*	*IE*	*IE*	*IE*
2009	3,364.77	57,112	*2,507*	*71,461*	*10,212*	*425*	*19,451*	*IE*	*IE*	*IE*
2010	3,196.77	55,694	*2,444*	*69,687*	*5,957*	*248*	*11,347*	*7,186*	*299*	*13,688*
2011	3,105.10	54,538	*2,394*	*68,241*	*5,324*	*222*	*10,140*	*7,044*	*293*	*13,417*
2012	2,903.74	51,063	*2,241*	*63,893*	*5,203*	*217*	*9,911*	*6,601*	*275*	*12,573*
2013	2,808.67	49,574	*2,176*	*62,029*	*4,533*	*189*	*8,634*	*6,612*	*275*	*12,594*
2014	2,969.56	50,805	*2,230*	*63,570*	*5,640*	*235*	*10,743*	*7,999*	*333*	*15,237*
2015	2,902.69	49,184	*2,159*	*61,541*	*5,547*	*231*	*10,565*	*8,265*	*344*	*15,744*
2016	2,971.31	50,945	*2,236*	*63,745*	*5,040*	*212*	*9,600*	*8,242*	*347*	*15,699*
2017	2,894.98	49,468	*2,171*	*61,897*	*5,954*	*251*	*11,341*	*7,980*	*336*	*15,200*
2018	2,837.13	48,588	*2,133*	*60,796*	*5,826*	*245*	*11,097*	*7,918*	*333*	*15,081*
2019	2,794.66	48,394	*2,124*	*60,554*	*5,324*	*224*	*10,140*	*7,785*	*328*	*14,828*
2020	2,498.20	42,567	*1,868*	*53,262*	*6,216*	*262*	*11,840*	*7,361*	*310*	*14,021*
Trend										
1990 – 2020	-5.5%			15.0%			37.1%			NA
2005 – 2020	-42.0%			-31.9%			-36.8%			NA
2019 - 2020	-10.6%			-12.0%			16.8%			-5.4%

The production data in energy statistics are provided in the physical units 1000 tonnes. To convert these data to volume, country specific density was used which are presented in the following table.

Table 319Activity data used for estimate emissions from venting and flaring for Oil and Gas (IPCC category 1.B.2)

Activity data	**Liquifaction et séparation**		**Raffinage et Pétrochimie**		***Exploration et Production***		***Transport par Canalisations***	
	Volume de gaz torchés							
	Source	***10^3 Sm^3***	**Source**	***10^3 Sm^3***	**Source**	***10^3 Sm^3***	**Source**	***10^3 Sm^3***
1990	Inter-polation	*1,091,401.78*	Inter-polation	*158,009.04*	Inter-polation	*2,045,165.49*	Inter-polation	*2,437.87*
1991		*1,104,765.20*		*153,275.89*		*2,136,718.60*		*2,547.00*
1992		*1,121,358.12*		*151,176.22*		*2,070,391.17*		*2,467.94*
1993		*1,162,172.23*		*150,827.46*		*2,134,603.79*		*2,544.48*
1994		*1,036,389.03*		*143,773.99*		*2,027,698.93*		*2,417.05*
1995		*1,036,110.62*		*147,524.93*		*2,468,875.72*		*2,942.94*
1996		*1,140,846.44*		*148,179.74*		*2,659,565.44*		*3,170.24*
1997		*1,404,384.25*		*141,994.61*		*3,000,866.59*		*3,577.08*
1998		*1,416,467.01*		*140,926.98*		*3,204,785.40*		*3,820.16*
1999		*1,513,017.73*		*125,076.26*		*3,401,709.94*		*4,054.89*
2000		*1,552,050.06*		*143,546.23*		*3,300,064.40*		*3,933.73*
2001		*1,480,333.03*		*143,140.53*		*3,116,219.07*		*3,714.58*
2002		*1,540,412.75*		*139,297.07*		*3,263,999.03*		*3,890.74*
2003		*1,630,560.16*		*150,073.00*		*3,299,627.53*		*3,933.21*
2004		*1,380,942.58*		*122,627.83*		*3,267,204.63*		*3,894.56*
2005		*1,400,375.22*		*133,496.29*		*3,642,787.01*		*4,342.26*
2006		*1,335,172.86*		*134,791.68*		*3,514,333.47*		*4,189.14*
2007		*1,388,682.23*		*140,770.40*		*3,478,111.09*		*4,145.96*
2008		*1,194,968.30*		*157,574.87*		*3,486,837.49*		*4,156.37*
2009		*1,208,610.12*		*158,130.04*		*3,350,608.13*		*3,993.98*
2010	MEM	*808,005.79*	*MEM*	*247,760.29*	*MEM*	*4,997,487.32*	*MEM*	*4,094.19*
2011		*882,249.66*		*238,104.41*		*3,603,855.02*		*3,961.93*
2012		*944,582.80*		*207,564.71*		*3,495,425.74*		*4,122.15*
2013		*1,168,255.94*		*202,173.54*		*3,661,400.24*		*3,948.46*
2014		*2,034,896.81*		*137,074.24*		*3,947,811.01*		*3,990.08*
2015		*981,162.02*		*148,712.23*		*3,514,199.55*		*4,051.60*
2016		*866,480.09*		*128,524.37*		*3,257,053.06*		*4,547.97*
2017		*452,315.14*		*118,847.71*		*3,268,898.53*		*4,626.70*
2018		*548,653.00*		*86,302.94*		*2,913,298.57*		*4,668.20*
2019		*506,697.73*		*132,460.29*		*2,736,762.11*		*3,775.00*
2020		*612,806.88*		*140,523.53*		*3,185,360.20*		*4,567.01*
Trend								
1990 – 2020		*-43.9%*		*-11.1%*		*55.8%*		*87.3%*
2005 – 2020		*-56.2%*		*5.3%*		*-12.6%*		*5.2%*
2019 - 2020		*20.9%*		*6.1%*		*16.4%*		*21.0%*

Table 320 Country specific Density and NCV for selected fuels and default data for comparison

Fuel	**Country specific (CS) Density**	**Country specific (CS) NCV**	**For comparison**	
			Average Density	**IPCC default NCV**
	kt / 10^6m^3	**TJ/kt**	**kt / 10^6m^3**	**TJ/kt**
Crude oil	0.799	46.2 * 0.95 = 43.89	0.853	42.3
Natural Gas Liquids (NGL) / Condensate	0.525 = Average (0.52 - 0.53)	47.4 * 0.95 = 45.03		44.2
GPL aux champ		46.02 * 0.95 = 43.72	0.539	47.3

Conversion from GCV to NCV	**Default**
Petroleum products	1 NCV = 0.95 x GCV

Source		
	CS Density	MEM
	Average Density	IEA (2019): Oil information: database documentation; page 65 [351]
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités de mesure et taux de conversion utilisés. Annex 3.[352]
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [353]: Table 4 Difference between net and gross calorific values for selected fuels

Note:

D	Default	CS	Country specific	PS	Plant specific

3.3.2.3.2.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2006 IPCC GL and 2019 Refinement to the 2006 IPCC GL[354] were applied. According to personal communication with national stakeholders, it was assumed that each 50% of the production of crude oil, condensate and GPL aux Champ in oil production segment was carried out with

- lower-emitting technologies and practices, and
- higher-emitting technologies and practices.

Table 321 TIER 1 emission factors for oil production and disaggregation of TIER 1 EF

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Onshore: Most activities occurring with higher- emitting technologies and practices	**TIER 1 Emission factors for oil production**						
	All	3.43	12.40	1.48	0.00019	Tons/thousand cubic meters onshore oil production	Table 4.2.4A (new)
	Disaggregation of TIER 1 emission factors for oil production						

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[351] IEA (2019): Oil information: database documentation (2019 first release) Table Oil products - Average densities, volume and heat equivalents; available on 08.07.2022 at https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/Oil_documentation%20aie.pdf

[352] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'énergie et des mines.

[353] https://unstats.un.org/unsd/energystats/methodology/ires/

[354] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Stationary Combustion - 4.2.2.3 Choice of emission factor.

Sub-segment	Emission source	CH_4	CO_2	NMVOC	N_2O	Units	Source
	Leaks	7%	0%	7%	0%		Table 4A.2.2 (new)
	Vents	83%	3%	83%	0%		
	Flares	10%	97%	10%	100%		
	Disaggregated TIER 1 emission factors for oil production						
	Leaks	0.24	NA	0.10	NA	Tons/thousand cubic meters onshore oil production	Calculated
	Vents	2.85	0.37	1.228	NA		
	Flares	0.34	12.03	0.148	0.000019		
Onshore: Most activities occurring with lower-emitting technologies and practices	**TIER 1 Emission factors for oil production**						
	All	2.91	44.99	1.25	0.00067	Tons/thousand cubic meters onshore oil production	Table 4.2.4A (new)
	Disaggregation of TIER 1 emission factors for oil production						
	Leaks	9%	0%	9%	0%		Table 4A.2.2 (new)
	Vents	78%	1%	78%	0%		
	Flares	13%	99%	13%	100%		
	Disaggregated TIER 1 emission factors for oil production						
	Leaks	0.26	NA	0.11	NA	Tons/thousand cubic meters onshore oil production	Calculated
	Vents	2.27	0.45	0.975	NA		
	Flares	0.38	44.54	0.163	0.00067		
venting and flaring	Calculated						
	venting and flaring	0.012	2.0	-	0.000023	Tons/thousand cubic meters onshore oil production	Calculated

Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor and Annex 4A.2 Disaggregation of Tier 1 factors presented in Section 4.2.2.3

2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor TABLE 4.2.4(CONTINUED) tier 1 emission factors for fugitive emissions (including venting and flaring) from oil and gas operations in developed countries a,b

3.3.2.3.2.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category *1.B.2.a.ii Fugitive emissions from Oil production and upgrading* are presented in the following table.

Table 322Uncertainty for IPCC category 1.B.2.a.ii *Fugitive emissions from* Oil production and upgrading.

Uncertainty	**Oil exploration**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. Chapter 4.2
Emission factor (EF)	42%	42%	806%	1000%	Table 4.2.4A (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	44%	44%	806%	1000%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.3.2.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
    - consistent use of energy balance data,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- cross-checked with 2006 IPCC default values
- time series consistency - plausibility checks of dips and jumps.

3.3.2.3.2.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.B.2.a.ii Oil production and upgrading*.

Table 323Recalculations done since NC in IPCC category *1.B.2.a.ii Fugitive emissions from Oil production and upgrading*

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.a.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.ii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.ii	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2 Application of reporting guidance for leaks, venting and flaring	AD	Completeness Comparability Transparency

Source category	**Revisions of data**					**Type of revision**	**Type of improvement**
1.B.2.a.ii	Use of country-specific GCV and country-specific density					AD	Accuracy
Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*		*Method*

3.3.2.3.2.7 Source-specific improvements

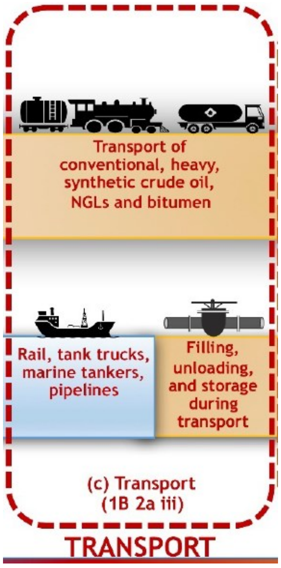
Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 324Planned improvements for IPCC category *1.B.2.a.ii Fugitive emissions from Oil production and upgrading*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production of crude oil, natural gas liquids (NGL)/ condensate and GPL aux champs	AD	Completeness Consistency Transparency	high
1.B.2.a.ii	Application of Tier 2 method for CO_2 for flaring Application of Tier 2 method for CH_4 for venting	M	Accuracy Comparability	medium
1.B.2.a.ii	Development of country-specific EF for CO_2 and CH_4	EF	Accuracy	medium
1.B.2.a.ii	Investigation on share of activities occurring with lower-emitting or higher-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.a.ii	Use of activity data from installation: amount of gas vented and flared	AD	Accuracy	medium

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.3.3 Fugitive emissions from oil transport (IPCC category 1.B.2.a.iii)

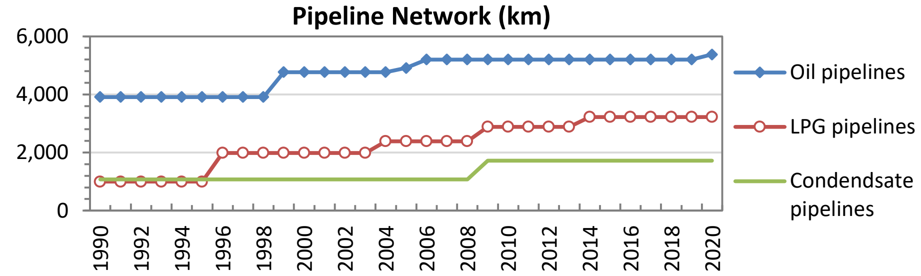


According to the 2019 IPCC Refinements to the 2006 IPCC GL[355] the segment *Oil Tranport* includes fugitive emissions, including equipment leaks, venting and flaring, related to the transport of marketable crude oil (including conventional, heavy and synthetic crude oil and bitumen) , etc, to upgraders and refineries.

In Algeria, the transportation systems comprise manly by through pipelines. At the tanker terminal Arzew. Algiers and Skikda the petroleum products are transferred to marine tankers. Occasionally, tank trucks and rail cars are used for short transports. Also, oil was only fed in tanks for short term.

Evaporation losses from storage, filling and unloading activities and fugitive equipment leaks are the primary sources of these emissions.

In the following figure an overview of the Algerian pipeline network for oil, LPG and condensate is provided.



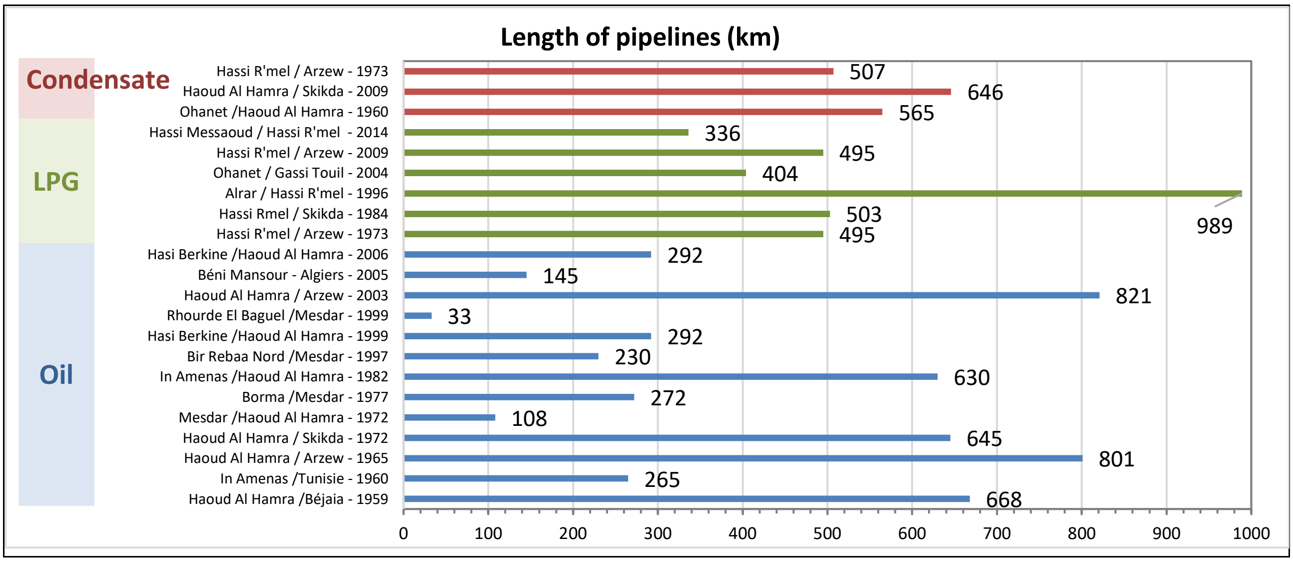


Figure 123 Pipeline network for oil, LPG and condensate transport

The following table provides an overview of activities occurring in Algeria.

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[355] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.56/57

Table 325 Activities of segment Oil transport occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
• Pipelines	x			
• Tanker Trucks and Rail Cars			x	
• Tanks			x	
• Loading of offshore production on tanker ships without VRU				x
• Loading of offshore production on tanker ships with VRU				x

In the following figures the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Oil transport* (IPCC category 1.B.2.a.iii) are provided.

This section describes the emissions from IPCC category 1.B.2.a.iii Oil transport and provides an overview of fugitive emissions in the following figures and tables.

Fugitive GHG emissions from IPCC category 1.B.2.a.iii Oil transport amounted to 12.12 kt CO_2 equivalent in 1990, 20.27 kt CO_2 equivalent in 2005 and 11.08 kt CO_2 equivalent in 2020. These results show that oil transport emits low amounts of CO_2 equivalents compared to other operations, which may be due to the control of GHG leakages in oil transport.

The overall trend in greenhouse gas emissions in IPCC category 1.B.2.a.iii Oil transport shows a decrease of 8.6% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, which resulted in a 45.3% downward trend in GHG emissions.

In the period 2019-2020, GHG emissions decreased by 10%.

This decrease in GHG emissions from oil transport confirms what was previously stated about improving the control of GHG leakages in oil transport.

The most important gas in IPCC category 1.B.2.a.iii Oil transport is CH_4 with a part of 99.3% of 2020 emissions, CH_4 emissions are mainly the result of leakage and evaporation from oil transport and storage.

In IPCC category 1.B.2.a.iii Oil transport, CO_2 emissions have a part of 0.4% in 2020 emissions. CO_2 emissions are mainly the result of the evaporation of hydrocarbons.

N_2O has not been estimated for IPCC category 1.B.2.a.iii Oil transport.

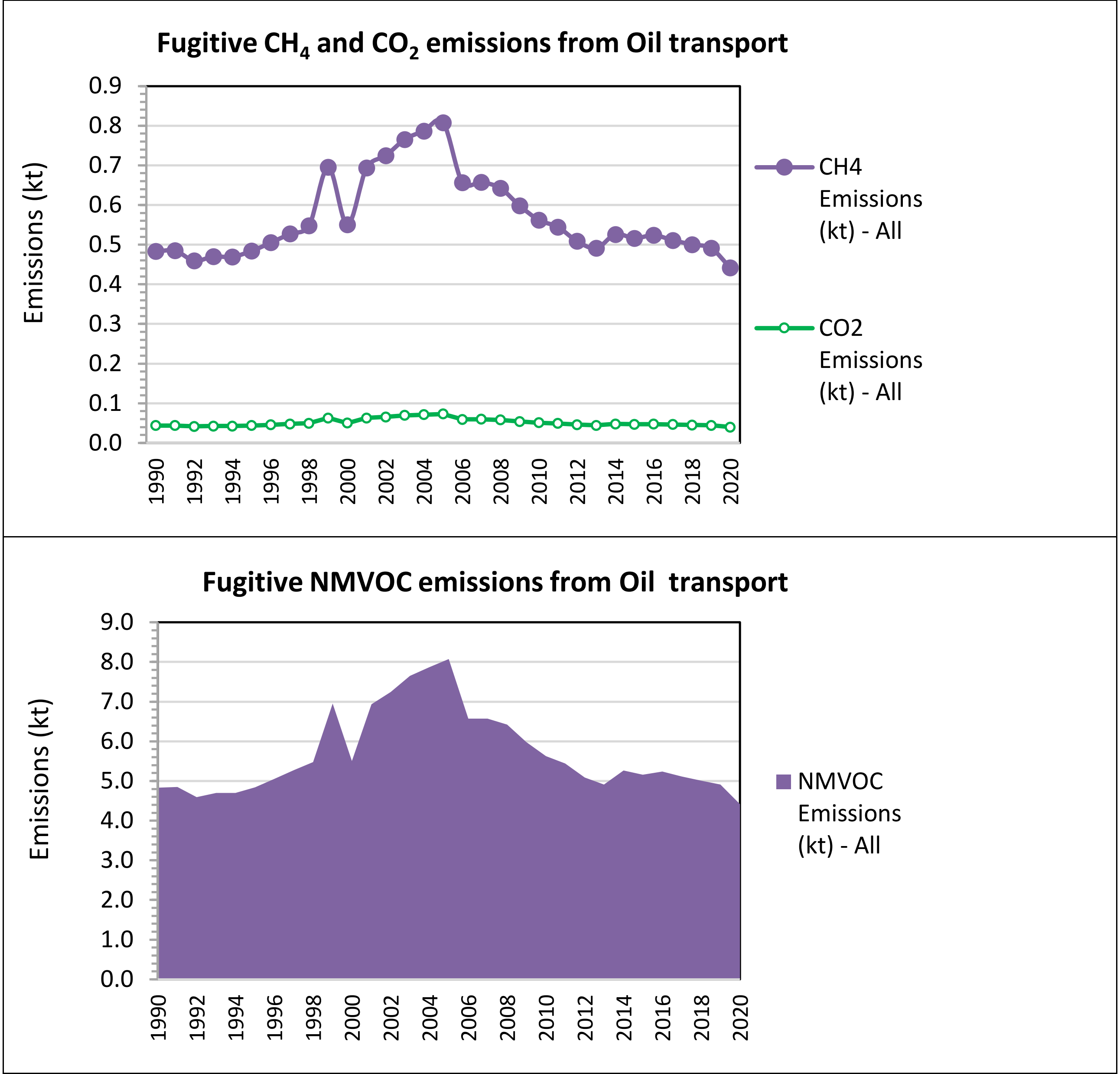
Fugitive CO_2 emissions from IPCC category 1.B.2.a.iii Oil transport amounted to 0.04 kt in 1990. 0.07 kt in 2005 and 0.04 kt in 2020.

The overall trend in CO_2 emissions from IPCC category 1.B.2.a.iii Oil transport from fuels shows a decrease of 8.6% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005, which resulted in a 45.3% downward trend in CO_2 emissions. In the period 2019-2020, CO_2 emissions have decreased by 10%.

Fugitive CH_4 emissions from IPCC category 1.B.2.a.iii Oil transport amounted to 0.48 kt in 1990, 0.81 kt in 2005 and 0.44 kt in 2020.

The overall trend in IPCC category 1.B.2.a.iii Oil transport CH_4 emissions shows an increase of 8.6% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, which resulted in a downward trend of 45.3% in CH_4 emissions. In the period 2019-2020, CH_4 emissions decreased by 10%.

Fugitive N_2O emissions from IPCC category 1.B.2.a.iii Oil transport have not been estimated.



‘All ‘ is related to fugitive emissions from leaks. venting and flaring. However. leaks are the primary sources of these emissions.

No N_2O emissions were emitted during oil transport.

Figure 124 Fugitive emission of CH_4. CO_2. N_2O and NMVOC from IPCC category 1.B.2.a.iii Oil transport

Table 326 Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from Oil transport (IPCC category 1.B.2.a.iii)

	Fugitive emissions from IPCC category (according to reporting rules)							
	1.B.2.a.iii leaks - Oil transport					**1.B.2.c.iii venting and Flaring – oil transport**		
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**N_2O**
	kt CO_2 eq	**kt**				**kt**		
1990	12.12	0.48	0.04	4.83	NA	0.26	4.90	0.00006
1991	12.17	0.48	0.04	4.85	NA	0.26	5.11	0.00006
1992	11.54	0.46	0.04	4.60	NA	0.24	4.96	0.00006
1993	11.79	0.47	0.04	4.70	NA	0.26	5.11	0.00006
1994	11.78	0.47	0.04	4.70	NA	0.26	4.85	0.00006
1995	12.15	0.48	0.04	4.84	NA	0.28	5.91	0.00007
1996	12.67	0.51	0.05	5.05	NA	0.29	6.36	0.00007
1997	13.23	0.53	0.05	5.27	NA	0.31	7.18	0.00008
1998	13.75	0.55	0.05	5.48	NA	0.33	7.67	0.00009
1999	17.44	0.70	0.06	6.95	NA	0.50	8.15	0.00009
2000	13.80	0.55	0.05	5.50	NA	0.31	7.89	0.00009
2001	17.40	0.69	0.06	6.93	NA	0.46	7.47	0.00009
2002	18.17	0.72	0.07	7.24	NA	0.46	7.82	0.00009
2003	19.20	0.77	0.07	7.65	NA	0.44	7.90	0.00009
2004	19.74	0.79	0.07	7.87	NA	0.43	7.82	0.00009
2005	20.27	0.81	0.07	8.08	NA	0.44	8.72	0.00010
2006	16.48	0.66	0.06	6.57	NA	0.28	8.40	0.00010
2007	16.49	0.66	0.06	6.57	NA	0.27	8.31	0.00010
2008	16.11	0.64	0.06	6.42	NA	0.28	8.33	0.00010
2009	15.00	0.60	0.05	5.98	NA	0.26	8.01	0.00009
2010	14.11	0.56	0.05	5.62	NA	0.24	8.21	0.00009
2011	13.66	0.54	0.05	5.44	NA	0.22	7.94	0.00009
2012	12.77	0.51	0.05	5.09	NA	0.21	8.26	0.00009
2013	12.33	0.49	0.04	4.91	NA	0.20	7.91	0.00009
2014	13.20	0.53	0.05	5.26	NA	0.23	8.00	0.00009
2015	12.95	0.52	0.05	5.16	NA	0.23	8.12	0.00009
2016	13.15	0.52	0.05	5.24	NA	0.23	9.11	0.00010
2017	12.83	0.51	0.05	5.11	NA	0.23	9.27	0.00011
2018	12.56	0.50	0.05	5.01	NA	0.23	9.35	0.00011
2019	12.32	0.49	0.04	4.91	NA	0.21	7.56	0.00009
2020	11.08	0.44	0.04	4.42	NA	0.21	9.15	0.00011
Trend								
1990 – 2020	*-8.6%*	*-8.6%*	*-8.6%*	*-8.6%*	NA	*-20.3%*	*86.8%*	*87.3%*
2005 – 2020	*-45.3%*	*-45.3%*	*-45.3%*	*-45.3%*	NA	*-52.3%*	*4.9%*	*5.2%*
2019 - 2020	*-10.0%*	*-10.0%*	*-10.0%*	*-10.0%*	NA	*-0.2%*	*20.9%*	*21.0%*

Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.

3.3.2.3.3.1 Choice of method

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from oil transportation activities the Tier 1 method according to 2019 Refinements to 2006 IPCC GL[356] has been applied. Fugitive emissions include emissions from venting, flaring, and leaks.

Equation 4.2.11 (new) General equation for estimating fugitive emissions from oil transportation *(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)*

$$\begin{aligned} \boldsymbol{Emissions_{oil\ transport}} &= \boldsymbol{AD_{pipelines} * EF_{pipelines}} \\ &+ \boldsymbol{AD_{tanker\ trucks\ and\ rail\ cars} * EF_{tanker\ trucks\ and\ rail\ cars}} \\ &+ \boldsymbol{AD_{tanks} * EF_{tanks}} \end{aligned}$$

Where:

$Emissions_{oil\ transportation}$ = emissions of CH_4, CO_2, NMVOC and N_2O due to all relevant from oil transportation activities

$Activity_{pipelines}$ = Volume of oil transported by pipelines

$EF_{pipelines}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for oil transported by pipelines

$Activity_{tanker\ trucks\ and\ rail\ cars}$ = Volume on oil transported by tanker trucks and rail cars

$EF_{tanker\ trucks\ and\ rail\ cars}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for oil transported by tanker trucks and rail cars

$Activity_{tanks}$ = Volume of crude oil feed

EF_{tanks} = default emission factor of CH_4, CO_2, NMVOC and N_2O for tanks

Note: *In Algeria, there is no loading of offshore production on tanker ships. Therefore, this part of the formula is omitted.*

3.3.2.3.3.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of thousand cubic meters oil transported by pipeline. Production data of crude oil, natural gas liquids (NGL)/condensate and GPL aux champ were used for estimating the fugitive emissions of CH_4, CO_2, N_2O and NMVOC for the years

- 1990 - 2020 are taken from the Energy balance provided by MEM and UN statistics[357]
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[358].

It is necessary to clarify that Activity data used to estimate emissions of venting and flaring from Oil transport (IPCC category 1.B.2.a.iii) were provided by the MEM for the period between 2019-2020.

For the period 1990 – 2018, missing data of venting and flaring volumes have been completed by using a ratio of flaring and venting volumes to oil production of the times series 2019 -2020 applied to the period 1990 -2018 to generate flaring and venting volumes based on annual oil production.

For the period 1990 – 2009 the Activity Data used to estimate emissions of venting and flaring from Oil transport (IPCC category 1.B.2.a.iii) were estimated using the Interpolation method.

The data are provided in above **Erreur ! Source du renvoi introuvable.** and 324.

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[356] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method

[357] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[358] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2006 IPCC GL and 2019Refinement to the 2006 IPCC GL[359] were applied.

Table 327 TIER 1 emission factors for oil transport

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Pipelines	leaks	0.0054	0.00049	0.054	NA	Tonne per thousand cubic meters oil transported by pipeline	TABLE 4.2.4B (NEW)
Tanker Trucks and Rail Cars	All	0.025	0.0023	0.25	NA	Tonne per thousand cubic meters oil transported by tanker truck or rail car	
Tanks	All	0.002	NA	NA	NA	Tonne per thousand cubic meters crude oil feed	
Pipelines	venting and flaring	0.012	2.0	NA	0.000023	Tons/thousand cubic meters onshore oil production	TABLE 4.2.4 (CONTINUE)
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor and Annex 4A.2 Disaggregation of Tier 1 factors presented in Section 4.2.2.3 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor TABLE 4.2.4(CONTINUED) tier 1 emission factors for fugitive emissions (including venting and flaring) from oil and gas operations in developed countries a,b							

3.3.2.3.3.3 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category *1.B.2.a.i Fugitive emissions from oil transport* are presented in the following table.

Table 328Uncertainty for IPCC category 1.B.2.a.iii Fugitive emissions from oil transport.

Uncertainty	**Oil transport**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	NA	2006 IPCC GL. Chapter 4.2
Emission factor (EF)	141%	141%	206%	NA	Table 4.2.4B (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	142%	142%	206%	NA	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

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[359] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

3.3.2.3.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
  - consistent use of energy balance data,
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- time series consistency - plausibility checks of dips and jumps.

3.3.2.3.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.B.2.a.iii Fugitive emissions from oil transport*.

Table 329Recalculations done since NC in IPCC category *1.B.2.a.iii Fugitive emissions from oil transport*

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.a.iii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.iii	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.iii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.iii	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2	AD	Completeness
1.B.2.a.iii	Use of country-specific GCV and density	AD	Accuracy

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.3.3.6 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 330Planned improvements for IPCC category *1.B.2.a.iii Fugitive emissions from oil transport*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production of crude oil, natural gas liquids (NGL)/ condensate and GPL aux champs	AD	Completeness Consistency Transparency	high
1.B.2.a.iii	Application of Tier 2 method for CH_4	M	Accuracy Comparability	medium
1.B.2.a.iii	Estimation of fugitive emissions from transport activities with tanker trucks and Rail Cars and from tank feeds	AD	Completness	high
1.B.2.a.iii	Estimation of fugitive emissions from loading activities at the tanker terminal related to import and export of crude oil, condensate and GPL aux champs	AD	Completness	High
	Investigation related to pipeline transport: material of pipelines, maintenance, breakdown/accidents	AD	Completness	High

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.3.4 Fugitive emissions from oil refining and storage (IPCC category 1.B.2.a.iv)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[360] the segment *Oil Refining* includes fugitive emissions, including equipment leaks, venting and flaring, at petroleum refineries. Refineries process crude oils, natural gas liquids and synthetic crude oils to produce final refined products (e.g., primarily fuels and lubricants).

CH_4 emission sources include storage tanks, blowdowns, asphalt blowing, equipment leaks, vents, loading operations, wastewater treating, cooling towers, catalytic cracking/reforming/fluid cracking, flares, delayed coking and coke calcining.

CO_2 emissions included under 1.B.2.a.iv include asphalt blowing, calcination, anode production, process vents, and flaring.

In the following table and figure an overview of refinery capacity and finished products are provided.

Algiers Refinery - RA1G • Treatment capacity: 2.57 million tons per year of 'BHM'[361]. increased at 3.7 million tons per year after rehabilitation (2019) • Finished products: LPG, gasoline, kerosene, gas-oil	**Hassi Messaoud Refinery - RHM** • Treatment capacity: 1.07 million tons per year of 'BHM' • Finished products: fuel (gasoline, kerosene, gas-oil)
Arzew Refinery - RA1Z • Treatment capacity: 2.5 million tons per year of 'BHM', increased at 3.750 million tons per year after rehabilitation (2012) and 270.000 t/y of 'BRI' • Finished products: LPG, gasoline, kerosene, gas-oil, naphtha and fuel, lubricants and bitumen	**Skikda Refinery RA1K** • Treatment capacity: 15 million tons per year of 'BHM'. increased at 16.5 million tons per year after rehabilitation (2013) and 277.000 t/y of 'BRI' • Finished products: LPG, gasoline, kerosene, gas-oil. naphtha, fuel, aromatics and bitumen
Adrar – RA1D • Treatment capacity: 0.6 million tons per year of finished products: LPG, unleaded gasoline, gas-oil, kerosene	**Skikda Condensate Refinery RA2K** • Treatment capacity: 5 million tons per year of condensate • Finished products: Butan, fuels (gas-oil, kerosene) , naphtha
Source: Sonatrach: Oil and gas map of Algeria.	

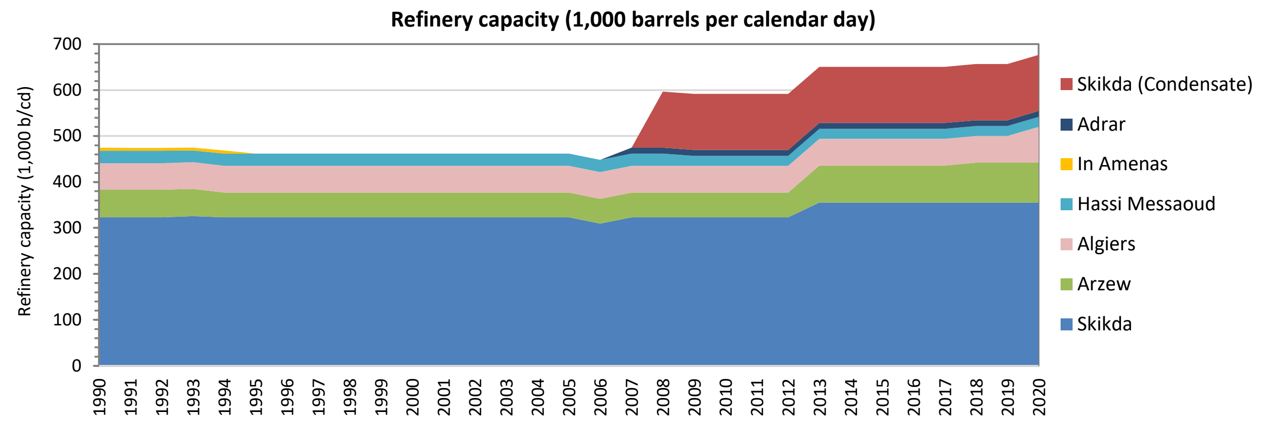

Figure 125 Refinery capacity

Source: Organization of the Petroleum Exporting Countries (OPEC)(2022): Data download. Section 3 — Oil data: downstream.

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[360] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.58

Table 4.1.[362]

In the following figures the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Oil refining and storage* (IPCC category 1.B.2.a.iv) are provided.

This section describes the emissions from IPCC category 1.B.2.a.iv oil refining and storage and provides an overview of fugitive emissions in the following figures and tables.
Fugitive GHG emissions from IPCC category 1.B.2.a.iv Oil Refining and Storage amounted to 122.90 kt CO_2 equivalent in 1990, 142.33 kt CO_2 equivalent in 2005 and 130.33 kt CO_2 equivalent in 2020.

For venting and flaring, fugitive GHG emissions from IPCC category 1.B.2.a.iv oil refining and storage were 364.50 kt CO_2 equivalent in 1990. 307.96 kt CO_2 equivalent in 2005 and 324.17 kt CO_2 equivalent in 2020.

The overall trend in greenhouse gas emissions from IPCC category 1.B.2.a.iv oil refining and storage shows an increase of 6% over the period 1990-2020. However, the period 2005 -2020 is characterized by a decrease of 8.4% in GHG emissions. In the period 2019-2020, GHG emissions increased by 1.1%.

The overall greenhouse gas emission trend for venting and flaring in IPCC category 1.B.2.a.iv Oil Refining and Storage shows a decrease of 11.1% over the period 1990-2020, an increase of 5.3% in GHG emissions between 2005 and 2020. These emissions increased by 6.1% over the period 2019-2020.

The most important gas in the IPCC category 1.B.2.a.iv oil refining and storage is CO_2 with a part of 77.99% of 2020 emissions. The CO_2 emissions are mainly the result of flaring.

In IPCC category 1.B.2.a.iv Oil Refining and Storage, CH_4 emissions have a part of 22% in the 2020 emissions, CH_4 emissions are mainly the result of leakage during oil refining.
N_2O is only a minor source in the IPCC category 1.B.2.a.iv oil refining and storage, with a 0.01% part in 2020 emissions.

Fugitive CO_2 emissions from IPCC category 1.B.2.a.iv oil refining and storage amounted to 95.85 kt in 1990. 111.01 kt in 2005 and 101.65 kt in 2020.
The overall trend of CO_2 emissions from IPCC category 1.B.2.a.iv oil refining and storage from fuels shows an increase of 6% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005 which resulted in a downward trend of 8.4% in CO_2 emissions. In the period 2019-2020, CO_2 emissions increased by 1.1%.
For venting and flaring, fugitive CO_2 emissions amounted to 316.02 kt in 1990, 266.99 kt in 2005 and 281.05kt in 2020.
The overall trend of CO_2 emissions from flaring and venting in IPCC category 1.B.2.a.iv oil refining and storage from fuels shows a decrease of 11.1% in the period 1990-2020, 5.3% from 2005- 2020 and an increase of 6.1% during the period 2019-2020.

Fugitive CH_4 emissions from IPCC category 1.B.2.a.iv oil refining and storage amounted to 1.08 kt in 1990. 1.25 kt in 2005 and 1.15 kt in 2020.
The overall trend of CH_4 emissions from IPCC category 1.B.2.a.iv oil refining and storage from fuels shows an

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[362] Available on 05. June 2022: https://asb.opec.org/data/ASB_Data.php

increase of 6% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005 which resulted in a downward trend of 8.4% in CH_4 emissions. In the period 2019-2020, CH_4 emissions increased by 1.1%.

Fugitive CH_4 emissions from Venting and flaring in IPCC category 1.B.2.a.iv oil refining and storage amounted to 1.90kt in 1990. 1.60 kt in 2005 and 1.69 kt in 2020.

The overall trend of CH_4 emissions from flaring and venting in IPCC category 1.B.2.a.iv oil refining and storage from fuels shows a decrease of 11.1% in the period 1990-2020, 5.3% from 2005- 2020 and an increase of 6.1% during the period 2019-2020.

Fugitive N_2O emissions from IPCC category 1.B.2.a.iv oil refining and storage amounted to 0.00003 kt in 1990, 0.00004 kt in 2005 and 0.00003 kt in 2020.

The overall trend of N_2O emissions from IPCC category 1.B.2.a.iv oil refining and storage shows an increase of 6% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, which resulted in a downward trend of 8.4% in N_2O emissions. In the period 2019-2020, N_2O emissions increased by 1.1%.

Fugitive N_2O emissions from venting and flaring in IPCC category 1.B.2.a.iv oil refining and storage amounted to 0.0036kt in 1990, 0.0031kt in 2005 and 0.0032kt in 2020.

The overall trend of N_2O emissions from flaring and venting in IPCC category 1.B.2.a.iv oil refining and storage from fuels shows a decrease of 11.1% in the period 1990-2020, 5.3% from 2005- 2020 and an increase of 6.1% during the period 2019-2020.

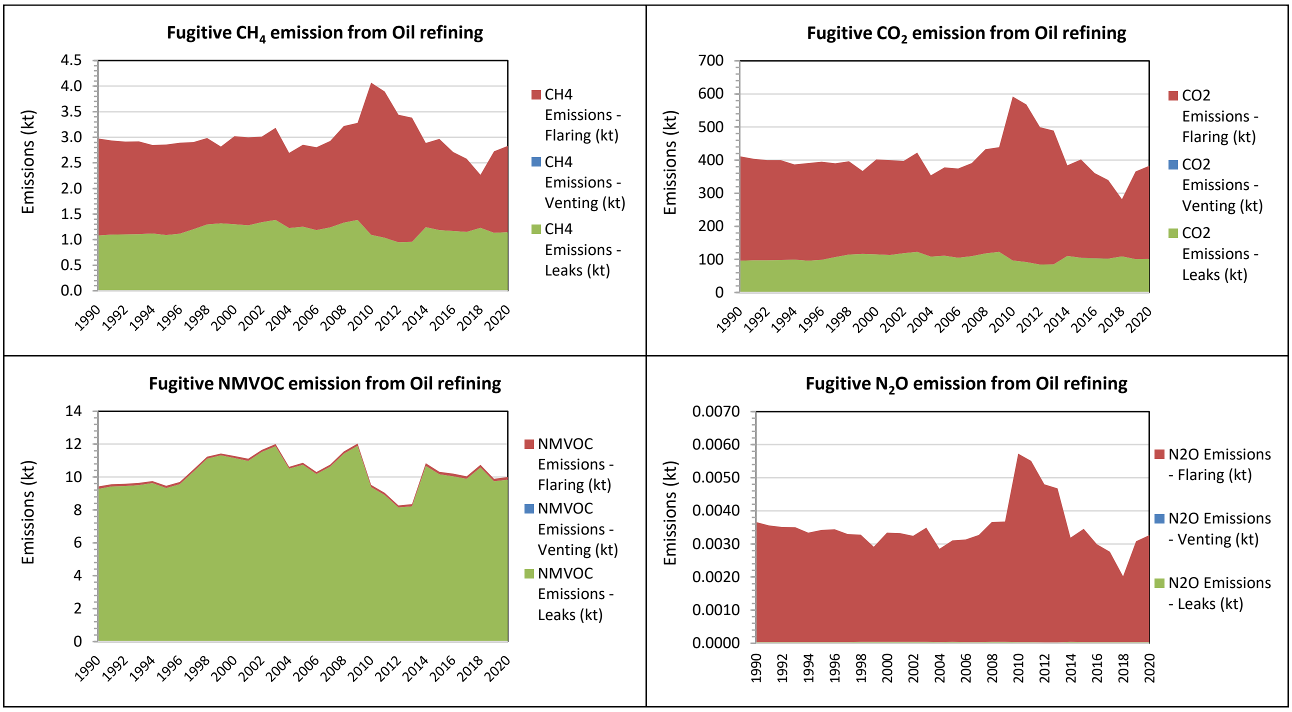

Figure 126 Fugitive emission of CH_4, CO_2, N_2O and NMVOC from IPCC category 1.B.2.a.iv Oil refining and storage

Table 331Fugitive emissions of CH4. CO2. N2O and NMVOC emissions from Oil refining and storage (IPCC category 1.B.2.a.iv)

	Fugitive emissions from IPCC category (according to reporting rules)												
	1.B.2.a.iv Oil refining and storage					**1.B.2.a.iv venting - Oil refining and storage**				**1.B.2.a.iv Flaring - Oil refining and storage**			
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**				**kt**				**kt**			
1990	122.90	1.08	95.85	9.28	NA	IE	IE	IE	IE	1.90	316.02	0.14	0.0036
1991	124.89	1.10	97.41	9.43	NA	IE	IE	IE	IE	1.84	306.55	0.14	0.0035
1992	125.26	1.10	97.69	9.46	NA	IE	IE	IE	IE	1.81	302.35	0.14	0.0035
1993	126.02	1.11	98.29	9.51	NA	IE	IE	IE	IE	1.81	301.65	0.14	0.0035
1994	127.54	1.12	99.48	9.63	NA	IE	IE	IE	IE	1.73	287.55	0.13	0.0033
1995	123.60	1.09	96.40	9.33	NA	IE	IE	IE	IE	1.77	295.05	0.13	0.0034
1996	126.75	1.12	98.86	9.57	NA	IE	IE	IE	IE	1.78	296.36	0.14	0.0034
1997	136.88	1.20	106.76	10.33	NA	IE	IE	IE	IE	1.70	283.99	0.13	0.0033
1998	147.20	1.30	114.81	11.11	NA	IE	IE	IE	IE	1.69	281.85	0.13	0.0032
1999	149.87	1.32	116.89	11.31	NA	IE	IE	IE	IE	1.50	250.15	0.11	0.0029
2000	147.67	1.30	115.18	11.15	NA	IE	IE	IE	IE	1.72	287.09	0.13	0.0033
2001	145.45	1.28	113.44	10.98	NA	IE	IE	IE	IE	1.72	286.28	0.13	0.0033
2002	152.61	1.34	119.03	11.52	NA	IE	IE	IE	IE	1.67	278.59	0.13	0.0032
2003	157.27	1.38	122.66	11.87	NA	IE	IE	IE	IE	1.80	300.15	0.14	0.0035
2004	139.26	1.23	108.61	10.51	NA	IE	IE	IE	IE	1.47	245.26	0.11	0.0028
2005	142.33	1.25	111.01	10.74	NA	IE	IE	IE	IE	1.60	266.99	0.12	0.0031
2006	134.86	1.19	105.18	10.18	NA	IE	IE	IE	IE	1.62	269.58	0.12	0.0031
2007	140.81	1.24	109.82	10.63	NA	IE	IE	IE	IE	1.69	281.54	0.13	0.0032
2008	151.21	1.33	117.93	11.41	NA	IE	IE	IE	IE	1.89	315.15	0.14	0.0036
2009	157.54	1.39	122.87	11.89	NA	IE	IE	IE	IE	1.90	316.26	0.14	0.0036
2010	124.27	1.09	96.92	9.38	NA	IE	IE	IE	IE	2.97	495.52	0.15	0.0057
2011	117.93	1.04	91.98	8.90	NA	IE	IE	IE	IE	2.86	476.21	0.14	0.0055
2012	108.01	0.95	84.24	8.15	NA	IE	IE	IE	IE	2.49	415.13	0.13	0.0048
2013	108.88	0.96	84.92	8.22	NA	IE	IE	IE	IE	2.43	404.35	0.14	0.0046
2014	141.45	1.24	110.32	10.68	NA	IE	IE	IE	IE	1.64	274.15	0.17	0.0032
2015	134.61	1.18	104.99	10.16	NA	IE	IE	IE	IE	1.78	297.42	0.16	0.0034
2016	133.01	1.17	103.74	10.04	NA	IE	IE	IE	IE	1.54	257.05	0.16	0.0030
2017	131.04	1.15	102.20	9.89	NA	IE	IE	IE	IE	1.43	237.70	0.15	0.0027
2018	140.10	1.23	109.27	10.58	NA	IE	IE	IE	IE	1.04	172.61	0.17	0.0020
2019	128.96	1.13	100.58	9.73	NA	IE	IE	IE	IE	1.59	264.92	0.16	0.0030
2020	130.33	1.15	101.65	9.84	NA	IE	IE	IE	IE	1.69	281.05	0.16	0.0032
Trend													
1990 – 2020	*6.0%*	*6.0%*	*6.0%*	*6.0%*	NA	NA	NA	NA	NA	*-11.1%*	*10.0%*	*10.0%*	*10.0%*
2005 – 2020	*-8.4%*	*-8.4%*	*-8.4%*	*-8.4%*	NA	NA	NA	NA	NA	*5.3%*	*30.2%*	*30.2%*	*30.2%*
2019 - 2020	*1.1%*	*1.1%*	*1.1%*	*1.1%*	NA	NA	NA	NA	NA	*6.1%*	*-2.2%*	*-2.2%*	*-2.2%*

Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.

3.3.2.3.4.1 Choice of method

For estimating fugitive emissions (leaks) of CH4, CO2, N2O and NMVOC from oil refining the Tier 1 method according to 2019 Refinements to 2006 IPCC GL has been applied.

For estimating emissions from venting and flaring of CH4, CO2 and N2O from oil production and upgrading activities the Tier 1 method according to 2006 IPCC GL has been applied.

Equation 4.2.1 General equation for estimating fugitive emissions from Oil refining and storage (2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\begin{aligned} \boldsymbol{Emissions_{refining}} &= \boldsymbol{AD_{oil\,refining} * EF_{oil\,refining-leaks}} \\ &+ \boldsymbol{AD_{oil\,refining} * EF_{oil\,refining-venting}} \\ &+ \boldsymbol{AD_{oil\,refining} * EF_{oil\,refining-flaring}} \end{aligned}$$

Where:

Emissions $_{\text{oil refining}}$ = emissions of CH_4, CO_2, NMVOC and N_2O from oil refining activities

Activity data $_{\text{oil refining}}$ = activity data of oil refining

$EF_{\text{oil refining-leaks/venting/flaring}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for leaks, venting and flaring for oil refining

3.3.2.3.4.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of thousand cubic meters onshore oil production. Production data of crude oil, natural gas liquids (NGL)/condensate and GPL aux champ were used for estimating the fugitive emissions of CH_4, CO_2, N_2O and NMVOC for the years.

- 1990 - 2020 are taken from the Energy balance provided by MEM and UN statistics[363] .
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[364].

It is necessary to clarify that Activity data used to estimate emissions of venting and flaring from oil refining and storage were provided by the MEM for the period between 2010-2020.

For the period 1990 – 2009, missing data of venting and flaring volumes have been completed by using a ratio of flaring and venting volumes to oil refining of the times series 2010 -2020 applied to the period 1990 -2009 to generate flaring and venting volumes based on annual oil refining.

The decrease in the quantity of crude oil refined between 1990 and 1999 can be explained by average refining capacity in Algeria, and the import of refined products from abroad, on the other hand.

The increase in the quantities of oil refined from 1999 onwards is the result of the increase in refining capacity in the country following the commissioning of new refineries, and to the increase in imports of refined products.

The year 2010 was characterized by the resumption of refining activity as well as the commissioning of the new condensate refinery in Skikda (TOPC-RA2K). Both the processing of natural gas and oil declined as a result of the reduction in the quantities of NG processed in the LNG units.

A slight decrease in the quantities of refined oil and natural gas is recorded in 2011, which is due to the

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[363] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[364] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

decrease in demand from European customers.

The increase in imports in 2012 led to a decrease in the quantity of oil refined due to the rehabilitation programme of the Arzew and Skikda refineries.

The decrease in the quantities of liquefied gas in 2012 is due to the decrease in demand by European customers due to the crisis.

In 2013, the quantity of refined oil increased following the completion of the rehabilitation programme of the Arzew and Skikda refineries.

In the case of natural gas, the quantity processed fell as a result of the decrease in Sonelgaz demand for power plants, thanks to the improvement in the specific consumption of these plants.

The year 2014 was characterized by an increase in the quantity of oil refined with the completion of the rehabilitation of the Arzew and Skikda refineries.

The quantities of natural gas processed increased as a result of increased demand from Sonelgaz power plants.

In 2015, the quantity of refined oil decreased due to the shutdown of some refineries for maintenance.

The amount of natural gas processed as a result of lower demand from regional customers.

For the year 2016 a slight decrease was recorded for condensate, rewarded by crude oil refining.

There was a slight decrease in the quantities of natural gas processed due to lower demand from Sonelgaz power plants and Sonatrach customers.

The year 2017 was marked by a slight decrease in the quantity of refined oil in the refineries at national level.

An increase in demand from Sonatrach’s customers led to an increase in processed gas production in 2017.

In 2018, the quantities of refined oil increased as a result of strong demand from Sonatrach's foreign processing activities.

For natural gas, the quantities processed decreased due to lower demand from Sonatrach's customers.

The year 2019 recorded a decrease in the quantity of refined oil due to the suspension of processing operations abroad.

Natural gas processing in 2019 recorded a slight decrease.

In 2020, the amount of oil refined decreased slightly. The amount of gas processed increased slightly. This year was marked by the Covid19 pandemic, which impacted the global and regional economy.

In the following figure and table, the used activity data are provided.

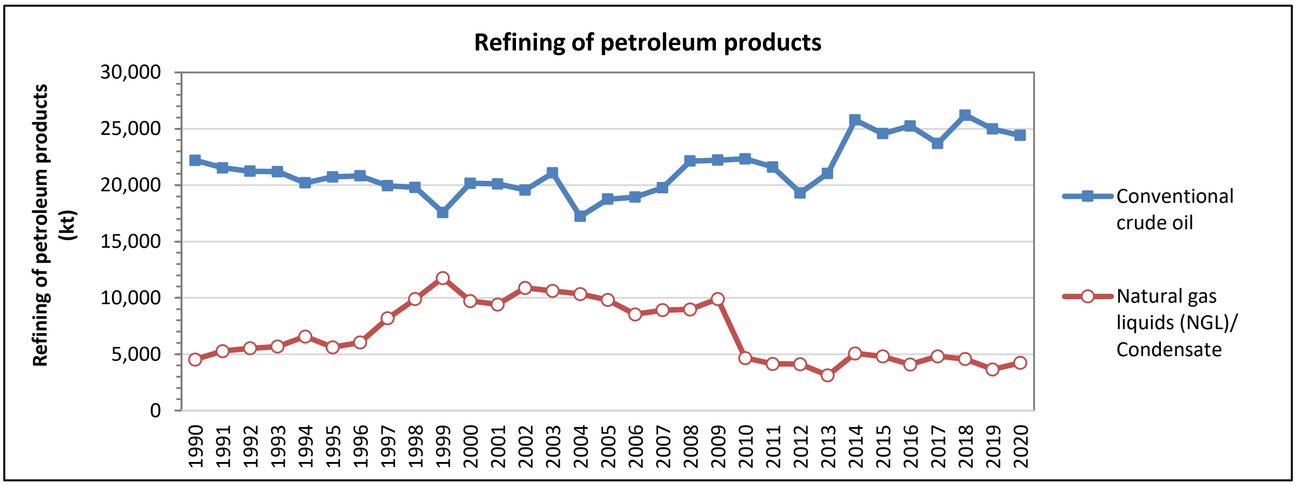

Figure 127 Activity data for Oil refining and storage (IPCC category 1.B.2.a.iv)

Table 332Activity data for Oil refining and storage (IPCC category 1.B.2.a.iv)

Activity data	**Total**	**Crude Oil**			**Condensate**			**GPL aux Champs**		
	PJ	**Kt**	**PJ**	***10^3 m^3***	**kt**	**PJ**	***10^3 m^3***	**kt**	**PJ**	***10^3 m^3***
1990	1.178	22.200	974	27.778	4.533	204.121	8.634	NA	NA	NA
1991	1.183	21.535	945	26.946	5.280	237.758	10.057	NA	NA	NA
1992	1.181	21.240	932	26.577	5.530	249.016	10.533	NA	NA	NA
1993	1.186	21.191	930	26.515	5.681	255.815	10.821	NA	NA	NA
1994	1.182	20.200	887	25.275	6.569	295.802	12.512	NA	NA	NA
1995	1.162	20.727	910	25.935	5.609	252.573	10.684	NA	NA	NA
1996	1.186	20.819	914	26.050	6.039	271.936	11.503	NA	NA	NA
1997	1.244	19.950	876	24.962	8.186	368.616	15.592	NA	NA	NA
1998	1.314	19.800	869	24.775	9.889	445.302	18.836	NA	NA	NA
1999	1.301	17.573	771	21.988	11.768	529.913	22.415	NA	NA	NA
2000	1.323	20.168	885	25.235	9.721	437.737	18.516	NA	NA	NA
2001	1.307	20.111	883	25.164	9.413	423.867	17.930	NA	NA	NA
2002	1.349	19.571	859	24.488	10.881	489.971	20.726	NA	NA	NA
2003	1.403	21.085	925	26.383	10.611	477.813	20.211	NA	NA	NA
2004	1.222	17.229	756	21.558	10.343	465.745	19.701	NA	NA	NA
2005	1.265	18.756	823	23.468	9.818	442.105	18.701	NA	NA	NA
2006	1.216	18.938	831	23.696	8.536	384.376	16.259	NA	NA	NA
2007	1.269	19.778	868	24.747	8.909	401.172	16.970	NA	NA	NA
2008	1.376	22.139	972	27.701	8.976	404.189	17.097	NA	NA	NA
2009	1.421	22.217	975	27.799	9.910	446.247	18.876	NA	NA	NA
2010	1.190	22.335	980	27.947	4.657	209.699	8.870	NA	NA	NA
2011	1.135	21.614	949	27.044	4.146	186.684	7.897	NA	NA	NA
2012	1.033	19.307	847	24.158	4.118	185.413	7.843	NA	NA	NA
2013	1.064	21.039	923	26.325	3.115	140.286	5.934	NA	NA	NA
2014	1.360	25.779	1.131	32.256	5.067	228.178	9.652	NA	NA	NA
2015	1.294	24.570	1.078	30.744	4.797	216.013	9.137	NA	NA	NA
2016	1.293	25.258	1.109	31.604	4.097	184.501	7.804	NA	NA	NA
2017	1.257	23.700	1.040	29.655	4.813	216.730	9.168	NA	NA	NA

Activity data	Total	Crude Oil			Condensate			GPL aux Champs		
	PJ	Kt	PJ	10^3 m^3	kt	PJ	10^3 m^3	kt	PJ	10^3 m^3
2018	1.356	26.210	1.150	32.796	4.574	205.983	8.713	NA	NA	NA
2019	1.261	24.978	1.096	31.254	3.650	164.362	6.952	NA	NA	NA
2020	1.262	24.420	1.072	30.555	4.231	190.514	8.059	NA	NA	NA
Trend										
1990 – 2020	*7.1 %*	*10.0 %*			*— 6.7 %*			NA		
2005 – 2020	*— 0.2 %*	*30.2 %*			*56.9 %*			NA		
2019 - 2020	*0.1 %*	*—2.2 %*			*15.9 %*			NA		

The data are provided above in **Erreur ! Source du renvoi introuvable.**.

The production data in energy statistics are provided in the physical units 'tons'. To convert these data to volume, country specific density was used which are presented in the following table.

Table 333 Country specific Density and NCV for selected fuels and default data for comparison

Fuel	**Country specific (CS) Density**	**Country specific (CS) NCV**	**For comparison**	
			Average Density	**IPCC default NCV**
	kt / 10^6m^3	**TJ/kt**	**kt / 10^6m^3**	**TJ/kt**
Crude oil	0.799	46.2 * 0.95 = 43.89	0.853	42.3
Natural Gas Liquids (NGL) / Condensate	0.525 = Average (0.52 - 0.53)	47.4 * 0.95 = 45.03		44.2
Conversion from GCV to NCV		**Default**		
Petroleum products		1 NCV = 0.95 x GCV		
Source	CS Density	MEM		
	Average Density	IEA (2019): Oil information: database documentation; page 65 [365]		
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[366]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2		
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [367]: Table 4 Difference between net and gross calorific values for selected fuels		
Note:				
D Default		CS Country specific		PS Plant specific

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[365] IEA (2019): Oil information: database documentation (2019 first release) Table Oil products - Average densities, volume and heat equivalents; available on 08.07.2022 at https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/Oil_documentation%20aie.pdf

[366] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'énergie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[367] https://unstats.un.org/unsd/energystats/methodology/ires/

3.3.2.3.4.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2006 IPCC GL and 2019Refinement to the 2006 IPCC GL[368] were applied.

Table 334 TIER 1 emission factors for oil refining and storage and disaggregation of TIER 1 EF

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Refinery	**TIER 1 Emission factors for oil refining and storage**						
	All	0.03	5.58	0.26	0.0000877	Tonnes/thousand cubic meters oil refined	TABLE 4.2.4C (NEW)
	Disaggregation of TIER 1 emission factors for oil refining and storage						
	Leaks	99%	45%	98%	1%		TABLE 4A.2.3 (NEW)
	Vents	NA	NA	NA	NA		
	Flares	1%	55%	2%	99%		
	Disaggregated TIER 1 emission factors for oil refining and storage						
	Leaks	0.03	2.63	0.25	NA	Tonnes/thousand cubic meters oil refined	Calculated
	Vents	NA	NA	NA	NA		
	Flares	*0.0003*	*3.22*	*0.005*	*0.0000868*		
	TIER 1 emission factors for venting and flaring oil refining and storage						
	venting and flaring	0.012	2.0	-	0.000023	Tons/thousand cubic meters onshore oil production	Calculated

Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor
and Annex 4A.2 Disaggregation of Tier 1 factors presented in Section 4.2.2.3

2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor, TABLE 4.2.4(CONTINUED) tier 1 emission factors for fugitive emissions (including venting and flaring) from oil and gas operations in developed countries [a,b]

3.3.2.3.4.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category *1.B.2.a.iv Oil refining and storage* are presented in the following table.

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[368] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

Table 335Uncertainty for IPCC category 1.B.2.a.iv Oil refining and storage.

Uncertainty	**Oil exploration**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. Chapter 4.2
Emission factor (EF)	139%	139%	1803%	141%	TABLE 4.2.4C (NEW); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	140%	140%	1803%	142%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.3.4.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
    - consistent use of energy balance data,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI
- time series consistency - plausibility checks of dips and jumps.

3.3.2.3.4.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.B.2.a.iv Fugitive emissions from Oil refining and storage*.

Table 336Recalculations done since NC in IPCC category *1.B.2.a.iv Fugitive emissions from Oil refining and storage*

<table>
<tr><th>Source category</th><th colspan="4">Revisions of data</th><th colspan="2">Type of revision</th><th>Type of improvement</th></tr>
<tr><td>1.B.2.a.i</td><td colspan="4">Application of methodology of the 2006 IPCC guidelines</td><td colspan="2">M</td><td>Comparability
Completeness</td></tr>
<tr><td>1.B.2.a.i</td><td colspan="4">Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines</td><td colspan="2">EF</td><td>Accuracy
Completeness
Transparency</td></tr>
<tr><td>1.B.2.a.i</td><td colspan="4">Revision of activity data due to updated energy statistics and use of data of UN statistics</td><td colspan="2">AD</td><td>Accuracy
Comparability
Completeness</td></tr>
<tr><td>1.B.2.a.i</td><td colspan="4">Estimation of emissions for sources which were not included in the estimations of NC1 and NC2</td><td colspan="2">AD</td><td>Completeness</td></tr>
<tr><td>1.B.2.a.i</td><td colspan="4">Use of country-specific GCV and density for several fuels</td><td colspan="2">AD</td><td>Accuracy</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td><i>Note</i></td><td><i>AD</i></td><td><i>Activity data</i></td><td><i>EF</i></td><td><i>Emission factor</i></td><td><i>M</i></td><td colspan="2"><i>Method</i></td></tr>
</table>

3.3.2.3.4.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 337Planned improvements for IPCC category *1.B.2.a.iv Fugitive emissions from Oil refining and storage*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.iv	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: refining of crude oil and natural gas liquids (NGL)/ condensate	AD	Completeness Consistency Transparency	high
1.B.2.a.iv	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.a.iv	Use of activity data from installation: amount of gas flared	AD	Accuracy	medium
1.B.2.a.iv	Preparation of an overview of process units related to e.g., hydrogen production, bitumen, asphalt blowing, etc. and technology applied	AD	Transparency Completeness	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.3.5 Fugitive emissions from Distribution of oil products (IPCC category 1.B.2.a.v)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[369] the segment *Distribution of oil products* includes fugitive emissions, including equipment leaks. venting and flaring from the

- transport and distribution of refined products.
- including those at bulk terminals and retail facilities.

Evaporation losses from storage, filling and unloading activities and equipment leaks are the primary sources of these emissions.

The following table provides an overview of occurring activities in Algeria.

Table 338 Activities of segment Refined Product Distribution in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
Refined Product Distribution				
• gasoline	x			
• diesel				
• jet kerosene	x			
• aviation fuel				

In the following figures the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Distribution of oil products* (IPCC category 1.B.2.a.v) are provided.

This section describes the emissions from IPCC category 1.B.2.a.v *Distribution of oil products* and provides an overview of fugitive emissions in the following figure and table.

Fugitive GHG emissions from IPCC category 1.B.2.a.v *Distribution of oil products* have not been estimated for CO_2, CH_4 and N_2O.

Fugitive NMVOC emissions from IPCC category 1.B.2.a.v *Distribution of oil products* amounted to 7.360.5 kt in 1990. 7.147.1 kt in 2005 and 11.961.4 kt in 2020.

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[369] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4: Fugitive Emissions, - 4.2.2.3 Choice of emission factor, page 4.60

The overall trend of NMVOC emissions in IPCC category 1.B.2.a.v *Distribution of oil products* from fuels shows a significant increase of 62.5% over the period 1990-2020. These trends increased to 67.4% between 2005 and 2020. However, in the period 2019-2020, CO_2 emissions have decreased to 14.1%.

The increase in fugitive emissions in the form of NMVOCs due to the distribution of oil products can be explained by the increase in Algerian oil revenues which induced the launch of several infrastructure projects and an improvement in the standard of living of the citizen, causing a massive consumption of oil products which increased the fugitive emissions from the distribution of these oil products.

From 2015 onwards. following the fall in oil prices, the number of infrastructure projects has decreased, which has impacted the consumption of oil products at national level.

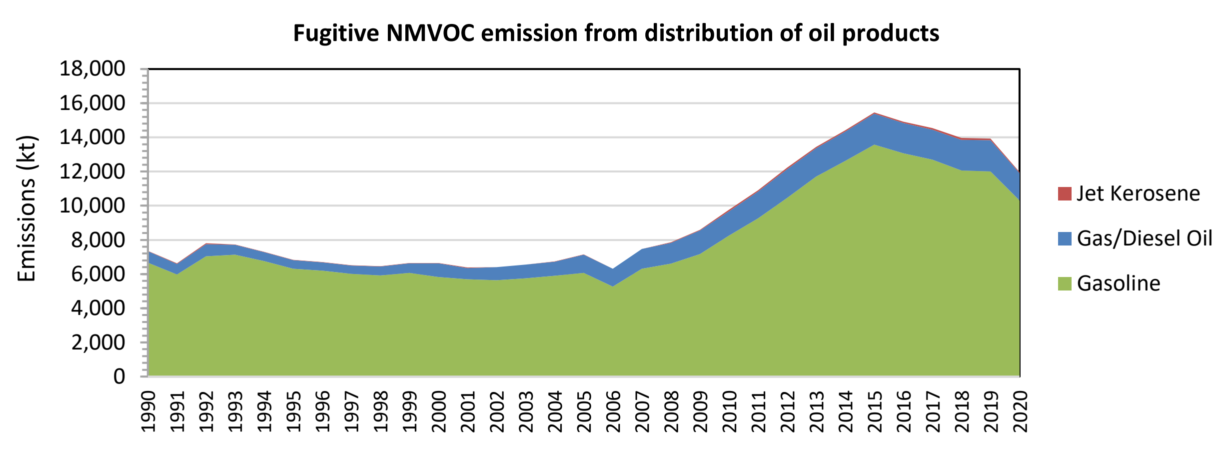

Figure 128 Fugitive emission of NMVOC from IPCC category 1.B.2.a.v Distribution of oil products

Table 339Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from Distribution of oil products (IPCC category 1.B.2.a.v)

Fugitive emissions of CH_4. CO_2. N_2O and NMVOC from IPCC category 1.B.2.a.i Distribution of oil products													
	Total NMVOC	**Gasoline**				**Gas/diesel oil**				**Jet kerosene**			
		CH_4	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
1990	7,360.5	NA	NA	6,669.1	NA	NA	NA	661.5	NA	NA	NA	29.9	NA
1991	6,628.4	NA	NA	5,985.9	NA	NA	NA	616.4	NA	NA	NA	26.2	NA
1992	7,803.8	NA	NA	7,048.9	NA	NA	NA	710.0	NA	NA	NA	44.8	NA
1993	7,738.7	NA	NA	7,131.7	NA	NA	NA	579.2	NA	NA	NA	27.8	NA
1994	7,308.4	NA	NA	6,770.2	NA	NA	NA	519.3	NA	NA	NA	18.9	NA
1995	6,841.5	NA	NA	6,310.7	NA	NA	NA	512.7	NA	NA	NA	18.1	NA
1996	6,709.4	NA	NA	6,197.3	NA	NA	NA	493.5	NA	NA	NA	18.5	NA
1997	6,515.1	NA	NA	6,013.5	NA	NA	NA	478.4	NA	NA	NA	23.2	NA
1998	6,464.2	NA	NA	5,921.6	NA	NA	NA	520.9	NA	NA	NA	21.7	NA
1999	6,648.8	NA	NA	6,071.7	NA	NA	NA	555.2	NA	NA	NA	21.9	NA
2000	6,651.5	NA	NA	5,826.6	NA	NA	NA	805.6	NA	NA	NA	19.2	NA
2001	6,383.3	NA	NA	5,701.0	NA	NA	NA	657.9	NA	NA	NA	24.3	NA
2002	6,408.5	NA	NA	5,649.0	NA	NA	NA	753.9	NA	NA	NA	5.6	NA
2003	6,560.1	NA	NA	5,750.1	NA	NA	NA	807.2	NA	NA	NA	2.8	NA
2004	6,740.1	NA	NA	5,897.1	NA	NA	NA	819.1	NA	NA	NA	23.9	NA
2005	7,147.1	NA	NA	6,071.7	NA	NA	NA	1,065.6	NA	NA	NA	9.7	NA
2006	6,318.1	NA	NA	5,263.0	NA	NA	NA	1,055.2	NA	NA	NA	0.0	NA
2007	7,464.3	NA	NA	6,310.7	NA	NA	NA	1,153.6	NA	NA	NA	0.0	NA
2008	7,865.4	NA	NA	6,607.8	NA	NA	NA	1,217.4	NA	NA	NA	40.2	NA
2009	8,582.9	NA	NA	7,168.4	NA	NA	NA	1,385.5	NA	NA	NA	29.0	NA
2010	9,760.6	NA	NA	8,261.1	NA	NA	NA	1,415.5	NA	NA	NA	84.0	NA
2011	10,911.5	NA	NA	9,262.9	NA	NA	NA	1,563.6	NA	NA	NA	84.9	NA
2012	12,239.5	NA	NA	10,465.3	NA	NA	NA	1,679.7	NA	NA	NA	94.5	NA
2013	13443.6	NA	NA	11,711.3	NA	NA	NA	1,660.0	NA	NA	NA	72.4	NA
2014	14.416.0	NA	NA	12,630.1	NA	NA	NA	1,708.4	NA	NA	NA	77.5	NA
2015	15.462.5	NA	NA	13,565.7	NA	NA	NA	1,812.0	NA	NA	NA	84.8	NA
2016	14.,924.4	NA	NA	13,076.6	NA	NA	NA	1,762.0	NA	NA	NA	85.9	NA
2017	14,544.1	NA	NA	12,704.1	NA	NA	NA	1,751.6	NA	NA	NA	88.3	NA
2018	13,963.0	NA	NA	12,054.7	NA	NA	NA	1,800.1	NA	NA	NA	108.2	NA
2019	13,922.0	NA	NA	11,997.3	NA	NA	NA	1,836.6	NA	NA	NA	88.2	NA
2020	11,961.4	NA	NA	10,300.6	NA	NA	NA	1,613.2	NA	NA	NA	47.6	NA
Trend													
1990 – 2020	*62.5 %*	*NA*	*NA*	*54.5 %*	*NA*	*NA*	*NA*	*143.9 %*	*NA*	*NA*	*NA*	*59.4 %*	*NA*
2005 – 2020	*67.4 %*	*NA*	*NA*	*69.6 %*	*NA*	*NA*	*NA*	*51.4 %*	*NA*	*NA*	*NA*	*390.4 %*	*NA*
2019 - 2020	*14.1 %*	*NA*	*NA*	*14.1 %*	*NA*	*NA*	*NA*	*—12.2 %*	*NA*	*NA*	*NA*	*—46.0 %*	*NA*

3.3.2.3.5.1 Choice of method

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from *distribution of oil products* activities the Tier 1 method according to 2019 Refinements to 2006 IPCC GL[370] has been applied. Fugitive emissions include emissions from venting and leaks.

Equation 4.2.12 (new) General equation for estimating fugitive emissions from distribution of oil products (2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\begin{aligned} \boldsymbol{Emissions}_{\boldsymbol{fuel\ disribution}} = {} & \boldsymbol{AD}_{\boldsymbol{gasoline\ distribution}} * \boldsymbol{EF}_{\boldsymbol{gasoline\ distribution}} \\ & + \boldsymbol{AD}_{\boldsymbol{diesel\ distribution}} * \boldsymbol{EF}_{\boldsymbol{diesel\ distribution}} \\ & + \boldsymbol{AD}_{\boldsymbol{jet\ kerosene\ distribution}} * \boldsymbol{EF}_{\boldsymbol{jet\ kerosene\ distribution}} \end{aligned}$$

Where:

Emissions $_{\text{fuel distribution}}$ = emissions of NMVOC emitted due to all relevant activities on distribution of oil products
AD $_{\text{gasoline distribution}}$ = activity data - volumes of gasoline consumed
EF $_{\text{gasoline distribution}}$ = default emission factor of NMVOC for leaks and venting from for gasoline distribution
AD $_{\text{diesel distribution}}$ = activity data - volumes of diesel consumed
EF $_{\text{diesel distribution}}$ = default emission factor of NMVOC for leaks and venting from for diesel distribution
AD $_{\text{jet kerosene distribution}}$ = activity data - volumes of jet kerosene consumed
EF $_{\text{jet kerosene distribution}}$ = default emission factor of NMVOC for leaks and venting from for jet kerosene distribution

3.3.2.3.5.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of Tonnes per thousand cubic meters product consumed. Gross consumption data of gasoline, diesel and jet kereosene were used for estimating the fugitive emissions of NMVOC for the years

- 1990 - 2009 are taken from the Energy balance provided by UN statistics[371] for and from Algeria
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[372].

The total fuel consumption decreased by 96% in the period 1990 –2015 due to the allocation of Jet kerosene used *in international aviation* with the Jet kerosene exported according to the energy balance. Due to allocation of Jet kerosene used in international aviation and Jet kerosene exported, the emission in the period 2010 – 2020 are not complete or not estimated.

In the following figure and table, the used activity data are provided.

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[370] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method

[371] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[372] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

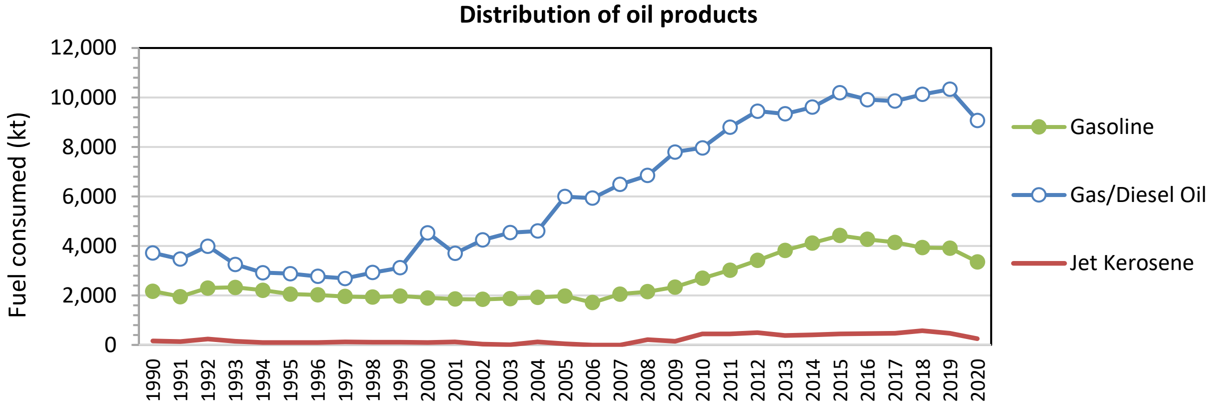

Figure 129 Activity data for Distribution of oil products (IPCC category 1.B.2.a.v)

Table 340Activity data for Distribution of oil products (IPCC category 1.B.2.a.v)

Activity data	Total	Gasoline			Gas/Diesel Oil			Jet Kerosene		
	PJ	Kt	PJ	10^3 m^3	kt	PJ	10^3 m^3	kt	PJ	10^3 m^3
1990	252.6	2.177	92.5	2.938	3.722	153.4	4.410	160	6.7	199
1991	231.8	1.954	83.1	2.637	3.468	142.9	4.109	140	5.8	174
1992	272.5	2.301	97.8	3.105	3.995	164.6	4.733	240	10.0	299
1993	239.5	2.328	99.0	3.142	3.259	134.3	3.861	149	6.2	186
1994	218.6	2.210	94.0	2.982	2.922	120.4	3.462	101	4.2	126
1995	210.5	2.060	87.6	2.780	2.885	118.9	3.418	97	4.0	121
1996	204.6	2.023	86.0	2.730	2.777	114.4	3.290	99	4.1	123
1997	199.6	1.963	83.5	2.649	2.692	110.9	3.190	124	5.2	154
1998	207.8	1.933	82.2	2.609	2.931	120.8	3.473	116	4.8	144
1999	217.9	1.982	84.3	2.675	3.124	128.7	3.701	117	4.9	146
2000	272.0	1.902	80.9	2.567	4.533	186.8	5.371	103	4.3	128
2001	237.1	1.861	79.1	2.511	3.702	152.6	4.386	130	5.4	162
2002	254.5	1.844	78.4	2.489	4.242	174.8	5.026	30	1.3	37
2003	267.6	1.877	79.8	2.533	4.542	187.2	5.382	15	0.6	19
2004	277.1	1.925	81.8	2.598	4.609	189.9	5.461	128	5.3	159
2005	333.5	1.982	84.3	2.675	5.996	247.1	7.104	52	2.2	65
2006	317.7	1.718	73.0	2.318	5.937	244.7	7.034	NE	NE	NE
2007	355.1	2.060	87.6	2.780	6.491	267.5	7.691	NE	NE	NE
2008	383.0	2.157	91.7	2.911	6.850	282.3	8.116	215	9.0	268
2009	427.2	2.340	99.5	3.158	7.796	321.3	9.237	155	6.5	193
2010	461.6	2.697	114.6	3.639	7.965	328.2	9.437	450	18.8	560
2011	510.1	3.024	128.5	4.081	8.798	362.6	10.424	454	19.0	566
2012	555.8	3.416	145.2	4.610	9.451	389.5	11.198	506	21.1	630
2013	563.6	3.823	162.5	5.159	9.340	384.9	11.067	387	16.2	482
2014	588.7	4.123	175.3	5.564	9.613	396.2	11.390	415	17.3	517
2015	627.4	4.428	188.3	5.976	10.196	420.2	12.080	454	18.9	565
2016	609.2	4.269	181.5	5.761	9.914	408.6	11.746	460	19.2	572
2017	602.2	4.147	176.3	5.597	9.856	406.2	11.678	473	19.7	589
2018	608.9	3.935	167.3	5.310	10.128	417.4	12.000	579	24.2	721

Activity data	Total	Gasoline			Gas/Diesel Oil			Jet Kerosene		
	PJ	Kt	PJ	10^3 m^3	kt	PJ	10^3 m^3	kt	PJ	10^3 m^3
2019	612.1	3.916	166.5	5.285	10.334	425.9	12.244	472	19.7	588
2020	527.6	3.362	142.9	4.538	9.077	374.1	10.754	255	10.6	318
Trend										
1990 – 2020	*108.9 %*	*54.5 %*			*143.9 %*			*59.4 %*		
2005 – 2020	*58.2 %*	*69.6 %*			*51.4 %*			*390.4 %*		
2019 - 2020	*—13.8 %*	*14.1 %*			*—12.2 %*			*—46.0 %*		

The production data in energy statistics are provided in the physical units 'tonnes'. To convert these data to volume, default density was used which are presented in the following table.

Table 341 Country specific Density and NCV for selected fuels and default data for comparison

Fuel	**Country specific (CS) Density**	**Country specific (CS) NCV**	**Average Density**	**For comparision**
				IPCC default NCV
	kt / 10^3m^3	**TJ/kt**	**kt / 10^3m^3**	**TJ/kt**
Gasoline	-	44.75 * 0.95 = 42.51	0.741	44.3
Gas/Diesel Oil	-	43.38 * 0.95 = 41.21	0.844	43.0
Jet Kerosene	-	46.02 * 0.95 = 43.72	0.803	44.1
Conversion from GCV to NCV		**Default**		
Petroleum products		1 NCV = 0.95 x GCV		
Source	CS Density	MEM		
	Average Density	IEA (2019): Oil information: database documentation; page 65 [373]		
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[374]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2		
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [375]: Table 4 Difference between net and gross calorific values for selected fuels		
Note:				
D Default	CS Country specific	PS Plant specific		

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[373] IEA (2019): Oil information: database documentation (2019 first release) Table Oil products - Average densities, volume and heat equivalents; available on 08.07.2022 at https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/Oil_documentation%20aie.pdf

[374] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines. https://www.energy.gov.dz/?rubrique=textes-legislatifs-et-reglementaires

[375] https://unstats.un.org/unsd/energystats/methodology/ires/

3.3.2.3.5.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2019 Refinement to the 2006 IPCC GL[376] were applied.

Table 342 TIER 1 emission factors for Distribution of oil products

Sub-segment	Emission source	CH_4	CO_2	NMVOC	N_2O	Units	Source
Gasoline	All	NA	NA	2.27	NA	Tonnes per thousand cubic meters product consumed	TABLE 4.2.4D (NEW)
Gas/Diesel Jet kerosene	All	NA	NA	0.15	NA	Tonnes per thousand cubic meters product consumed	
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor							

3.3.2.3.5.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category *1.B.2.a.v Distribution of oil products* are presented in the following table.

Table 343Uncertainty for IPCC category 1.B.2.a.v Distribution of oil products.

Uncertainty	Oil exploration				Reference
	CO_2	CH_4	NMVOC	N_2O	
Activity data (AD)	NA	NA	10%	NA	2006 IPCC GL. Chapter 4.2
Emission factor (EF)	NA	NA	28%	NA	Table 4.2.4D (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	NA	NA	30%	NA	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.3.5.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
  - consistent use of energy balance data,
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI
- time series consistency - plausibility checks of dips and jumps.

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[376] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor

3.3.2.3.5.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.B.2.a.v Distribution of oil products*.

Table 344Recalculations done since NC in IPCC category *1.B.2.a.v* Distribution of oil products

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.a.i	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.i	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.i	Revision of activity data due to updated energy statistics and use of data from UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.i	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2	AD	Completeness

Note *AD* *Activity data* *EF* *Emission factor* *M* *Method*

3.3.2.3.5.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective. developments presented in following table will be explored.

Table 345Planned improvements for IPCC category *1.B.2.a.v Distribution of oil products*

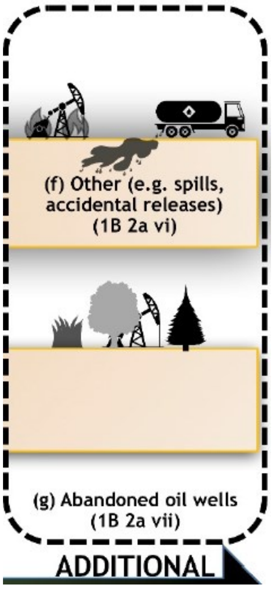
GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.v	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: consumption of gasoline, gas/diesel, jet kerosene	AD	Completeness Consistency Transparency	high
1.B.2.a.v	Application of Tier 2 method for CO_2 and CH_4 for flaring	M	Accuracy Comparability	medium
1.B.2.a.v	Use of activity data from installation: amount of gas flared	AD	Accuracy	medium
1.B.2.a.v	Development of country-specific EF for CO_2 and CH_4	EF	Accuracy	medium
1.B.2.a.v	Investigation regarding technology applied at gas station	EF	Accuracy	medium

Note *AD* *Activity data* *EF* *Emission factor* *M* *Method*

3.3.2.3.6 Fugitive emissions from Other (IPCC category 1.B.2.a.vi)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[377] the segment *Abandoned wells* includes fugitive emissions from

- spills and other accidental releases.
- Anomalous leak events: releases from emergency pressure relieving equipment such as
    - emergency shutdowns (ESD).
    - emergency safety blowdowns (ESB).
    - breakout/surge tanks
- waste oil treatment facilities and
- oilfield waste disposal facilities



The following table provides an overview of occurring activities in Algeria.

Table 346 Activities of segment Other (Oil) occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	**Included elsewhere (IE)**	**Not estimated (NE)**	
• Spills and other accidental releases			x	
• Anomalous leak events (emergency releases)			x	
• waste oil treatment facilities			x	
• oilfield waste disposal facilities			x	

This category has not been estimated due to lack of activity data and resources.

3.3.2.3.6.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 347Planned improvements for IPCC category *1.B.2.a.vi Other*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.vi	Estimation of emission from activities listed unter *Other*	M	Completeness	high
1.B.2.a.vi	Collection of activity data per year • spills and other accidental releases. • Anomalous leak events: releases from emergency pressure relieving equipment such as ○ emergency shutdowns (ESD). ○ emergency safety blowdowns (ESB).	AD	Completeness	high

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[377] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.2.2.3 Choice of emission factor, page 4.62

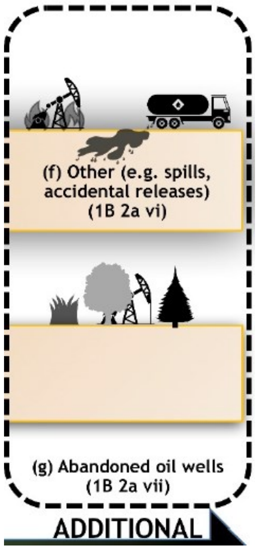
GHG source & sink category	Planned improvement	Type of improvement	Priority
	○ breakout/surge tanks • waste oil treatment facilities and • oilfield waste disposal facilities		

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.3.7 Fugitive emissions from Abandoned Oil Wells (IPCC category 1.B.2.a.vii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[378] the segment *Abandoned Oil Wells* includes fugitive emissions, including leaks from

- plugged or properly decommissioned wells
- unplugged wells.
- Onshore



The following table provides an overview of occurring activities in Algeria.

Table 348 Activities of segment Abandoned Oil Wells occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
Onshore				
• plugged or properly decommissioned wells			x	
• unplugged wells			x	
Offshore				
• plugged or properly decommissioned wells				X
• unplugged wells				X

This category has not been estimated due to lack of activity data and resources.

3.3.2.3.7.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective. developments presented in following table will be explored.

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[378] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.2.2.3 Choice of emission factor, page 4.62

Table 349Planned improvements for IPCC category *1.B.2.a.vii Abandoned oil wells*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.a.vii	Estimation of emission from abandoned wells applying Tier 1 method	M	Completeness	high
1.B.2.a.vii	Collection of activity data counts of abandoned onshore wells in each year of the time series, including the fraction of wells that are effectively plugged.	AD	Completeness	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.4 Fugitive emissions from Gaz systems (IPCC category 1.B.2.b)

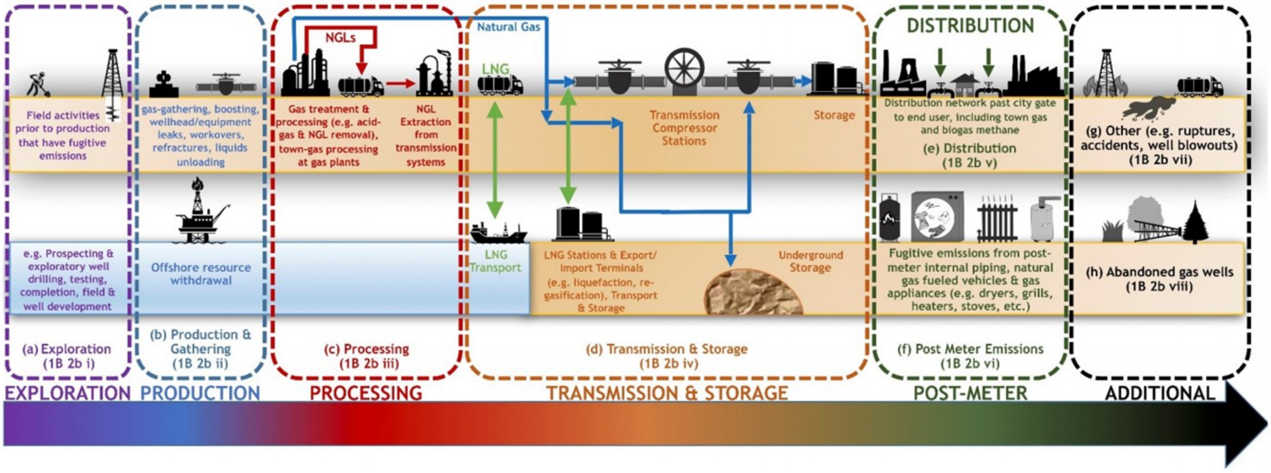


Figure 130 Key segments included in natural gas systems.

Source: 2019 Refinement to the 2006 IPCC GL. Chapter 4: Fugitive Emissions. Figure 4.2.0. Page 4.36.

In the following table is the status of reporting of sources of IPCC category 1.B.2.b Natural gas provided.

Table 350Status of reporting and key category of IPCC category 1.B.2.b

IPCC code	**Description**		**CH_4**		**CO_2**		**NMVOC**		**N_2O**	
			Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
1.B.2.b	**Natural gas**	**LA 1990 & 2020 TA**								
1.B.2.b.i	Exploration	Leaks	NA		NA		NA		NA	
		Venting	IE in IPCC category 1.B.2.a.ii Oil production and upgrading							
		Flaring	IE in IPCC category 1.B.2.a.ii Oil production and upgrading							
1.B.2.b.ii	Production and gathering	Leaks	✓		✓		✓		✓	
		Venting	IE in IPCC category 1.B.2.a.ii Oil production and upgrading							
		Flaring	IE in IPCC category 1.B.2.a.ii Oil production and upgrading							
1.B.2.b.iii	Processing	All	✓		✓		✓		✓	
1.B.2.b.iv	Transmission and storage	All	IE in IPCC category 1.B.2.a.iv Oil transport							
1.B.2.b.v	Distribution	All	✓		✓		✓		NA	
1.B.2.b.vi	Other									
1.B.2.b.vi.1	Gas post-meter	All	NE		NE		NE		NE	
1.B.2.b.vi.2	Abandoned wells	All	NE		NE		NE		NE	

IPCC code	Description		CH_4		CO_2		NMVOC		N_2O	
			Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
1.B.2.b.vi.3	Other	All	NE		NE		NE		NE	
1.B.2.c.	**Venting and flaring**	**LA 1990 & 2020**								
1.B.2.c.i.	Venting									
1.B.2.c.i.1.	Oil		✓		✓		✓		✓	
1.B.2.c.i.2.	Gas		✓		✓		✓		✓	
1.B.2.c.i.3.	Combined		NO		NO		NO		NO	
1.B.2.c.ii.	Flaring									
1.B.2.c.ii.1.	Oil		✓		✓		✓		✓	
1.B.2.c.ii.2.	Gas		✓		✓		✓		✓	
1.B.2.c.ii.3.	Combined		NO		NO		NO		NO	
All: sum of leak. venting and flaring	A '✓' indicates: emissions from this category have been estimated. Notation keys: IE -included elsewhere. NO – not occurrent. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF										

This section describes emissions resulting from IPCC category 1.B.2.b Natural gas and 1.B.2.c venting and flaring.

This section describes the emissions from IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring and provides an overview of fugitive emissions in the following figures and tables.

The IPCC category 1. B.2.b Natural gas is for CH_4 key categories .

Fugitive GHG emissions from IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring amounted to 11,328.85kt CO_2 equivalents in 1990 for 1.B.2.b, 2,517.70 Kt CO_2 equivalents for venting and flaring. Emissions reached 19,995.01kt CO_2 equivalents in 2005 for 1.B.2.b, 3,230.46 kt CO_2 equivalents for venting and flaring and accounted to 20,673.46kt CO_2 equivalents in 2020 for 1.B.2.b, 1,413.66kt CO_2 equivalents for venting flaring.

The overall trend of greenhouse gas emissions for the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring shows a significant increase of 82.5% for 1.B.2.b, and a decrease of 43.9% for venting and flaring, over the period 1990-2020. However, the period 2005-2020 was characterized by a decreased trends of 56.2% from IPCC category 1.B.2.C natural gas flaring and venting. Over the period 2019-2020 for 1.B.2.b there was a decrease of 6.1%compared an increase of 20.9% for venting and flaring.

The most important gas in the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring is CH_4 with a part of 98.2% in 2020 emissions for 1.B.2.b. 13.0% for venting and flaring, CH_4 emissions are mainly the result of leakage from the different stages of natural gas production.

In the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring, CO_2 emissions account for 1.8% of the 2020 emissions for 1.B.2.b and 86.7% for venting and flaring, CO_2 emissions are mainly the result of flaring during natural gas production and processing activities.

N_2O is only a minor source in the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring, with a part of 0.3% in 2020 emissions from venting and flaring.

Fugitive CO_2 emissions from IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring amounted to 222.56 kt for 1.B.2.b and 2,182.80 Kt for venting and flaring in 1990, 396.33 kt for 1.B.2.b and 2,800.75 Kt for venting and flaring in 2005 and 374.02 kt for 1.B.2.b and 1,225.61 Kt for venting and flaring in 2020.

The overall trend of CO_2 emissions for the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring shows a significant increase of 68.1% for 1.B.2.b, and a decrease of 43.9% for venting and flaring, over the period 1990-2020. However, the period 2005-2020 was characterized by a decreased trends of 56.2% from IPCC category 1.B.2.c natural gas flaring and venting. Over the period 2019-2020 for 1.B.2.b there was a decrease of 5.7% compared to an increase of 20.9% for venting and flaring.

Fugitive CH_4 emissions from IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring amounted to 444.25Kt for 1.B.2.b, 13.10Kt for venting and flaring in 1990, 783.95 Kt for 1.B.2.b, 16.80Kt for venting and flaring in 2005 and 811.98Kt for 1.B.2.b, 7.35 Kt for venting and flaring in 2020.

The overall trend of CH_4 emissions for the IPCC category 1.B.2.b natural gas and 1.b.2.c venting and flaring shows a significant increase of 82.8% for 1.B.2.b, and a decrease of 43.9% for venting and flaring, over the period 1990-2020. However, the period 2005-2020 was characterized by a decreased trends of 56.2% from IPCC category 1.B.2.c natural gas flaring and venting. Over the period 2019-2020 for 1.B.2.b there was a decrease of 6.1% compared to an increase of 20.9% for venting and flaring.

Fugitive N_2O emissions from IPCC category 1.b.2.c venting and flaring were 0.025kt in 1990. 0.032kt in 2005 and 0.014kt in 2020.

The overall trend of N_2O emissions from IPCC category 1.b.2.c venting and flaring shows a significant decrease of 43.9% over the period 1990-2020 for venting and flaring. However, the peak in GHG emissions was reached in 2014, Since 2014, N_2O emissions from IPCC category 1.b.2.c natural gas venting and flaring have decreased by 69.9%. In the period 2019-2020, N_2O emissions increased by 20.9% for venting and flaring.

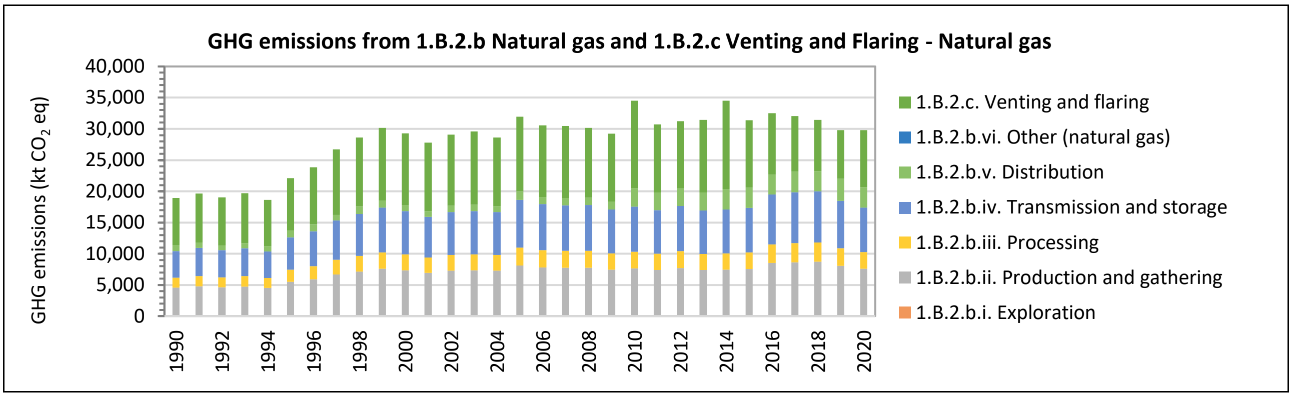


Figure 131 GHG emissions from IPCC category 1.B.2.b Natural gas

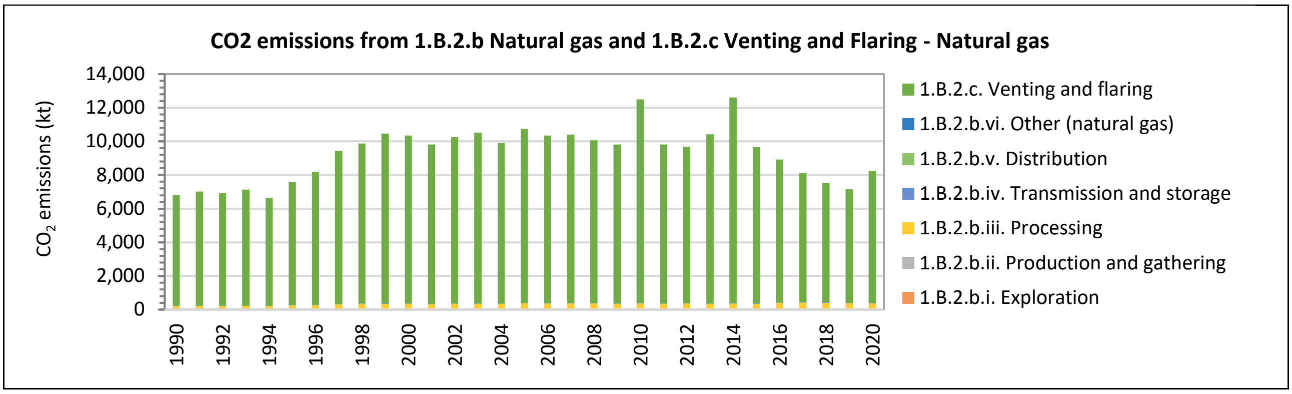


Figure 132 CO_2 emissions from IPCC category 1.B.2.b Natural gas

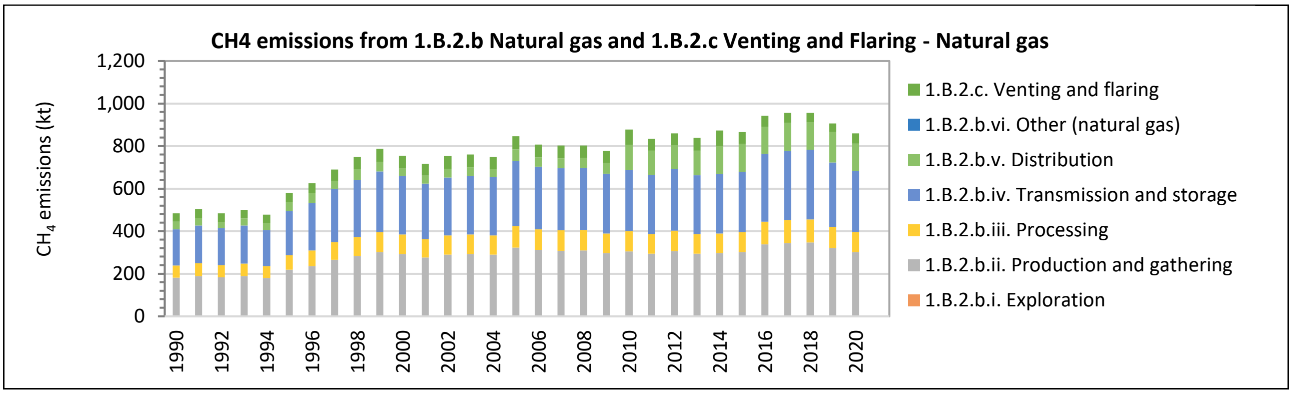


Figure 133 CH_4 emissions from IPCC category 1.B.2.b Natural gas

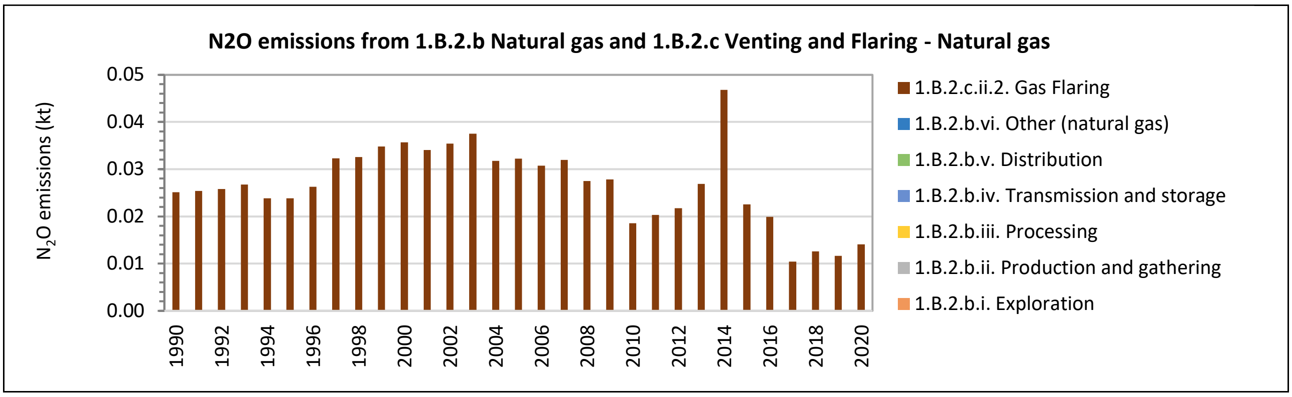


Figure 134 N_2O emissions from IPCC category 1.B.2.b Natural gas

Table 351Fugitive emissions of GHG from IPCC category 1.B.2.b Natural gas

GHG	1.B.2.b.	1.B.2.b.i.	1.B.2.b.ii.	1.B.2.b.iii.	1.B.2.b.iv.	1.B.2.b.v.	1.B.2.b.vi.	1.B.2.c.i.2.	1.B.2.c.ii.2.
	Leaks							Venting and flaring	
	Natural gas	Exploration	Production and gathering	Processing	Transmission and storage	Distribution	Other	Venting – Natural gas	Flaring - Natural gas
	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq	kt CO_2 eq
1990	11,328.85	NA	4,557.43	1,598.23	4,287.62	885.57	NE	IE	2,517.70
1991	11,785.39	NA	4,761.46	1,669.78	4,479.49	874.66	NE	IE	2,548.53
1992	11,298.80	NA	4,613.61	1,617.93	4,340.45	726.81	NE	IE	2,586.81
1993	11,721.99	NA	4,756.96	1,668.20	4,475.26	821.58	NE	IE	2,680.96
1994	11,204.54	NA	4,518.29	1,584.50	4,250.82	850.93	NE	IE	2,390.80
1995	13,683.52	NA	5,502.58	1,929.68	5,176.45	1,074.81	NE	IE	2,390.16
1996	14,734.44	NA	5,927.66	2,078.75	5,577.09	1,150.95	NE	IE	2,631.77
1997	16,214.83	NA	6,688.65	2,345.62	6,292.73	887.84	NE	IE	3,239.71
1998	17,611.97	NA	7,143.16	2,505.01	6,720.15	1,243.66	NE	IE	3,267.58
1999	18,533.88	NA	7,582.49	2,659.07	7,133.30	1,159.02	NE	IE	3,490.31
2000	17,731.60	NA	7,355.37	2,579.43	6,919.71	877.10	NE	IE	3,580.35
2001	16,849.27	NA	6,945.48	2,435.68	6,534.25	933.86	NE	IE	3,414.91
2002	17,685.20	NA	7,274.35	2,551.01	6,843.52	1,016.31	NE	IE	3,553.51
2003	17,850.80	NA	7,352.84	2,578.54	6,917.33	1,002.09	NE	IE	3,761.46
2004	17,620.79	NA	7,280.05	2,553.01	6,849.77	937.95	NE	IE	3,185.63
2005	19,995.01	NA	8,117.63	2,846.74	7,637.44	1,393.20	NE	IE	3,230.46
2006	19,067.66	NA	7,831.15	2,746.28	7,368.03	1,122.21	NE	IE	3,080.05
2007	18,922.62	NA	7,750.26	2,717.91	7,291.96	1,162.49	NE	IE	3,203.49
2008	18,978.67	NA	7,769.99	2,724.83	7,310.52	1,173.32	NE	IE	2,756.62
2009	18,360.03	NA	7,466.38	2,618.36	7,025.88	1,249.40	NE	IE	2,788.09
2010	20,516.49	NA	7,654.80	2,684.43	7,203.08	2,974.17	NE	IE	1,863.95
2011	19,816.47	NA	7,407.53	2,597.72	6,970.54	2,840.68	NE	IE	2,035.22
2012	20,487.43	NA	7,707.78	2,703.01	7,252.90	2,823.73	NE	IE	2,179.01
2013	19,821.61	NA	7,383.02	2,589.12	6,947.49	2,901.99	NE	IE	2,695.00
2014	20,369.51	NA	7,460.58	2,616.32	7,021.31	3,271.30	NE	IE	4,694.21
2015	20,637.15	NA	7,575.90	2,656.76	7,129.75	3,274.73	NE	IE	2,263.40
2016	22,682.65	NA	8,504.72	2,982.49	8,003.23	3,192.20	NE	IE	1,998.84
2017	23,172.54	NA	8,652.08	3,034.16	8,141.81	3,344.49	NE	IE	1,043.42
2018	23,242.14	NA	8,729.86	3,061.44	8,214.96	3,235.88	NE	IE	1,265.66
2019	22,022.99	NA	8,059.52	2,826.36	7,584.56	3,552.56	NE	IE	1,168.88
2020	20,673.46	NA	7,597.38	2,664.30	7,149.96	3,261.82	NE	IE	1,413.66
Trend									
1990 – 2020	82.5%	NA	66.7 %	66.7 %	66.8 %	268.3 %	*NA*	*NA*	-43.9%
2005 – 2020	3.4%	NA	— 6.4 %	— 6.4 %	— 6.4 %	134.1 %	*NA*	*NA*	-56.2%
2019 - 2020	-6.1%	NA	— 5.7 %	— 5.7 %	— 5.7 %	—8.2 %	*NA*	*NA*	20.9%

Table 352Fugitive emissions of CO_2 from IPCC category 1.B.2.b Natural gas

CO_2	**1.B.2.b.**	**1.B.2.b.i.**	**1.B.2.b.ii.**	**1.B.2.b.iii.**	**1.B.2.b.iv.**	**1.B.2.b.v.**	**1.B.2.b.vi.**	**1.B.2.c.i.2.**	**1.B.2.c.ii.2.**
	leaks								
	Natural gas	**Exploration**	**Production and gathering**	**Processing**	**Transmission and storage**	**Distribution**	**Other**	**Venting – Natural gas**	**Flaring - Natural gas**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	222.56	NA	22.95	186.23	12.29	1.10	NE	IE	2,182.80
1991	232.44	NA	23.98	194.57	12.81	1.09	NE	IE	2,209.53
1992	225.09	NA	23.23	188.53	12.43	0.90	NE	IE	2,242.72
1993	232.16	NA	23.95	194.38	12.80	1.02	NE	IE	2,324.34
1994	220.62	NA	22.75	184.63	12.19	1.06	NE	IE	2,072.78
1995	268.61	NA	27.71	224.85	14.71	1.33	NE	IE	2,072.22
1996	289.60	NA	29.85	242.22	16.10	1.43	NE	IE	2,281.69
1997	326.15	NA	33.68	273.32	18.05	1.10	NE	IE	2,808.77
1998	348.62	NA	35.97	291.89	19.22	1.54	NE	IE	2,832.93
1999	369.81	NA	38.18	309.84	20.35	1.44	NE	IE	3,026.04
2000	358.45	NA	37.04	300.56	19.76	1.09	NE	IE	3,104.10
2001	338.66	NA	34.97	283.81	18.71	1.16	NE	IE	2,960.67
2002	354.70	NA	36.63	297.25	19.55	1.26	NE	IE	3,080.83
2003	358.48	NA	37.02	300.46	19.76	1.24	NE	IE	3,261.12
2004	355.17	NA	36.66	297.49	19.86	1.16	NE	IE	2,761.89
2005	396.33	NA	40.87	331.71	22.01	1.73	NE	IE	2,800.75
2006	382.11	NA	39.43	320.01	21.28	1.39	NE	IE	2,670.35
2007	378.24	NA	39.03	316.70	21.07	1.44	NE	IE	2,777.36
2008	379.21	NA	39.12	317.51	21.12	1.46	NE	IE	2,389.94
2009	364.88	NA	37.60	305.10	20.63	1.55	NE	IE	2,417.22
2010	376.15	NA	38.54	312.80	21.12	3.69	NE	IE	1,616.01
2011	364.00	NA	37.30	302.70	20.48	3.53	NE	IE	1,764.50
2012	378.53	NA	38.81	314.96	21.25	3.51	NE	IE	1,889.17
2013	362.89	NA	37.18	301.69	20.42	3.60	NE	IE	2,336.51
2014	367.40	NA	37.57	304.86	20.91	4.06	NE	IE	4,069.79
2015	372.99	NA	38.15	309.57	21.20	4.07	NE	IE	1,962.32
2016	417.91	NA	42.82	347.53	23.59	3.96	NE	IE	1,732.96
2017	425.24	NA	43.57	353.55	23.97	4.15	NE	IE	904.63
2018	428.87	NA	43.96	356.73	24.17	4.02	NE	IE	1,097.31
2019	396.78	NA	40.58	329.34	22.45	4.41	NE	IE	1,013.40
2020	374.02	NA	38.26	310.45	21.26	4.05	NE	IE	1,225.61
Trend									
1990 – 2020	68.0%	NA	66.7%	66.7%	73.0%	268.3%	*NA*	NA	-43.9%
2005 – 2020	-5.6%	NA	-6.4%	-6.4%	-3.4%	134.1%	*NA*	NA	-56.2%
2019 - 2020	-5.7%	NA	-5.7%	-5.7%	-5.3%	-8.2%	*NA*	NA	20.9%

Table 353Fugitive emissions of CH_4 from IPCC category 1.B.2.b Natural gas

CH_4	**1.B.2.b.**	**1.B.2.b.i.**	**1.B.2.b.ii.**	**1.B.2.b.iii.**	**1.B.2.b.iv.**	**1.B.2.b.v.**	**1.B.2.b.vi.**	**1.B.2.c.i.2.**	**1.B.2.c.ii.2.**
	leaks								
	Natural gas	**Exploration**	**Production and gathering**	**Processing**	**Transmission and storage**	**Distribution**	**Other**	**Venting – Natural gas**	**Flaring - Natural gas**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	444.25	NA	181.38	56.48	171.01	35.38	NE	IE	13.10
1991	462.12	NA	189.50	59.01	178.67	34.94	NE	IE	13.26
1992	442.95	NA	183.62	57.18	173.12	29.04	NE	IE	13.46
1993	459.59	NA	189.32	58.95	178.50	32.82	NE	IE	13.95
1994	439.36	NA	179.82	55.99	169.55	34.00	NE	IE	12.44
1995	536.60	NA	218.99	68.19	206.47	42.94	NE	IE	12.43
1996	577.79	NA	235.91	73.46	222.44	45.98	NE	IE	13.69
1997	635.55	NA	266.20	82.89	250.99	35.47	NE	IE	16.85
1998	690.53	NA	284.29	88.52	268.04	49.68	NE	IE	17.00
1999	726.56	NA	301.77	93.97	284.52	46.30	NE	IE	18.16
2000	694.93	NA	292.73	91.15	276.00	35.04	NE	IE	18.62
2001	660.42	NA	276.42	86.07	260.62	37.31	NE	IE	17.76
2002	693.22	NA	289.51	90.15	272.96	40.60	NE	IE	18.48
2003	699.69	NA	292.63	91.12	275.90	40.03	NE	IE	19.57
2004	690.62	NA	289.74	90.22	273.20	37.47	NE	IE	16.57
2005	783.95	NA	323.07	100.60	304.62	55.66	NE	IE	16.80
2006	747.42	NA	311.67	97.05	293.87	44.83	NE	IE	16.02
2007	741.78	NA	308.45	96.05	290.84	46.44	NE	IE	16.66
2008	743.98	NA	309.23	96.29	291.58	46.87	NE	IE	14.34
2009	719.81	NA	297.15	92.53	280.21	49.91	NE	IE	14.50
2010	805.61	NA	304.65	94.87	287.28	118.82	NE	IE	9.70
2011	778.10	NA	294.81	91.80	278.00	113.49	NE	IE	10.59
2012	804.36	NA	306.76	95.52	289.27	112.81	NE	IE	11.33
2013	778.35	NA	293.83	91.50	277.08	115.94	NE	IE	14.02
2014	800.08	NA	296.92	92.46	280.02	130.69	NE	IE	24.42
2015	810.57	NA	301.51	93.89	284.34	130.83	NE	IE	11.77
2016	890.59	NA	338.48	105.40	319.19	127.53	NE	IE	10.40
2017	909.89	NA	344.34	107.22	324.71	133.61	NE	IE	5.43
2018	912.53	NA	347.44	108.19	327.63	129.27	NE	IE	6.58
2019	865.05	NA	320.76	99.88	302.48	141.93	NE	IE	6.08
2020	811.98	NA	302.37	94.15	285.15	130.31	NE	IE	7.35
Trend									
1990 – 2020	82.8%	NA	66.7%	66.7%	66.7%	268.3%	*NA*	NA	-43.9%
2005 – 2020	3.6%	NA	-6.4%	-6.4%	-6.4%	134.1%	*NA*	NA	-56.2%
2019 - 2020	-6.1%	NA	-5.7%	-5.7%	-5.7%	-8.2%	*NA*	NA	20.9%

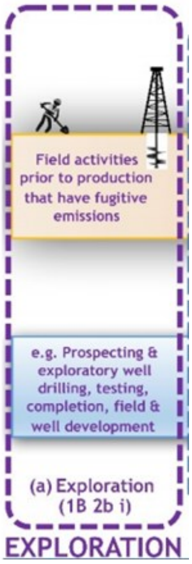
Table 354Fugitive emissions of N_2O from IPCC category 1.B.2.b Natural gas

N_2O	1.B.2.b.	1.B.2.b.i.	1.B.2.b.ii.	1.B.2.b.iii.	1.B.2.b.iv.	1.B.2.b.v.	1.B.2.b.vi.	1.B.2.c.i.2.	1.B.2.c.ii.2.
	leaks								
	Natural gas	Exploration	Production and gathering	Processing	Transmission and storage	Distribution	Other	Venting – Natural gas	Flaring - Natural gas
	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	NA	NA	NA	NA	NA	NA	NA	NA	0.0251
1991	NA	NA	NA	NA	NA	NA	NA	NA	0.0254
1992	NA	NA	NA	NA	NA	NA	NA	NA	0.0258
1993	NA	NA	NA	NA	NA	NA	NA	NA	0.0267
1994	NA	NA	NA	NA	NA	NA	NA	NA	0.0238
1995	NA	NA	NA	NA	NA	NA	NA	NA	0.0238
1996	NA	NA	NA	NA	NA	NA	NA	NA	0.0262
1997	NA	NA	NA	NA	NA	NA	NA	NA	0.0323
1998	NA	NA	NA	NA	NA	NA	NA	NA	0.0326
1999	NA	NA	NA	NA	NA	NA	NA	NA	0.0348
2000	NA	NA	NA	NA	NA	NA	NA	NA	0.0357
2001	NA	NA	NA	NA	NA	NA	NA	NA	0.0340
2002	NA	NA	NA	NA	NA	NA	NA	NA	0.0354
2003	NA	NA	NA	NA	NA	NA	NA	NA	0.0375
2004	NA	NA	NA	NA	NA	NA	NA	NA	0.0318
2005	NA	NA	NA	NA	NA	NA	NA	NA	0.0322
2006	NA	NA	NA	NA	NA	NA	NA	NA	0.0307
2007	NA	NA	NA	NA	NA	NA	NA	NA	0.0319
2008	NA	NA	NA	NA	NA	NA	NA	NA	0.0275
2009	NA	NA	NA	NA	NA	NA	NA	NA	0.0278
2010	NA	NA	NA	NA	NA	NA	NA	NA	0.0186
2011	NA	NA	NA	NA	NA	NA	NA	NA	0.0203
2012	NA	NA	NA	NA	NA	NA	NA	NA	0.0217
2013	NA	NA	NA	NA	NA	NA	NA	NA	0.0269
2014	NA	NA	NA	NA	NA	NA	NA	NA	0.0468
2015	NA	NA	NA	NA	NA	NA	NA	NA	0.0226
2016	NA	NA	NA	NA	NA	NA	NA	NA	0.0199
2017	NA	NA	NA	NA	NA	NA	NA	NA	0.0104
2018	NA	NA	NA	NA	NA	NA	NA	NA	0.0126
2019	NA	NA	NA	NA	NA	NA	NA	NA	0.0117
2020	NA	NA	NA	NA	NA	NA	NA	NA	0.0141
Trend									
1990 – 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	-43.9%
2005 – 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	-56.2%
2019 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	20.9%

Table 355Fugitive emissions of NMVOC from IPCC category 1.B.2.b Natural gas

NMVOC	**1.B.2.b.**	**1.B.2.b.i.**	**1.B.2.b.ii.**	**1.B.2.b.iii.**	**1.B.2.b.iv.**	**1.B.2.b.v.**	**1.B.2.b.vi.**	**1.B.2.c.i.2.**	**1.B.2.c.ii.2.**
	leaks								
	Natural gas	**Exploration**	**Production and gathering**	**Processing**	**Transmission and storage**	**Distribution**	**Other**	**Venting – Natural gas**	**Flaring - Natural gas**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	46.859	NA	39.180	4.636	2.544	0.500	NA	0.433	0.004
1991	48.865	NA	40.934	4.780	2.658	0.494	NA	0.453	0.005
1992	47.188	NA	39.663	4.540	2.575	0.410	NA	0.439	0.004
1993	49.543	NA	40.895	5.529	2.656	0.464	NA	0.452	0.005
1994	47.802	NA	38.843	5.956	2.522	0.480	NA	0.429	0.004
1995	57.704	NA	47.305	6.721	3.072	0.606	NA	0.523	0.005
1996	62.096	NA	50.959	7.178	3.309	0.649	NA	0.563	0.006
1997	69.356	NA	57.502	7.619	3.734	0.501	NA	0.636	0.006
1998	73.489	NA	61.409	7.391	3.988	0.702	NA	0.679	0.007
1999	77.052	NA	65.186	6.979	4.233	0.654	NA	0.721	0.007
2000	75.144	NA	63.233	7.309	4.106	0.495	NA	0.699	0.007
2001	71.502	NA	59.710	7.388	3.877	0.527	NA	0.660	0.007
2002	74.486	NA	62.537	7.315	4.061	0.573	NA	0.691	0.007
2003	76.038	NA	63.212	8.157	4.105	0.565	NA	0.699	0.007
2004	75.048	NA	62.586	7.869	4.064	0.529	NA	0.692	0.007
2005	82.892	NA	69.786	7.788	4.532	0.786	NA	0.772	0.008
2006	80.136	NA	67.324	7.808	4.372	0.633	NA	0.744	0.008
2007	79.113	NA	66.628	7.502	4.327	0.656	NA	0.737	0.007
2008	79.489	NA	66.798	7.692	4.338	0.662	NA	0.739	0.007
2009	76.504	NA	64.188	7.443	4.168	0.705	NA	0.710	0.007
2010	79.504	NA	65.808	7.745	4.273	1.678	NA	0.728	0.007
2011	76.839	NA	63.682	7.419	4.135	1.603	NA	0.704	0.007
2012	79.656	NA	66.263	7.497	4.303	1.593	NA	0.733	0.007
2013	76.843	NA	63.471	7.612	4.121	1.638	NA	0.702	0.007
2014	78.694	NA	64.138	8.546	4.165	1.846	NA	0.709	0.007
2015	79.900	NA	65.129	8.694	4.229	1.848	NA	0.720	0.007
2016	88.435	NA	73.114	8.772	4.748	1.801	NA	0.808	0.008
2017	89.197	NA	74.381	8.098	4.830	1.887	NA	0.822	0.008
2018	89.383	NA	75.050	7.634	4.873	1.826	NA	0.830	0.008
2019	75.791	NA	69.287	0.000	4.499	2.005	NA	0.766	0.008
2020	71.396	NA	65.314	0.000	4.241	1.841	NA	0.722	0.007
Trend									
1990 – 2020	*52.4 %*	*NA*	*66.7 %*	*−100.0 %*	*66.7 %*	*268.3 %*	*NA*	*66.7 %*	*66.7 %*
2005 – 2020	*−13.9 %*	*NA*	*− 6.4 %*	*−100.0 %*	*− 6.4 %*	*134.1 %*	*NA*	*− 6.4 %*	*− 6.4 %*
2019 - 2020	*− 5.8 %*	*NA*	*− 5.7 %*	*NA*	*− 5.7 %*	*−8.2 %*	*NA*	*− 5.7 %*	*− 5.7 %*

3.3.2.4.1 Fugitive emissions from Natural gas exploration (IPCC category 1.B.2.b.i)



According to the 2019 IPCC Refinements to the 2006 IPCC GL[379] the segment *Natural gas Exploration* includes fugitive emissions, including equipment leaks, venting and flaring from gas field activities prior to production. It must be noted that the GHG emissions from IPCC category 1.B.2.c.i natural gas venting and flaring were included in IPCC category 1.B.2.a.ii Oil production and upgrading for the whole period (1990 – 2020). In addition, Natural gas exploration (IPCC category 1.B.2.b.i) does not generate fugitive emissions in the form of leaks.

- geological and geophysical surveys and tests.
- prospecting and exploratory well drilling.
- well/drill stem testing.
- field development and well development
    - construction/drilling.
    - testing, well completion.
    - any fracture stimulation

Note: Unlike the guidance of the 2006 IPCC GL, in this segment, factors are not disaggregated to drilling, testing and servicing operation; EFs are applied to the whole segment.

In the following figure an overview of the active rigs and completed well in Algeria is provided.

The following table provides an overview of occurring activities in Algeria.

Table 356 Activities of segment Natural gas Exploration occurring in Algeria

	Occurring			**Not occurring (NO)**
	Estimated	**Included elsewhere (IE)**	**Not estimated (NE)**	
Onshore				
• Onshore conventional Gas exploration		x		
• Onshore unconventional gas exploration without flaring or gas capture				x
• Onshore unconventional gas exploration with flaring or gas capture				x
Note: Unconventional gas exploration refers to exploration that includes well completions with hydraulic fracturing. Conventional gas exploration emission factors refers to exploration where hydraulic fracturing well completion practices are not used.				

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[379] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.48

3.3.2.4.2 Fugitive emissions from Natural gas production (IPCC category 1.B.2.b.ii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[380] the segment *Natural gas production* includes fugitive emissions from onshore production, including equipment leaks, venting and flaring, from the gas wellhead through to the inlet of gas processing plants, or, where processing is not required, to the tie-in points on gas transmission systems. In the production stage, wells are used to withdraw raw gas from underground formations. Leaks emissions are estimated for natural gas production. However, It must be noted that the GHG emissions from IPCC category 1.B.2.c.ii natural gas venting and flaring were included in IPCC category 1.B.2.a.ii Oil production and upgrading for the whole period (1990 – 2020).

- wells themselves (e.g., as wellhead leaks and from well workovers and refractures).
- well-site equipment such as pneumatic controllers, dehydrators, and separators.
- gathering and boosting stations (with multiple emission sources on site, such as compressors, pneumatic controllers and tanks)
- gathering pipelines.

The following table provides an overview of occurring activities in Algeria.

Table 357 Activities of segment Natural gas production occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
Onshore oil production				
• Onshore: Most activities occurring with <u>higher</u>-emitting technologies and practices	x[381]	x[382]		
• Onshore: Most activities occurring with <u>lower</u>-emitting technologies and practices	X[381]	X[382]		
• Onshore Coal Bed Methane				x
• Gathering	X[381]	X[382]		
Offshore oil production				x

In the following figures and table, the fugitive emissions (leaks) of CH_4, CO2, N_2O and NMVOC from the segment *Natural gas production* (IPCC category 1.B.2.b.ii) are provided.

This section describes the emissions from IPCC category 1.B.2.b.ii Natural gas production and provides an overview of fugitive emissions (leaks) in the following figures and tables.

Fugitive GHG emissions from IPCC category 1.B.2.b.ii Natural gas production amounted to 4,557.52kt CO_2 equivalent in 1990. 8,117.79kt CO_2 equivalent in 2005 and 7,597.53kt CO_2 equivalent in 2020.

The overall trend of greenhouse gas emissions in IPCC category 1.B.2.b.ii Natural gas production shows a

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[380] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.68

[381] Leaks emissions are estimated and reported separately for natural gas production.

[382] Venting and flaring are estimated and reported under oil production fugitive emissions.

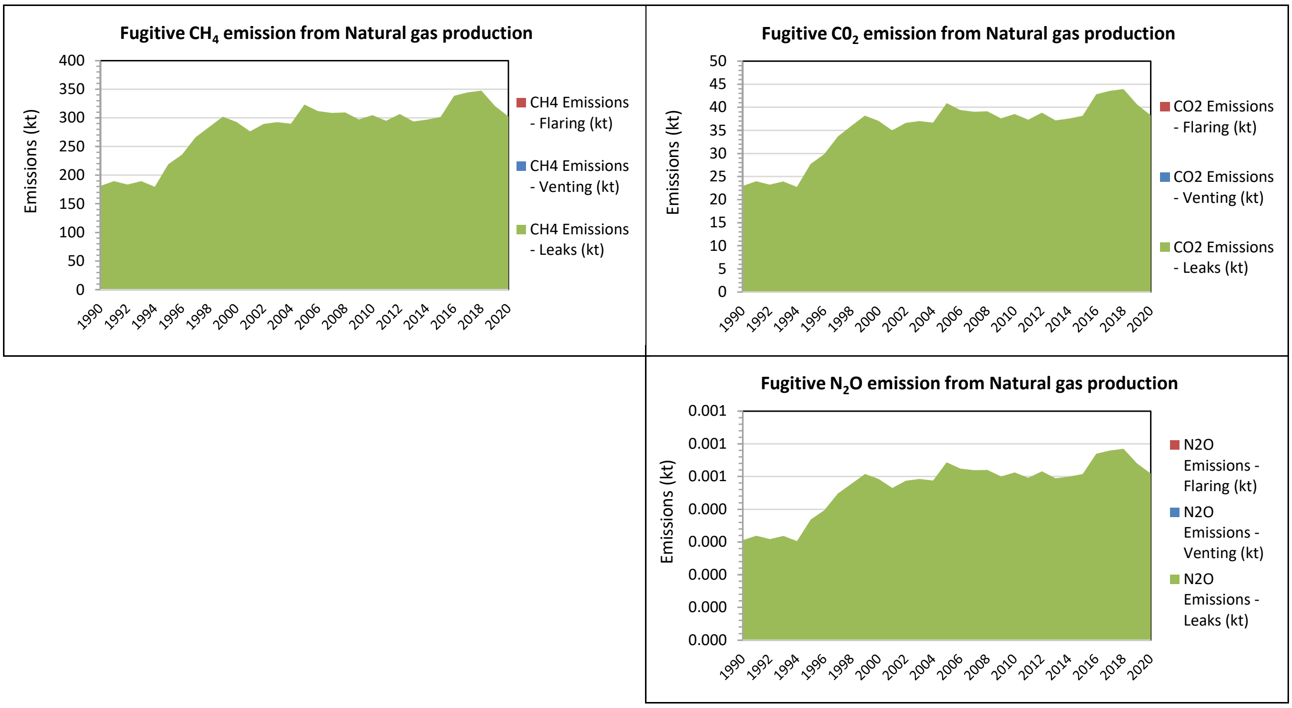
significant increase of 66.7% over the period 1990-2020. However, the peak in GHG emissions was reached in 2018. Since 2018, GHG emissions from IPCC category 1.B.2.b.ii Natural gas production have decreased by 13.0% . In the period 2019-2020, GHG emissions decreased by 5.7%.

The most important gas in IPCC category 1.B.2.b.ii Natural gas production is CH_4 with a part of 99.50% of 2020 emissions, CH_4 emissions are mainly the result of leakage during gas production.

In the IPCC category 1.B.2.a.ii Natural gas production, CO_2 emissions have a part of 0.5% in the 2020 emissions, CO_2 emissions are mainly the result of leakage.

The overall trend of CO_2 emissions in IPCC category 1.B.2.b.ii Natural gas production shows a significant increase of 66.7% over the period 1990-2020. However, the peak of CO_2 emissions was reached in 2018. Since 2018, CO_2 emissions from IPCC category 1.B.2.b.ii Natural gas production have decreased by 13%. In the period 2019-2020, CO_2 emissions decreased by 5.7%.

The overall trend of CH_4 emissions in IPCC category 1.B.2.b.ii Natural gas production shows a significant increase of 66.7% over the period 1990-2020. However, the peak of CH_4 emissions was reached in 2018. Since 2018, CH_4 emissions from IPCC category 1.B.2.b.ii Natural gas production have decreased by 13%. In the period 2019-2020, CH_4 emissions decreased by 5.7%.



Fugitive CH_4 emission from Natural gas production

Fugitive $C0_2$ emission from Natural gas production

Fugitive N_2O emission from Natural gas production

Figure 135 Fugitive emission of CH_4, CO_2 and N_2O from IPCC category 1.B.2.b.ii Natural gas production

Table 358Fugitive emissions of CH_4, CO_2 and N_2O emissions from Natural gas production (IPCC category 1.B.2.b.ii)

	Fugitive emissions from IPCC category (according to reporting rules)												
	1.B.2.b.ii leaks - Natural gas production					**1.B.2.c.i.1 Venting - Natural gas production**				**1.B.2.c.ii.1 Flaring - Natural gas production**			
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**				**kt**				**kt**			
1990	4,557.52	181.38	22.95	43.63	NA	IE	IE	IE	IE	IE	IE	NA	IE
1991	4,761.56	189.50	23.98	45.58	NA	IE	IE	IE	IE	IE	IE	NA	IE
1992	4,613.70	183.62	23.23	44.17	NA	IE	IE	IE	IE	IE	IE	NA	IE
1993	4,757.05	189.32	23.95	45.54	NA	IE	IE	IE	IE	IE	IE	NA	IE
1994	4,518.38	179.82	22.75	43.25	NA	IE	IE	IE	IE	IE	IE	NA	IE
1995	5,502.69	218.99	27.71	52.68	NA	IE	IE	IE	IE	IE	IE	NA	IE
1996	5,927.78	235.91	29.85	56.75	NA	IE	IE	IE	IE	IE	IE	NA	IE
1997	6,688.78	266.20	33.68	64.03	NA	IE	IE	IE	IE	IE	IE	NA	IE
1998	7,143.30	284.29	35.97	68.38	NA	IE	IE	IE	IE	IE	IE	NA	IE
1999	7,582.64	301.77	38.18	72.59	NA	IE	IE	IE	IE	IE	IE	NA	IE
2000	7,355.51	292.73	37.04	70.41	NA	IE	IE	IE	IE	IE	IE	NA	IE
2001	6,945.61	276.42	34.97	66.49	NA	IE	IE	IE	IE	IE	IE	NA	IE
2002	7,274.49	289.51	36.63	69.64	NA	IE	IE	IE	IE	IE	IE	NA	IE
2003	7,352.98	292.63	37.02	70.39	NA	IE	IE	IE	IE	IE	IE	NA	IE
2004	7,280.20	289.74	36.66	69.69	NA	IE	IE	IE	IE	IE	IE	NA	IE
2005	8,117.79	323.07	40.87	77.71	NA	IE	IE	IE	IE	IE	IE	NA	IE
2006	7,831.31	311.67	39.43	74.97	NA	IE	IE	IE	IE	IE	IE	NA	IE
2007	7,750.41	308.45	39.03	74.20	NA	IE	IE	IE	IE	IE	IE	NA	IE
2008	7,770.15	309.23	39.12	74.38	NA	IE	IE	IE	IE	IE	IE	NA	IE
2009	7,466.53	297.15	37.60	71.48	NA	IE	IE	IE	IE	IE	IE	NA	IE
2010	7,654.96	304.65	38.54	73.28	NA	IE	IE	IE	IE	IE	IE	NA	IE
2011	7,407.68	294.81	37.30	70.91	NA	IE	IE	IE	IE	IE	IE	NA	IE
2012	7,707.94	306.76	38.81	73.79	NA	IE	IE	IE	IE	IE	IE	NA	IE
2013	7,383.17	293.83	37.18	70.68	NA	IE	IE	IE	IE	IE	IE	NA	IE
2014	7,460.73	296.92	37.57	71.42	NA	IE	IE	IE	IE	IE	IE	NA	IE
2015	7,576.05	301.51	38.15	72.53	NA	IE	IE	IE	IE	IE	IE	NA	IE
2016	8,504.89	338.48	42.82	81.42	NA	IE	IE	IE	IE	IE	IE	NA	IE
2017	8,652.25	344.34	43.57	82.83	NA	IE	IE	IE	IE	IE	IE	NA	IE
2018	8,730.04	347.44	43.96	83.57	NA	IE	IE	IE	IE	IE	IE	NA	IE
2019	8,059.68	320.76	40.58	77.16	NA	IE	IE	IE	IE	IE	IE	NA	IE
2020	7,597.53	302.37	38.26	72.73	NA	IE	IE	IE	IE	IE	IE	NA	IE
Trend													
1990 – 2020	*66.7%*	*66.7%*	*66.7%*	*66.7%*	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 – 2020	*-6.4%*	*-6.4%*	*-6.4%*	*-6.4%*	NA	NA	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	*-5.7%*	*-5.7%*	*-5.7%*	*-5.7%*	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.

3.3.2.4.2.1 Choice of method

For estimating fugitive emissions (leaks) of CH4, CO2, N2O and NMVOC from IPCC category 1.B.2.b.ii Natural gas production, the Tier 1 method according to 2019 Refinements to 2006 IPCC GL has been applied.
For estimating emissions from venting and flaring of CH4, CO2 and N2O from IPCC category 1.B.2.b.ii Natural gas production, the Tier 1 method according to 2006 IPCC GL has been applied.

Equation 4.2.14 (new) General equation for estimating fugitive emissions from Natural gas production and gathering

(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\begin{aligned}\boldsymbol{Emissions_{Natural\ gas\ production}} &= \boldsymbol{AD_{Natural\ gas\ production} * EF_{leaks}}\\ &+ \boldsymbol{AD_{Natural\ gas\ production} * EF_{venting}}\\ &+ \boldsymbol{AD_{Natural\ gas\ production} * EF_{flaring}}\\ &+ \boldsymbol{AD_{gathering} * EF_{gathering}}\end{aligned}$$

Where:

$\text{Emissions}_{\text{Natural gas production}}$ = emissions of CH_4, CO_2, NMVOC and N_2O from Natural gas production activities
$\text{AD}_{\text{Natural gas production}}$ = activity data on exploration of conventional natural gas
$\text{EF}_{\text{leaks/venting/flaringl}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from leaks, venting and flaring from natural gas production
$\text{AD}_{\text{Natural gas production}}$ = activity data on exploration of conventional natural gas
$\text{EF}_{\text{leaks/venting/flaringl}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from gathering of natural gas

Note: In Algeria, there are no activities related coal bed production or offshore natural gas production. *Therefore*, *this part of the formula is omitted.*

3.3.2.4.2.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of thousand cubic meters onshore natural gas production. Production data of natural gas were used for estimating the fugitive emissions of CH_4, CO_2, N_2O and NMVOC for the years. Volumes of flared gas from IPCC category 1.B.2.b.ii Natural gas production activities for the period 2010 -2020 have been used to calculate greenhouse gas emissions from venting and flaring IPCC category 1.B.2.c.ii Natural gas production.

- 1990 - 2009 are taken from the Energy balance provided by MEM and UN statistics[383] .
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[384].

It is necessary to clarify that Activity data used to estimate emissions of venting and flaring from IPCC category 1.B.2.b.ii Natural gas production were provided by the MEM for the period between 2010-2020.

For the period 1990 – 2009, missing data of venting and flaring volumes have been completed by using a ratio of flaring and venting volumes to natural gas production of the times series 2010 -2020 applied to the period 1990 -2009 to generate flaring and venting volumes based on annual natural gas production.

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[383] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[384] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 359Activity data for Natural gas production (IPCC category 1.B.2.b.ii)

Activity data	**Natural gas (including LNG)**		
	TJ (gross)	**TJ (net)**	***10^6* m^3**
1990	2,013.176	1,811.858	50.883
1991	2,103.304	1,892.974	53.161
1992	2,037.992	1,834.193	51.510
1993	2,101.314	1,891.183	53.110
1994	1,995.888	1,796.299	50.446
1995	2,430.683	2.187.615	61.435
1996	2,618.456	2,356.610	66.181
1997	2,954.611	2,659.150	74.677
1998	3,155.383	2,839.845	79.752
1999	3,349.452	3,014.507	84.657
2000	3,249.123	2,924.211	82.121
2001	3,068.060	2,761.254	77.545
2002	3,213.335	2,892.001	81.217
2003	3,248.006	2,923.205	82.093
2004	3,215.856	2,894.270	81.280
2005	3,585.843	3,227.259	90.632
2006	3,459.294	3,113.364	87.433
2007	3,423.561	3,081.205	86.530
2008	3,432.279	3,089.051	86.750
2009	3,298.164	2,968.348	83.361
2010	3,381.396	3043.256	85.464
2011	3,272.168	2,944.951	82.704
2012	3,404.799	3,064.319	86.056
2013	3,261.338	2,935.205	82.430
2014	3,295.600	2,966.040	83.296
2015	3,346.539	3,011.885	84.583
2016	3,756.835	3,381.151	94.953
2017	3,821.927	3,439.734	96.599
2018	3,856.287	3,470.659	97.467
2019	3,560.172	3,204.155	89.983
2020	3,356.031	3,020.428	84.823
Trend			
1990 – 2020			*66.7%*
2005 – 2020			*-6.4%*
2019 - 2020			*-5.7%*

The data are provided in Chapter 3.3.2.4.1 and **Erreur ! Source du renvoi introuvable.**, respectively, above and Table 359.

3.3.2.4.2.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2019 Refinement to the 2006 IPCC GL[385] were applied. According to personal communication with national stakeholders, it was assumed that each 50% of the production of natural gas was carried out with

- lower-emitting technologies and practices, and
- higher-emitting technologies and practices.

Table 360 TIER 1 emission factors for natural gas production and gathering, and disaggregation of TIER 1 EF

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Onshore: Most activities occurring with higher- emitting technologies and practices	**TIER 1 Emission factors natural gas production and gathering**						
	All	4.09	1.45	0.98	0.000025	Tonnes/million cubic meters onshore gas production	Table 4.2.4A (new)
	Disaggregation of TIER 1 emission factors for natural gas production and gathering						
	Leaks	11%	4%	11%	0%	%	Table 4A.2.5 (new)
	Vents	89%	31%	89%	0%		
	Flares	0%	65%	0%	100%		
	Disaggregated TIER 1 emission factors for natural gas production and gathering						
	Leaks	0.45	0.06	0.11	NA	Tonnes/million cubic meters onshore gas production	Calculated
	Vents	3.6401	0.4495	0.8722	NA		
	Flares	NA	0.9425	NA	0.000025		

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[385] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

Sub-segment	Emission source	CH_4	CO_2	NMVOC	N_2O	Units	Source
Onshore: Most activities occurring with lower-emitting technologies and practices	**TIER 1 Emission factors for gas production and gathering**						
	All	2.54	3.60	0.61	0.000061	Tonnes/million cubic meters onshore gas production	Table 4.2.4G (new)
	Disaggregation of TIER 1 emission factors for gas production and gathering						
	Leaks	11%	4%	11%	0%	%	Table 4A.2.5 (new)
	Vents	89%	31%	89%	0%		
	Flares	0%	65%	0%	100%		
	Disaggregated TIER 1 emission factors for gas production and gathering						
	Leaks	0.28	0.14	0.07	NA	Tonnes/million cubic meters onshore gas production	Calculated
	Vents	2.26	1.12	0.54	NA		
	Flares	NA	2.34	NA	0.000061		
Gathering	**TIER 1 Emission factors for gathering activities**						
	All	3.20	0.35	0.77	0.000006	Tonnes/million cubic meters onshore gas production	Table 4.2.4G (new)
	TIER 1 emission factors for venting and flaring gas production and gathering						
	venting and flaring	0.012	2.0	-	0.000023	Tons/thousand cubic meters onshore oil production	Calculated
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor and Annex 4A.2 Disaggregation of Tier 1 factors presented in Section 4.2.2.3 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor TABLE 4.2.4(CONTINUED) tier 1 emission factors for fugitive emissions (including venting and flaring) from oil and gas operations in developed countries a,b							

3.3.2.4.2.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category *1.B.2.b.ii Natural gas production and gathering* are presented in the following table.

Table 361Uncertainty for IPCC category 1.B.2.b.ii Natural Gas production and gathering.

Uncertainty	Oil exploration				Reference
	CO_2	CH_4	NMVOC	N_2O	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. vol. 2Chapter 4.2
Emission factor (EF)	28%	28%	261%	1000%	Table 4.2.4G (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	30%	30%	261%	1000%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.4.2.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
    - consistent use of energy balance data,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- cross-checked with 2006 IPCC default values
- time series consistency - plausibility checks of dips and jumps.

3.3.2.4.2.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category *1.B.2.b.ii Natural Gas production and gathering*.

Table 362Recalculations done since NC in IPCC category *1.B.2.b.ii* Natural Gas production and gathering

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.ii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.b.ii	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2 Application of reporting guidance for leaks venting and flaring	AD	Completeness Comparability Transparency

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.4.2.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective developments presented in following table will be explored.

Table 363Planned improvements for IPCC category *1.B.2.b.ii* Natural Gas production and gathering

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.b.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.ii	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.ii	Preparation of data set related to active well population	AD	Transparency Accuracy	medium
1.B.2.b.ii	Investigation on share of activities occurring with lower-emitting or higher-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.b.ii	Use of activity data from installation: amount of gas vented and flared	AD	Accuracy	medium

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.4.3 Fugitive emissions from Natural gas processing (IPCC category 1.B.2.b.iii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[386] the segment *Natural gas processing* includes fugitive emissions from gas processing facilities, including equipment leaks venting and flaring. It must be important to clarify that for the IPCC category 1.B.2.b.iii, the 2006 IPCC GL were used to estimate GHG emissions from venting and flaring.

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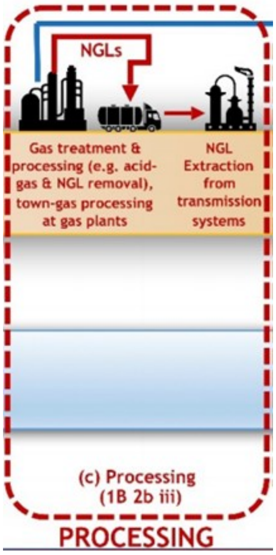

During natural gas processing natural gas liquids (NGLs) and various other constituents from the raw gas are removed resulting in "pipeline quality" gas which is injected into the transmission system.

Fugitive emission sources include:

- compressors.
- equipment leaks.
- pneumatic controllers.
- uncombusted gas from engines and flaring and
- CO_2 from flaring and sour gas removal.

Fugitive emissions from equipment leaks are not estimated but it planned to completeness. under this category, emissions from only natural gas liquification are estimated.

The following table provides an overview of occurring technological segment in Algeria.

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[386] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.68

Table 364 Technological segment of Natural gas processing occurring in Algeria.

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
• Without LDAR or with limited LDAR or less than 50% of centrifugal compressors have dry seals	x			
• Extensive LDAR and around 50% or more of centrifugal compressors have dry seals	x			
• Sour gas (acid gas removal)				

In the following figures and table, the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Natural gas processing* (IPCC category 1.B.2.b.iii) are provided.
This section describes the emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing and provides an overview of fugitive emissions in the following figures and tables.

Fugitive GHG emissions from IPCC category 1.B.2.c venting and flaring from Natural gas processing amounted to 2,517.70 kt CO_2 equivalent in 1990, 3,230.46 kt CO_2 equivalent in 2005 and 1,413.66kt CO_2 equivalent in 2020.

The overall trend of greenhouse gas emissions in IPCC category 1.B.2.c. venting and flaring from Natural gas processing shows a significant decrease of 43.9% over the period 1990-2020. However, the peak in GHG emissions was reached in 2014. Since 2014, GHG emissions from IPCC category 1.B.2.c venting and flaring from Natural gas processing have decreased by 69.9%. over the period 2019-2020 the trend increased by 20.9%.

The most important gas in IPCC category IPCC category 1.B.2.c. venting and flaring from Natural gas processing is CO_2 with a part of 86.7% of 2020 emissions. CO_2 emissions are mainly the result of venting and flaring during gas processing.

In IPCC category IPCC category 1.B.2.c. venting and flaring from Natural gas processing CH_4 emissions account for 13.0% of the 2020 emissions. CH_4 emissions are mainly the result of venting and flaring during gas processing.

Fugitive CO_2 emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing amounted to 2182.80 kt in 1990, 2800.75 kt in 2005 and 1225.61kt in 2020.
The overall trend of CO_2emissions in IPCC category 1.B.2.c. venting and flaring from Natural gas processing shows a significant decrease of 43.9% over the period 1990-2020. However, the peak in CO_2 emissions was reached in 2014. Since 2014, CO_2 emissions from IPCC category 1.B.2.c venting and flaring from Natural gas processing have decreased by 69.9%. over the period 2019-2020 the trend increased by 20.9%.
Fugitive CH_4 emissions from IPCC category 1.B.2.a.iii Natural gas processing amounted to 13.10kt in 1990. 16.80kt in 2005 and 7.35kt in 2020.
The overall trend of CH_4 emissions in IPCC category 1.B.2.c. venting and flaring from Natural gas processing shows a significant decrease of 43.9% over the period 1990-2020. However, the peak in CH_4 emissions was reached in 2014. Since 2014, CH_4 emissions from IPCC category 1.B.2.c venting and flaring from Natural gas processing have decreased by 69.9%. over the period 2019-2020 the trend increased by 20.9%.

Fugitive N_2O emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing amounted to 0.025kt in 1990. 0.032kt in 2005 and 0.014kt in 2020.

The overall trend of N_2O emissions in IPCC category 1.B.2.c. venting and flaring from Natural gas processing shows a significant decrease of 43.9% over the period 1990-2020. However, the peak in N_2O emissions was reached in 2014. Since 2014, N_2O emissions from IPCC category 1.B.2.c venting and flaring from Natural gas processing have decreased by 69.9%. over the period 2019-2020 the trend increased by 20.9%.

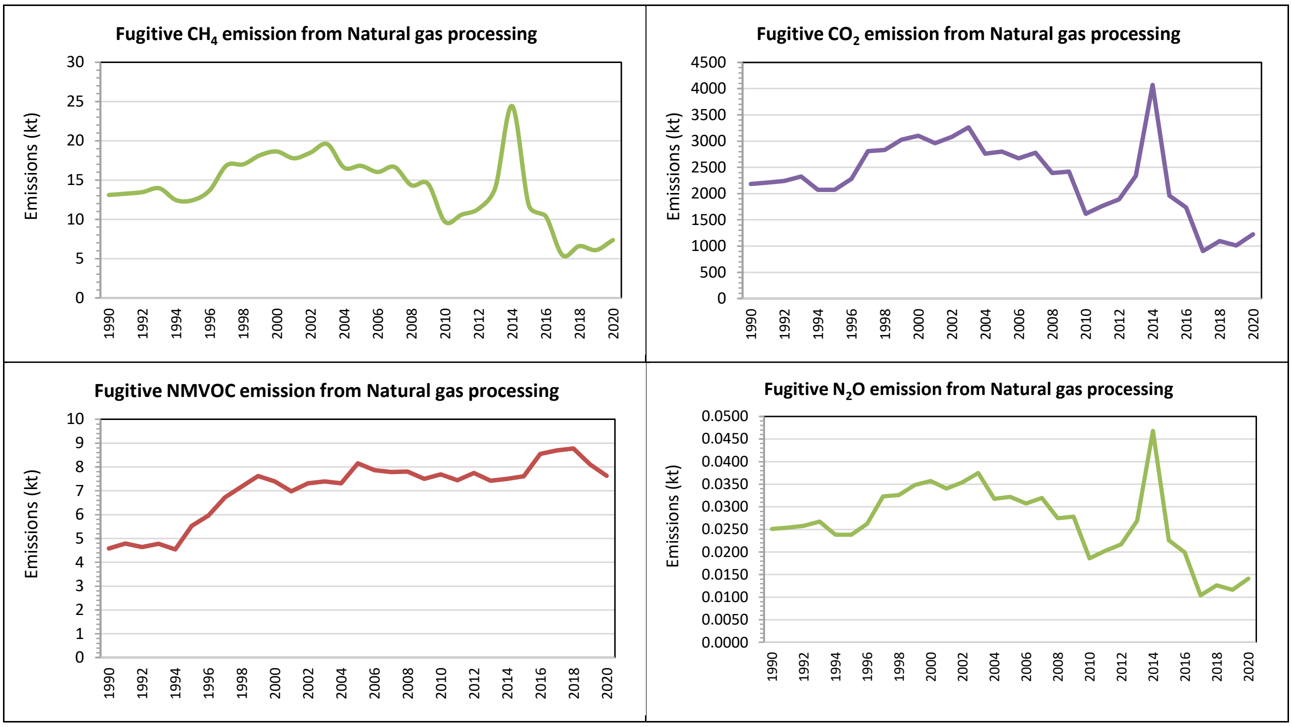

Figure 136 Fugitive emission of CH_4, CO_2, N_2O and NMVOC from IPCC category 1.B.2.c. venting and flaring from Natural gas processing.

Table 365 Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing (LNG).

	Fugitive emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing (LNG).				
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**			
1990	2,517.70	13.10	2182.80	4.58	0.025
1991	2,548.53	13.26	2209.53	4.78	0.025
1992	2,586.81	13.46	2242.72	4.64	0.026
1993	2,680.96	13.95	2324.34	4.78	0.027
1994	2,390.80	12.44	2072.78	4.54	0.024
1995	2,390.16	12.43	2072.22	5.53	0.024
1996	2,631.77	13.69	2281.69	5.96	0.026
1997	3,239.71	16.85	2808.77	6.72	0.032
1998	3,267.58	17.00	2832.93	7.18	0.033
1999	3,490.31	18.16	3026.04	7.62	0.035
2000	3,580.35	18.62	3104.10	7.39	0.036
2001	3,414.91	17.76	2960.67	6.98	0.034
2002	3,553.51	18.48	3080.83	7.31	0.035

	Fugitive emissions from IPCC category 1.B.2.c. venting and flaring from Natural gas processing (LNG).				
	GHG	CH_4	CO_2	NMVOC	N_2O
	kt CO_2 eq	kt			
2003	3,761.46	19.57	3261.12	7.39	0.038
2004	3,185.63	16.57	2761.89	7.32	0.032
2005	3,230.46	16.80	2800.75	8.16	0.032
2006	3,080.05	16.02	2670.35	7.87	0.031
2007	3,203.49	16.66	2777.36	7.79	0.032
2008	2,756.62	14.34	2389.94	7.81	0.027
2009	2,788.09	14.50	2417.22	7.50	0.028
2010	1,863.95	9.70	1616.01	7.69	0.019
2011	2,035.22	10.59	1764.50	7.44	0.020
2012	2,179.01	11.33	1889.17	7.75	0.022
2013	2,695.00	14.02	2336.51	7.42	0.027
2014	4,694.21	24.42	4069.79	7.50	0.047
2015	2,263.40	11.77	1962.32	7.61	0.023
2016	1,998.84	10.40	1732.96	8.55	0.020
2017	1,043.42	5.43	904.63	8.69	0.010
2018	1,265.66	6.58	1097.31	8.77	0.013
2019	1,168.88	6.08	1013.40	8.10	0.012
2020	1,413.66	7.35	1225.61	7.63	0.014
Trend					
1990 – 2020	*-43.9%*	*-43.9%*	*-43.9%*	*66.7%*	*-43.9%*
2005 – 2020	*-56.2%*	*-56.2%*	*-56.2%*	*-6.4%*	*-56.2%*
2019 - 2020	*20.9%*	*20.9%*	*20.9%*	*-5.7%*	*20.9%*

Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.

3.3.2.4.3.1.1 Choice of method

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from Natural gas processing activities the Tier 1 method according to 2006 IPCC GL[387] has been applied. Fugitive emissions include emissions from venting and Flaring.

Equation 4.2.14 (new) General equation for estimating fugitive emissions from gas processing

(2006 IPCC GL. Vol. 2. Chap. 4)

$$\boldsymbol{Emissions}_{\boldsymbol{Natural\ gas\ processing}} = \boldsymbol{AD}_{\boldsymbol{Natural\ gas\ processing}} * \boldsymbol{EF}_{\boldsymbol{All}}$$

$$+\boldsymbol{AD}_{\boldsymbol{Sour\ gas\ processed}} * \boldsymbol{EF}_{\boldsymbol{Sour\ gas\ processed}}$$

Where:

Emissions$_{\text{Natural gas processing}}$ = emissions of CH_4, CO_2, NMVOC and N_2O from Natural gas processing activities

AD$_{\text{Natural gas processing}}$ = activity data on volume of natural gas processed or produced

EF$_{\text{All}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from All (sum of leaks, venting and flaring) from Natural gas processing

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[387] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method. Page 4.72

$AD_{Natural\ gas\ processing}$ = activity data on volume of sour gas processed
$EF_{leaks/venting/flaringl}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from sour gas processing

3.3.2.4.3.1.2 Choice of Activity data (AD)

The emission factors (EF) is related to throughput and presented in the unit of thousand cubic meters onshore natural gas production. Production data of natural gas were used for estimating the fugitive emissions of NMVOC for the years. Volumes of flared gas from IPCC category 1.B.2.b.ii Natural gas production activities for the period 1990 -2020 were used for estimating the fugitive emissions of CH_4, CO_2 and N_2O from venting and flaring IPCC category 1.B.2.c.iii Natural gas processing.

- 1990 - 2020 are taken from the Energy balance provided by UN statistics[388] for and from Algeria
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[389].

It is necessary to clarify that Activity data used to estimate emissions of venting and flaring from natural gas processing were provided by the MEM for the period between 2010-2020.

For the period 1990 – 2009, missing data of venting and flaring volumes have been completed by using a ratio of flaring and venting volumes to gas production of the times series 2010 -2020 applied to the period 1990 -2009 to generate flaring and venting volumes based on annual natural gas production

The data are provided in Chapter 3.3.2.4.1 and **Erreur ! Source du renvoi introuvable.**. respectively. and Table 359 above.

3.3.2.4.3.1.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2019 Refinement to the 2006 IPCC GL[390] were applied. According to personal communication with national oil and gas stakeholders in Algeria, it was assumed that each 50% of the production of natural gas was carried out

- without LDAR[391], or with limited LDAR, or less than 50% of centrifugal compressors have dry seals
- with extensive LDAR, and around 50% or more of centrifugal compressors have dry seals.

Table 366 TIER 1 emission factors for Natural gas processing (LNG)

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Sour gas processing	**TIER 1 Emission factors for Natural gas processing**						
	venting and flaring	0.012	2.0	0.13	0.000023	Tonnes/million cubic meters gas produced	Table 4.2.4H (new)
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor							

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[388] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[389] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

[390] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

[391] LDAR - leak detection and repair practices

3.3.2.4.3.1.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category 1.B.2.b.iii *Natural gas processing* are presented in the following table.

Table 367Uncertainty for IPCC category 1.B.2.b.iii Natural gas processing (LNG).

Uncertainty	**Oil exploration**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. Vol. 2. Chapter 4.2
Emission factor (EF)	14%	14%	261%	1000%	Table 4.2.4H (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	17%	17%	261%	1000%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.4.3.1.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
    - consistent use of energy balance data,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- cross-checked with 2006 IPCC default values
- time series consistency - plausibility checks of dips and jumps.

3.3.2.4.3.1.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.B.2.b.iii *Natural gas processing*.

Table 368Recalculations done since NC in IPCC category 1.B.2.b.iii Natural gas processing (LNG)

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness

Source category	Revisions of data	Type of revision	Type of improvement
1.B.2.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.ii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
Note	*AD* *Activity data*	*EF* *Emission factor*	*M* *Method*

3.3.2.4.3.1.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

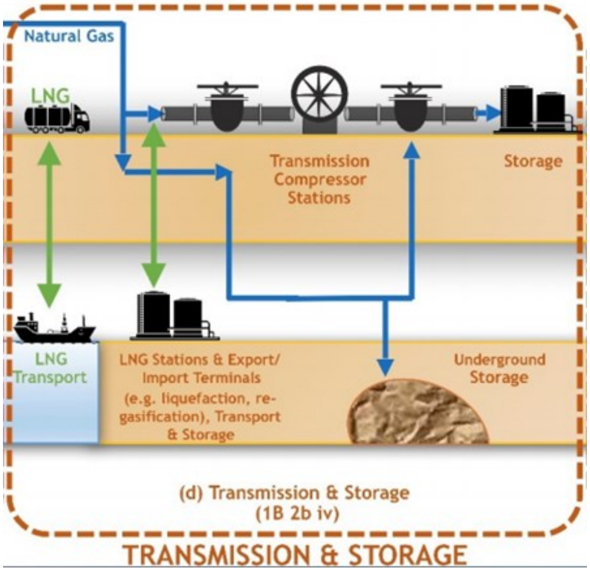
Table 369Planned improvements for IPCC category 1.B.2.b.iii Natural gas processing

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.b.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production and processing of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.iii	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.iii	Data collection to estimate • Fugitives emissions from equipment leaks • Fugitives emissions (leaks, venting and flaring) from natural gas processing	AD	Completeness	high
1.B.2.b.iii	Preparation of data set related to applied technology for natural gas processing	AD	Transparency	medium
1.B.2.b.iii	Estimation of fugitive emissions from sour gas processing Preparation of data set related to sour gas processing	AD	Completeness	high
1.B.2.b.iii	Investigation on share of • most activities occurring with higher- emitting technologies and practices • most activities occurring with lower-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.b.iii	Use of activity data from installation: amount of gas vented and flared	AD	Accuracy	medium
Note	*AD* *Activity data*	*EF* *Emission factor*	*M*	*Method*

3.3.2.4.4 Fugitive emissions from Natural gas Transmission and Storage (IPCC category 1.B.2.b.iv)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[392] the segment *Natural gas Transmission and Storage* includes fugitive emissions from systems used to transport processed natural gas to market (i.e., to industrial consumers and natural gas distribution systems), including natural gas storage systems.

- Natural gas transmission involves high pressure, large diameter pipelines that transport gas long distances from field production and processing areas to distribution systems or large volume customers such as power plants or chemical plants.
- Compressor station facilities are used to move the gas throughout the transmission system.



This source also includes Liquified Natural Gas (LNG) stations and import and export terminals.

The following table provides an overview of occurring activities in Algeria.

Table 370 Activities of segment Natural gas Transmission and Storage occurring in Algeria

	Occurring			**Not occurring (NO)**
	Estimated	**Included elsewhere (IE)**	**Not estimated (NE)**	
• Transmission: Limited LDAR or less than 50% of centrifugal compressors have dry seals	x			
• Transmission: Extensive LDAR, and around 50% or more of centrifugal compressors have dry seals	x			
• Storage: Limited LDAR or most activities occurring with higher- emitting technologies and practices	x			
• Storage: Storage: Extensive LDAR and lower-emitting technologies and practices	x			
• LNG: Import/Export	x			
• LNG: Storage	x			

In the following figures and table, the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Natural gas Transmission and Storage* (IPCC category 1.B.2.b.iv) are provided.

This section describes the emissions from IPCC category 1.B.2.b.iv Transmission and storage and provides an overview of fugitive emissions in the following figures and tables.

Fugitive GHG emissions from IPCC category 1.B.2.b.iv Transmission and storage amounted to 4.287.62 kt CO_2 equivalent in 1990, 7.637.44 kt CO_2 equivalent in 2005 and 7.149.96 kt CO_2 equivalent in 2020.
The overall trend of greenhouse gas emissions in IPCC category 1.B.2.b.iv Transmission and storage shows a

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[392] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.74

significant increase of 66.8% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, which resulted in a downward trend of 6.4% in GHG emissions.

In the period 2019-2020, GHG emissions decreased by 5.7%.

The most important gas in IPCC category 1.B.2.b.iv Transmission and storage is CH_4 with a part of 99.70% of the 2020 emissions, CH_4 emissions are mainly the result of methane leakage during transmission and storage of natural gas.

In IPCC category 1.B.2.b.iv Transmission and storage, CO_2 emissions have a part of 0.30% in 2020 emissions. CO_2 emissions are mainly the result of leakage during transmission and storage of natural gas.

N_2O has not been estimated for IPCC category 1.B.2.b.iv Transmission and storage.

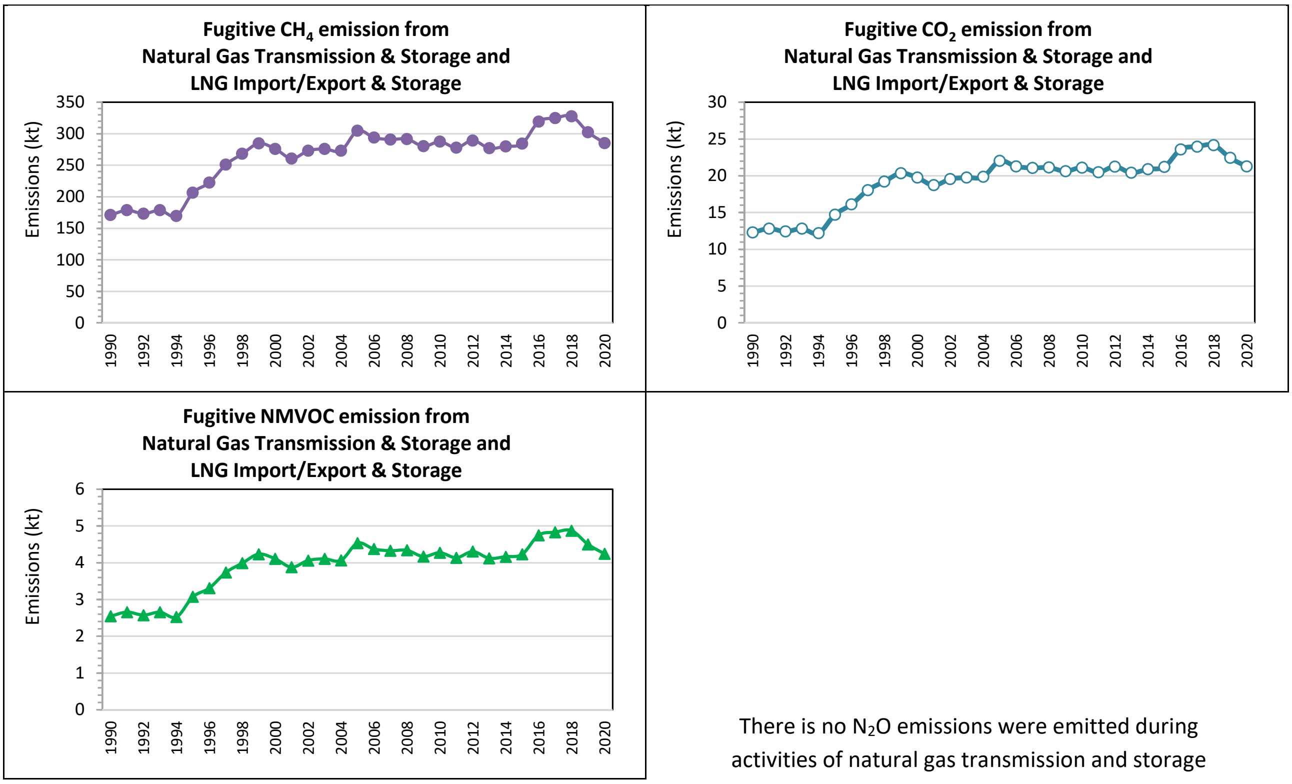
Fugitive CO_2 emissions from IPCC category 1.B.2.b.iv Transmission and storage amounted to 12.29 kt in 1990. 22.01 kt in 2005 and 21.26 kt in 2020.

The overall trend in IPCC 1.B.2.b.iv Transmission and Storage CO_2 emissions from fuels shows a significant increase of 73.0% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005, which resulted in a downward trend of 3.4% in CO_2 emissions. In the period 2019-2020, CO_2 emissions have decreased by 5.3%.

Fugitive CH_4 emissions from IPCC category 1.B.2.b.iv Transmission and storage amounted to 171.01 kt in 1990, 304.62 kt in 2005 and 285.15 kt in 2020.

The overall trend in IPCC category 1.B.2.b.iv Transmission and storage CH_4 emissions shows a significant increase of 66.7% over the period 1990-2020. However, the peak in GHG emissions was reached in 2005, which resulted in a downward trend of 6.4% in CH_4 emissions. In the period 2019-2020, CH_4 emissions decreased by 5.7%.

Fugitive N_2O emissions from IPCC category 1.B.2.b.iv Transmission and storage have not been estimated.



There is no N_2O emissions were emitted during activities of natural gas transmission and storage

Figure 137 Fugitive emission of CH_4, CO_2, N_2O and NMVOC from IPCC category 1.B.2.b.iv Natural gas Transmission and Storage

Table 371Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from Natural gas Transmission and Storage (IPCC category 1.B.2.b.iv)

	Fugitive emissions from IPCC category 1.B.2.a.iv Natural gas Transmission and Storage				
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**			
1990	4,287.62	171.01	12.29	2.54	NA
1991	4,479.49	178.67	12.81	2.66	NA
1992	4,340.45	173.12	12.43	2.58	NA
1993	4,475.26	178.50	12.80	2.66	NA
1994	4,250.82	169.55	12.19	2.52	NA
1995	5,176.45	206.47	14.71	3.07	NA
1996	5,577.09	222.44	16.10	3.31	NA
1997	6,292.73	250.99	18.05	3.73	NA
1998	6,720.15	268.04	19.22	3.99	NA
1999	7,133.30	284.52	20.35	4.23	NA
2000	6,919.71	276.00	19.76	4.11	NA
2001	6,534.25	260.62	18.71	3.88	NA
2002	6,843.52	272.96	19.55	4.06	NA
2003	6,917.33	275.90	19.76	4.10	NA
2004	6,849.77	273.20	19.86	4.06	NA
2005	7,637.44	304.62	22.01	4.53	NA
2006	7,368.03	293.87	21.28	4.37	NA
2007	7,291.96	290.84	21.07	4.33	NA
2008	7,310.52	291.58	21.12	4.34	NA
2009	7,025.88	280.21	20.63	4.17	NA
2010	7,203.08	287.28	21.12	4.27	NA
2011	6,970.54	278.00	20.48	4.14	NA
2012	7,252.90	289.27	21.25	4.30	NA
2013	6,947.49	277.08	20.42	4.12	NA
2014	7,021.31	280.02	20.91	4.16	NA
2015	7,129.75	284.34	21.20	4.23	NA
2016	8,003.23	319.19	23.59	4.75	NA
2017	8,141.81	324.71	23.97	4.83	NA
2018	8,214.96	327.63	24.17	4.87	NA
2019	7,584.56	302.48	22.45	4.50	NA
2020	7,149.96	285.15	21.26	4.24	NA
Trend					
1990 – 2020	*66.8%*	*66.7%*	*66.7%*	*66.7%*	*66.7%*
2005 – 2020	*-6.4%*	*-6.4%*	*-6.4%*	*-6.4%*	*-6.4%*
2019 - 2020	*-5.7%*	*-5.7%*	*-5.7%*	*-5.7%*	*-5.7%*
Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.					

3.3.2.4.4.1 Choice of method

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from Natural gas Transmission and Storage activities the Tier 1 method according to 2019 Refinements to 2006 IPCC GL[393] has been applied. Fugitive emissions include emissions from venting, flaring, and leaks.

Equation 4.2.16 (new) General equation for estimating fugitive emissions from Natural gas transmission and storage
(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\begin{aligned} \boldsymbol{Emissions_{Transmission\ and\ storage}} &= \boldsymbol{AD\_Natural\_gas_{Transmission}} * \boldsymbol{EF_{All\_transmission\_Natural\_gas}} \\ &+ \boldsymbol{AD\_Natural\_gas_{Storage}} * \boldsymbol{EF_{All\_strorage\_Natural\_gas}} \\ &+ \boldsymbol{AD\_LNG_{Import/export}} * \boldsymbol{EF_{All\_Import/export\_LNG}} \\ &+ \boldsymbol{AD\_LNG_{Storage}} * \boldsymbol{EF_{All\_strorage\_LNG}} \end{aligned}$$

Where:

$Emissions_{Transmission\ and\ Storage}$ = emissions of CH_4, CO_2, NMVOC and N_2O from Natural gas Transmission and Storage activities
$AD\_Natural\ gas_{Transmission}$ = activity data on volume of natural gas consumed or length of transmission pipeline
$EF_{All\_\_transmission\_Natural\_gas}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from All (sum of leaks, venting and flaring) of Natural gas transmitted
$AD\_Natural\ gas_{Storage}$ = activity data on volume of natural gas consumed
$EF_{All\_storage\_Natural\_gas}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from All (sum of leaks, venting and flaring) for Natural gas consumed
$AD\_LNG_{Import/export}$ = activity data on number of export/import LNG stations
$EF_{All\_import/export\ \_LNG}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for for LNG imports and exports
$AD\_LNG_{storage}$ = activity data on number of LNG stations
$EF_{All\_storage\_LNG}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for for LNG storage

3.3.2.4.4.2 Choice of Activity data (AD)

The emisson factors (EF) is related to throughput and presented in the unit of thousand cubic meters natural gas transmission and storage. Consumption data of natural gas were used for estimating the fugitive emissions of CH_4, CO_2, N_2O and NMVOC for the years

- 1990 - 2020 are taken from the Energy balance provided by UN statistics[394] for and from Algeria
- 2010 – 2020 are taken from the National Energy balance provided by MEM[395].

The data are provided in Chapter 3.3.2.4.1 and **Erreur ! Source du renvoi introuvable.**. respectively, and Table 359 above.

The number of LNG stations were provided by SONATRACH[396]

Table 372 Number of LNG stations

	1990 - 1995	1995 - 2003	2004 - 2008	2009 - 2013	2014 - 2020

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[393] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method. Page 4.76

[394] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[395] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

LNG stations	2	3	4	5	6

3.3.2.4.4.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2019 Refinement to the 2006 IPCC GL[397] were applied. According to personal communication with national stakeholders, it was assumed that each 50% of the production of natural gas was carried out

- without LDAR[398], or with limited LDAR, or less than 50% of centrifugal compressors have dry seals
- with extensive LDAR, and around 50% or more of centrifugal compressors have dry seals.

Table 373 TIER 1 emission factors for Natural gas Transmission and Storage

Sub-segment	Emission source	CH_4	CO_2	NMVOC	N_2O	Units	Source
Transmission	**TIER 1 Emission factors for Natural gas Transmission**						
Limited LDAR or less than 50% of centrifugal compressors have dry seals	All	3.36	0.23	0.05	NA	Tonnes/ million cubic meter gas consumption	Table 4.2.4I (new)
Extensive LDAR. and around 50% or more of centrifugal compressors have dry seals	All	1.29	0.15	0.02	NA	Tonnes/ million cubic meter gas consumption	
Storage	**TIER 1 Emission factors for Storage**						
Limited LDAR or most activities occurring with higher- emitting technologies and practices	All	*0.67*	*0.06*	*0.0094*	*NA*	Tonnes/ million cubic meter gas consumption	Table 4.2.4I (new)
Extensive LDAR and lower-emitting technologies and practices	All	*0.67*	*0.06*	*0.0094*	*NA*	Tonnes/ million cubic meter gas consumption	
LNG	**TIER 1 Emission factors for LNG import/export and storage**						
Import/Export	All	1.600	14.687	NA	NA	Tonnes/ station	Table 4.2.4I (new)
Storage	All	22	277	NA	NA	Tonnes/ station	
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor							

3.3.2.4.4.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category 1.B.2.b.iv *Natural gas Transmission and Storage* are presented in the following table.

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[397] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

[398] LDAR - leak detection and repair practices

Table 374Uncertainty for IPCC category 1.B.2.b.iv Natural gas Transmission and Storage.

Uncertainty	**Oil exploration**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. Vol. 2. Chapter 4.2
Emission factor (EF)	36%	36%	269%	36%	Table 4.2.4I (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	37%	37%	269%	37%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.4.4.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
    - consistent use of energy balance data,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- cross-checked with 2006 IPCC default values
- time series consistency - plausibility checks of dips and jumps.

3.3.2.4.4.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.B.2.b.iv *Natural gas Transmission and Storage*.

Table 375Recalculations done since NC in IPCC category 1.B.2.b.iv Natural gas Transmission and Storage

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.ii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
Note	*AD* *Activity data* *EF* *Emission factor*	*M*	*Method*

3.3.2.4.4.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

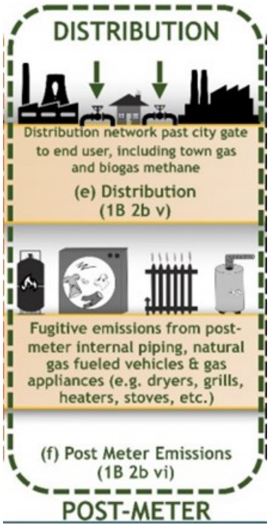
Table 376Planned improvements for IPCC category 1.B.2.b.iv Natural gas Transmission and Storage

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.b.iv	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production and Transmission and Storage of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.iv	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.iv	Preparation of data set related to pipeline length which are in operation	AD	Transparency	high
1.B.2.b.iv	Preparation of data set related to applied equipment and technology for natural gas transmission and storage	AD	Transparency	medium
1.B.2.b.iv	Investigation for transmission and storage on share of • most activities occurring with higher- emitting technologies and practices • most activities occurring with lower-emitting technologies and practices	AD	Accuracy Transparency	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

3.3.2.4.5 Fugitive emissions from Natural gas distribution (IPCC category 1.B.2.b.v)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[399] the segment *Natural gas distribution* includes fugitive emissions from the distribution of natural gas. Distribution pipelines take the high-pressure gas from the transmission system at “city gate” stations, reduce the pressure and distribute the gas through primarily underground mains and service lines to individual end users.



- Emission sources include leaks from pipelines, metering and regulating stations, meters and short-term surface storage.

The following table provides an overview of occurring activities in Algeria.

Table 377 Activities of segment Natural gas distribution occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	**Included elsewhere (IE)**	**Not estimated (NE)**	
• Gas Distribution: Less than 50% plastic pipelines or limited or no leak detection and repair programs	x			
• Gas Distribution: Greater than 50% plastic pipelines and leak detection and repair programs are in use	x			
• Short term surface storage			x	
• Town gas distribution			x	

In the following figures and table the fugitive emissions of CH_4, CO_2, N_2O and NMVOC from the segment *Natural gas distribution* (IPCC category 1.B.2.b.v) are provided.
This section describes the emissions from IPCC category 1.B.2.b.v Natural gas distribution and provides an overview of fugitive emissions in the following figures and tables.

Fugitive GHG emissions from IPCC category 1.B.2.b.v Natural gas distribution amounted to 885.57 kt CO_2 equivalent in 1990, 1.393.20 kt CO_2 equivalent in 2005 and 3.261.82 kt CO_2 equivalent in 2020.
The overall trend of greenhouse gas emissions in IPCC category 1.B.2.b.v Natural gas distribution shows a significant increase of 268.3% over the period 1990-2020. However, the peak of GHG emissions was reached in 2005, which showed an increase of 134.1% in GHG emissions.
In the period 2019-2020, GHG emissions decreased by 8.2%.

The most important gas in IPCC category 1.B.2.b.v Natural gas distribution is CH_4 with a part of 99.88% of 2020 emissions, CH_4 emissions are mainly the result of leakage during natural gas distribution.

In the IPCC category 1.B.2.b.v Natural gas distribution. CO_2 emissions have a part of 0.12% in the 2020 emissions. The CO_2 emissions are mainly the result of leakage during the distribution of natural gas.
N_2O has not been estimated in the IPCC category 1.B.2.b.v Natural gas distribution.
Fugitive CO_2 emissions from IPCC category 1.B.2.b.v Natural gas distribution amounted to 1.10 kt in 1990.

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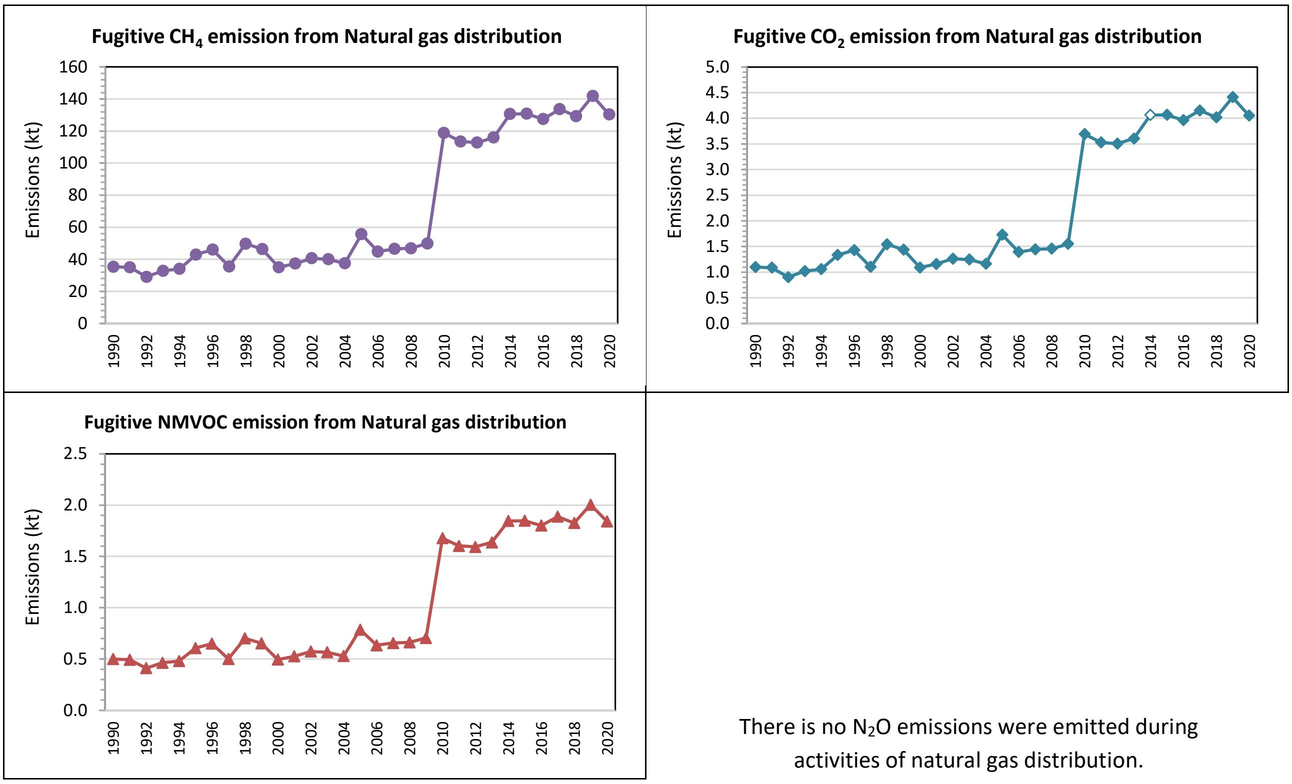
[399] 2019 Refinement to the 2006 IPCC Guidelines, Chapter 4.2.2.3 Choice of emission factor, page 4.74

1.73 kt in 2005 and 4.05 kt in 2020.

The overall trend in CO_2 emissions from IPCC category 1.B.2.b.v Natural gas distribution from fuels shows a significant increase of 268.3% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005 which showed an increase of 134.1% in CO_2 emissions. In the period 2019-2020, CO_2 emissions decreased by 8.2%.

Fugitive CH_4 emissions from IPCC category 1.B.2.b.v Natural gas distribution amounted to 35.38 kt in 1990. 55.66 kt in 2005 and 130.31 kt in 2020.
The overall trend in IPCC category 1.B.2.b.v Natural gas distribution emissions from fuels shows a significant increase of 268.3% over the period 1990-2020. However, the peak in greenhouse gas emissions was reached in 2005, which showed an increase of 134.1% in CH_4 emissions. In the period 2019-2020, CH_4 emissions decreased by 8.2%.



There is no N_2O emissions were emitted during activities of natural gas distribution.

Figure 138 Fugitive emission of CH_4, CO_2, N_2O and NMVOC from IPCC category 1.B.2.b.v Natural gas distribution

Table 378Fugitive emissions of CH_4, CO_2, N_2O and NMVOC emissions from Natural gas distribution (IPCC category 1.B.2.b.v)

	Fugitive emissions from IPCC category 1.B.2.a.v Natural gas distribution				
	GHG	**CH_4**	**CO_2**	**NMVOC**	**N_2O**
	kt CO_2 eq	**kt**			
1990	885.57	35.38	1.10	0.50	NA
1991	874.66	34.94	1.09	0.49	NA
1992	726.81	29.04	0.90	0.41	NA
1993	821.58	32.82	1.02	0.46	NA
1994	850.93	34.00	1.06	0.48	NA
1995	1,074.81	42.94	1.33	0.61	NA
1996	1,150.95	45.98	1.43	0.65	NA
1997	887.84	35.47	1.10	0.50	NA
1998	1,243.66	49.68	1.54	0.70	NA
1999	1,159.02	46.30	1.44	0.65	NA
2000	877.10	35.04	1.09	0.49	NA
2001	933.86	37.31	1.16	0.53	NA
2002	1,016.31	40.60	1.26	0.57	NA
2003	1,002.09	40.03	1.24	0.57	NA
2004	937.95	37.47	1.16	0.53	NA
2005	1,393.20	55.66	1.73	0.79	NA
2006	1,122.21	44.83	1.39	0.63	NA
2007	1,162.49	46.44	1.44	0.66	NA
2008	1,173.32	46.87	1.46	0.66	NA
2009	1,249.40	49.91	1.55	0.71	NA
2010	2,974.17	118.82	3.69	1.68	NA
2011	2,840.68	113.49	3.53	1.60	NA
2012	2,823.73	112.81	3.51	1.59	NA
2013	2,901.99	115.94	3.60	1.64	NA
2014	3,271.30	130.69	4.06	1.85	NA
2015	3,274.73	130.83	4.07	1.85	NA
2016	3,192.20	127.53	3.96	1.80	NA
2017	3,344.49	133.61	4.15	1.89	NA
2018	3,235.88	129.27	4.02	1.83	NA
2019	3,552.56	141.93	4.41	2.00	NA
2020	3,261.82	130.31	4.05	1.84	NA
Trend					
1990 – 2020	*268.3%*	*268.3%*	*268.3%*	*268.3%*	NA
2005 – 2020	*134.1%*	*134.1%*	*134.1%*	*134.1%*	NA
2019 - 2020	*-8.2%*	*-8.2%*	*-8.2%*	*-8.2%*	NA

Note: GHG (kt CO_2 eq) = CO_2 (kt CO_2) + CH_4 (kt CO_2 eq) + N_2O (kt CO_2 eq); NMVOC as precursor is not included.

3.3.2.4.5.1 Choice of method

For estimating fugitive emissions of CH_4, CO_2, N_2O and NMVOC from Natural gas distribution activities the Tier 1 method according to 2019 Refinements to 2006 IPCC GL[400] has been applied. Fugitive emissions include emissions from venting, flaring, and leaks.

Equation 4.2.17 (new) General equation for estimating fugitive emissions from Natural gas distribution
(2019 Refinement to 2006 IPCC GL. Vol. 2. Chap. 4)

$$\begin{aligned}\boldsymbol{Emissions_{distribution}} = {} & \boldsymbol{AD_{gas\ distribution}} * \boldsymbol{EF_{gas\ distribution}} \\ & + \boldsymbol{AD_{surface\ storage}} * \boldsymbol{EF_{surface\ storage}} \\ & + \boldsymbol{AD_{distribution\ of\ town\ gas}} * \boldsymbol{EF_{distribution\ of\ town\ gas}}\end{aligned}$$

Where:

$\text{Emissions}_{\text{Transmission and Storage}}$ = emissions of CH_4, CO_2, NMVOC and N_2O due to all relevant natural gas distribution activities

$\text{AD}_{\text{gas distribution}}$ = activity data on volume of natural gas consumed or length of distribution pipeline

$\text{EF}_{\text{gas distribution}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for fugitive emissions from gas distribution

$\text{AD}_{\text{Surface storage}}$ = activity data on volume of natural gas stored (in surface storage) or consumed

$\text{EF}_{\text{surface storage}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for for surface storage

$\text{AD}_{\text{distribution of town gas}}$ = activity data on length of town gas distribution pipeline

$\text{EF}_{\text{distribution of town gas}}$ = default emission factor of CH_4, CO_2, NMVOC and N_2O for for town gas distribution

3.3.2.4.5.2 Choice of Activity data (AD)

The emisson factors (EF) is related to throughput and presented in the unit of thousand cubic meters natural gas distribution. Consumption data of natural gas were used for estimating the fugitive emissions of CH_4. CO_2. N_2O and NMVOC for the years

- 1990 - 2020 are taken from the Energy balance provided by UN statistics[401] for and from Algeria
- 2010 – 2020 are taken from the National Energy balance prepared by MEM[402].

In the following figure and table, the used activity data are provided.

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[400] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2 Methodological issues - Choice of method. Page 4.76

[401] United Nations - Statistics Division - Energy Statistics: https://unstats.un.org/unsd/energystats/ ; https://unstats.un.org/unsd/energystats/data/

[402] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years
https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

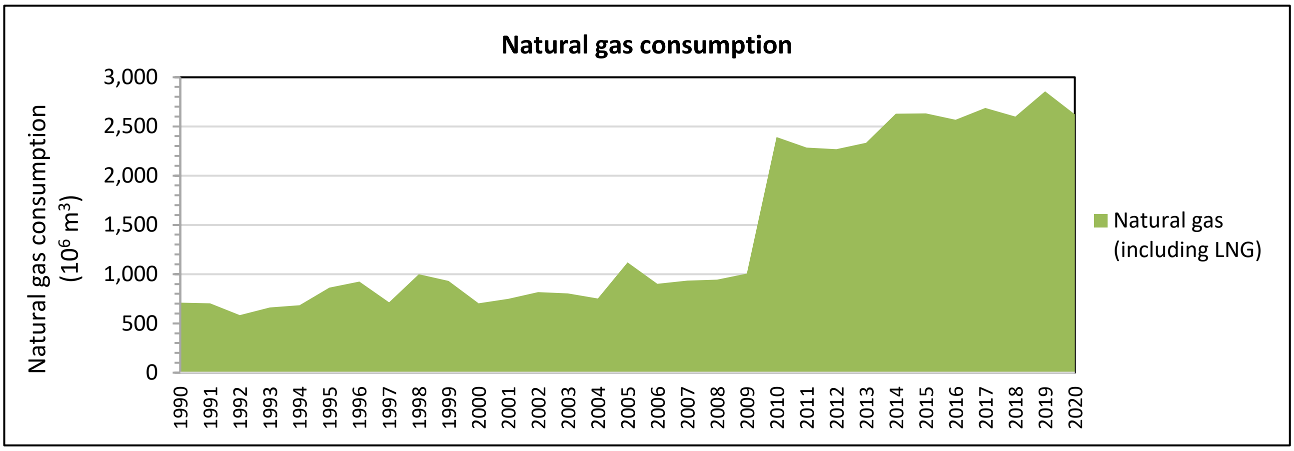

Figure 139 Activity data for Natural gas exploration (IPCC category 1.B.2.b.v)

Table 379Activity data for Natural gas exploration (IPCC category 1.B.2.b.v)

Activity data	**Natural gas (including LNG) consumed**		
	TJ (gross)	**TJ (net)**	***10^6* m^3**
1990	2,013.176	1,811.858	50.883
1991	2,103.304	1,892.974	53.161
1992	2,037.992	1,834.193	51.510
1993	2,101.314	1,891.183	53.110
1994	1,995.888	1,796.299	50.446
1995	2,430.683	2,187.615	61.435
1996	2,618.456	2,356.610	66.181
1997	2,954.611	2,659.150	74.677
1998	3,155.383	2,839.845	79.752
1999	3,349.452	3,014.507	84.657
2000	3,249.123	2,924.211	82.121
2001	3,068.060	2,761.254	77.545
2002	3,213.335	2,892.001	81.217
2003	3,248.006	2,923.205	82.093
2004	3,215.856	2,894.270	81.280
2005	3,585.843	3,227.259	90.632
2006	3,459.294	3,113.364	87.433
2007	3,423.561	3,081.205	86.530
2008	3432.279	3,089.051	86.750
2009	3.298.164	2,968.348	83.361
2010	3,381.396	3,043.256	85.464
2011	3,272.168	2,944.951	82.704
2012	3,404.799	3,064.319	86.056
2013	3,261.338	2,935.205	82.430
2014	3,295.600	2,966.040	83.296
2015	3,346.539	3,011.885	84.583
2016	3,756.835	3,381.151	94.953
2017	3,821.927	3,439.734	96.599
2018	3,856.287	3,470.659	97.467

Activity data	Natural gas (including LNG) consumed		
	TJ (gross)	TJ (net)	*10⁶* m³
2019	3,560.172	3,204.155	89.983
2020	3,356.031	3,020.428	84.823
Trend			
1990 – 2020			*66.7%*
2005 – 2020			*-6.4%*
2019 - 2020			*-5.7%*

The production data in energy statistics are provided in the physical units 10^6 m^3. To convert these data to energy unit, country specific NCV was used which are presented in the following table.

Table 380 Country specific Density and NCV for selected fuels and default data for comparison

Fuel	**Country specific (CS) Density**	**Country specific (CS) NCV**	**For comparison**	
			Average Density	**IPCC default NCV**
	kt / 10^6m^3	**TJ/kt**	**kt / 10^6m^3**	**TJ/kt**
Natural gas (including LNG)	-	39.565 * 0.9 = 35.609	-	48.0
Conversion from GCV to NCV			**Default**	
Natural gas			1 NCV = 0.9 x GCV	
Source	CS Density	MEM (20##) Please provide Source		
	CS Gross Caloric Value (GCV)	Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés. Annex 3.[403]		
	Default Net Calorific values (NCVs)	2006 IPCC Guidelines. Vol. 2. Chap. 1 (1.4.1.3). Table 1.2		
	Conversion from GCV to NCV	International Recommendations for 150 Energy Statistics (IRES) (2018) [404]: Table 4 Difference between net and gross calorific values for selected fuels		
Note:				
D Default	CS Country specific	PS Plant specific		

3.3.2.4.5.3 Choice of Emission factor (EF)

The following Tier 1 emission factors of the 2019 Refinement to the 2006 IPCC GL[405] were applied. According to personal communication with national stakeholders, its was assumed that each 50% of the production of natural gas was carried out

- less than 50% plastic pipelines, or limited or no leak detection and repair programs
- greater than 50% plastic pipelines and leak detection and repair programs are in use.

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[403] Décision n°271 du 27 décembre 2012 fixant les unités des mesure et taux de conversion utilisés en matière des reporting et de circulation de l'information statistitique dans le secteur de l'energie et des mines.

[404] https://unstats.un.org/unsd/energystats/methodology/ires/

[405] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Fugitive Emissions - 4.2.2.3 Choice of emission factor.

Table 381 TIER 1 emission factors for Natural gas distribution

Sub-segment	**Emission source**	**CH_4**	**CO_2**	**NMVOC**	**N_2O**	**Units**	**Source**
Gas Distribution	**TIER 1 Emission factors for Natural gas distribution**						
Less than 50% plastic pipelines. or limited or no leak detection and repair programs	All	2.92	0.09	0.04	NA	Tonnes/ million cubic meter gas consumption	Table 4.2.4J (new)
Greater than 50% plastic pipelines. and leak detection and repair programs are in use	All	0.62	0.02	0.01	NA	Tonnes/ million cubic meter gas consumption	
Source: 2019 Refinement to the 2006 IPCC GL. Volume 2. Chapter 4.2.2.3 Choice of emission factor							

3.3.2.4.5.4 Uncertainty assessment and time-series consistency

The time-series are considered to be consistent as the same methodology is applied to the whole period. Activity data are considered to be almost consistent as two data sets were used. The data set from UN statistics are official data from and for Algeria.

The uncertainties for activity data and emission factors used for IPCC category 1.B.2.b.v *Natural gas distribution* are presented in the following table.

Table 382Uncertainty for IPCC category 1.B.2.b.v Natural gas distribution.

Uncertainty	**Oil exploration**				**Reference**
	CO_2	**CH_4**	**NMVOC**	**N_2O**	
Activity data (AD)	10%	10%	10%	10%	2006 IPCC GL. Vol. 2. Chapter 4.2
Emission factor (EF)	122%	122%	500%	NA	Table 4.2.4J (new); 2019 Refinement to the 2006 IPCC GL. Chapter 4.2.2.3
Combined Uncertainty (U)	122%	122%	500%	NA	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

3.3.2.4.5.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Consistent use of definition of fuel
- Checked of calculations by spreadsheets
  - consistent use of energy balance data,
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control/visual checks for data consistency through all steps of calculation.
- cross-checked from different sources: Energy statistics of MEM, national statistics of ONS, international energy statistics of UN, IEA, JODI, OPEC
- cross-checked with 2006 IPCC default values
- time series consistency - plausibility checks of dips and jumps.

3.3.2.4.5.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 1.B.2.b.v *Natural gas distribution*.

Table 383 Recalculations done since NC in IPCC category 1.B.2.b.v Natural gas distribution

Source category	**Revisions of data**	**Type of revision**	**Type of improvement**
1.B.2.b.v	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.v	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.v	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness

Note *AD* *Activity data* *EF* *Emission factor* *M* *Method*

3.3.2.4.5.7 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 384 Planned improvements for IPCC category 1.B.2.b.v Natural gas distribution

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
1.B.2.b.v	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: gas distribution of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.v	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.v	Preparation of data set related to pipeline length which are in operation	AD	Transparency	high
1.B.2.b.v	Preparation of data set related to applied equipment, technology and material for natural gas distribution	AD	Transparency	medium
1.B.2.b.v	Investigation for gas distribution on share of • less than 50% plastic pipelines or limited or no leak detection and repair programs • greater than 50% plastic pipelines and leak detection and repair programs are in use	AD	Accuracy Transparency	high
1.B.2.b.v	Investigation regarding short term surface storage	AD	Accuracy Transparency	high
1.B.2.b.v	Investigation regarding town gas distribution	AD	Accuracy	high

GHG source & sink category	Planned improvement	Type of improvement		Priority
			Transparency	

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*	

3.3.2.4.6 Fugitive emissions from Post-Meter (IPCC category 1.B.2.b.vi)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[406] the segment *Post-Meter* includes fugitive emissions beyond

- gas meters and from internal piping and the end of pipe appliances (e.g., home heating, water heating, stoves, barbecues).
- natural gas-fueled vehicles.

The following table provides an overview of occurring activities in Algeria.

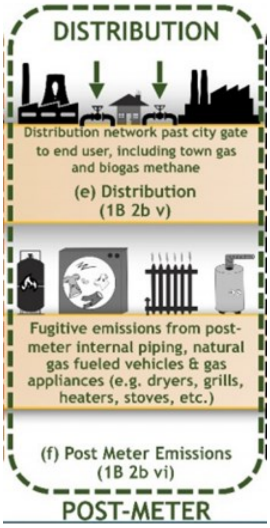

Table 385 Activities of segment Post-Meter occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
• Natural gas-fueled vehicles			x	
• Appliances in commercial and residential sector			x	
• Leakage at industrial plants and power stations			x	

This category has not been estimated due to lack of activity data and resources.

3.3.2.4.6.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 386 Planned improvements for IPCC category 1.B.2.b.vi *Post-Meter*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.a.vi	Estimation of emission from Post-Meter activities -	M	Completeness	high
1.B.2.a.vi	Collection of activity data: • Number of car with LPG as fuel • Number of appliance • Number of Non-residential and commercial gas consumed	AD	Completeness	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

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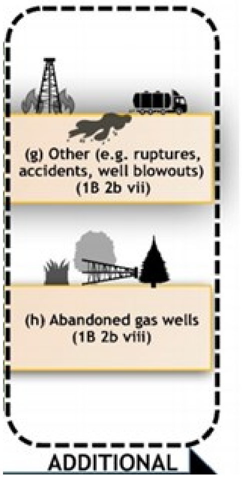
[406] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.2.2.3 Choice of emission factor, page 4.74

3.3.2.4.7 Fugitive emissions from Other (IPCC category 1.B.2.b.vii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[407] the segment *Abandoned wells* includes fugitive emissions from

- well blowouts and pipeline ruptures or dig-ins.
- accidents, and
- emergency pressure releases



The following table provides an overview of occurring activities in Algeria.

Table 387 Activities of segment Other (Natural Gas) occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
• well blowouts			x	
• pipeline ruptures			x	
• dig-ins			x	
• accidents			x	
• emergency pressure releases			x	

This category has not been estimated due to lack of activity data and resources.

3.3.2.4.7.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 388 Planned improvements for IPCC category *1.B.2.a.vii Other*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.a.vi	Estimation of emission from activities listed unter *Other*	M	Completeness	high
1.B.2.a.vi	Collection of activity data per year • well blowouts • pipeline ruptures • dig-ins. • accidents, and • emergency pressure releases	AD	Completeness	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*

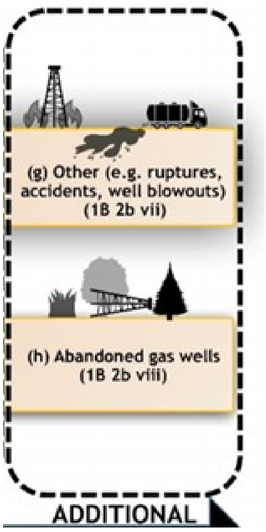
---

[407] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.2.2.3 Choice of emission factor, page 4.82

3.3.2.4.8 Fugitive emissions from Abandoned Gas Wells (IPCC category 1.B.2.b.viii)

According to the 2019 IPCC Refinements to the 2006 IPCC GL[408] the segment *Abandoned Oil Wells* includes fugitive emissions, including leaks from

- plugged or properly decommissioned wells
- unplugged wells.
- Onshore



The following table provides an overview of occurring activities in Algeria.

Table 389 Activities of segment Abandoned Gas Wells occurring in Algeria

	Occurring			Not occurring (NO)
	Estimated	Included elsewhere (IE)	Not estimated (NE)	
Onshore				
• plugged or properly decommissioned wells			x	
• unplugged wells			x	
Offshore				
• plugged or properly decommissioned wells				X
• unplugged wells				X

This category has not been estimated due to lack of activity data and resources.

3.3.2.4.8.1.1 Source-specific improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 390 Planned improvements for IPCC category *1.B.2.a.viii Abandoned oil wells*

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.a.vii	Estimation of emission from abandoned wells applying Tier 1 method	M	Completeness	high
1.B.2.a.vii	Collection of activity data: counts of abandoned onshore wells in each year of the time series, including the fraction of wells that are effectively plugged.	AD	Completeness	high

Note	*AD*	*Activity data*	*EF*	*Emission factor*	*M*	*Method*	

---

[408] 2019 Refinement to the 2006 IPCC Guidelines, Volume 2, Chapter 4.2.2.3 Choice of emission factor, page 4.82

3.4 Carbon dioxide Transport and Storage (IPCC category 1.C)

This section describes GHG emissions resulting from carbon dioxide transport, injection and geological storage (CCGS) only. All these activities are not existing in Algeria.

4 Industrial processes and product use (IPPU) (IPCC sector 2)

4.1 Overview of the sector and background information

In the Sector *Industrial Processes and Product Use (IPPU),* emissions originating from industrial processes, from the use of greenhouse gases in products, and from non-energy uses of fossil fuel carbon are considered. Emissions from this sector comprise emissions from the following subcategories:

Table 391 Overview of categories of IPCC sector 2 *Industrial Processes and Product Use (IPPU) and* status of estimation.

IPCC Code	IPCC category	CO_2	CH_4	N_2O	HFC	PFC	SF_6	NF3
2.A	**Mineral Industry**	✓	NA	NA	NA	NA	NA	NA
2.B	**Chemical Industry**	✓	✓	✓	NA	NA	NA	NA
2.C	**Metal Industry**	✓	✓	NO	NO	NO	NO	NA
2.D	**Other Production**	✓	NA	NA	NA	NA	NA	NA
2.E	**Production of HFC/PFC and SF_6**	NA	NA	NA	NO	NO	NO	NO
2.F	**Consumption of HFC/PFC and SF_6**	NA	NA	NA	✓*	NE	NE	NE
2.G	**Other Product Manufacture and Use**	NE	NO	NE	✓*	NA	NE	NA
2.H	**Other**	NA	NO	NA	NA	NA	NA	NA

** Only 2.G.1.b Refrigeration and Stationary Air Conditioning*

In the IPCC sector 2 Industrial Processes and Product Use (IPPU), GHG emissions originating from a wide variety of industrial activities. The main emission sources in Algeria are releases from industrial processes that chemically or physically transform materials like

- Cement and Lime industry in category 2.A Mineral Industry,
- Ammonia, nitric acid and Urea production 2.B Chemical Industy,
- Iron and steel (primary and secondary) in category 2.C Metal Industry;
- Refrigeration and Stationary Air Conditioning in category 2.F Consumption of HFC/PFC and SF_6;
- Use of Electrical Equipment 2.G Other product manufacture and use.

During these processes, many different greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), can be produced.

The so called F-gases hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), sulfur hexafluoride (SF_6) and Other halogenated gases are oftentimes used in products such as refrigerators, foams or aerosol cans as well as electrical equipment.

Due to lack of data and resources GHG emissions from the use of greenhouse gases (HFC, PFC) and Other halogenated gases used in products except for category 2.G.1.b Refrigeration and Stationary Air Conditioning were not estimated for all subcategories from in this inventory cycle (2.F Consumption of HFC/PFC and SF_6). The estimation of these greenhouse gases is planned for the next inventory cycle (see Chapter 4.7).

Categories where emissions are not occurring (NO) because there is no such production or consumption in Algeria, and categories that are not estimated (NE) or included elsewhere (IE) are summarized in the following table, which gives an overview of the IPCC categories included in this sector and provides information on the status of emission estimates of all categories. A „✓" indicates that emissions from this sub-category have been estimated. None sub-category is key category. Emission trend

Emissions from the IPCC sector 2 Industrial Processes and Product Use (IPPU) are an important source of GHGs in Algeria. In the year 2020, about 5.5% of national total GHGs emissions and 6.5% of national total CO_2 emissions from Algeria arose from IPCC sector 2 and Industrial Processes Product Use (IPPU).

Emissions from the IPCC sector 2 Industrial Processes and Product Use (IPPU) decreased by 11.8% from 13,791.41 kt CO_2 equivalents in 1990 to 12,166.30 kt CO_2 equivalents in 2020, which is mainly caused by increasing emissions from mineral and metal industry, particularly cement, zinc and Iron and Steel production.

Algeria's greenhouse gas emissions from IPCC sector IPPU amounted to 12,166.30 kt CO2 equivalents in 2020 and 13,791.41kt CO_2 equivalents in 1990. Compared to 1990 GHG emissions decreased by 11.8%, compared to 2005 GHG emissions decreased by 41.6%, compared to 2019 GHG emissions decreased by 5.2%.

The general trend is marked by significant dips and jumps due to the

- Increase of production after internal political disturbances between 1992-1999
- world economic crisis (2009)
- increased production of cement and zinc
- reduction of export of for e.g., zinc
- shut down of lead production (2006)
- change of technology in iron & steel industry
- worldwide pandemic and national lockdown due to COVID

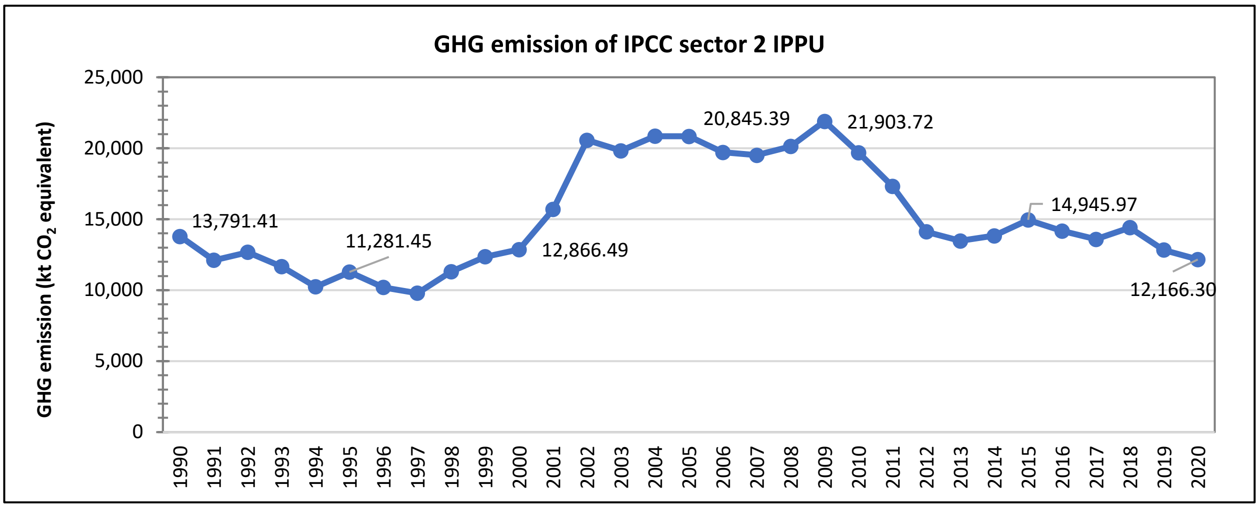


Figure 140 Trend of GHG emission of IPCC sector 2 IPPU by category for the period 1990 – 2020

In 2020, the IPCC category 2.A *Mineral industry* had with 72.0% the highest contribution to GHG emissions of IPCC sector 2 IPPU, followed by the IPCC category 2.B. *Chemical industry* with a share of 0.9%, and IPCC category *2.C. Metal industry* with a share of 16.4%. The IPCC category 2.F *Product uses as substitutes for ODS* contribute 9.9% of the GHG emissions of IPCC sector 2 IPPU. Regarding GHG emissions, the other categories of IPCC sector 2 play a minor role.

In 1990, the IPCC category 2.C Metal industry had with 71.8% the highest contribution to GHG emissions of IPCC sector 2 IPPU, followed by the IPCC category 2.A Mineral industry with a share of 19.3% and IPCC category 2.B. *Chemical industry* with a share of 8.9%. Regarding GHG emissions, in 1990 the other categories of IPCC sector 2 play a minor role.

The GHG emissions of IPCC sector 2 comprise of

IPCC category	share in 1990	share in 2005	share in 2020
2.A Mineral industry	19.3%	25.6%	72.0%
2.B. Chemical industry	8.9%	7.6%	0.9%
2.C. Metal industry	71.8%	66.3%	16.4%
2.D. Non-energy products from fuels and solvent use	NA	0.4%	0.5%
2.E. Electronics industry	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	0.1%	9.9%
2.G. Other product manufacture and use	0.001%	0.006%	0.3%
2.H. Other	NA	NA	NA

Until 2010, the dominant category in IPCC sector 2 IPPU regarding GHG emissions was the *Metal industry* (IPCC category 2.C) with production of pig iron in a blast furnace and zinc and lead production, followed by the IPCC category 2.A *Mineral Industry.*

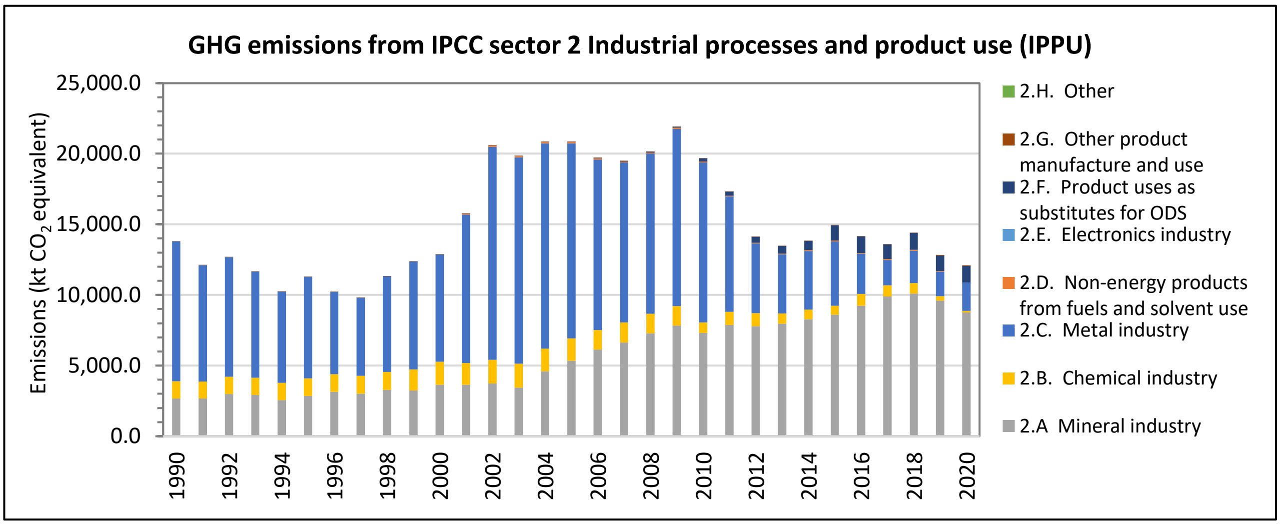


Figure 141 GHG emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU) by category

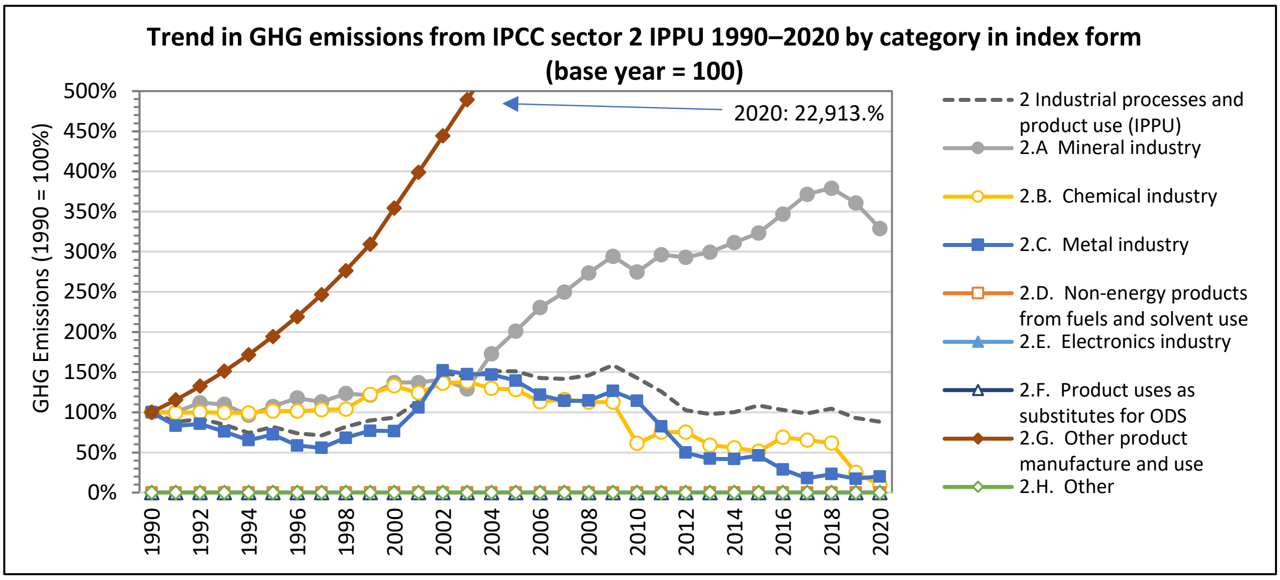


Figure 142 Trend in GHG emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU) 1990–2020 by gas in index form (base year = 100)

The IPCC category with the highest increase in GHG emissions compared to 1990 was the IPCC category 2.F. Product uses as substitutes for ODS with was the results of use of HFCs (HCFC-123, HFC-32, HFC-134a, and R-410A) in refrigerators, freezers, and mobile air condition in the IPCC category 2.F.1 Refrigeration and air conditioning.

The IPCC category with the high increase in GHG emissions compared to 1990 was the IPCC category 2.A Mineral industry which includes the cement industry.

Also, the IPCC category 2.B. Chemical industry showed a significant increase in GHG emissions compared to 1990 as a result on increased fertilizer product (Ammonia production, Nitric acid production, Urea production).

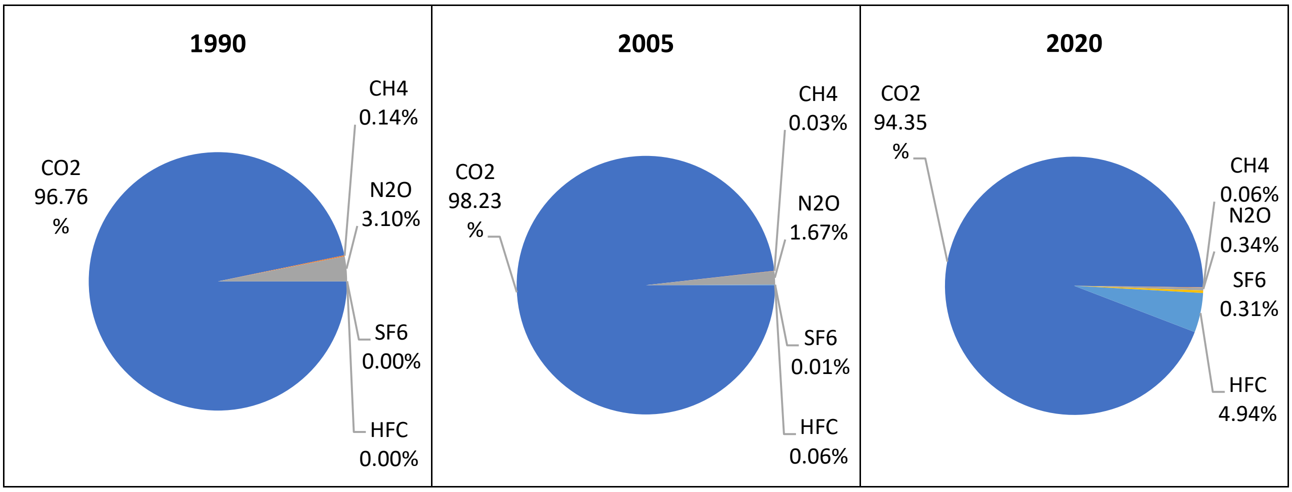


Figure 143 Share of greenhouse gases from IPCC sector 2 Industrial Processes and Product Use (IPPU)

In IPCC sector 2, the most important greenhouse gas was in all years CO_2, However, in 2020 the contribution of N_2O in total GHG emission of IPCC sector 2 was 0.34% and HFC had a contribution of 4.94% in total GHG emission of IPCC sector 2.

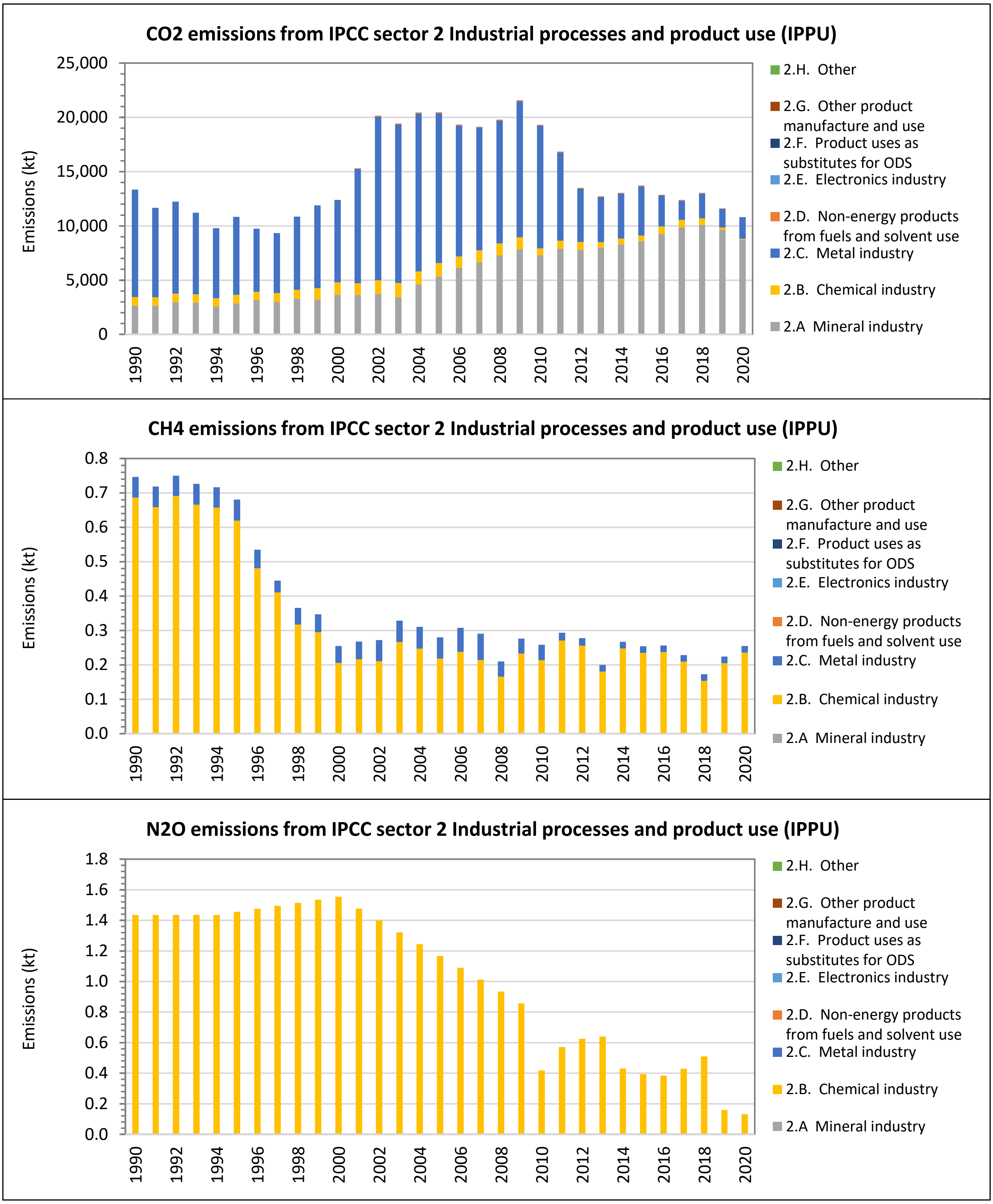


Figure 144 CO_2, N_2O and CH_4 Emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU)

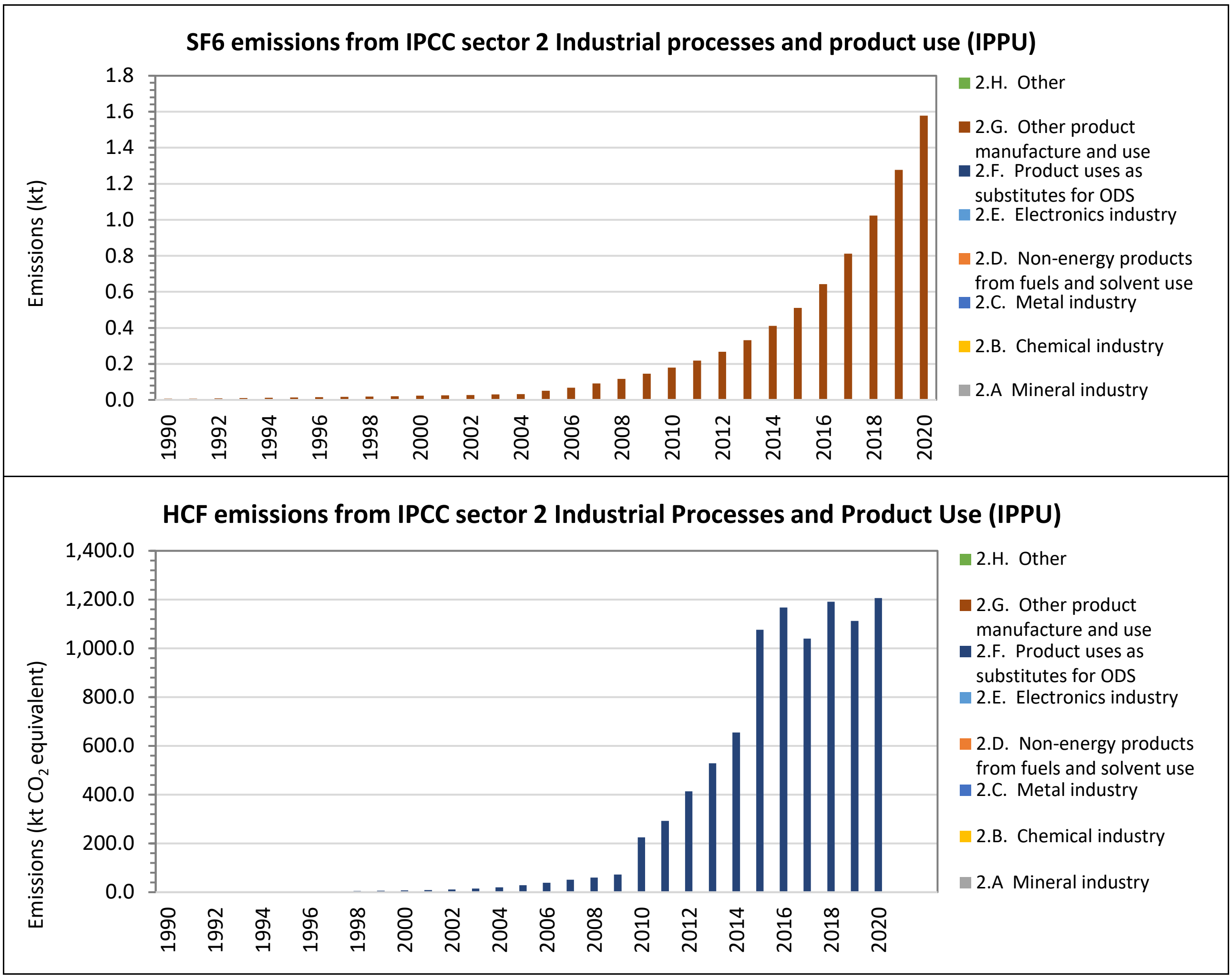


Figure 145 SF_6 and HFC Emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU)

Table 392 GHG emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU)

GHG emissions	2	2A	2B	2C	2D	2E	2F	2G	2H
	TOTAL IPPU	**Mineral Industry**	**Chemical Industry**	**Metal Industry**	**Other Production**	**Production of HFC/PFC and SF_6**	**Consumption of HFC/PFC and SF_6**	**Other Product Manufacture and Use**	**Other**
	kt CO_2 equivalent								
1990	**13,791.41**	2,660.95	1,226.61	9,903.69	IE	NA	NA	0.16	NO
1991	**12,116.32**	2,661.19	1,217.88	8,237.07	IE	NA	NA	0.18	NO
1992	**12,671.39**	2,981.50	1,227.99	8,461.69	IE	NA	NA	0.21	NO
1993	**11,662.56**	2,922.80	1,220.06	7,519.46	IE	NA	NA	0.24	NO
1994	**10,238.08**	2,562.19	1,217.30	6,457.64	IE	NA	0.69	0.27	NO
1995	**11,281.45**	2,853.81	1,246.60	7,179.51	IE	NA	1.22	0.31	NO
1996	**10,200.17**	3,136.17	1,244.04	5,817.50	IE	NA	2.12	0.34	NO
1997	**9,792.48**	3,005.18	1,263.38	5,520.45	IE	NA	3.09	0.39	NO
1998	**11,315.39**	3,283.40	1,275.00	6,752.34	IE	NA	4.20	0.43	NO
1999	**12,359.18**	3,228.19	1,501.94	7,622.85	IE	NA	5.71	0.49	NO
2000	**12,866.49**	3,650.17	1,631.06	7,577.95	IE	NA	6.76	0.56	NO
2001	**15,690.85**	3,648.86	1,522.55	10,511.13	IE	NA	7.68	0.63	NO
2002	**20,576.90**	3,742.90	1,668.25	15,081.88	72.52	NA	10.65	0.70	NO
2003	**19,827.75**	3,435.86	1,694.53	14,604.80	77.41	NA	14.38	0.77	NO
2004	**20,858.68**	4,599.98	1,591.27	14,553.53	93.27	NA	19.79	0.84	NO
2005	**20,845.39**	5,346.57	1,573.96	13,811.84	83.19	NA	28.60	1.24	NO
2006	**19,713.67**	6,133.88	1,388.60	12,062.93	87.85	NA	38.72	1.70	NO
2007	**19,512.72**	6,637.72	1,421.13	11,316.71	84.31	NA	50.63	2.23	NO
2008	**20,131.36**	7,276.83	1,382.75	11,339.48	69.57	NA	59.90	2.82	NO
2009	**21,903.72**	7,832.98	1,380.76	12,534.53	80.24	NA	71.72	3.49	NO
2010	**19,695.67**	7,310.01	750.17	11,317.78	89.15	NA	224.30	4.26	NO
2011	**17,332.78**	7,884.16	922.76	8,159.81	69.16	NA	291.73	5.17	NO
2012	**14,116.12**	7,796.00	923.69	4,917.78	58.96	NA	413.40	6.29	NO
2013	**13,469.76**	7,968.03	723.32	4,178.45	63.68	NA	528.56	7.73	NO
2014	**13,838.12**	8,288.39	684.66	4,135.94	64.86	NA	654.74	9.53	NO
2015	**14,945.97**	8,598.86	628.85	4,561.54	68.39	NA	1,076.51	11.82	NO
2016	**14,173.09**	9,228.53	843.59	2,847.99	70.75	NA	1,167.40	14.83	NO
2017	**13,584.19**	9,888.20	803.72	1,776.22	57.19	NA	1,040.16	18.70	NO
2018	**14,405.40**	10,086.06	756.00	2,286.91	61.91	NA	1,191.00	23.52	NO
2019	**12,836.82**	9,601.94	309.48	1,713.05	71.34	NA	1,111.67	29.34	NO
2020	**12,166.30**	8,755.03	113.90	1,992.63	62.50	NA	1,206.05	36.19	NO
Trend									
1990 - 2020	**-11.8%**	229.0%	-90.7%	-79.9%	NA	NA	NA	22950.1%	NA
2005 - 2020	**-41.6%**	63.8%	-92.8%	-85.6%	-24.9%	NA	4117.6%	2826.9%	NA
2019 - 2020	**-5.2%**	-8.8%	-63.2%	16.3%	-12.4%	NA	8.5%	23.3%	NA

Table 393 CO_2 emissions in kt from IPCC sector 2 Industrial Processes and Product Use (IPPU)

CO_2 emissions	**2**	**2A**	**2B**	**2C**	**2D**	**2E**	**2F**	**2G**	**2H**
	TOTAL IPPU	**Mineral Industry**	**Chemical Industry**	**Metal Industry**	**Other Production**	**Production of HFC/PFC and SF_6**	**Consumpt-ion of HFC/PFC and SF_6**	**Other Product Manufacture and Use**	**Other**
	kt								
1990	**13,344.62**	2,660.95	781.47	9,902.20	IE	NA	NA	NA	NO
1991	**11,670.20**	2,661.19	773.43	8,235.58	IE	NA	NA	NA	NO
1992	**12,224.45**	2,981.50	782.74	8,460.21	IE	NA	NA	NA	NO
1993	**11,216.19**	2,922.80	775.44	7,517.95	IE	NA	NA	NA	NO
1994	**9,791.24**	2,562.19	772.89	6,456.16	IE	NA	NA	NA	NO
1995	**10,829.04**	2,853.81	797.27	7,177.96	IE	NA	NA	NA	NO
1996	**9,744.59**	3,136.17	792.29	5,816.13	IE	NA	NA	NA	NO
1997	**9,332.27**	3,005.18	807.49	5,519.60	IE	NA	NA	NA	NO
1998	**10,850.11**	3,283.40	815.58	6,751.13	IE	NA	NA	NA	NO
1999	**11,886.94**	3,228.19	1,037.19	7,621.56	IE	NA	NA	NA	NO
2000	**12,389.55**	3,650.17	1,162.66	7,576.71	IE	NA	NA	NA	NO
2001	**15,235.69**	3,648.86	1,076.99	10,509.84	IE	NA	NA	NA	NO
2002	**20,141.69**	3,742.90	1,245.93	15,080.34	72.52	NA	NA	NA	NO
2003	**19,410.43**	3,435.86	1,293.91	14,603.25	77.41	NA	NA	NA	NO
2004	**20,459.41**	4,599.98	1,214.23	14,551.93	93.27	NA	NA	NA	NO
2005	**20,460.79**	5,346.57	1,220.71	13,810.31	83.19	NA	NA	NA	NO
2006	**19,340.88**	6,133.88	1,057.97	12,061.18	87.85	NA	NA	NA	NO
2007	**19,151.00**	6,637.72	1,114.19	11,314.79	84.31	NA	NA	NA	NO
2008	**19,784.89**	7,276.83	1,100.12	11,338.37	69.57	NA	NA	NA	NO
2009	**21,566.21**	7,832.98	1,119.55	12,533.44	80.24	NA	NA	NA	NO
2010	**19,336.19**	7,310.01	620.38	11,316.66	89.15	NA	NA	NA	NO
2011	**16,858.33**	7,884.16	745.79	8,159.23	69.16	NA	NA	NA	NO
2012	**13,503.37**	7,796.00	731.19	4,917.22	58.96	NA	NA	NA	NO
2013	**12,737.87**	7,968.03	528.20	4,177.97	63.68	NA	NA	NA	NO
2014	**13,038.78**	8,288.39	550.07	4,135.46	64.86	NA	NA	NA	NO
2015	**13,733.90**	8,598.86	505.59	4,561.06	68.39	NA	NA	NA	NO
2016	**12,869.94**	9,228.53	723.15	2,847.51	70.75	NA	NA	NA	NO
2017	**12,391.61**	9,888.20	670.47	1,775.74	57.19	NA	NA	NA	NO
2018	**13,034.56**	10,086.06	600.16	2,286.43	61.91	NA	NA	NA	NO
2019	**11,642.71**	9,601.94	256.87	1,712.57	71.34	NA	NA	NA	NO
2020	**10,878.29**	8,755.03	68.61	1,992.15	62.50	NA	NA	NA	NO
Trend									
1990 - 2020	**-18.5%**	229.0%	-91.2%	-79.9%	NA	NA	NA	NA	NA
2005 - 2020	**-46.8%**	63.8%	-94.4%	-85.6%	-24.9%	NA	NA	NA	NA
2019 - 2020	**-6.6%**	-8.8%	-73.3%	16.3%	-12.4%	NA	NA	NA	NA

Table 394 CH_4 emissions in kt from IPCC sector 2 Industrial Processes and Product Use (IPPU)

CH_4 emissions	**2**	**2A**	**2B**	**2C**	**2D**	**2E**	**2F**	**2G**	**2H**
	TOTAL IPPU	**Mineral Industry**	**Chemical Industry**	**Metal Industry**	**Other Production**	**Production of HFC/PFC and SF_6**	**Consumpt-ion of HFC/PFC and SF_6**	**Other Product Manufacture and Use**	**Other**
	kt								
1990	0.75	NO	0.69	0.06	NO	NA	NA	NA	NO
1991	0.72	NO	0.66	0.06	NO	NA	NA	NA	NO
1992	0.75	NO	0.69	0.06	NO	NA	NA	NA	NO
1993	0.73	NO	0.67	0.06	NO	NA	NA	NA	NO
1994	0.72	NO	0.66	0.06	NO	NA	NA	NA	NO
1995	0.68	NO	0.62	0.06	NO	NA	NA	NA	NO
1996	0.53	NO	0.48	0.05	NO	NA	NA	NA	NO
1997	0.44	NO	0.41	0.03	NO	NA	NA	NA	NO
1998	0.37	NO	0.32	0.05	NO	NA	NA	NA	NO
1999	0.35	NO	0.29	0.05	NO	NA	NA	NA	NO
2000	0.26	NO	0.21	0.05	NO	NA	NA	NA	NO
2001	0.27	NO	0.22	0.05	NO	NA	NA	NA	NO
2002	0.27	NO	0.21	0.06	NO	NA	NA	NA	NO
2003	0.33	NO	0.27	0.06	NO	NA	NA	NA	NO
2004	0.31	NO	0.25	0.06	NO	NA	NA	NA	NO
2005	0.28	NO	0.22	0.06	NO	NA	NA	NA	NO
2006	0.31	NO	0.24	0.07	NO	NA	NA	NA	NO
2007	0.29	NO	0.21	0.08	NO	NA	NA	NA	NO
2008	0.21	NO	0.17	0.04	NO	NA	NA	NA	NO
2009	0.28	NO	0.23	0.04	NO	NA	NA	NA	NO
2010	0.26	NO	0.21	0.04	NO	NA	NA	NA	NO
2011	0.29	NO	0.27	0.02	NO	NA	NA	NA	NO
2012	0.28	NO	0.26	0.02	NO	NA	NA	NA	NO
2013	0.20	NO	0.18	0.02	NO	NA	NA	NA	NO
2014	0.27	NO	0.25	0.02	NO	NA	NA	NA	NO
2015	0.25	NO	0.23	0.02	NO	NA	NA	NA	NO
2016	0.26	NO	0.24	0.02	NO	NA	NA	NA	NO
2017	0.23	NO	0.21	0.02	NO	NA	NA	NA	NO
2018	0.17	NO	0.15	0.02	NO	NA	NA	NA	NO
2019	0.22	NO	0.20	0.02	NO	NA	NA	NA	NO
2020	0.25	NO	0.24	0.02	NO	NA	NA	NA	NO
Trend									
1990 - 2020	-65.8%	NA	-65.7%	-67.7%	NA	NA	NA	NA	NA
2005 - 2020	-8.9%	NA	7.8%	-68.5%	NA	NA	NA	NA	NA
2019 - 2020	13.8%	NA	15.1%	0.0%	NA	NA	NA	NA	NA

Table 395 N_2O emissions in kt from IPCC sector 2 Industrial Processes and Product Use (IPPU)

N_2O emissions	2	2A	2B	2C	2D	2E	2F	2G	2H
	TOTAL IPPU	Mineral Industry	Chemical Industry	Metal Industry	Other Production	Production of HFC/PFC and SF_6	Consumption of HFC/PFC and SF_6	Other Product Manufacture and Use	Other
	kt								
1990	**1.44**	NO	1.44	NO	NO	NA	NA	NE	NO
1991	**1.44**	NO	1.44	NO	NO	NA	NA	NE	NO
1992	**1.44**	NO	1.44	NO	NO	NA	NA	NE	NO
1993	**1.44**	NO	1.44	NO	NO	NA	NA	NE	NO
1994	**1.44**	NO	1.44	NO	NO	NA	NA	NE	NO
1995	**1.46**	NO	1.46	NO	NO	NA	NA	NE	NO
1996	**1.48**	NO	1.48	NO	NO	NA	NA	NE	NO
1997	**1.50**	NO	1.50	NO	NO	NA	NA	NE	NO
1998	**1.52**	NO	1.52	NO	NO	NA	NA	NE	NO
1999	**1.53**	NO	1.53	NO	NO	NA	NA	NE	NO
2000	**1.55**	NO	1.55	NO	NO	NA	NA	NE	NO
2001	**1.48**	NO	1.48	NO	NO	NA	NA	NE	NO
2002	**1.40**	NO	1.40	NO	NO	NA	NA	NE	NO
2003	**1.32**	NO	1.32	NO	NO	NA	NA	NE	NO
2004	**1.24**	NO	1.24	NO	NO	NA	NA	NE	NO
2005	**1.17**	NO	1.17	NO	NO	NA	NA	NE	NO
2006	**1.09**	NO	1.09	NO	NO	NA	NA	NE	NO
2007	**1.01**	NO	1.01	NO	NO	NA	NA	NE	NO
2008	**0.93**	NO	0.93	NO	NO	NA	NA	NE	NO
2009	**0.86**	NO	0.86	NO	NO	NA	NA	NE	NO
2010	**0.42**	NO	0.42	NO	NO	NA	NA	NE	NO
2011	**0.57**	NO	0.57	NO	NO	NA	NA	NE	NO
2012	**0.62**	NO	0.62	NO	NO	NA	NA	NE	NO
2013	**0.64**	NO	0.64	NO	NO	NA	NA	NE	NO
2014	**0.43**	NO	0.43	NO	NO	NA	NA	NE	NO
2015	**0.39**	NO	0.39	NO	NO	NA	NA	NE	NO
2016	**0.38**	NO	0.38	NO	NO	NA	NA	NE	NO
2017	**0.43**	NO	0.43	NO	NO	NA	NA	NE	NO
2018	**0.51**	NO	0.51	NO	NO	NA	NA	NE	NO
2019	**0.16**	NO	0.16	NO	NO	NA	NA	NE	NO
2020	**0.13**	NO	0.13	NO	NO	NA	NA	NE	NO
Trend									
1990 - 2020	-90.8%	NA	-90.8%	NA	NA	NA	NA	NA	NA
2005 - 2020	-88.7%	NA	-88.7%	NA	NA	NA	NA	NA	NA
2019 - 2020	-17.0%	NA	-17.0%	NA	NA	NA	NA	NA	NA

Table 396 HFC and SF_6 emissions from IPCC sector 2 Industrial Processes and Product Use (IPPU)

	SF_6 emissions	**HFC emissions**
	TOTAL IPPU	**TOTAL IPPU**
	kt CO_2 equivalent	
1990	0.16	**NA**
1991	0.18	**NA**
1992	0.21	**NA**
1993	0.24	**NA**
1994	0.27	**0.69**
1995	0.31	**1.22**
1996	0.34	**2.12**
1997	0.39	**3.09**
1998	0.43	**4.20**
1999	0.49	**5.71**
2000	0.56	**6.76**
2001	0.63	**7.68**
2002	0.70	**10.65**
2003	0.77	**14.38**
2004	0.84	**19.79**
2005	1.24	**28.60**
2006	1.70	**38.72**
2007	2.23	**50.63**
2008	2.82	**59.90**
2009	3.49	**71.72**
2010	4.26	**224.30**
2011	5.17	**291.73**
2012	6.29	**413.40**
2013	7.73	**528.56**
2014	9.53	**654.74**
2015	11.82	**1,076.51**
2016	14.83	**1,167.40**
2017	18.70	**1,040.16**
2018	23.52	**1,191.00**
2019	29.34	**1,111.67**
2020	36.19	**1,206.05**
Trend		
1990 - 2020	22,950.1%	NA
2005 - 2020	2,826.9%	4,117.6%
2019 - 2020	23.3%	8.5%

4.2 Mineral Industry (IPCC category 2.A)

The IPCC category 2.A comprises the process-related carbon dioxide (CO_2) emissions resulting from the use of carbonate raw materials such as limestone and dolomite in the production and use of a variety of mineral industry products. As described in the 2006 IPCC Guidelines, Vol. 3, Chap 1, there are two broad pathways for release of CO_2 from carbonates:

(1) Calcination, and
(2) acid-induced release of CO_2.

Ad (1): The primary process resulting in the release of CO_2 is the calcination of carbonate compounds, during which, through heating, a metallic oxide is formed. A typical calcination reaction, here shown for the mineral calcite or calcium carbonate, would be:

$$\boxed{CACO_3 + \text{heat} \rightarrow CaO + CO_2}$$

Ad (2): Acid-induced release of CO_2 as a result of small quantities of carbonate being present as an impurity in an acidification process to upgrade a non-carbonate material. The formation of CO_2 can be via an equation such as:

$$\boxed{CACO_3 + H_2SO_4 \rightarrow CaSO4 + H_2O + CO_2}$$

In the following table, an overview of the IPCC sub-categories included in this chapter is given and is provided information on the status of emission estimates of all subcategories. 2.A „✓" indicates that emissions from this sub-category have been estimated.

Table 397 Overview of sub-categories of category 2.A. *Mineral Industry* and status of estimation.

IPCC Code	**IPCC Category**	**CO_2**		**CH_4**		**N_2O**	
2.A	**Mineral Industry**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.A.1	Cement production	✓	-	NA	-	NA	-
2.A.2	Lime production	✓	-	NA	-	NA	-
2.A.3	Glass Production	✓	-	NA	-	NA	-
2.A.4	Other Process Uses of Carbonates						
2.A.4.a	Ceramics	NE	-	NA	-	NA	-
2.A.4.b	Other Uses of Soda Ash	NE	-	NA	-	NA	-
2.A.4.c	Non Metallurgical Magnesia Production	NE	-	NA	-	NA	-
2.A.4.d	Other	NE	-	NA	-	NA	-
2.A.5	Other	NO	-	NA	-	NA	-

An overview of the GHG emission, which are only CO_2 emissions, from fuel combustion in IPCC category 2.A. *Mineral Industry* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020 , 2005 – 2020, 2019 – 2020;

The only gas is CO_2.

The greenhouse gas emissions from IPCC category 2.A. *Mineral Industry* amounted to 2,660.95 kt CO_2 equivalents in 1990, 5,346.57 kt CO_2 equivalents in 2005 and 8,755.03 kt CO_2 equivalents in 2020.

The overall trend of GHG emissions from IPCC category 2.A. *Mineral Industry* shows an increase of 229% from 1990 to 2020, 63.8% from 2005 to 2020 and a decrease of 8.8% from 2019 to 2020. In general, most of the GHG emissions from IPCC category 2.A. *Mineral Industry* come from subcategory 2.A.1 *Cement Production*. Indeed, CO_2 emissions from the subcategory 2.A.1 cement production represent 99% of the total CO_2 emissions of the IPCC category 2.A. *Mineral industry* in 1990, 99.6% in 2005 and 99.7% in 2020. Moreover, cement production was responsible for 2,636.19 kt of CO_2 emissions in 1990 and 8,725.07 kt of CO_2 emissions in 2020, either an increase of 231% in the period 1990 - 2020. Compared to 2005, CO_2 emissions have increased by 63.9% to 5,324.80 kt. The upward trend in emissions is a consequence of the high demand for cement resulting from population growth, shrinking households and economic development, which are driving the growth of the construction industry. This high demand for cement has resulted in the inauguration and opening of new cement factories to increase production and meet demand. Indeed, six (06) cement plants (Société des Ciments de Tébessa in 1995, M'sila 2004, Sarl Amouda in 2012, Société des Ciments de Sigus in 2019, Société Saoura Ciment in 2020) with important production capacities have been put into service which has contributed to the considerable increase of GHG emissions of the IPCC category 2.A. *Mineral industry*.

The GHG emissions of the IPCC category 2.A.2. Lime production are very low in comparison with the emissions generated by cement production, due to the very slight increase or even stability of the quantities of lime produced during the whole period (1990-2020).

Below the share of subcategories 2.A.1, 2.A.2, and 2.A.3 in the global CO_2 emissions of the IPCC category 2.A. *Mineral industry* for the year 2020.

- 99.7% the IPCC category 12.A.1. Cement production
- 0.3% the IPCC category 2.A.2. Lime production
- Less than 0.1% the IPCC category 2.A.3. Glass production

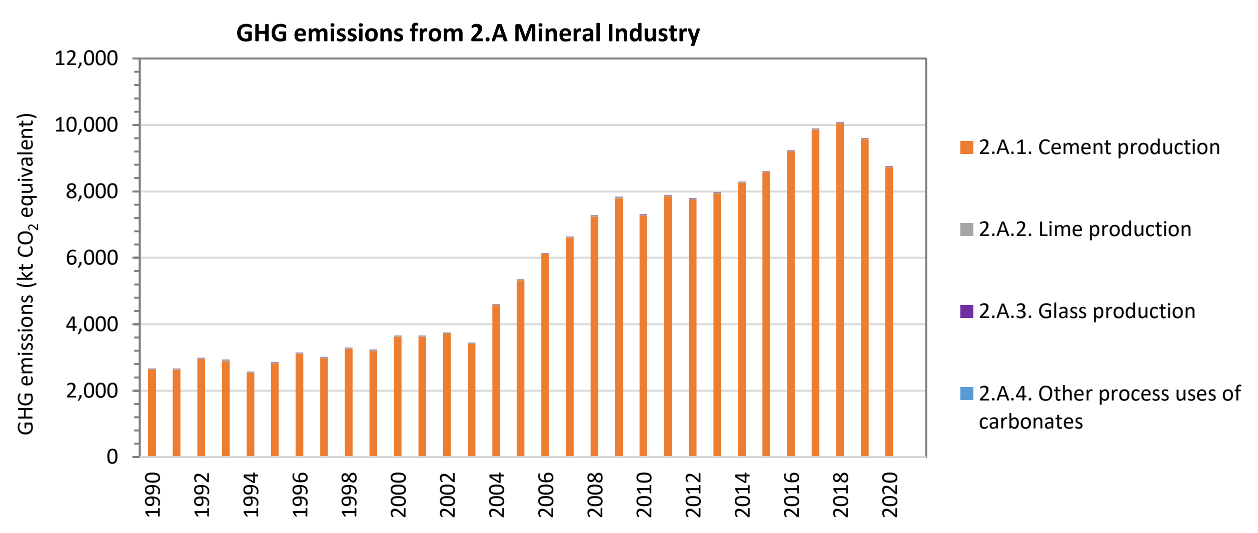


Figure 146 CO_2 Emissions from IPCC category 2.A. *Mineral Industry* by category

Table 398 GHG Emissions by fuels from IPCC category 2.A *Mineral industry*

GHG emission	**2.A**	**2.A.1**	**2.A.2**	**2.A.3**	**2.A.4**
	Mineral industry	**Cement production**	**Lime production**	**Glass production**	**Other process uses of carbonates**
	kt CO_2 eq				
1990	2,660.95	2,636.19	18.89	5.87	NE
1991	2,661.19	2,630.37	25.18	5.64	NE
1992	2,981.50	2,950.69	26.90	3.92	NE
1993	2,922.80	2,891.20	28.50	3.10	NE
1994	2,562.19	2,534.90	24.38	2.92	NE
1995	2,853.81	2,821.81	29.59	2.41	NE
1996	3,136.17	3,107.52	26.90	1.75	NE
1997	3,005.18	2,975.32	28.04	1.82	NE
1998	3,283.40	3,259.69	22.09	1.62	NE
1999	3,228.19	3,197.08	29.76	1.35	NE
2000	3,650.17	3,620.45	28.04	1.68	NE
2001	3,648.86	3,623.44	23.81	1.61	NE
2002	3,742.90	3,719.41	21.18	2.31	NE
2003	3,435.86	3,407.75	24.90	3.22	NE
2004	4,599.98	4,576.00	20.77	3.20	NE
2005	5,346.57	5,324.80	18.77	3.00	NE
2006	6,133.88	6,116.03	14.14	3.71	NE
2007	6,637.72	6,608.58	26.33	2.81	NE
2008	7,276.83	7,237.15	36.63	3.05	NE
2009	7,832.98	7,792.51	37.20	3.27	NE
2010	7,310.01	7,271.06	36.05	2.90	NE
2011	7,884.16	7,845.46	36.05	2.64	NE
2012	7,796.00	7,755.07	37.77	3.15	NE
2013	7,968.03	7,939.42	27.47	1.13	NE
2014	8,288.39	8,259.62	28.04	0.72	NE
2015	8,598.86	8,584.46	13.74	0.66	NE
2016	9,228.53	9,201.58	25.75	1.20	NE
2017	9,888.20	9,858.54	28.62	1.04	NE
2018	10,086.06	10,055.91	28.62	1.54	NE
2019	9,601.94	9,571.74	28.62	1.58	NE
2020	8,755.03	8,725.07	28.62	1.35	NE
Trend					
1990 - 2020	229.0%	231.0%	51.5%	-77.0%	NA
2005 - 2020	63.8%	63.9%	52.4%	-55.0%	NA
2019 - 2020	-8.8%	-8.8%	0.0%	-14.5%	NA

4.2.1 Cement production (IPCC category 2.A.1)

4.2.1.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.A.1	Cement production	✓	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the CO_2 emissions estimations from cement production. Process-related CO_2 emissions are released during clinker production. Cement Production is a key source with regards to CO_2 emissions.

As described in the EMEP/EEA air pollutant emission inventory guidebook 2019[409].

> in cement manufacture, CO_2 is produced during the production of clinker, a nodular intermediate product that is then finely ground, along with a small proportion of calcium sulfate [gypsum ($CaSO_4$,H_2O) or anhydrite ($CaSO_4$)], into hydraulic (typically portland) cement.
>
> During the production of clinker, limestone, which is mainly calcium carbonate ($CaCO_3$) , is heated, or calcined, to produce lime (CaO) and CO_2 as a by-product. The CaO then reacts with silica (SiO_2). alumina (Al_2O_3). and iron oxide (Fe_2O_3) in the raw materials to make the clinker minerals (chiefly calcium silicates). The proportion in the raw materials of carbonates other than $CaCO_3$ is generally very small.
>
> The basic chemistry of the cement manufacturing process begins with decomposition of calcium carbonate at about 900 ˚C to leave calcium oxide (CaO) and liberated gaseous carbon dioxide (CO_2); this process is known as calcination.

$$CaCO_3 + heat \rightarrow CaO + CO_2 \quad \text{… typical calcination reaction}$$

$$CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2 \quad \text{… acid-induced release of } CO_2$$

> The other carbonates. if present. exist mainly as impurities in the primary limestone raw material. A small amount of MgO (typically 1-2%) in the clinker-making process is desirable as it acts as a flux. but much more than this amount can lead to problems with the cement.
>
> The production of clinker takes place in a kiln system in which the minerals of the raw mix are transformed at high temperatures into new minerals with hydraulic properties. The fine particles of the raw mix move from the cool end to the hot end of the kiln system and the combustion gases move the other way from the hot end to the cold end.
>
> After calcination the clinkering process follows, in which the calcium oxide reacts at a high temperature (typically 1.400–1.500 ˚C) with silica, alumina, and ferrous oxide to form the silicates, aluminates and ferrites of calcium that constitute the clinker. The clinker is then rapidly cooled.
>
> The cement industry is highly energy intensive. According to EMEP EEA Guidebook 2016**Erreur ! Signet non défini.** the t heoretical thermal energy demand for the chemical/mineralogical reactions of clinker production (not including drying and preheating) is about 1,700 MJ/tonne clinker. The actual thermal energy demand for different kiln systems and sizes is approximately 3.000 – 6.500 MJ/tonne clinker (European Commission, 2010). According to the IPCC guidelines, the combustion (energy) related emissions from fuel consumption are accounted for in the IPCC Sector 1.A.2.f.

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[409] Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 2.A.1 Cement production, sub-chapter 2.1.2 Pyro-processing to produce clinker. Available (05. June 2022) on https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/2-industrial-processes/2-a-mineral-products/2-a-1-cement-production/view

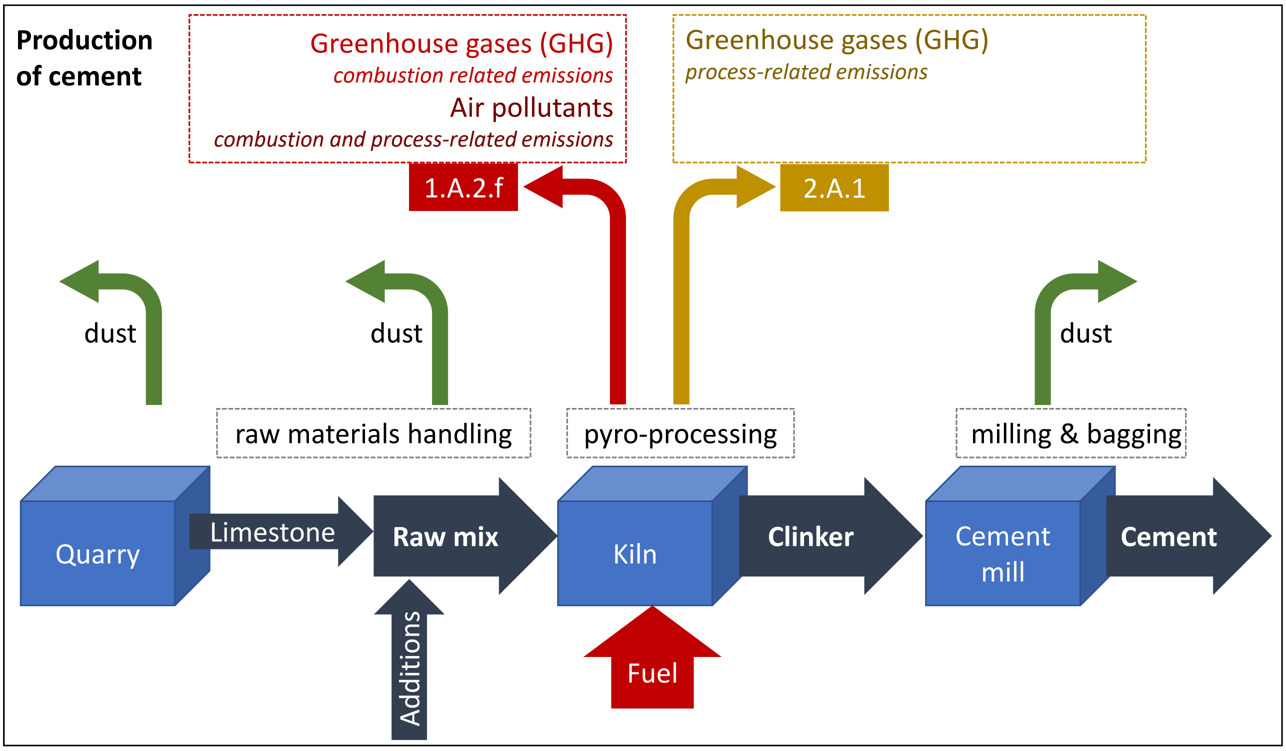

Figure 147 Schematic illustration of cement production and allocation of emissions

Currently, there are 20 integrated cement plants in Algeria, of which 14 are owned by the Groupe Industriel des Ciments d'Algérie (GICA), 3 by the Lafarge Holcim Group and 3 by the private sector. The annual production is about 21 million tons (in 2020). The cements manufactured in Algeria are mainly ordinary Portland cements of type CEMI, CEM II/A. CEMII/B with two classes of resistance: 32.5 and 42.5. Most cement factories use slag, natural pozzolan and limestone, which are widely available. Algeria, which had been a net importer of cement for decades, became a net exporter in 2018. Cement in Algeria is made entirely from domestically produced clincker, Indeed, the clincker import is stopped in 2019.

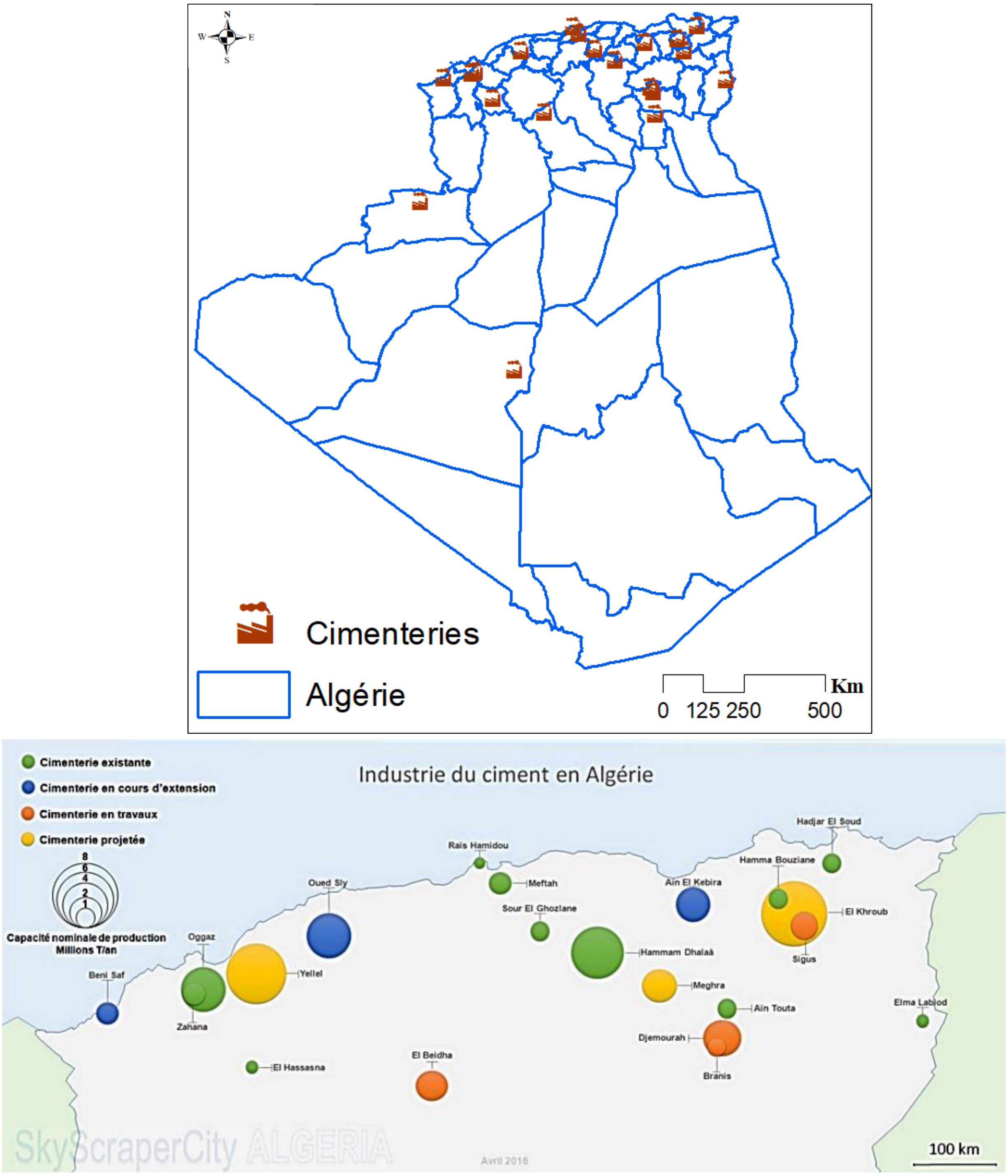

Figure 148 Cement Industry of Algeria

Table 399 Operating Cement companies in Algeria. production capacities and additions used

	Cement producers	Name		Location	Starting	Annual capacity (t)	Additions used	Product
1	GICA - Groupe Industriel des Ciments d'Algérie	ECDE	Entreprise des Ciments & Dérivés d'Ech-Cheliff	Chlef	1978	1,200,000	Limestone and Natural pozzolana	Portland
2		SCAEK	Société des Ciment d'Aïn El Kebira	Aïn El Kebira, Sétif		1,000,000		
3		SCHB	Société des Ciments de Hamma Bouziane	Boussouf – Constantine	1982	1,000,000	Limestone and Slag	
4		SCIMAT	Société des Ciment d'Aïn Touta	Batna	1987	1,000,000	Limestone and Natural pozzolana	
5		SCT	Société des Ciments de Tébessa	Tébessa	1995	500,000		
6		SCHS	Société des Ciments de Hadjar-Soud	Azzaba,Skikda		900,000		
7		SCSEG	Société des Ciments de Sour El Ghozlane	Bouira	1983	1,000,000	Limestone	Portland
8		SCMI	Société des Ciments de la Mitidja	Blida		800,000		
9		SCIBS	Société des Ciments de Beni Saf	AïnTemouchen	1979	1,200,000	Natural pozzolana	
10		SCS	Société des Ciments de Sigus	Taxas-Sigus, Oum El Bouaghi	2007			
11		SSC	Société Saoura Ciment	Hai Essalem. Bechar				
12		SCIZ	Société des Ciments de Zahana	Zahana, Mascra		1,200,000		
13		SCIS	Société des Ciments de Saïda	Saïda	1978	500,000	Natural pozzolana	
14		SCAL	Societe des Ciments d'Alger	Alger		1,200,000		
15	LAFARGE	Oggaz ligne blanc				550,000		
16		Oggaz ligne gris				4,400,000		
17		Msila			2004	5,000,000	Limestone and Natural pozzolana	
18		Biskra CILAS						
19	Sarl AMOUDA	SAC				2,500,000		
20	Entreprise HAMEL	STG				1,500,000		

The Cement production was responsible for 2,636.19 kt CO_2 emissions in 1990 and for 8,725.07 kt CO_2 emissions in 2020, which is an increase of 231% in the period 1990 – 2020, Compared to 2005, CO_2 emissions increased by 63.9% from 5,324.80 kt. The strongly increasing emissions are a consequence of the high demand for cement. Rising population, shrinking households and economic development are the drivers of the growing construction industry Indeed, the production of clinker decreased by 5.99% in 2003. 7.5% in 2010 and 18.4% in 2020, which influenced the production of cement that decreased by 7.5% in 2003. 9.3% in 2010 and 23% in 2020. The significant decrease in cement production during the year 2020 due to restrictions on the movement of cement trucks and the reduction of staff by 50% due to the corona pandemic.

The cement production increased between 2005-2009 due to the Five-Year Economic Plans 2005-2009 and 2010-2014[410], dedicated for major projects as AutoRoute EAST WEST and 1-million housing programs.

An overview of the cement production (IPCC sub-category 2.A.1) related CO_2 emissions is provided in the following figure and table.

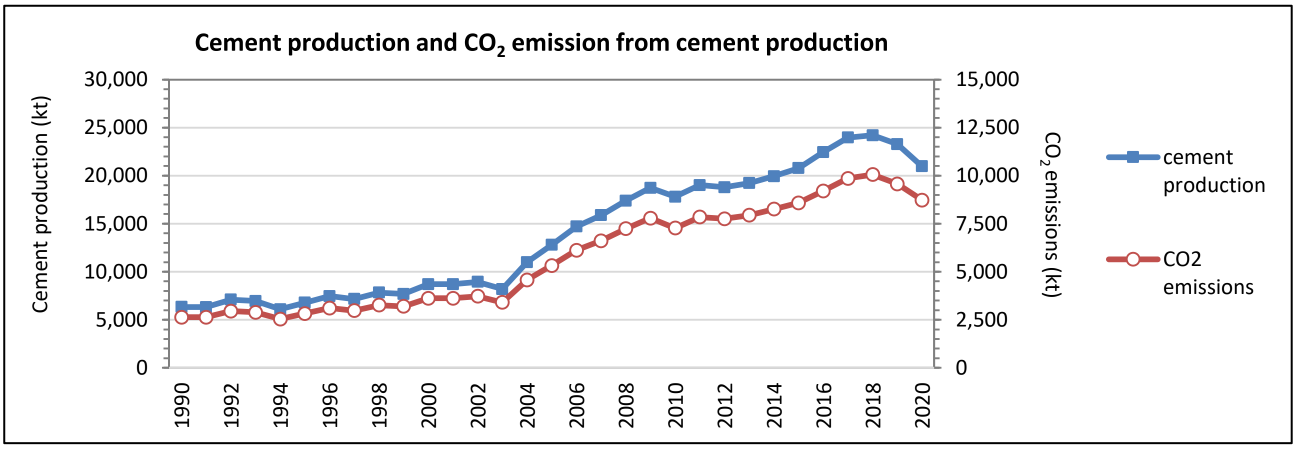

Figure 149 Production of Cement and CO_2 emissions from IPCC sub-category 2.A.1 Cement production

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[410] https://www.oecd-ilibrary.org/sites/9789264304161-10-en/index.html?itemId=/content/component/9789264304161-10-en

The wider ***economic agenda*** *in which SME policy is framed remains almost unchanged. The SME Policy Index 2014 noted that the overall economic policy framework was set by the Five Year Economic Plan (2010-2014), which placed private sector development as one of the country's key priorities (together with public investment in infrastructure, housing and social services), with the aim of reducing reliance on the hydrocarbon sector and diversifying the country's economic structure.*

Table 400 Activity data and CO_2 emissions from Cement production (IPCC sub-category 2.A.1)

Years	**Cement production**	**Source**	**Clinker production**	**CO_2 emission**
	kt		**kt**	**kt**
1990	6,337.00	ONS[411] (several years): Annuaire statistique de l'Algérie: Chapitre XIII: Industrie et Energie	5,069.60	2,636.19
1991	6,323.00		5,058.40	2,630.37
1992	7,093.00		5,674.40	2,950.69
1993	6,950.00		5,560.00	2,891.20
1994	6,093.50		4,874.80	2,534.90
1995	6,783.20		5,426.56	2,821.81
1996	7,470.00		5,976.00	3,107.52
1997	7,152.20		5,721.76	2,975.32
1998	7,835.80		6,268.64	3,259.69
1999	7,685.30		6,148.24	3,197.08
2000	8,703.00		6,962.40	3,620.45
2001	8,710.20		6,968.16	3,623.44
2002	8,940.90		7,152.72	3,719.41
2003	8,191.70		6,553.36	3,407.75
2004	11,000.00	US Geological Survey (several years): Algeria Minerals Yearbook[412]	8,800.00	4,576.00
2005	12,800.00		10,240.00	5,324.80
2006	14,702.00		11,761.60	6,116.03
2007	15,886.00		12,708.80	6,608.58
2008	17,397.00		13,917.60	7,237.15
2009	18,732.00		14,985.60	7,792.51
2010	17,799.54	Plant specific data	14,239.63	7,271.06
2011	19,019.21		15,215.37	7,845.46
2012	18,791.00		15,032.80	7,755.07
2013	19,219.80		15,375.84	7,939.42
2014	19,934.66		15,947.73	8,259.62
2015	20,776.98		16,621.58	8,584.46
2016	22,447.25		17,957.80	9,201.58
2017	23,957.64		19,166.11	9,858.54
2018	24,193.86		19,355.09	10,055.91
2019	23,274.69		18,619.75	9,571.74
2020	20,973.72		16,778.98	8,725.07
Trend				

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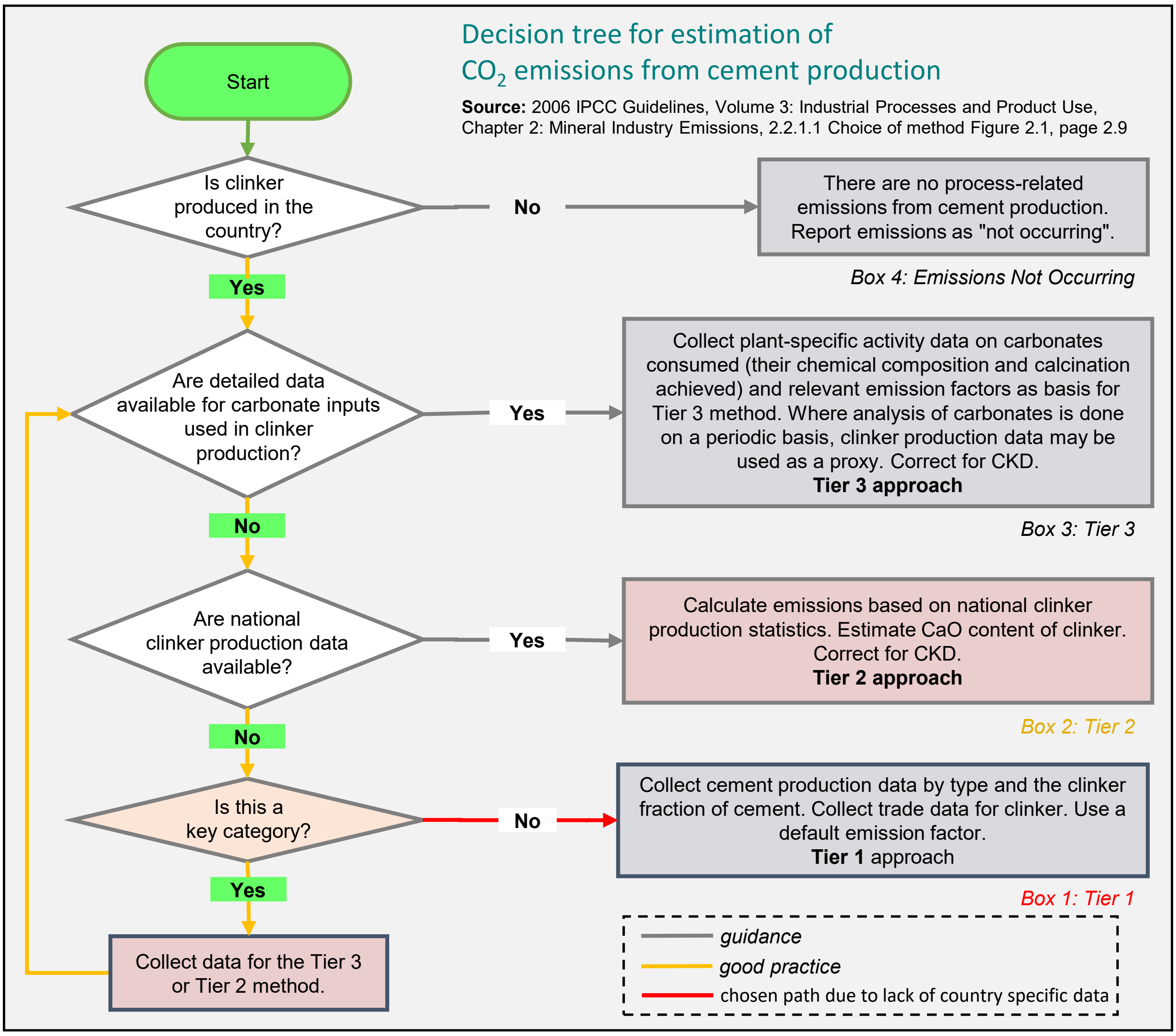
[411] https://www.ons.dz/spip.php?rubrique379
https://dspace.univ-guelma.dz/jspui/bitstream/123456789/3067/1/M%C3%A9moire%20master2%20.pdf

[412] https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

Years	Cement production	Source	Clinker production	CO_2 emission
	kt		kt	kt
1990 – 2020	230.97%		230.97%	231.0%
2005 – 2020	63.86%		63.86%	63.9%
2019 - 2020	-9.89%		-9.89%	-8.8%

4.2.1.2 Methodological issues

In the following is provided the decision tree and the decision (highlighted) for Tier 2 method for estimating CO_2 emissions from IPCC sub-category 2.A.1 *Cement production.*


Decision tree for estimation of CO_2 emissions from cement production

Source: 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, 2.2.1.1 Choice of method Figure 2.1, page 2.9

Figure 150 Decision tree for estimating GHG emission from IPCC category 2.A.1 Cement production

4.2.1.2.1 Choice of methods

The 2006 IPCC Guidelines Tier 1 approach[413] has been applied: CO_2 emissions are based on clinker production estimates inferred from cement production data, correcting for imports and exports of clinker.

Equation 2.1: Tier 1 - Emissions based on cement production (2006 IPCC GL. Vol. 3. Chap. 2.2.1.1*)*

$$\boldsymbol{CO_2\ emissions = \left[\sum_i (Mass_{ci}\ x\ ClFrac_{\ cl\ i}) - Imp + Exp\right] x\ EE_{cl\ i}}$$

Where:

CO_2 Emissions = emissions of CO_2 from cement production in tonnes

$Mass_{cli}$ = weight (mass) of cement produced of type i in tonnes

$CFlrac_{cl\ l}$ = clinker fraction of cement of type i, fraction

Im = imports for consumption of clinker, tonnes

Ex = exports of clinker, tonnes

$EF_{cl\ i}$ = emission factor for clinker, tonnes CO_2/tonne clinker

4.2.1.2.2 Choice of activity data

The activity data used for estimation of the CO_2 emissions were taken from different different national and international sources:

1990 – 2003	ONS[414] (several years): Annuaire statistique de l'Algérie: Chapitre XIII: Industrie et Energie
2004 - 2009	US Geological Survey (several years): Algeria Minerals Yearbook[415]
2010 - 2020	Plant specific data

For 2004 – 2009 the data from US British geological survey were taken as the data from national statistics were much lower. The data from US British geological survey were for the period 2010 – 2017 almost the same as the plant specific data. It is assumed that the national statistics only collected production data from the government owned cement plant.

For the period 2010 – 2020 it was possible to collect plant specific data from 18 out of 20 cement plants for production, import and export. Based on the provided plant specific data, a clinker fraction factor of 80% is assumed.

No CO_2 emissions were recovered.

4.2.1.2.3 Choice of emission factors

The default clinker emission factor EF_{clc} of the 2006 IPCC Guidelines[416] was applied. In Tier 1. it is *good practice* to

- use a default CaO content for clinker of 65%;
- assume that 100 percent of the CaO is from calcium carbonate material; and
- incorporate a 2 percent correction factor for CKD.

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[413] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 2: Mineral Industry Emissions, Sub-chapter 2.2 Cement Production

[414] https://www.ons.dz/spip.php?rubrique379

[415] https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[416] 2006 IPCC GL. Vol 3. IPPU, Chap. Chapter 2: Mineral Industry Emissions. sub-chap 2.2.1.2. (p. 2.12)

Equation 2.42: Emissions factor for clinker (2006 IPCC GL. Vol. 3. Chap. 2)

For the default CaO composition, 1 tonne of clinker contains 0.65 tonnes CaO from CaCO3.

This carbonate is 56.03% CaO and 43.97% CO_2 by weight.

$$\boldsymbol{Emission\ factor_{clc}} = CaO\ composition\ \boldsymbol{x}\ CKD\ correction$$

$$= \left(\frac{0.65}{0.5603}\right) \text{x } 0.4397\ \mathbf{x}\ \text{ CKD correction}$$

$$= 1.1601 \text{ tonnes } CaCO_3 \text{ (unrounded) x } 0.4397\ \mathbf{x}\ \text{ CKD correction}$$

$$= 0.5101 \text{ tonnes } CO_2 \text{ (unrounded) } \boldsymbol{x}\ 1.02$$

$$= 0.52 \text{ tonnes } CO_2 \text{ / tonne clinker}$$

4.2.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.A.1 *Cement production* are presented in the following table.

Table 401 Uncertainty for IPCC sub-category 2.A.1 Cement production.

Uncertainty	**CO_2**	**Reference**
Activity data (AD)	3%	2006 IPCC GL. Vol. 3. Chap.2. Table 2.3 Default uncertainty values for cement production
Emission factor (EF)	7%	
Combined Uncertainty (U)	7%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are consistent as the same methodology is applied to the whole period. Activity data are consistent as national and international data were always compared, see here Figure 151.

4.2.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed:

- Checked of calculations by spreadsheets
    - documented sources.
    - use of units.
    - record keeping; use of write protection.
    - strictly defined interfaces between spreadsheets/calculation modules.
    - unique structure of sheets which do the same.
    - unique use of formulas; special cases are documented/highlighted.
    - quick-control checks for data consistency through all steps of calculation.
- time series consistency
    - plausibility checks of dips and jumps.
    - yearly public trend repeated values.
- cross-checked from different sources:
    - Plant specific data
    - National Statistic published by Office National des Statistics (ONS)[417] (several years): Annuaire

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[417] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

statistique de l'Algérie: Chapitre XIII: Industrie et Energie

- international production statistics of UN statistics[418]
- US Geological Survey (several years): Algeria Minerals Yearbook[419]

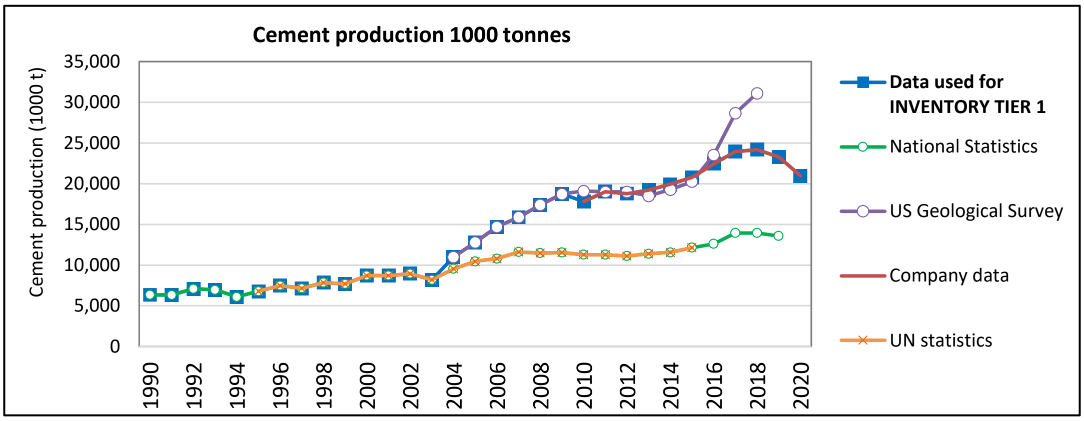

Figure 151 Comparison of national and international data set of the cement production

4.2.1.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category 2.A.1 Cement production.

Table 402 Recalculations done since submission 2010 IPCC sub-category 2.A.1 Cement production

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.A.1	2006 IPCC Guidelines TIER 2 methodology was applied	method	Accuracy
2.A.1	Revision of cement production data in national statistics	AD	Accuracy

4.2.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.1	Application of TIER 2 or higher methodology	M	Accuracy	high
2.A.1	Revision of activity data (1990-2020): improvement of time series consistency by collection of plant specific acticvity data from all cement plants • Production of clinker • Production of cement per type • Clinker fraction • CaO composition of clinker and the MgO content • CaO content of the raw material inputs	AD	Accuracy Transparency Completeness Consistency Comparabiliy	high
2.A.1	Investigation on amount of cement kiln dust (CKD) which is recycled or not returned to the kiln	AD	Accuracy Transparency	High

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[418] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

[419] https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.1	Revision of activity data (1990-2020): improvement of time series consistency • for imports for consumption of clinker • exports of clinker	AD	Accuracy Transparency Comparabiliy	high
2.A.1	Cross-check of national and international data sources	AD	Accuracy Transparency	Medium
2.A.1	Percentage share in cement kiln dust (CKD) which is recycled	AD	Accuracy Transparency Comparabiliy	Medium

4.2.2 Lime production (IPCC category 2.A.2)

4.2.2.1 Category description

IPCC code	Description	CO$_2$		CH$_4$		N$_2$O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.A.2	Lime production	✓	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

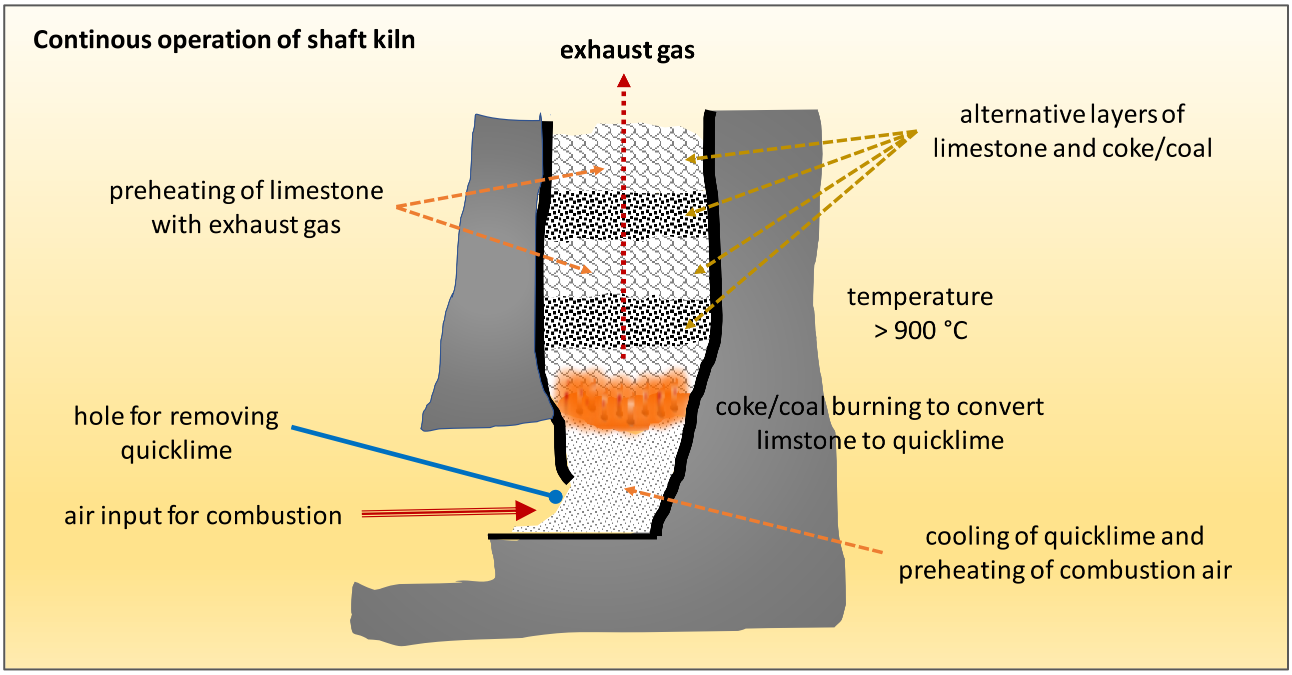

Figure 152 Illustration of a shaft kiln for lime production

This chapter includes the CO$_2$ emissions estimations from lime production. Process-related CO$_2$ emissions are released during (quick-)lime production. Calcium oxide (CaO) , also called as quicklime, is formed by heating limestone to decompose the carbonates. This is usually done in shaft or rotary kilns at high temperatures and the process releases CO$_2$. Depending on the product requirements (e.g., metallurgy, pulp and paper, construction materials, effluent treatment, water softening. pH control, and soil stabilisation), primarily high calcium limestone (calcite) is utilized in accordance with the following reaction:

$$CaCO_3 \text{ (high-purity limestone)} + \text{heat} \rightarrow CaO \text{ (quicklime)} + CO_2$$

Dolomite and dolomitic (high magnesium) limestones may also be processed at high temperature to obtain dolomitic lime (and release CO$_2$) in accordance with the following reaction:

$$CaMg(CO_3)_2 \text{ (dolomite)} + \text{heat} \rightarrow CaO{\cdot}MgO \text{ (dolomitic lime)} + 2CO_2.$$

At some facilities, hydrated (slaked) lime also is produced, using additional hydration operations.

The lime production was responsible for 18.89 kt CO_2 emissions in 1990 and for 28.62 kt CO_2 emissions in 2020, which is an increase of 51.5% in the period 1990 – 2020. Compared to 2005. CO_2 emissions increased by 52.4% from 18.77 kt to 28.62 Kt. The increase in CO_2 emissions is a consequence of the high demand for lime in different industrial sectors, which use lime as raw material such as:

- chemical and pharmaceutical manufacturing.
- environmental remediation.
- water treatment.
- paper industry.
- manufacture of paints, varnishes, inks and sealants.
- plaster.
- glass and ceramics.
- manufacture of food products and as additives for food products.
- mining.
- manufacture of other non-metallic mineral products (plaster, cement…).
- building and construction sector

Almost all sectors increased their activities in the last decades.

An overview of the lime production (IPCC sub-category 2.A.2) related CO_2 emissions is provided in the following figure and table.

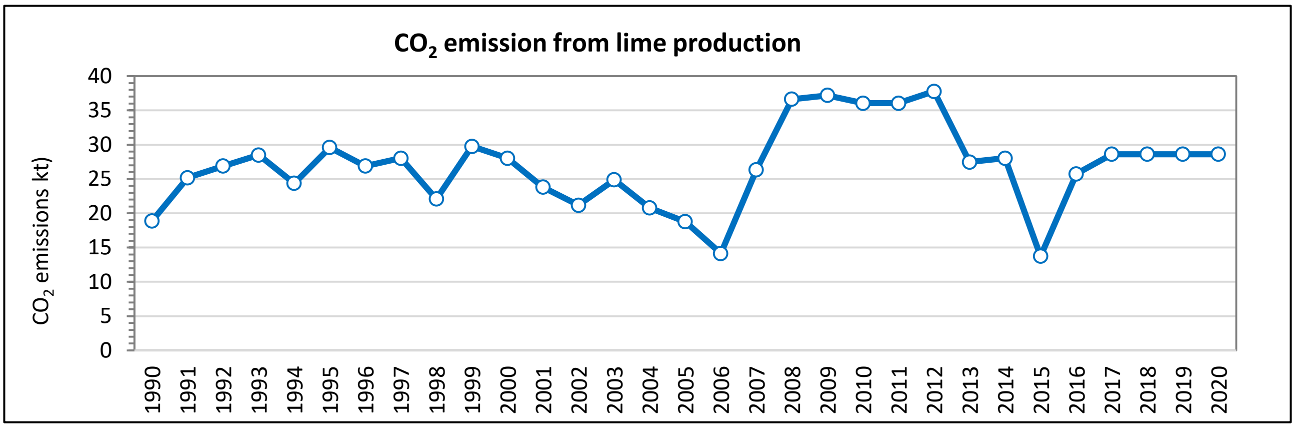

Figure 153 CO_2 emissions from IPCC sub-category 2.A.2 Lime production

Table 403 Activity data and CO_2 emissions from Lime production (IPCC sub-category 2.A.2)

Year	Activity data: Lime production		CO_2 emissions
	kt	Source	kt
1990	33.00		18.89
1991	44.00		25.18
1992	47.00		26.90
1993	49.80		28.50
1994	42.60		24.38
1995	51.70		29.59
1996	47.00		26.90

Year	Activity data: Lime production		CO_2 emissions
	kt	Source	kt
1997	49.00	ONS (Statistic Annuaires)[420]	28.04
1998	38.60		22.09
1999	52.00		29.76
2000	49.00		28.04
2001	41.60		23.81
2002	37.00		21.18
2003	43.50		24.90
2004	36.30		20.77
2005	32.80		18.77
2006	24.70		14.14
2007	46.00	US geological survey[421]	26.33
2008	64.00		36.63
2009	65.00		37.20
2010	63.00		36.05
2011	63.00		36.05
2012	66.00		37.77
2013	48.00		27.47
2014	49.00		28.04
2015	24.00		13.74
2016	45.00		25.75
2017	50.00		28.62
2018	50.00		28.62
2019	50.00	As of 2018	28.62
2020	50.00		28.62
Trend			
1990 – 2020	*51.5%*		*51.5%*
2005 - 2020	*52.4%*		*52.4%*
2019 – 2020	*0.0%*		*0.0%*

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[420] https://www.ons.dz/spip.php?rubrique289

[421] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

4.2.2.2 Methodological issues

4.2.2.2.1 Choice of methods

The 2006 IPCC Guidelines Tier 1 approach[422] has been applied which is based on applying a default emission factor to national level lime production data.

Equation: Tier 1 - Emissions based on national lime production data

(2006 IPCC Guidelines. Vol. 3. Chapter 2. sub-chapter 2.3.1.1)

$$CO_2\ emissions = Mass_{hydraled\ lime} \times Emission\ \mathbf{Factor}_{\mathbf{hydroled\ lime}} \times CF_{\mathbf{hydroled\ lime}}$$

Where:

CO_2 Emissions = emissions of CO_2 from lime production (tonnes)
$Mass_{hydralic\ lime}$ = weight (mass) of hydraulic lime produced (tonnes)
$EF_{hydralic\ lime}$ = emission hydraulic factor for lime (tonnes CO_2/tonne lime)
$CF_{hydralic\ lime}$ = default correction factor for hydrated lime

It is not necessary for good practice to account for lime kiln dust (LKD) in Tier 1.

According to information provided by US geologic survey, the type of lime produced is hydraulic lime.

4.2.2.2.2 Choice of activity data

For Algeria it was possible to collect country specific data on lime production for the period 1990-2006 from ONS. For the period 2007-2018, data on lime production was taken from US Geological Survey (USGS)-Minerals Yearbook (different years)[423].

According to information provided by US geologic survey, the type of lime produced is hydraulic lime.

4.2.2.2.3 Choice of emission factors

Tier 1 is an output-based method and applies an emission factor to the total quantity of lime produced.

Table 404 Basic parameters for the calculation of emission factors for lime production

Lime Type	**Stoichiometric Ratio**		**Range of**		**Share (default)**	**CO_2 Emission factor (EF)**			
			CaO Content	**MgO Content**		**High-calcium lime**	**Dolomitic lime**	**Default lime**	**Hydrauli c lime**
	tonnes CO_2 / tonne CaO	**tonnes CO_2 / CaO·MgO]**	**%**		**%**	**(tonne CO_2 / t lime)**			
High-calcium lime	0.785	-	93-98	0.3-2.5	100	0.75			
Dolomitic lime	-	0.913	55-57	38-41	0		0.77		
Hydraulic lime	0.785		65-92	NA	NA				0.59
Default Lime								0.75	

Source: Table 2.4 of 2006 IPCC Guidelines. Volume 3: Industrial Processes and Product Use. Chapter 2: Mineral Industry Emissions, sub-chapter 2.3.1.2 - Choice of emission factor (Lime Production)

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[422] Source: 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, Sub-chapter 2.3.1.1 Lime Production - Choice of method

[423] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

$CF_{hydralic\ lime}$ = default correction factor for hydrated lime

The default correction factor for hydrated lime ($CF_{hydralic\ lime}$) is 0.97 based on the assumption that the vast majority of hydrated lime produced is high-calcium (90 percent) and the default water content is 0.28.

4.2.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.A.2 Lime *production* are presented in the following table.

Table 405 Uncertainty for IPCC sub-category 2.A.2 Lime production.

Uncertainty	**CO_2**	**Reference**
Activity data (AD)	5%	based on 2006 IPCC GL. Vol. 3. Chap.2. Table 2.5 Default uncertainty values for lime production. page 2.25 and sub-chapter 2.3.2.2. page 2.26.
Emission factor (EF)	15%	
Combined Uncertainty (U)	16%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as Tier 1 approach is applied to the time series 1990 -2020.

4.2.2.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed:

- Checked of calculations by spreadsheets
    - documented sources.
    - use of units.
    - record keeping; use of write protection.
    - unique use of formulas; special cases are documented/highlighted.
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from three sources:
    - national statistic ONS.
    - US Geological Survey (USGS) Minerals Yearbook.
    - international production statistics of UN statistics[424]
- time series consistency - plausibility checks of dips and jumps.

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[424] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

4.2.2.5 Category-specific recalculations including explanatory information and justifications.

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category 2.A.2 Lime production.

Table 406 Recalculations done since submission 2010 IPCC sub-category 2.A.2 Lime production.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.A.2	Application of 2006 IPCC Guidelines	method	Accuracy Comparability
2.A.2	Application of default emission factors of 2006 IPCC Guidelines	EF	Accuracy Transparency
2.A.2	Revision of activity data	AD	Accuracy

4.2.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 407 Planned improvement for IPCC sub-category 2.A.2 Lime production

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.2	Application Tier 2 method or higher	meth	Accuracy Comparability	Medium
2.A.2	Collection of production data for 1990 - 2020 • plant specific production data • types of lime produced. • carbonates consumed including their chemical composition and calcination achieved	AD	Accuracy Comparability Consistency Completeness Transparency	Medium
2.A.2	Analysis of industries that produce non-marketed lime, e.g., sugar production, pulp and paper manufacturing facilities. metallurgy, water softeners.	AD	Accuracy Transparency	Medium
2.A.2	Investigation regarding lime kiln dust (LKD) production. its composition and use.	AD	Accuracy Transparency	Medium

4.2.3 Glass Production (IPCC category 2.A.3)

4.2.3.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.A.3	Glass production	✓	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

As described in the 2006 IPCC guidelines[425], many kinds of glass articles and compositions are used commercially, but the glass industry can be divided into four main categories: containers, flat (window) glass. fibre glass, and specialty glass. The major glass raw materials which emit CO_2 during the melting process are limestone (CaCO3), dolomite $Ca.Mg(CO_3)_2$ and soda ash (Na_2CO_3). Where these materials are mined as carbonate minerals for their use in the glass industry, they represent primary CO_2 production and should be included in emissions estimates. Where carbonate materials are produced through the carbonation of a hydroxide they do not result in net CO_2 emissions and should not be included in the emissions estimate. Minor CO_2-emitting glass raw materials are barium carbonate ($BaCO_3$), bone ash ($3CaO_2P_2O5$ + $XCaCO_3$), potassium carbonate (K_2CO_3) and strontium carbonate ($SrCO_3$). Additionally, powdered anthracite coal or some other organic material may be added to create reducing conditions in the molten glass, and will combine with available oxygen in the glass melt to produce CO_2. The action of these carbonates in the fusion of glass is a complex high-temperature chemical reaction, and is not to be directly compared to the calcination of carbonates to produce quicklime or burnt dolomitic lime. Nevertheless, this fusion (in the region of 1500°C) has the same net effect in terms of CO_2 emissions.

The glass production was responsible for 5.87 kt of CO_2 emissions in 1990 and 1.35 kt of CO_2 emissions in 2020. a decrease of 77% over the period 1990 - 2020. In 2005, CO_2 emissions decreased to 3.01 kt, either a decrease of 55%. From 2019 to 2020, a decrease of 14.5% was observed. The decrease in GHG emissions is a consequence of the decrease in glass production. Indeed, since 2010, it was notices a clear decrease in CO_2 emissions due to the decrease in the production of glass in the country, explained by the reduction of its use in different areas, and the trend to use plastic, which is easy to recycle and cheaper than glass especially in the beverage sector.

An overview of the glass production (IPCC category 2.A) related CO_2 emissions is provided in the following figure and table.

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[425] Source: 2006 IPCC GL, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, Sub-chapter 2.4 Glass production

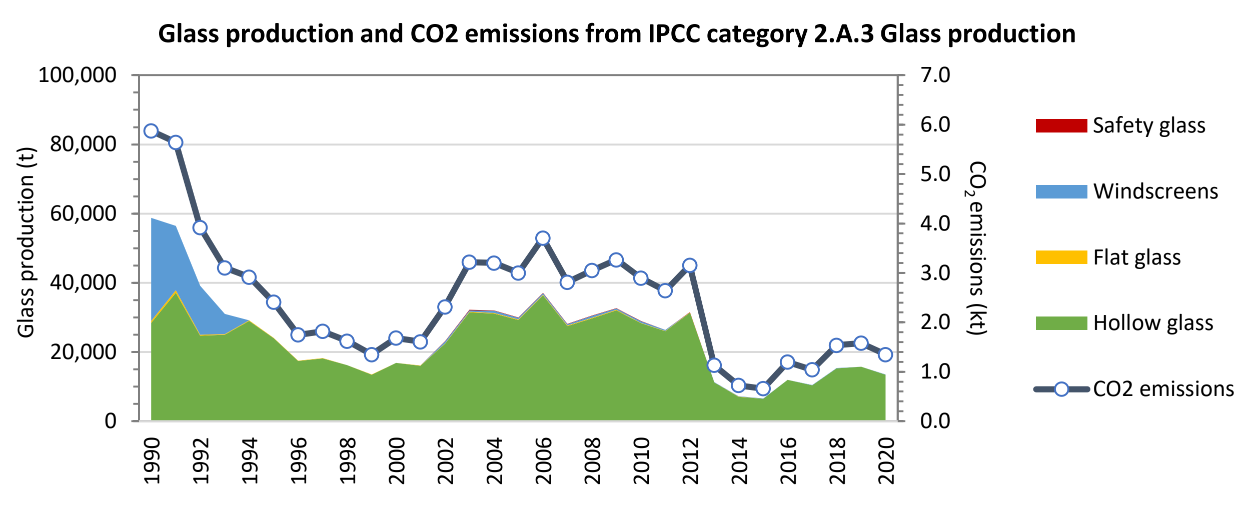

Figure 154 CO_2 emissions from IPCC sub-category 2.A.3 Glass production

Table 408 Activity data and CO_2 emissions from Glass production (IPCC sub-category 2.A.3)

	Glass production					CO_2 emissions
	Hollow glass	**Flat glass**	**Windscreens**	**Safety glass**	**Total**	
	t	**t**	**t**	**t**	**t**	**kt**
1990	28,387	29,798	0	548	59,281	5.87
1991	37,110	18,613	0	703	57,129	5.64
1992	24,701	14,208	0	274	39,457	3.92
1993	25,022	5,871	0	149	31,191	3.10
1994	28,973	0	0	189	29,351	2.92
1995	23,998	0	0	95	24,188	2.41
1996	17,356	0	0	130	17,616	1.75
1997	18,134	0	0	60	18,254	1.82
1998	16,176	0	0	28	16,232	1.62
1999	13,464	0	0	24	13,513	1.35
2000	16,801	0	0	27	16,855	1.68
2001	16,005	0	0	75	16,156	1.61
2002	22,414	517	8,969	97	23,126	2.31
2003	31,472	432	10,963	140	32,185	3.22
2004	31,091	610	8,410	209	32,119	3.20
2005	29,285	436	8,509	167	30,056	3.00
2006	36,380	427	7,361	169	37,144	3.71
2007	27,521	379	5,582	162	28,223	2.81
2008	29,700	586	3,658	177	30,639	3.05
2009	32,040	425	3,466	147	32,760	3.27
2010	28,285	477	4,498	159	29,079	2.90
2011	26,038	217	5,152	81	26,417	2.64
2012	31,369	39	5,539	60	31,528	3.15
2013	11,166	34	3,357	71	11,342	1.13
2014	7,072	79	3,055	40	7,232	0.72

	Glass production					CO_2 emissions
	Hollow glass	Flat glass	Windscreens	Safety glass	Total	
	t	t	t	t	t	kt
2015	6,462	65	2,065	33	6,592	0.66
2016	11,909	39	1,241	20	11,988	1.20
2017	10,372	23	865	20	10,435	1.04
2018	15,272	25	2,509	37	15,372	1.54
2019	15,694	34	2,745	15	15,757	1.58
2020	13,441	24	1,776	6	13,477	1.35
Trend						
1990 – 2020	*-52.7%*	*-99.9%*	*NA*	*-98.9%*	*-77%*	*-77%*
2005 - 2020	*-54.1%*	*-94.4%*	*-79.1%*	*-96.5%*	*-55%*	*-55%*
2019 – 2020	*-14.4%*	*-27.6%*	*-35.3%*	*-60.8%*	*-14.5%*	*-14.5%*

4.2.3.2 Methodological issues

4.2.3.2.1 Choice of methods

The 2006 IPCC Guidelines Tier 1 approach[426] has been applied which is based on applying a default emission factor to national level glass production data.

Equation 2.10: TIER 1 emissions based on glass production

(2006 IPCC Guidelines. Vol. 3. Chapter 2. sub-chapter 2.4.1.1)

$$CO_2\ emissions = Mass_{glass} \times EF_{\mathbf{glass}} \times (1 - CR)$$

Where:

CO_2 Emissions = emissions of CO_2 from glass production (tonnes)

$Mass_{glass}$ = mass of glass produced (tonnes)

EF_{glass} = default emission factor for manufacturing of glass (tonnes CO_2/tonne glass)

CR = cullet ratio for process (either national average or default) , fraction

4.2.3.2.2 Choice of activity data

Production data of differnet type of glasses was used:

- hollow glass
- flat glass
- windscreens
- safety glass

Data were taken from ONS[427], Statistic Annuaires and Collections Statistiques (Série E: Statistiques Economiques - l'activité industrielle).

Some glass data were provided in m^2. The density of glass is 2.5, which gives flat glass a mass of 2.5kg per m2 per mm of thickness, or 2500 kg per m^3.[428]

As descripted in the 2006 IPCC Guidelines, glass makers do not produce glass only from raw materials, but

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[426] Source: 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, Sub-chapter 2.3.1.1 Lime Production - Choice of method

[427] https://www.ons.dz/spip.php?rubrique289

[428] Available (04.09.2022) on https://www.saint-gobain-glass.co.uk/en-gb/architects/physical-properties#:~:text=The%20density% 20of%20

use a certain amount of recycled scrap glass (cullet). Most operations will use as much cullet as they can obtain, sometimes with restrictions for glass quality requirements. The cullet ratio (the fraction of the furnace charge represented by cullet) will be in the range of 0.4 to 0.6 for container applications, which are the bulk of glass production. Tier 1 assumes a default cullet ratio of 50%.

Activity data are provided the table above.

4.2.3.2.3 Choice of emission factors

Tier 1 applies a default emission factor, based on a 'typical' raw material mixture, to national glass production data. A 'typical' soda-lime batch might consist of sand (56.2 wt%), feldspar (5.3 wt%), dolomite (9.8 wt%). limestone (8.6 wt%) and soda ash (20.0 wt%). Based on this composition, one metric tonne of raw materials yields approximately 0.84 tonnes of glass, losing about 16.7 percent of its weight as volatiles, in this case virtually entirely CO_2.

Equation 2.13: TIER 1 Default emission factor for glass production

(2006 IPCC Guidelines. Vol. 3. Chapter 2. sub-chapter 2.4.1.2)

$$\boldsymbol{CO_2\ emissions = \frac{0.167}{0.84} = 0.20\ tonne\ CO2\ /\ tonne\ glass}$$

4.2.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.A.3 *Glass production* are presented in the following table.

Table 409 Uncertainty for IPCC sub-category 2.A.3 Glass production.

Uncertainty	CO_2	Reference
Activity data (AD)	5%	2006 IPCC GL. Vol. 3. Chap.2. sub-chapter 2.4.2.
Emission factor (EF)	60%	
Combined Uncertainty (U)	60%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be almost consistent as Tier 1 approach is applied to the time series 1990 - 2020.

4.2.3.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed:

- Checked of calculations by spreadsheets
    - documented sources.
    - use of units.
    - record keeping; use of write protection.
    - unique use of formulas; special cases are documented/highlighted.
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from two sources:
    - national statistic ONS.
    - international production statistics of UN statistics[429]

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glass%20is,or%202500%20kg%20per%20m3.&text=The%20compressive%20strength%20of%20glass,load%20of%20some%2010%20tonnes

[429] United Nations - Department of Economic and Social Affairs - Statistics Division Statistics - Energy Statistics https://unstats.un.org/unsd/energystats/

- time series consistency - plausibility checks of dips and jumps.

4.2.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category 2.A.3 Glass production.

Table 410 Recalculations done since submission 2010 IPCC sub-category 2.A.3 Glass production

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.A.3	No revision were performed as the emission were estimated the first time.		

4.2.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 411 Planned improvement for IPCC sub-category 2.A.3 Glass production

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.3	Application Tier 2 methodology or higher	meth	Accuracy Comparability	Medium
2.A.3	Collection of production data for 1990 - 2020 • plant specific production data • types of glass produced • carbonates consumed	AD	Accuracy Comparability Consistency Completenes Transparency	Medium
2.A.3	Investigation of glass production processes used in the country	AD	Accuracy Transparency	Medium
2.A.3	Investigation regarding cullet ration (recycled glass)	AD	Accuracy Transparency	Medium

4.2.4 Other Process Uses of Carbonates (IPCC category 2.A.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.A.4	Other Process Uses of Carbonates						
2.A.4.a	Ceramics	NE	-	NA	-	NA	-
2.A.4.b	Other Uses of Soda Ash	NE	-	NA	-	NA	-
2.A.4.c	Non-Metallurgical Magnesia Production	NE	-	NA	-	NA	-
2.A.4.d	Other (please specify)	NE	-	NA	-	NA	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

Emissions from IPCC category 2.A.4 *Other Process Uses of Carbonates* were not estimated due lack of data and resources.

4.2.4.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 412 Planned improvements for IPCC sub-category 2.A.4 Other Process Uses of Carbonates

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
2.A.4	Survey on process uses of carbonates and collection of activity data related to activites of • Production of ceramics • Other uses of soda ash • Non-metallurgical magnesium production • Other .	AD	Completness	Medium

4.2.5 Other (IPCC category 2.A.5)

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.A.5	Other (please specify)	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.A.5 *Other* does not exist in Algeria.

4.3 Chemical Industry (IPCC category 2.B)

The IPCC category 2.B comprises the production of various inorganic and organic chemicals. The following tables provides information which of the chemical industries are occurrent in Algeria.

Table 413 Overview of chemical industries occurring in Algeria.

IPCC code	**Description**	**Occurrent**		**Not occurrent NO**
		Estimated	**Not estimated (NE)**	
2.B.1	Ammonia Production (*including Urea production*)	x		
2.B.2	Nitric Acid Production	x		
2.B.3	Adipic Acid Production			x
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production			x
2.B.4.a	Caprolactam			
2.B.4.b	Glyoxal			
2.B.4.c	Glyoxylic acid			
2.B.5	Carbide Production			x
2.B.5.a	Silicon carbide			

2.B.5.b	Calcium carbide			
2.B.6	Titanium Dioxide Production			x
2.B.7	Soda Ash Production			x
2.B.8	Petrochemical and Carbon Black Production			
2.B.8.a	Methanol	x		
2.B.8.b	Ethylene	x		
2.B.8.c	Ethylene Dichloride and Vinyl Chloride Monomer			x
2.B.8.d	Ethylene Oxide			x
2.B.8.e	Acrylonitrile			x
2.B.8.f	Carbon Black			x
2.B.9	Fluor chemical Production			
2.B.9.a	By product emissions			x
2.B.9.b	Fugitive Emissions			x
2.B.10	Other – Urea production			
2.B.10.a	Hydrogen production			x
2.B.10.b	Other - Urea production	x		

An overview of the GHG emission from fuel combustion in IPCC category 2.B *Chemical Industry* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020, 2019 – 2020;

The greenhouse gas emissions from IPCC category 2.B *Chemical Industry* amounted to 1,226.6 kt CO_2 equivalents in 1990, 1,573.96 kt CO_2 equivalents in 2005 and 113.90 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC category 2.B *Chemical Industry* shows an dencrease by 90.7% from 1990 to 2020, 92.8% from 2005 to 2020 and by 63.2% from 2019 to 2020.
The most important gas is CO_2 with a share of 83% (2019). N_2O contribute with a share of 15.35% (2019) and CH_4 with a share of about 1.65% (2019). In 1990, CO_2 contribute with a share of 63.7%.

In 2019, the share in IPCC category 2.B *Chemical Industry* contributes with

- 76% the IPCC category 2.B.1. Ammonia production
- 23% the IPCC category 2.B.2. Nitric acid production
- 1% the IPCC category 2.B.8. Petrochemical and carbon black production

All other categories were not estimates (2.B.10) or not occurrent.

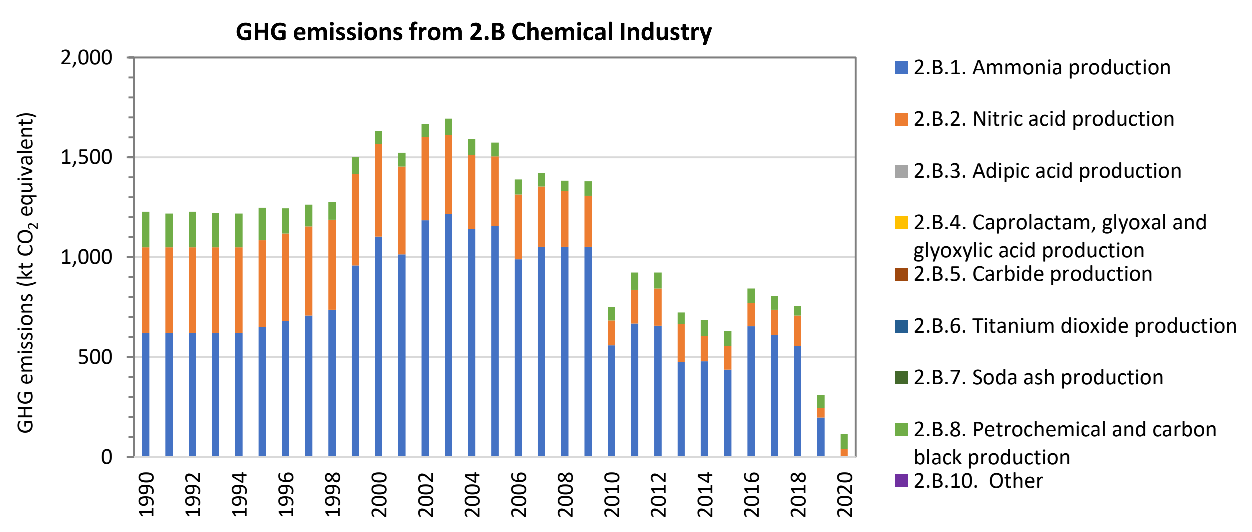

Figure 155 GHG Emissions from IPCC category 2.B *Chemical Industry* by category

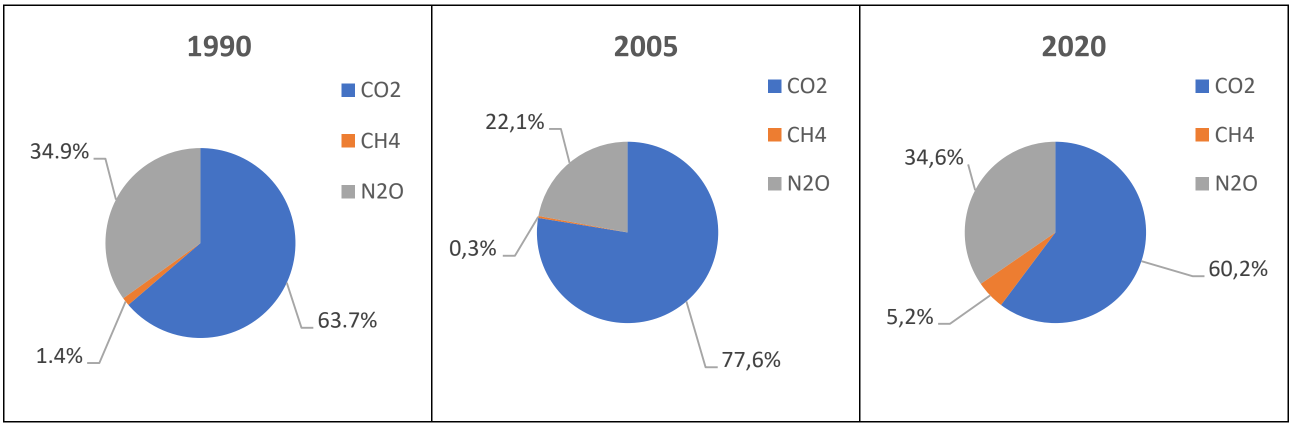

Figure 156 Share of greenhouse gases in IPCC category 2.B *Chemical Industry*

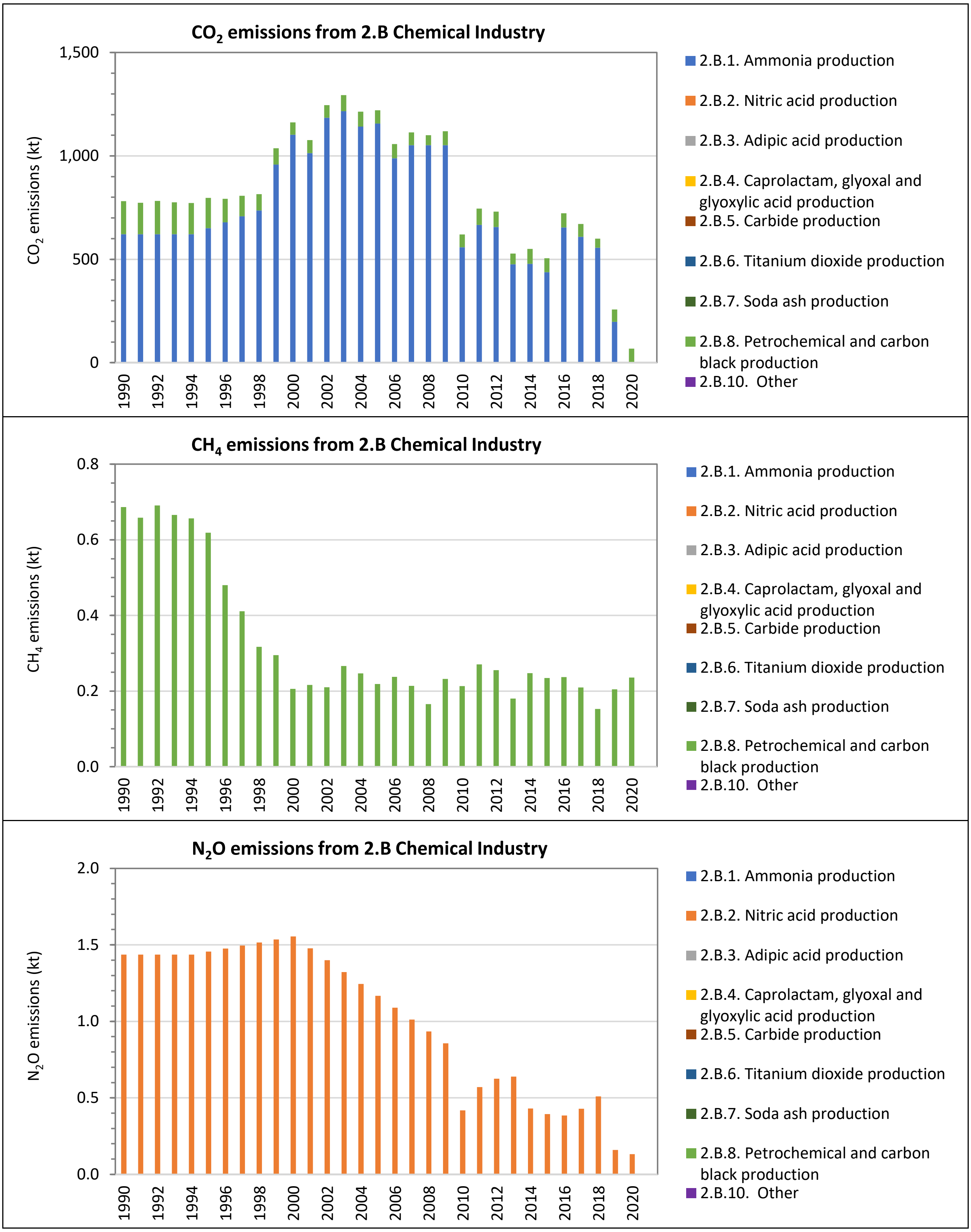

Figure 157 Emissions from IPCC category 2.B *Chemical Industry*

Table 414 GHG Emissions by fuels from IPCC category 2.B *Chemical Industry*

	2.B	2.B.1	2.B.2	2.B.3	2.B.4	2.B.5	2.B.6.	2.B.7.	2.B.8.	2.B.9	2.B.10.
GHG	**Chemical industry**	Ammonia production	Nitric acid production	Adipic acid production	Caprolactam. glyoxal & other production	Carbide production	Titanium dioxide production	Soda ash production	Petrochemical and carbon black production	Fluoro-chemical production	Other
	kt CO_2 eq										
1990	1,226.6	621.9	428.0	NO	NO	NO	NO	NO	177.4	NA	NO
1991	1,217.9	621.9	428.0	NO	NO	NO	NO	NO	168.6	NA	NO
1992	1,228.0	621.9	428.0	NO	NO	NO	NO	NO	178.8	NA	NO
1993	1,220.1	621.9	428.0	NO	NO	NO	NO	NO	170.8	NA	NO
1994	1,217.3	621.9	428.0	NO	NO	NO	NO	NO	168.0	NA	NO
1995	1,246.6	650.6	433.9	NO	NO	NO	NO	NO	162.7	NA	NO
1996	1,244.0	679.3	439.7	NO	NO	NO	NO	NO	125.5	NA	NO
1997	1,263.4	708.0	445.6	NO	NO	NO	NO	NO	110.1	NA	NO
1998	1,275.0	736.7	451.5	NO	NO	NO	NO	NO	87.1	NA	NO
1999	1,501.9	958.0	457.4	NO	NO	NO	NO	NO	86.8	NA	NO
2000	1,631.1	1,102.8	463.3	NO	NO	NO	NO	NO	65.2	NA	NO
2001	1,522.6	1,014.0	440.2	NO	NO	NO	NO	NO	68.6	NA	NO
2002	1,668.3	1,184.6	417.1	NO	NO	NO	NO	NO	66.8	NA	NO
2003	1,694.5	1,216.4	394.0	NO	NO	NO	NO	NO	84.4	NA	NO
2004	1,591.3	1,142.3	370.9	NO	NO	NO	NO	NO	78.3	NA	NO
2005	1,574.0	1,157.1	347.8	NO	NO	NO	NO	NO	69.3	NA	NO
2006	1,388.6	988.8	324.7	NO	NO	NO	NO	NO	75.4	NA	NO
2007	1,421.1	1,051.9	301.6	NO	NO	NO	NO	NO	67.9	NA	NO
2008	1,382.8	1,051.9	278.5	NO	NO	NO	NO	NO	52.5	NA	NO
2009	1,380.8	1,051.9	255.4	NO	NO	NO	NO	NO	73.7	NA	NO
2010	750.2	558.2	124.5	NO	NO	NO	NO	NO	67.7	NA	NO
2011	922.8	667.0	170.2	NO	NO	NO	NO	NO	85.8	NA	NO
2012	923.7	656.8	186.1	NO	NO	NO	NO	NO	81.0	NA	NO
2013	723.3	475.7	190.6	NO	NO	NO	NO	NO	57.2	NA	0.0001
2014	684.7	478.0	128.4	NO	NO	NO	NO	NO	78.5	NA	0.002
2015	628.8	437.3	117.4	NO	NO	NO	NO	NO	74.4	NA	0.003
2016	843.6	654.1	114.5	NO	NO	NO	NO	NO	75.2	NA	0.004
2017	803.7	609.5	128.0	NO	NO	NO	NO	NO	66.4	NA	0.003
2018	756.0	555.6	152.0	NO	NO	NO	NO	NO	48.5	NA	0.007
2019	309.5	197.2	47.5	NO	NO	NO	NO	NO	65.0	NA	NE
2020	113.9	0.0	39.4	NO	NO	NO	NO	NO	74.7	NA	NE
Trend											
1990 - 2020	-90.7%	-100.0%	-90.8%	NA	NA	NA	NA	NA	-57.9%	NA	NA
2005 - 2020	-92.8%	-100.0%	-88.7%	NA	NA	NA	NA	NA	7.8%	NA	NA
2019 - 2020	-63.2%	-100.0%	-17.0%	NA	NA	NA	NA	NA	15.1%	NA	NA

Table 415 CO_2 Emissions by fuels from IPCC category 2.B *Chemical Industry*

	2.B	2.B.1	2.B.2	2.B.3	2.B.4	2.B.5	2.B.6.	2.B.7.	2.B.8.	2.B.9	2.B.10.
CO_2	**Chemical industry**	Ammonia production	Nitric acid production	Adipic acid production	Caprolactam. glyoxal & other production	Carbide production	Titanium dioxide production	Soda ash production	Petrochemical and carbon black production	Fluoro-chemical production	Other
	kt										
1990	781.5	621.9	NA	NO	NO	NO	NO	NO	159.5	NA	NO
1991	773.4	621.9	NA	NO	NO	NO	NO	NO	151.5	NA	NO
1992	782.7	621.9	NA	NO	NO	NO	NO	NO	160.8	NA	NO
1993	775.4	621.9	NA	NO	NO	NO	NO	NO	153.5	NA	NO
1994	772.9	621.9	NA	NO	NO	NO	NO	NO	151.0	NA	NO
1995	797.3	650.6	NA	NO	NO	NO	NO	NO	146.6	NA	NO
1996	792.3	679.3	NA	NO	NO	NO	NO	NO	113.0	NA	NO
1997	807.5	708.0	NA	NO	NO	NO	NO	NO	99.5	NA	NO
1998	815.6	736.7	NA	NO	NO	NO	NO	NO	78.8	NA	NO
1999	1,037.2	958.0	NA	NO	NO	NO	NO	NO	79.1	NA	NO
2000	1,162.7	1,102.8	NA	NO	NO	NO	NO	NO	59.9	NA	NO
2001	1,077.0	1,014.0	NA	NO	NO	NO	NO	NO	63.0	NA	NO
2002	1,245.9	1,184.6	NA	NO	NO	NO	NO	NO	61.3	NA	NO
2003	1,293.9	1,216.4	NA	NO	NO	NO	NO	NO	77.5	NA	NO
2004	1,214.2	1,142.3	NA	NO	NO	NO	NO	NO	71.9	NA	NO
2005	1,220.7	1,157.1	NA	NO	NO	NO	NO	NO	63.7	NA	NO
2006	1,058.0	988.8	NA	NO	NO	NO	NO	NO	69.2	NA	NO
2007	1,114.2	1,051.9	NA	NO	NO	NO	NO	NO	62.3	NA	NO
2008	1,100.1	1,051.9	NA	NO	NO	NO	NO	NO	48.2	NA	NO
2009	1,119.5	1,051.9	NA	NO	NO	NO	NO	NO	67.7	NA	NO
2010	620.4	558.2	NA	NO	NO	NO	NO	NO	62.2	NA	NO
2011	745.8	667.0	NA	NO	NO	NO	NO	NO	78.8	NA	NO
2012	731.2	656.8	NA	NO	NO	NO	NO	NO	74.4	NA	NO
2013	528.2	475.7	NA	NO	NO	NO	NO	NO	52.5	NA	0.0001
2014	550.1	478.0	NA	NO	NO	NO	NO	NO	72.0	NA	0.002
2015	505.6	437.3	NA	NO	NO	NO	NO	NO	68.3	NA	0.003
2016	723.1	654.1	NA	NO	NO	NO	NO	NO	69.1	NA	0.004
2017	670.5	609.5	NA	NO	NO	NO	NO	NO	61.0	NA	0.003
2018	600.2	555.6	NA	NO	NO	NO	NO	NO	44.6	NA	0.007
2019	256.9	197.2	NA	NO	NO	NO	NO	NO	59.6	NA	NE
2020	68.6	0.0	NA	NO	NO	NO	NO	NO	68.6	NA	NE
Trend											
1990 - 2020	-91.2%	-100.0%	NA	NA	NA	NA	NA	NA	*-57.0%*	NA	NA
2005 - 2020	-94.4%	-100.0%	NA	NA	NA	NA	NA	NA	*7.8%*	NA	NA
2019 - 2020	-73.3%	-100.0%	NA	NA	NA	NA	NA	NA	*15.1%*	NA	NA

Table 416 N_2O Emissions by fuels from IPCC category 2.B *Chemical Industry*

	2.B	**2.B.1**	**2.B.2**	**2.B.3**	**2.B.4**	**2.B.5**	**2.B.6.**	**2.B.7.**	**2.B.8.**	**2.B.9**	**2.B.10.**
N_2O	**Chemical industry**	Ammonia production	Nitric acid production	Adipic acid production	Caprolactam. glyoxal & other production	Carbide production	Titanium dioxide production	Soda ash production	Petrochemical and carbon black production	Fluoro-chemical production	Other
	kt										
1990	1.44	NA	1.44	NO	NO	NO	NO	NO	NO	NA	NO
1991	1.44	NA	1.44	NO	NO	NO	NO	NO	NO	NA	NO
1992	1.44	NA	1.44	NO	NO	NO	NO	NO	NO	NA	NO
1993	1.44	NA	1.44	NO	NO	NO	NO	NO	NO	NA	NO
1994	1.44	NA	1.44	NO	NO	NO	NO	NO	NO	NA	NO
1995	1.46	NA	1.46	NO	NO	NO	NO	NO	NO	NA	NO
1996	1.48	NA	1.48	NO	NO	NO	NO	NO	NO	NA	NO
1997	1.50	NA	1.50	NO	NO	NO	NO	NO	NO	NA	NO
1998	1.52	NA	1.52	NO	NO	NO	NO	NO	NO	NA	NO
1999	1.53	NA	1.53	NO	NO	NO	NO	NO	NO	NA	NO
2000	1.55	NA	1.55	NO	NO	NO	NO	NO	NO	NA	NO
2001	1.48	NA	1.48	NO	NO	NO	NO	NO	NO	NA	NO
2002	1.40	NA	1.40	NO	NO	NO	NO	NO	NO	NA	NO
2003	1.32	NA	1.32	NO	NO	NO	NO	NO	NO	NA	NO
2004	1.24	NA	1.24	NO	NO	NO	NO	NO	NO	NA	NO
2005	1.17	NA	1.17	NO	NO	NO	NO	NO	NO	NA	NO
2006	1.09	NA	1.09	NO	NO	NO	NO	NO	NO	NA	NO
2007	1.01	NA	1.01	NO	NO	NO	NO	NO	NO	NA	NO
2008	0.93	NA	0.93	NO	NO	NO	NO	NO	NO	NA	NO
2009	0.86	NA	0.86	NO	NO	NO	NO	NO	NO	NA	NO
2010	0.42	NA	0.42	NO	NO	NO	NO	NO	NO	NA	NO
2011	0.57	NA	0.57	NO	NO	NO	NO	NO	NO	NA	NO
2012	0.62	NA	0.62	NO	NO	NO	NO	NO	NO	NA	NO
2013	0.64	NA	0.64	NO	NO	NO	NO	NO	NO	NA	NO
2014	0.43	NA	0.43	NO	NO	NO	NO	NO	NO	NA	NO
2015	0.39	NA	0.39	NO	NO	NO	NO	NO	NO	NA	NO
2016	0.38	NA	0.38	NO	NO	NO	NO	NO	NO	NA	NO
2017	0.43	NA	0.43	NO	NO	NO	NO	NO	NO	NA	NO
2018	0.51	NA	0.51	NO	NO	NO	NO	NO	NO	NA	NO
2019	0.16	NA	0.16	NO	NO	NO	NO	NO	NO	NA	NO
2020	0.13	NA	0.13	NO	NO	NO	NO	NO	NO	NA	NO
Trend											
1990 - 2020	-90.8%	NA	-90.8%	NA	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	-88.7%	NA	-88.7%	NA	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	-17.0%	NA	-17.0%	NA	NA	NA	NA	NA	NA	NA	NA

Table 417 CH_4 Emissions by fuels from IPCC category 2.B *Chemical Industry*

	2.B	**2.B.1**	**2.B.2**	**2.B.3**	**2.B.4**	**2.B.5**	**2.B.6.**	**2.B.7.**	**2.B.8.**	**2.B.9**	**2.B.10.**
CH_4	**Chemical industry**	Ammonia production	Nitric acid production	Adipic acid production	Caprolactam. glyoxal & other production	Carbide production	Titanium dioxide production	Soda ash production	Petrochemical and carbon black production	Fluoro-chemical production	Other
	kt										
1990	0.69	NO	NO	NO	NO	NO	NO	NO	0.69	NA	NO
1991	0.66	NO	NO	NO	NO	NO	NO	NO	0.66	NA	NO
1992	0.69	NO	NO	NO	NO	NO	NO	NO	0.69	NA	NO
1993	0.67	NO	NO	NO	NO	NO	NO	NO	0.67	NA	NO
1994	0.66	NO	NO	NO	NO	NO	NO	NO	0.66	NA	NO
1995	0.62	NO	NO	NO	NO	NO	NO	NO	0.62	NA	NO
1996	0.48	NO	NO	NO	NO	NO	NO	NO	0.48	NA	NO
1997	0.41	NO	NO	NO	NO	NO	NO	NO	0.41	NA	NO
1998	0.32	NO	NO	NO	NO	NO	NO	NO	0.32	NA	NO
1999	0.29	NO	NO	NO	NO	NO	NO	NO	0.29	NA	NO
2000	0.21	NO	NO	NO	NO	NO	NO	NO	0.21	NA	NO
2001	0.22	NO	NO	NO	NO	NO	NO	NO	0.22	NA	NO
2002	0.21	NO	NO	NO	NO	NO	NO	NO	0.21	NA	NO
2003	0.27	NO	NO	NO	NO	NO	NO	NO	0.27	NA	NO
2004	0.25	NO	NO	NO	NO	NO	NO	NO	0.25	NA	NO
2005	0.22	NO	NO	NO	NO	NO	NO	NO	0.22	NA	NO
2006	0.24	NO	NO	NO	NO	NO	NO	NO	0.24	NA	NO
2007	0.21	NO	NO	NO	NO	NO	NO	NO	0.21	NA	NO
2008	0.17	NO	NO	NO	NO	NO	NO	NO	0.17	NA	NO
2009	0.23	NO	NO	NO	NO	NO	NO	NO	0.23	NA	NO
2010	0.21	NO	NO	NO	NO	NO	NO	NO	0.21	NA	NO
2011	0.27	NO	NO	NO	NO	NO	NO	NO	0.27	NA	NO
2012	0.26	NO	NO	NO	NO	NO	NO	NO	0.26	NA	NO
2013	0.18	NO	NO	NO	NO	NO	NO	NO	0.18	NA	NO
2014	0.25	NO	NO	NO	NO	NO	NO	NO	0.25	NA	NO
2015	0.23	NO	NO	NO	NO	NO	NO	NO	0.23	NA	NO
2016	0.24	NO	NO	NO	NO	NO	NO	NO	0.24	NA	NO
2017	0.21	NO	NO	NO	NO	NO	NO	NO	0.21	NA	NO
2018	0.15	NO	NO	NO	NO	NO	NO	NO	0.15	NA	NO
2019	0.20	NO	NO	NO	NO	NO	NO	NO	0.20	NA	NO
2020	0.24	NO	NO	NO	NO	NO	NO	NO	0.24	NA	NO
Trend											
1990 - 2020	*-65.7%*	NA	NA	NA	NA	NA	NA	NA	*-65.7%*	NA	NA
2005 - 2020	*7.8%*	NA	NA	NA	NA	NA	NA	NA	*7.8%*	NA	NA
2019 - 2020	*15.1%*	NA	NA	NA	NA	NA	NA	NA	*15.1%*	NA	NA

4.3.1 Chemical industry in Algeria

The FERTIAL does have two plant sites: Annaba and Arzew. The plants are specialized in the production of ammonia, nitric acid, ammonium nitrate and urea

Table 418 Integrated chemical production

PLEASE complete	Complexe d'Annaba	Complexe d'Arzew
	Production capacity (t)	Production capacity (t)
Ammonia	x	660,000
Process unit		Chimicho process unit
		Kellogg process unit
Nitric Acid	x	240,000
Ammonium Nitrate (AN)	x	250,000
UAN (urea ammonium nitrate with 32% nitrogen)	x	x
CAN27 (Calcium Ammonitrate) with 27% nitrogen	x	x
NPK[430] fertilizers	x	
SSP (Simple Super Phosphate Fertilizer)	x	

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[430] The NPK meaning reflects the three elements found in this fertilizer mixtures—**n**itrogen, **p**hosphorus, and **p**otassium.

4.3.2 Ammonia Production (IPCC category 2.B.1)

4.3.2.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.1	Ammonia production	✓	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the process-related CO_2 emissions estimations from ammonia production. Combustion re-related GHG emissions are allocated in 1.A.2.c Chemicla industry. Ammonia production is a key source with regards to CO_2 emissions.

Algeria has two ammonia plants.

The process of ammonia production is based on the ammonia synthesis loop (also referred to as the Haber-Bosch process) reaction of nitrogen (derived from process air) with hydrogen to form anhydrous liquid ammonia. The hydrogen is derived from feedstock as natural gas (conventional steam reforming route). Anhydrous ammonia produced by catalytic steam reforming of natural gas (mostly CH_4) involves the following reactions with carbon dioxide produced as a by-product:

Primary steam reforming	$CH_4 + H2O \rightarrow CO + 3H_2$
	$CO + H2O \rightarrow CO_2 + H_2$
Secondary air reforming	$CH_4 + air \rightarrow CO + 2H_2 + 2N_2$
Overall reaction	$0.88\ CH_4 + 1.26\ Air + 1.24H_2O \rightarrow 0.88CO_2 + N_2 + 3H_2$
Ammonia synthesis	$N_2 + 3H_2 \rightarrow 2NH_3$
Secondary reformer Process gas shift conversion	$CO + H_2O \rightarrow CO_2 + H_2$

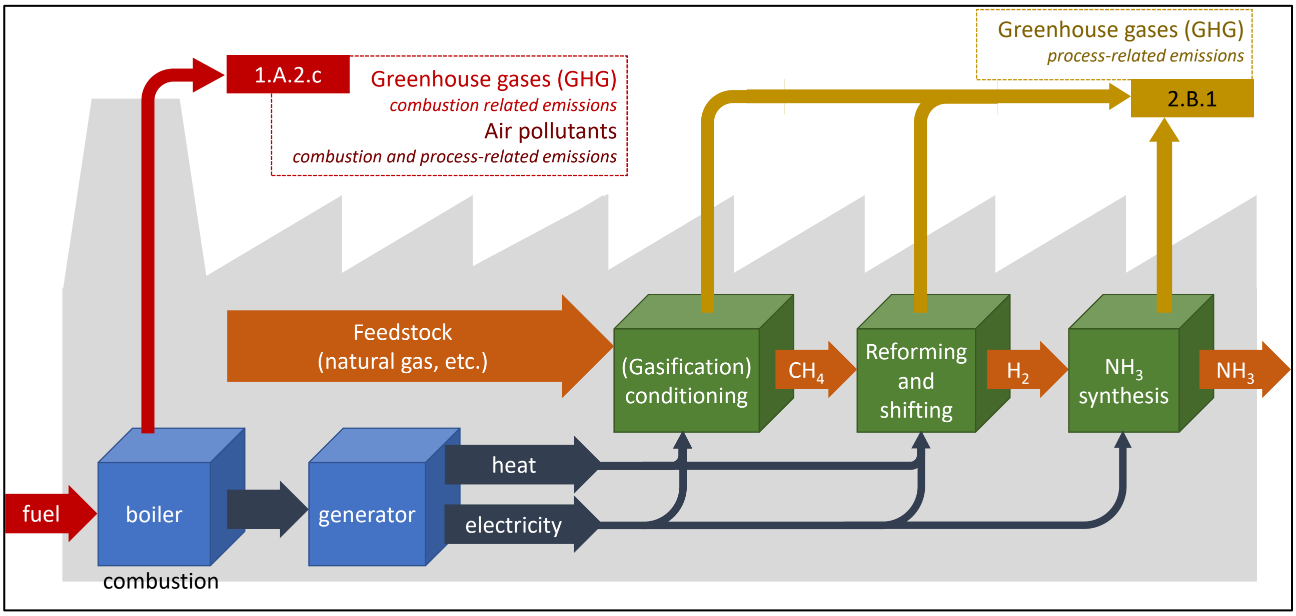

Figure 158 Schematic illustration of Ammonia production and allocation of emissions

According to the 2006 IPCC Guidelines, the processes that affect CO_2 emissions associated with ammonia production are:

- carbon monoxide shift at two temperatures using iron oxide, copper oxide and/or chromium oxide catalyst for conversion to carbon dioxide;
- carbon dioxide absorption by a scrubber solution of hot potassium carbonate, monoethanolamine (MEA). Sulfinol (alkanol amine and tetrahydrothiophene dioxide) or others;
- methanation of residual CO_2 to methane with nickel catalysts to purify the synthesis gas.

In the following figure, the production and control diagram of the ammonia production of FERTIAL-ARZEW is presented and the potential sources of CO_2 are presented.

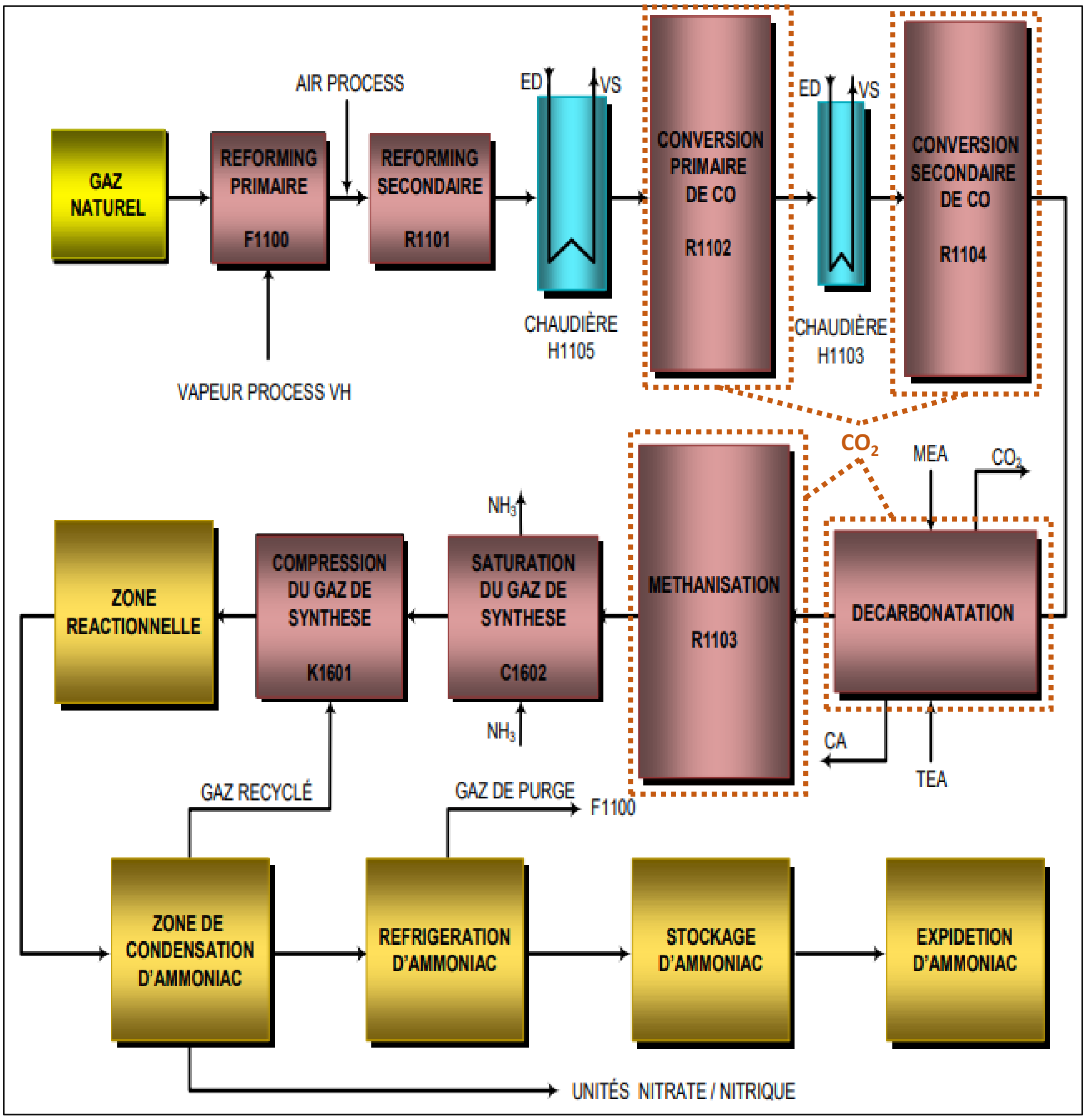

Figure 159 Production and control diagram of Ammonia production of FERTIAL-ARZEW

Source : LAHRECHE MOHAMED & OULDMILOUDE HOUCINE (2020) : La production d'ammoniac au niveau du complexe FERTIAL d'Arzew. [431]

The urea production process consists of two main equilibrium reactions, with incomplete conversion of the reactants. This is described in chapter 4.3.11.

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[431] http://e-biblio.univ-mosta.dz/bitstream/handle/123456789/15795/m%c3%a9moire%20master4444%20%282%29.pdf?sequence=1&isAllowed=y

Total emissions of CO_2 from ammonia production were 621.93 kt CO_2 in 1990 and 0.000004 kt in 2020, which is a decrease of 100% during the period 1990-2020, CO_2 emissions in 2005 increased by 100% from the 1990 levels. In fact, the CO_2 emissions amounted to 1,157.06 kt in 2005 compared to 621.93 kt in 1990. The significant increase in CO_2 emissions during the period (1990-2009) is probably due to the addition of new ammonia production facilities and new production units at existing facilities in 2012 and 2013 (Arzew and Annaba plants). Agriculture continues to drive demand for nitrogen fertilizers and the need for new ammonia production capacity for exportation purposes. Indeed, Algeria is among the largest exporters of ammonia in the world. The CO_2 emissions was decreased by 100 % between 2005 and 2020, and by 48.2% during the period 2005-2010. This decrease in emissions is due to the net decrease in ammonia production observed, especially during the year 2020 when the production reached a very low value (0.000002 kt). Moreover, the decrease in total CO_2 emissions from ammonia production during the period 2010-2020 may also be due to the inconsistency of the data used (Table 35). Currently, the amount of CO_2 recovered for urea production is not known. However, CO_2 emissions for urea production were estimated. Moreover, there is no information provided for recovery of CO_2 for urea production, Methanol and conversion of Calcium Nitrate.

CO_2 emissions from Urea production are allocated under IPCC sub-category 2.B.10.

An overview of the ammonia production (IPCC sub-category 2.B.1) related CO_2 emissions is provided in the following figure and table.

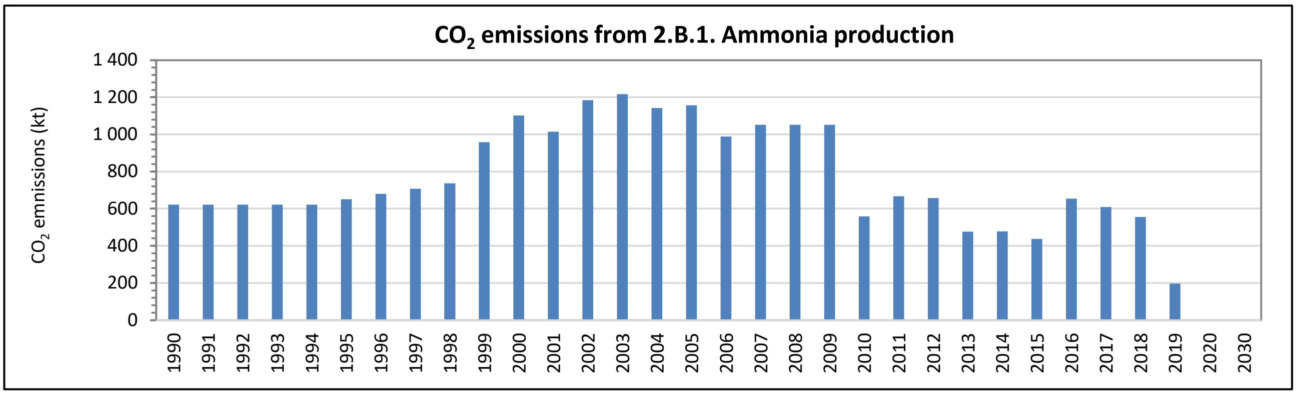

Figure 160 CO_2 emissions from IPCC sub-category 2.B.1 Ammonia production

Table 419 Activity data and CO_2 emissions from Ammonia production (IPCC sub-category 2.B.1)

Years	Activity data		CO_2 emissions
	Ammonia production	Source of activity data	
	kt		kt
1990	295.63	As of 1994	621.93
1991	295.63		621.93
1992	295.63		621.93
1993	295.63		621.93
1994	295.63	PS data; NC1[432]	621.93
1995	309.27	US geological survey[433]	650.63

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[432] Algeria (2001): Initial National Communication. GHG inventory; available (04.06.2022) on https://unfccc.int/documents/67381 and https://unfccc.int/documents/66299

[433] U.S. Geological Survey (several years): Algeria Minerals Yearbook. Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

Years	Activity data		CO_2 emissions
	Ammonia production	Source of activity data	
	kt		kt
1996	322.91		679.33
1997	336.56		708.03
1998	350.20		736.73
1999	455.40		958.05
2000	524.20	PS data; NC2[434]	1,102.79
2001	482.00	US geological survey	1,014.01
2002	563.10		1,184.62
2003	578.20		1,216.39
2004	543.00	US geological survey	1,142.34
2005	550.00		1,157.06
2006	470.00		988.76
2007	500.00		1,051.88
2008	500.00		1,051.88
2009	500.00		1,051.88
2010	265.34	MEM	558.20
2011	317.05		667.00
2012	312.21		656.82
2013	226.11		475.67
2014	227.24		478.05
2015	207.87		437.31
2016	310.91		654.07
2017	289.72		609.50
2018	264.10		555.61
2019	93.76		197.24
2020	0.000002		0.000004
Trend			
1990 – 2020	-100%		-100%
2005 – 2020	-100%		-100%
2019 - 2020	-100%		-100%

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[434] Algeria (2010): Second National Communication. GHG inventory; available on https://unfccc.int/documents/67403 and https://unfccc.int/documents/67404

4.3.2.2 Methodological issues

4.3.2.2.1 Choice of methods

Ammonia production

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[435] has been applied:

Equation 3.1: CO_2 emissions from ammonia production – TIER 1 (2006 IPCC GL. Vol. 3. Chap. 3)

$$\boldsymbol{Emissions_{CO_2} = AP \times EF_{CO_2} - R_{CO_2}}$$

$$with \qquad \boldsymbol{EF_{CO_2} = FR \times CCF \times COF \times \frac{44}{12}}$$

Where:

Emissions $_{CO2}$ = CO_2 emission (kg)
AP = ammonia production (tonnes)
EF_{CO2} = default CO_2 emission factor (tonnes CO_2/tonne NH_3)
FR = fuel requirement per unit of output (GJ/tonne ammonia produced)
CCF = carbon content factor of the fuel (kg C/GJ)
COF = carbon oxidation factor of the fuel, fraction
44/12 = ratio of molecular weight of CO_2 (44) to the molecular weight of carbon (12)
R_{CO2} = CO_2 recovered for downstream use (urea production) (kg)

4.3.2.2.2 Activity data

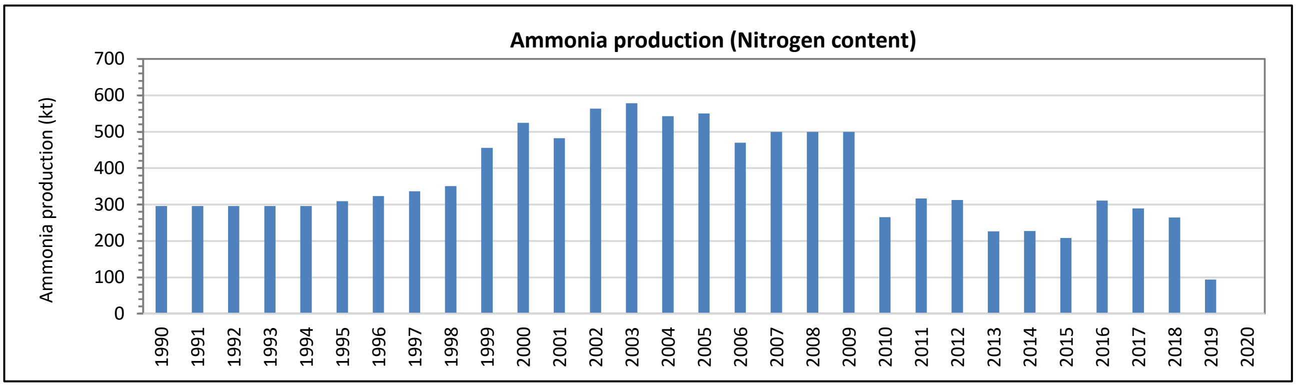

Figure 161 Ammonia production (N content of ammonia)

The Tier 1 method requires data on national production of ammonia. For the years 1994 and 2000 national data were available from the NC1 and NC2. For the years 1998-2009 activity data of ammonia production was taken from US geological survey. For 2010-2020 the national data of MEM.

The activity data are presented in Figure 161 and provided in Table 419 above.

No CO_2 emissions were recovered.

4.3.2.2.3 Emission factors

As no plant-level information is not available, it is *good practice* to use default factors. For the Tier 1 method it is *good practice* to use the highest total fuel requirement per ton of ammonia.

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[435] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions – 3.2.2.1 Choice of method

Equation 3.1: CO_2 emissions from ammonia production – TIER 1 (2006 IPCC GL. Vol. 3. Chap. 3)

$$EF_{CO_2} = FR \times CCF \times COF \times \frac{44}{12}$$

Where:

EF_{CO2} = default CO_2 emission factor (tonnes CO_2/tonne NH3)
FR = fuel requirement per unit of output (GJ/tonne ammonia produced)
CCF = carbon content factor of the fuel (kg C/GJ)
COF = carbon oxidation factor of the fuel, fraction
44/12 = ratio of molecular weight of CO_2 (44) to the molecular weight of carbon (12)

Table 420 Default CO_2 emission factor for IPCC category 2.B.1 *Ammonia production.*

Parameter		Unit	Value	Reference
FR	total fuel requirement	GJ(NCV)/tonne NH3	37.5	Table 3.1. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
CCF	carbon content factor of the fuel	kg C/GJ	15.3	
COF	carbon oxidation factor of the fuel	fraction	1	
con	Conversion factor of carbon in carbon dioxide (44/12)	-	3.67	
EF_{CO2}	**default CO_2 emission factor**	**tonnes CO_2/tonne NH3**	**2.104**	

4.3.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.B.1 *Ammonia production* are presented in the following table.

Table 421 Uncertainty for IPCC category 2.B.1 *Ammonia production.*

Uncertainty	**N_2O**	**Reference**
Activity data (AD)	7%	2006 IPCC GL. Vol. 3. IPPU Chap. 3.3.3.2
Emission factor (EF)	5%	Table 3.3. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
Combined Uncertainty (U)	9%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.3.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.

- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[436] and
    - US geological survey[437]
    - FAO[438]
    - UN statistics[439]
- cross checks with other relevant sectors (2.B.2. 2.B.10. 1.A.2.c) are performed to avoid double counting or omissions.

4.3.2.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.B.1 *Ammonia production.*

Table 422 Recalculations done since NC in IPCC category 2.B.1 *Ammonia production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.B.1	Application of 2006 IPCC Guidelines 1994 & 2020: revision of CO_2 EF from 1.5 t CO_2/ t NH_3 to 2.104 t CO_2/ t NH_3	EF	Accuracy Comparability

4.3.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 423 Planned improvements for IPCC category 2.B.1 *Ammonia production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.1	Application of Tier 2 methodology or higher	meth	Accuracy	High
2.B.1	Collection of plant specific activity data (1990-2020): • production capacity data per plant • ammonia production per plant • used fuel	AD	Accuracy Completeness Consistency Transparency	high
2.B.1	Collection of plant specific parameter • fuel requirement per unit of output • carbon content factor of the fuel • carbon oxidation factor of the fuel	EF	Accuracy Transparency Consistency Completeness Comparability	High
2.B.1	Collection of information on CO_2 recovery for urea and Methanol production and conversion of Calcium Nitrate. Collection of information on NH3 and HNO3 recovery for	AD	Accuracy	medium

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[436] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[437] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[438] FAO – FAOSTAT – Land, Inuts and Sustainability – Inputs - Fertilizers by Product https://www.fao.org/faostat/en/#data/RFB

[439] United Nations Industrial Development Organization UNIDO - Statistical Databases INDSTAT
https://www.unido.org/researchers/statistical-databases

GHG source & sink category	Planned improvement	Type of improvement		Priority
	Ammonia Nitrate production.			

4.3.3 Nitric Acid Production (IPCC category 2.B.2)

4.3.3.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.2	Nitric Acid Production	NA	-	NA	-	✓	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

Nitric acid is used as a raw material mainly in the manufacture of nitrogenous-based fertiliser. As described in the 2006 IPCC Guidelines[440], during the production of nitric acid (HNO3) , nitrous oxide (N_2O) is generated as an unintended by-product of the high temperature catalytic oxidation of ammonia (NH3). The amount of N_2O formed depends, inter alia, on combustion conditions (pressure, temperature) , catalyst composition and age and burner design.

Nitric acid production involves three distinct chemical reactions that can be summarised as follows:

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

$$2\ NO + O_2 \rightarrow 2\ NO_2$$

$$3\ NO_2 + H_2O \rightarrow 2\ HNO_3 + NO$$

To produce nitric acid, ammonia (NH_3) is reacted with air over precious metal – normally a platinum-rhodium (Pt-Rh) alloy – catalyst gauze pack in the ammonia oxidation reactor of nitric acid plants. The main product of this reaction is NO, which is metastable at the conditions present in the ammonia oxidation reactor and therefore reacts with the available oxygen to form NO_2, which is later absorbed in water to form HNO_3 – nitric acid. Simultaneously, undesired side reactions yield nitrous oxide (N_2O) , nitrogen and water.

The Fertial's nitric acid plant, located at Annaba, consists of two complete separate but identical production lines. No. 1 and No. 2. Commercial nitric acid production started in 1982. It is a 7.9 bars high pressure plant. Each lines have a design production capacity of 400 metric tonnes of HNO_3 (100% concentration) per day. No abatement technology is applied.

Nitrous oxide emissions from this source were estimated to be 38.74 Kt CO_2 Eq. (0.13 kt of N_2O) in 2020 (see Table 40). Emissions from nitric acid production have decreased by 90.79 % since 1990 following the decrease of the production by 90.79 % over the same time period. Emissions have decreased by 92 % since 2000, the highest year of production in the time series. Compared to 2005, N_2O emissions decreased by 88.67% from 348.7 kt CO_2 Eq (1.17 kt of N_2O) to 38.74 Kt CO_2 Eq (0.13 kt of N_2O). Currently, there is no information provided related to recovery of HNO3 for Ammonia nitrate and nitro phosphate plant production.

An overview of the Nitric acid production (IPCC sub-category 2.B.2) related N_2O emissions is provided in the following figure and table.

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[440] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions, chapter 3.3 Nitric acid production

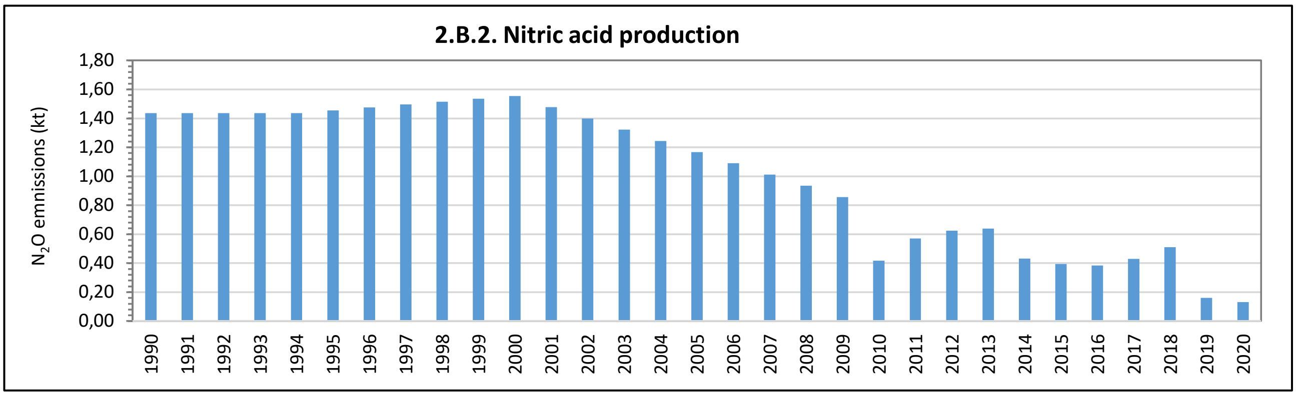

Figure 162 N_2O emissions from IPCC sub-category 2.B.2 Nitric acid production

Table 424 Activity data and N_2O emissions from Nitric acid production (IPCC sub-category 2.B.2)

	Activity data			**Source of activity data**	**N_2O emissions**
Years	**Annual capacity nitric acid production**	**Capacity utilisation factor**	**Nitric acid production**		
	kt	**%**	**kt**		**kt**
1990	*Annaba 1* 132.000 + *Annaba 2* 1132.000 = *Total* 264.000	60%	159 577	As of 1994	1.44
1991		60%	159 577		1.44
1992		60%	159 577		1.44
1993		60%	159 577		1.44
1994		60%	159 577	PS data; NC1[441]	1.44
1995		61%	161 769	interpolation	1.46
1996		62%	163 960		1.48
1997		63%	166 152		1.50
1998		64%	168 344		1.52
1999		65%	170 536		1.53
2000		65%	172 727	PS data; NC2[442]	1.55
2001		66%	164 116	interpolation	1.48
2002		67%	155 506		1.40
2003		68%	146 895		1.32
2004		69%	138 284		1.24
2005		69%	129 673		1.17
2006		70%	121 062		1.09
2007		71%	112 451		1.01
2008		72%	103 840		0.93
2009		73%	95 229		0.86
2010			46 404	MEM	0.42
2011			63 465		0.57
2012			69 397		0.62

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[441] Algeria (2001): Initial National Communication. GHG inventory; available on https://unfccc.int/documents/67381 and https://unfccc.int/documents/66299

[442] Algeria (2010): Second National Communication. GHG inventory; available on https://unfccc.int/documents/67403 and https://unfccc.int/documents/67404

Years	Activity data			Source of activity data	N_2O emissions
	Annual capacity nitric acid production	Capacity utilisation factor	Nitric acid production		
	kt	%	kt		kt
2013			71 071		0.64
2014			47 878		0.43
2015			43 774		0.39
2016			42 697		0.38
2017			47 732		0.43
2018			56 681		0.51
2019			17 710		0.16
2020			14 693		0.13
Trend					
1990 – 2020			-90.79%		-90.79%
2005 – 2020			-88.67%		-88.67%
2019 - 2020			-17.04%		-17.04%

4.3.3.2 Methodological issues

4.3.3.2.1 Choice of methods

The 2006 IPCC Guidelines Tier 1 approach[443] has been applied:

Equation 3.5: Tier 1 – N_2O emissions from nitric acid production – Tier 1 *(2006 IPCC GL. Vol. 3. Chap.* 3.3.2.1*)*

$$N_2O\ emissions = EF\ x\ NAP$$

Where:

N_2O emissions = emissions of N_2O from nitric acid production in kg

NAP = nitric acid production, tonnes

EF = N_2O emission factor (default) , kg N_2O/tonne nitric acid produced

When applying the Tier 1 method it is *good practice* to assume that there is no abatement of N_2O emissions and to use the highest default emission factor based on technology type.

4.3.3.2.2 Activity data

The Tier 1 method requires data on national production of nitric acid. For the years 1994 and 2000 national data were available from the NC1 and NC2. From 2010 – 2020 data were provided by MEM. For the years in between, interpolation was used, a capacity utilization factor of 80% of the production capacity was taken, as it is *good practice*[444].

The activity data are presented in Figure 162 and provided in Table 424 above.

No N_2O emissions were recovered.

4.3.3.2.3 Emission factors

As it is *good practice*, the highest emission factor based on the technology type was used. With 7.9 bars

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[443] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions, chap. 3.3 Nitric acid production -3.3.2.1 choice of method

[444] Source: 2006 IPCC Guidelines, Vol. 3 IPPU, Chapter 3: Chemical Industry Emissions, chap. 3.3 Nitric acid production -3.3.2.3 Choice of activity data

applied pressure, the Fertial's nitric acid plant line No. 1 and line No. 2' the operation conditions are defined as 'Single High Pressure'. as it is described in Tables 3.3A (new) 'Different plant types for the production of HNO3' of the 2006 IPPC Guidelines.

Table 425N_2O Emission Factor applied in IPCC category 2.B.2 *Nitric Acid Production.*

Production Process	**N_2O Emission Factor (relating to 100 percent pure acid)**
Single high-pressure plants	9 kg N_2O/tonne nitric acid
Source: 2019 Refinement to the 2006 IPCC Guidelines. Vol. 3 IPPU. Chapter 3: Chemical Industry Emissions. Chap. 3.3 Nitric acid production -3.3.2.2 Choice of emission factors. Table 3.3 (updated) Default factors for nitric acid production	

4.3.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.B.2 *Nitric Acid Production* are presented in the following table.

Table 426 Uncertainty for IPCC category 2.B.2 *Nitric Acid Production.*

Uncertainty	**N_2O**	**Reference**
Activity data (AD)	2%	2006 IPCC GL. Vol. 3. IPPU Chap. 3.3.3.2
Emission factor (EF)	40%	Table 3.3 (updated). 2019 Refinement to the 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
Combined Uncertainty (U)	40%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.3.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross checks with other relevant sectors (2.B.1) are performed to avoid double counting or omissions.

4.3.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.B.2 *Nitric Acid Production*.

Table 427 Recalculations done since NC in IPCC category 2.B.2 *Nitric Acid Production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.B.2	Application of 2006 IPCC Guidelines methodology	EF	Accuracy Comparability
2.B.2	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines 1994 & 2020: revision of N_2O EF from 5.5 kg N_2O/ t HNO_3 to 9 kg N_2O/ t HNO_3	EF	Accuracy Completeness Transparency

4.3.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 428 Planned improvements for IPCC category 2.B.2 *Nitric Acid Production*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.2	Collection of plant specific activity data (1990-2020): • utilization factor per line • nitric acid production per line	AD	Accuracy Completeness Transparency	high
2.B.2	Collection of plant-specific measurements: N_2O generation and destruction factors	Emi	Accuracy Transparency Consistency Completeness Comparability	High
2.B.2	Application of Tier 2 methodology or higher	meth	Accuracy	medium
2.B.2	Collection of information on HNO3 recovery for Ammonia nitrate and nitro phosphate plant production.			

4.3.4 Adipic Acid Production (IPCC category 2.B.3)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.3	Adipic Acid Production	NO	-	NA	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.3 *Adipic Acid Production* does not exist in Algeria.

4.3.5 Caprolactam. Glyoxal and Glyoxylic Acid Production (IPCC category 2.B.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.4	Caprolactam. Glyoxal and Glyoxylic Acid Production	NO	-	NA	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.4 *Caprolactam. Glyoxal and Glyoxylic Acid Production* does not exist in Algeria.

4.3.6 Carbide Production (IPCC category 2.B.5)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.5	Carbide Production	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.5 *Carbide Production* does not exist in Algeria.

4.3.7 Titanium Dioxide Production (IPCC category 2.B.6)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.6	Titanium Dioxide Production	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.6 *Titanium Dioxide Production* does not exist in Algeria.

4.3.8 Soda Ash Production (IPCC category 2.B.7)

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.B.7	Soda Ash Production	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.7 4.2.8 Soda Ash Production does not exist in Algeria.

4.3.9 Petrochemical and Carbon Black Production (IPCC category 2.B.8)

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.B.8	Petrochemical and Carbon Black Production						
2.B.8.a	Methanol	✓	-	✓	-	NA	-
2.B.8.b	Ethylene	✓	-	✓	-	NA	-
2.B.8.c	Ethylene Dichloride and Vinyl Chloride Monomer	NO	-	NO	-	NA	-
2.B.8.d	Ethylene Oxide	NO	-	NO	-	NA	-
2.B.8.e	Acrylonitrile	NO	-	NO	-	NA	-
2.B.8.f	Carbon Black	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

In the following flow chart are the main steps between raw materials and feedstocks through to building blocks, derivatives and everyday products presented.

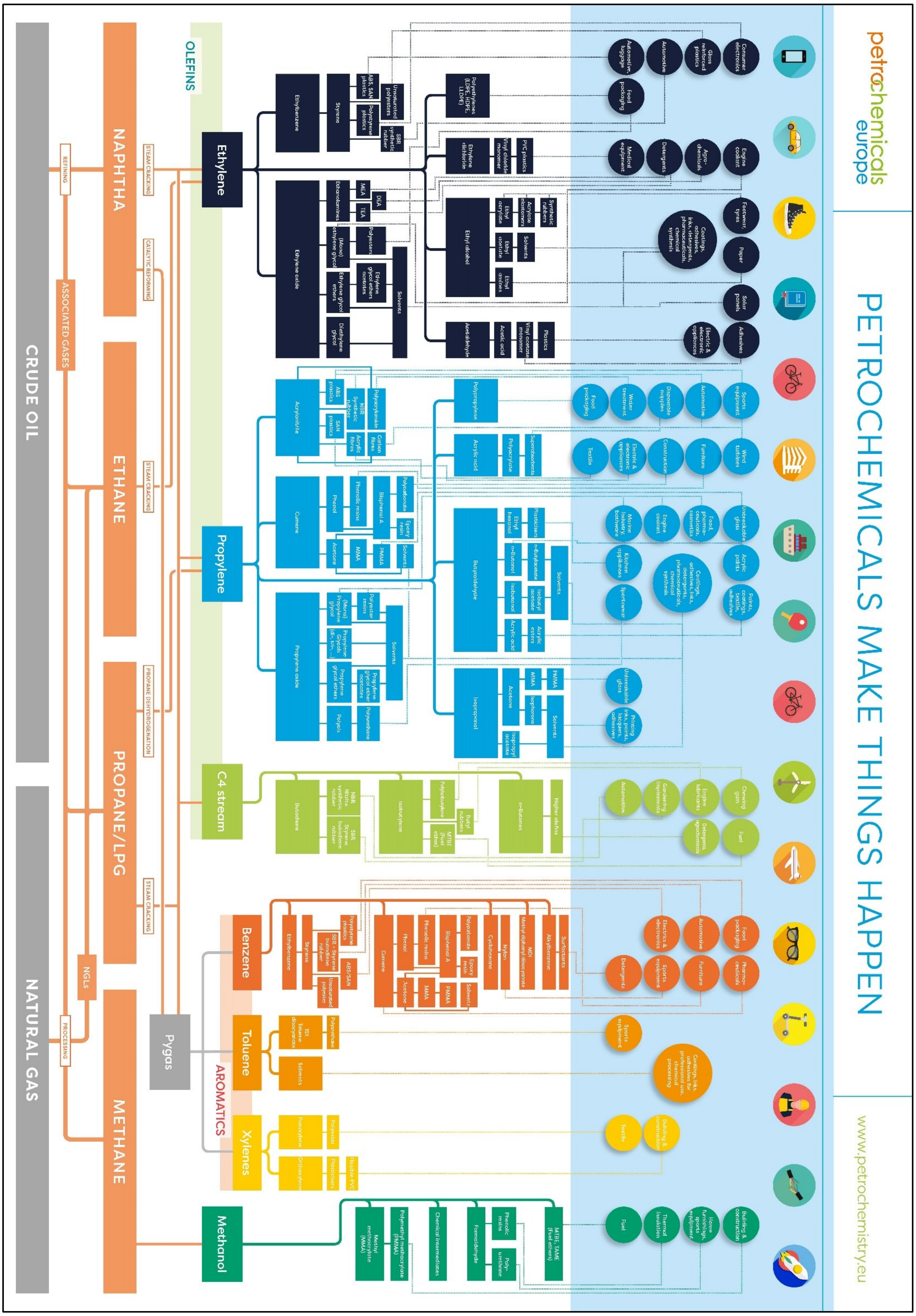

Figure 163 Petrochemical processes: raw materials and feedstocks through to building blocks. derivatives and everyday applicationsSource: Petrochemicals Europe[445]

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[445] Petrochemicals Europe; available (01.06.2022) on https://www.petrochemistry.eu/about-petrochemistry/flowchart/

4.3.9.1 Methanol Production (IPCC category 2.B.8.a)

4.3.9.1.1 Category description

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.B.8.a	Methanol production	✓	-	✓	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

As described in the 2006 IPCC Guidelines[446] worldwide almost all methanol is made by way of steam reforming of natural gas. The steam reforming and shift reaction produce 'synthesis gas' comprised of CO_2, carbon monoxide (CO) and hydrogen (H2). The natural gas to methanol production process produces methanol and by-product CO_2, CO, and H2 from the synthesis gas.

As described by the Methanol Institute (MI)[447] Methanol is a clear liquid chemical used in thousands of everyday products, including plastics, paints, cosmetics and fuels. Methanol is also an energy resource used in the marine, automotive, and electricity sectors and an emerging renewable energy resource.

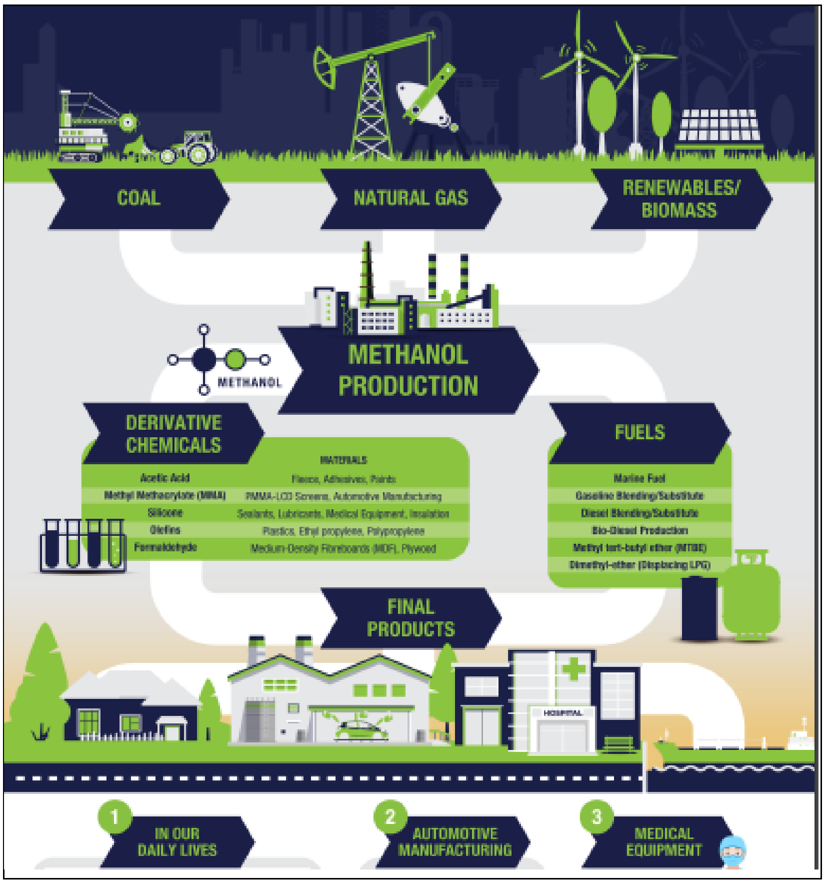

Figure 164 Essential Methanol Infographic

Source: Methanol Institute (MI)[447]

This chapter includes the process-related to CO_2 and CH_4 emissions estimations from *Methanol production*.

Emissions of CO_2 and CH_4 from Methanol production were 67.87 kt CO_2 equivalent in 1990 and 74.73 kt CO_2 equivalent in 2020, which is an increase of 10.1% in the period 1990 – 2020. The GHG emissions during the period 2019- 2020 were noted an increase of 15.1 % which is a result of the Hight use of methanol as hand sanitizer or surface cleaner and disinfector during the covid 19 pandemic, also, several companies in the public and private sectors have doubled their production capacities and asked for authorizations to introduce the production of hand disinfectant hydro-alcoholic gel.

An overview of the methanol production (IPCC sub-category 2.B.8.a) and related GHG emissions is provided in the following figure and table.

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[446] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions – 3.9 Petrochemical and carbon black production 3.9.1 Introduction

[447] Methanol Institute (MI); available (20.07.2022) on https://www.methanol.org/about-methanol/

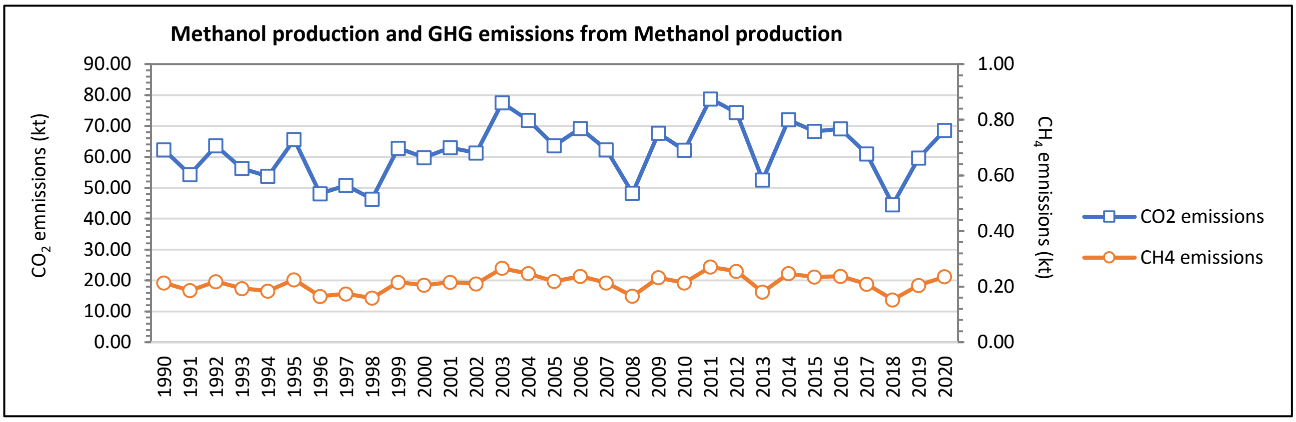

Figure 165 CO_2 and CH_4 emissions from IPCC sub-category 2.B.8.a Methanol production

Table 429 Activity data, CO_2 and CH_4 emissions from Methanol production (IPCC sub-category 2.B.8.a)

Years	Methanol production	CO_2 emissions	CH_4 emissions
	kt	kt	kt
1990	93.00	62.31	0.21
1991	81.00	54.27	0.19
1992	94.90	63.58	0.22
1993	84.00	56.28	0.19
1994	80.20	53.73	0.18
1995	97.90	65.59	0.23
1996	71.80	48.11	0.17
1997	75.80	50.79	0.17
1998	69.20	46.36	0.16
1999	93.80	62.85	0.22
2000	89.20	59.76	0.21
2001	94.00	62.98	0.22
2002	91.50	61.31	0.21
2003	115.70	77.52	0.27
2004	107.30	71.89	0.25
2005	95.00	63.65	0.22
2006	103.30	69.21	0.24
2007	93.00	62.31	0.21
2008	72.00	48.24	0.17
2009	101.00	67.67	0.23
2010	92.80	62.18	0.21
2011	117.60	78.79	0.27
2012	111.00	74.37	0.26
2013	78.40	52.53	0.18
2014	107.50	72.03	0.25
2015	101.90	68.27	0.23
2016	103.10	69.08	0.24
2017	91.00	60.97	0.21

Years	Methanol production	CO_2 emissions	CH_4 emissions
	kt	kt	kt
2018	66.50	44.56	0.15
2019	89.00	59.63	0.20
2020	102.40	68.61	0.24
Trend			
1990 – 2020	*10.1%*	*10.1%*	*10.1%*
2005 – 2020	*7.8%*	*7.8%*	*7.8%*
2019 - 2020	*15.1%*	*15.1%*	*15.1%*

4.3.9.1.2 Methodological issues

4.3.9.1.2.1 Choice of methods

For estimating the CO_2 emissions, the Tier 1 product-based emission factor method of the 2006 IPCC Guidelines[448] has been applied:

Equation 3.15: TIER 1 CO_2 emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$\boldsymbol{Emissions_{CO_2} = PF_{methanol} \times EF_{CO_2} \times \frac{GAF}{100}}$$

Where:

Emissions $_{CO2}$ = CO_2 emissions from production of petrochemical – methanol (tonnes)

PF $_{methanol}$ = annual production of petrochemical – methanol (tonnes)

EF_{CO2} = default CO_2 emission factor for petrochemical – methanol (tonnes CO_2/tonne product produced)

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[448] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions – 3.9 Petrochemical and carbon black production 3.9.2.1 Choice of method

For estimating the CH_4 emissions, the Tier 1 product-based emission factor method of the 2006 IPCC Guidelines has been applied, CH_4 emissions from petrochemical processes may be fugitive emissions and/or process vent emissions. Fugitive emissions are emitted from flanges, valves and other process equipment. Emissions from process vent sources include incomplete combustion of waste gas in flare and energy recovery systems.

Equation 3.23: TIER 1 - CH_4 Fugitive emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Fugitive} = PF_{methanol} \times EF_{CO_2\,fugitive}$$

Equation 3.24: TIER 1 - CH_4 Process vent emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Vent} = PF_{methanol} \times EF_{CO_2\,Vent}$$

Equation 3.25: TIER 1 - CH_4 Total emissions calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Total} = Emissions_{CH_4\,Fugitive} + Emissions_{CH_4\,Vent}$$

Where:

Emissions $_{CH4\ Total}$ = total emissions of CH_4 from production of petrochemical – methanol (tonnes)
Emissions $_{CH4\ Fugitive}$ = fugitive emissions of CH_4 from production of petrochemical – methanol (tonnes)
Emissions $_{CH4\ Vent}$ = process vent emissions of CH_4 from production of petrochemical – methanol (tonnes)
PF = annual production of petrochemical – methanol (tonnes)
$EF_{CH4\ Fugitive}$ = default CH_4 process vent emission factor for petrochemical – methanol (tonnes CH_4/tonne product produced)
$EF_{CH4\ Vent}$ = default CH_4 process vent emission factor for petrochemical – methanol (tonnes CH_4/tonne product produced)

4.3.9.1.2.2 Activity data

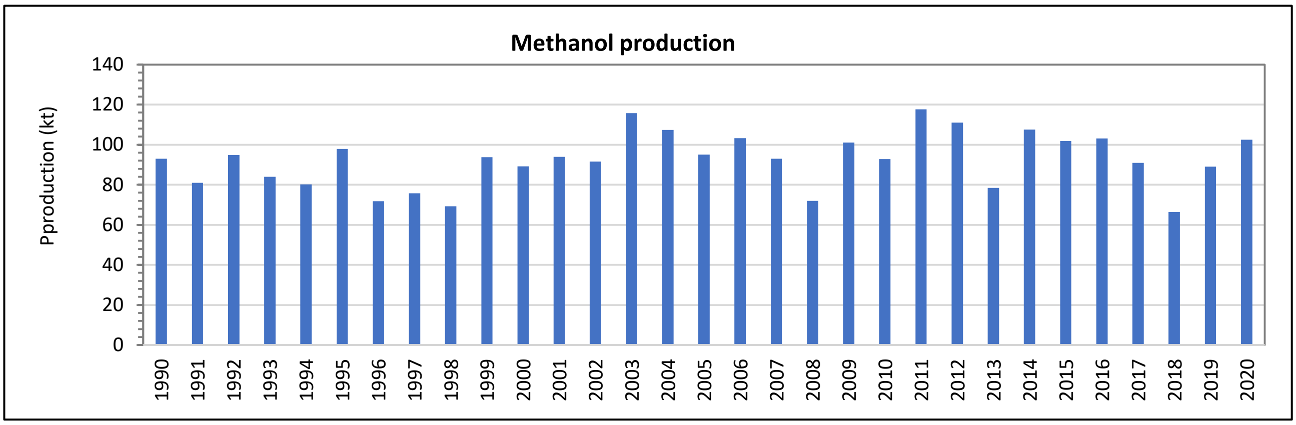

Figure 166 Methanol production

The Tier 1 product-based emission factor method requires data on national production of methanol. Activity data were taken from ONS (Statistic Annuaires)[449] and MEM (Bilan des Réalisations du secteur de l'énergie)[450].

The activity data are presented in Figure 166 and Table 429 provided in above.

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[449] https://www.ons.dz/spip.php?rubrique289

[450] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

4.3.9.1.2.3 Emission factors

The Tier 1 method allows for the selection of a 'default' feedstock and 'default' process in instances where activity data are not available to identify the feedstock or the process utilised to produce the petrochemical. Therefore, the methanol production CO_2 emission factors for Conventional Steam Reforming, without primary reformer, which is the default for process and natural gas default feedstock, was selected.

As no country specific EF for CH_4 was available, the default EF for CH_4 was applied.

Table 430 provides the default feedstocks and default processes for each petrochemical production process.

Table 430 Default CO_2 and CH_4 emission factors for IPCC category 2.B.8.a *Methanol production.*

EF	Parameter	**Unit**	**Value**	**Reference**
EF CO_2	Conventional Steam Reforming. without primary reformer (Default Process and Natural Gas Default Feedstock)	tonne CO_2/tonne methanol produced	0.67	Table 3.12. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
EF CH_4	CH_4 process vent emission factor for petrochemical for petrochemical	kg CH_4 / tonne of methanol produced	2.3	

4.3.9.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.B.8.a *Methanol production* are presented in the following table.

Table 431Uncertainty for IPCC category 2.B.8.a *Methanol production.*

Uncertainty	**CO_2**	**CH_4**	**Reference**
Activity data (AD)	7%	7%	Based on 2006 IPCC GL. Vol. 3 IPPU Chap. 3.3.3.2
Emission factor (EF)	30%	85%	Table 3.27. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
Combined Uncertainty (U)	31%	86%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.3.9.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.

- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[451] and
    - Information provided in Bilan des Réalisations du secteur de l'énergie published by MEM[452].

4.3.9.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.B.8.a *Methanol production.*

Table 432 Recalculations done since NC in IPCC category 2.B.8.a *Methanol production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.B.8.a	Application of 2006 IPCC Guidelines methodology	method	Accuracy
2.B.8.a	Emission factor from 2006 IPCC Guidelines: 1994 & 2020: revision of CH_4 EF from 2.0 kg CH_4 / tonne methanol produced to 2.3 kg CH_4 / tonne methanol produced	EF	Accuracy Comparability
2.B.8.a	Revision of activity data	AD	Accuracy consistency

4.3.9.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 433 Planned improvements for IPCC category 2.B.8.a *Methanol production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.8.a	Application of Tier 2 methodology or higher and /or Preparation of a carbon mass balance calculations according to Tier 2 carbon mass balance flow diagram (Figure 3.10. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3)	meth	Accuracy	medium
2.B.8.a	Collection of plant specific activity data (1990-2020): • production capacity data per plant • methanol production per plant • feedstock used	AD	Accuracy Completeness Consistency Transparency comparability	medium
2.B.8.a	Collection of information related to process applied for methanol production including plant specific parameter	EF	Accuracy Transparency	medium

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[451] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[452] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

4.3.9.2 Ethylene production (IPCC category 2.B.8.b)

4.3.9.2.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.8.b	Ethylene production	✓	-	✓	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the process-related to CO_2 and CH_4 emissions estimations from *Ethylene production*.

The Ethylene production was responsible for the emission of 109.51 kt CO_2 equivalent in 1990 and 0.13 kt CO_2 equivalent in 2000, which is a decrease of -99.9 % in the period 1990 – 2000. As it is not clear, if ethylene is still produced in Algeria, for the period 2001-2020 the notation key NE (not estimated) was used.

An overview of the Ethylene production (IPCC sub-category 2.B.8.b) related GHG emissions is provided in the following figure and table.

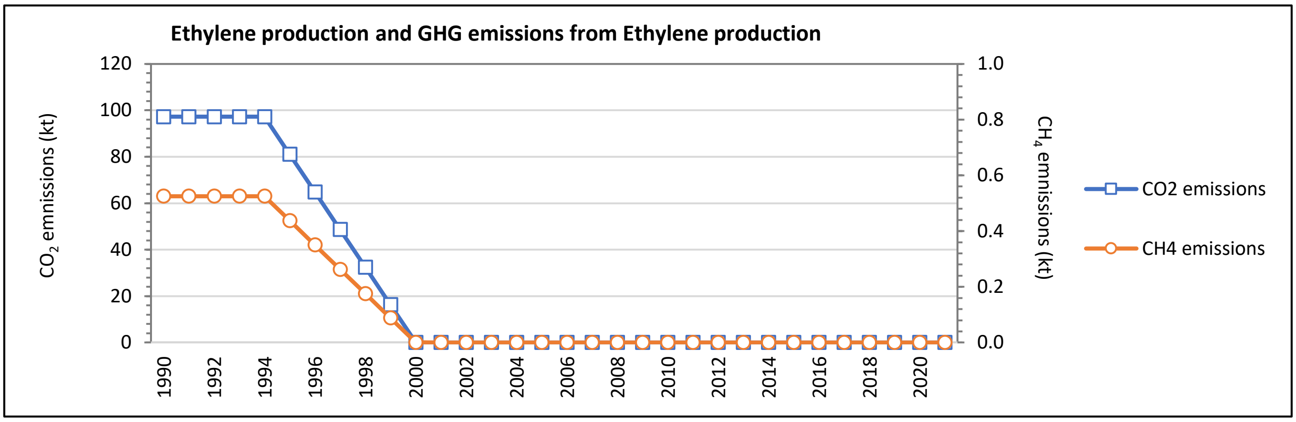

Figure 167 CO_2 and CH_4 emissions from IPCC sub-category 2.B.8.b Ethylene production

Table 434 Activity data , CO_2 and CH_4 emissions from Ethylene production (IPCC sub-category 2.B.8.b)

Years	Ethylene production	CO_2 emissions equivalent	CO_2 emissions	CH_4 emissions
	kt	kt	kt	kt
1990	78.73	109.04	97.23	0.472
1991	78.73	109.04	97.23	0.472
1992	78.73	109.04	97.23	0.472
1993	78.73	109.04	97.23	0.472
1994	78.73	109.04	97.23	0.472
1995	65.62	90.89	81.04	0.394
1996	52.52	72.74	64.86	0.315
1997	39.41	54.58	48.67	0.236
1998	26.30	36.43	32.48	0.158
1999	13.20	18.28	16.30	0.079
2000	0.09	0.12	0.11	0.001
2001	NE	NE	NE	NE
2002	NE	NE	NE	NE

Years	Ethylene production	CO_2 emissions equivalent	CO_2 emissions	CH_4 emissions
	kt	kt	kt	kt
2003	NE	NE	NE	NE
2004	NE	NE	NE	NE
2005	NE	NE	NE	NE
2006	NE	NE	NE	NE
2007	NE	NE	NE	NE
2008	NE	NE	NE	NE
2009	NE	NE	NE	NE
2010	NE	NE	NE	NE
2011	NE	NE	NE	NE
2012	NE	NE	NE	NE
2013	NE	NE	NE	NE
2014	NE	NE	NE	NE
2015	NE	NE	NE	NE
2016	NE	NE	NE	NE
2017	NE	NE	NE	NE
2018	NE	NE	NE	NE
2019	NE	NE	NE	NE
2020	NE	NE	NE	NE
Trend				
1990 – 2000	*-99.9%*	*NA*	*-99.9%*	*-99.9%*
2005 – 2020	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*NA*	*NA*	*NA*	*NA*

4.3.9.2.2 Methodological issues

4.3.9.2.2.1 Choice of methods

For estimating the CO_2 emissions, the Tier 1 product-based emission factor method of the 2006 IPCC Guidelines[453] has been applied:

Equation 3.15: TIER 1 CO_2 emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$\boldsymbol{Emissions_{CO_2} = PF_{ethylenel} \times EF_{CO_2} \times \frac{GAF}{100}}$$

Where:

Emissions $_{CO2}$ = CO_2 emissions from production of petrochemical – Ethylene (tonnes)
$PF_{Ethylene}$ = annual production of petrochemical – Ethylene (tonnes)
EF_{CO2} = default CO_2 emission factor for petrochemical – Ethylene (tonnes CO_2/tonne product produced)
GAF = Geographic Adjustment Factor for Tier 1 CO_2 emission factors for ethylene production

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[453] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions – 3.9 Petrochemical and carbon black production 3.9.2.1 Choice of method

For estimating the CH_4 emissions, the Tier 1 product-based emission factor method of the 2006 IPCC Guidelines has been applied, CH_4 emissions from petrochemical processes may be fugitive emissions and/or process vent emissions. Fugitive emissions are emitted from flanges, valves, and other process equipment. Emissions from process vent sources include incomplete combustion of waste gas in flare and energy recovery systems.

Equation 3.23: TIER 1 - CH_4 Fugitive emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Fugitive} = PF_{ethylene} \times EF_{CO_2\,fugitive}$$

Equation 3.24: TIER 1 - CH_4 Process vent emission calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Vent} = PF_{ethylene} \times EF_{CO_2\,Vent}$$

Equation 3.25: TIER 1 - CH_4 Total emissions calculation (2006 IPCC GL. Vol. 3. Chap. 3)

$$Emissions_{CH_4\,Total} = Emissions_{CH_4\,Fugitive} + Emissions_{CH_4\,Vent}$$

Where:

Emissions $_{CH4\ Total}$ = total emissions of CH_4 from from production of petrochemical – Ethylene (tonnes)
Emissions $_{CH4\ Fugitive}$ = fugitive emissions of CH_4 from production of petrochemical – Ethylene (tonnes)
Emissions $_{CH4\ Vent}$ = process vent emissions of CH_4 from production of petrochemical – Ethylene (tonnes)
PF = annual production of petrochemical – Ethylene (tonnes)
$EF_{CH4\ Fugitive}$ = default CH_4 process vent emission factor for petrochemical – Ethylene (tonnes CH_4/tonne product produced)
$EF_{CH4\ Vent}$ = default CH_4 process vent emission factor for petrochemical – Ethylene (tonnes CH_4/tonne product produced)

4.3.9.2.2.2 Activity data

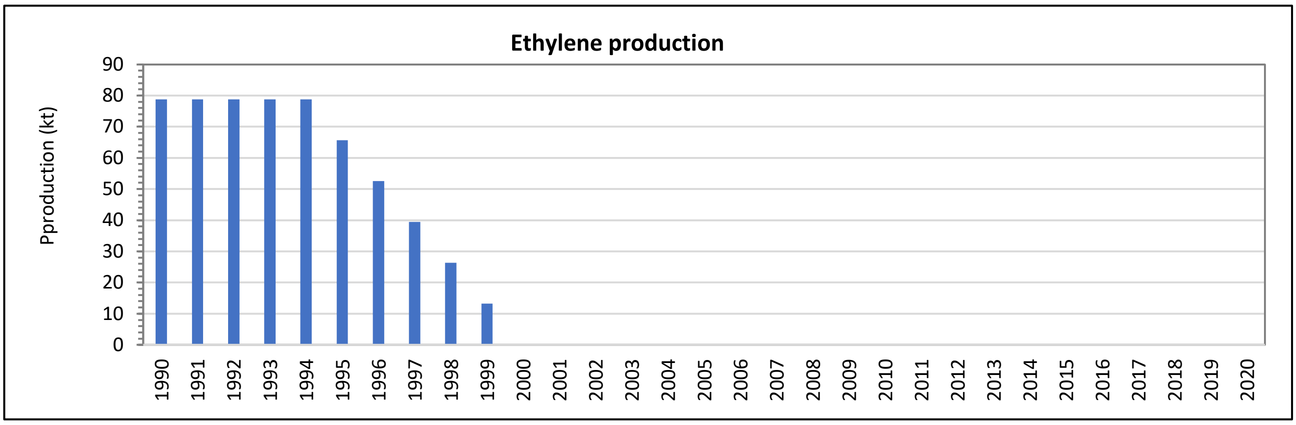

Figure 168 Ethylene production

The Tier 1 product-based emission factor method requires data on national production of Ethylene. Activity data for 1994 and 2000 were taken from the first and second national communication (NC). The years 1990-1993 are as of 1994. The years between 1994 and 2000. As it is not clear, if ethylene is still produced in Algeria, for the period 2001-2020 the notation key NE (not estimated) was used.

The activity data are presented in Table 434 Activity data , CO2 and CH4 emissions from Ethylene production (IPCC sub-category 2.B.8.b) Figure 168 and Table 434 provided in above.

4.3.9.2.2.3 Emission factors

The Tier 1 method allows for the selection of a 'default' feedstock and 'default' process in instances where activity data are not available to identify the feedstock or the process utilised to produce the petrochemical. Therefore, the Ethylene production CO_2 emission factors for Conventional Steam Reforming, without primary reformer, which is the default for process and natural gas default feedstock, was selected.

As no country specific EF for CH_4 was available, the default EF for CH_4 was applied.

Table 435 provides applied factors.

Table 435 Default CO_2 and CH_4 emission factors for IPCC category 2.B.8.b *Ethylene production.*

	Parameter	**Unit**	**Value**	**Reference** 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
EF CO_2	Steam cracking ethylene production Tier 1 CO_2 emission factors Feedstock: Ethylene (Total Process and Energy Feedstock Use)	tonne CO_2/tonne Ethylene produced	0.95	Table 3.14.
GAF	default geographic adjustment factors	-	130%	Table 3.15
EF CH_4	CH_4 process vent emission factor for petrochemical for petrochemical	kg CH_4 per tonne of Ethylene produced	6	Table 3.15

4.3.9.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.B.8.b *Ethylene production* are presented in the following table.

Table 436 Uncertainty for IPCC category 2.B.8.b *Ethylene production.*

Uncertainty	**CO_2**	**CH_4**	**Reference**
Activity data (AD)	7%	7%	Based on 2006 IPCC GL. Vol. 3 IPPU Chap. 3.3.3.2
Emission factor (EF)	32%		Table 3.27. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3
		10%	
Combined Uncertainty (U)	32%	12%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capcacity is used as activity data.

4.3.9.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources.
    - use of units and conversion factors.
    - strictly defined interfaces between spreadsheets/calculation modules.
    - unique structure of sheets which do the same.
    - record keeping, use of write protection.
    - unique use of formulas, special cases are documented/highlighted.

- quick-control checks for data consistency through all steps of calculation.

4.3.9.2.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.B.8.b *Ethylene production.*

Table 437 Recalculations done since NC in IPCC category 2.B.8.b *Ethylene production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.B.8.b	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.B.8.b	Emission factor from 2006 IPCC Guidelines: 1994 & 2020: revision of CH_4 EF from 1.0 kg CH_4 / tonne Ethylene produced to 6 kg CH_4 / tonne Ethylene produced	EF	Accuracy

4.3.9.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 438 Planned improvements for IPCC category 2.B.8.b *Ethylene production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.8.b	Application of Tier 2 methodology or higher and /or Preparation of a carbon mass balance calculations according to Tier 2 carbon mass balance flow diagram (Figure 3.10. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3)	meth	Accuracy	medium
2.B.8.b	Collection of plant specific activity data (1990-2020): • production capacity data per plant • Ethylene production per plant • feedstock used	AD	Accuracy Completeness Consistency Transparency comparability	medium
2.B.8.b	Collection of information related to process applied for Ethylene production including plant specific parameter	EF	Accuracy Transparency	medium

4.3.9.3 Other petrochemical production (IPCC category 2.B.8.c-f)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.B.8	Petrochemical and Carbon Black Production						
2.B.8.c	Ethylene Dichloride and Vinyl Chloride Monomer	NO	-	NO	-	NA	-
2.B.8.d	Ethylene Oxide	NO	-	NO	-	NA	-
2.B.8.e	Acrylonitrile	NO	-	NO	-	NA	-
2.B.8.f	Carbon Black	NO	-	NO	-	NA	-
A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC categories 2.B.8.c - 2.B.8.c do not exist in Algeria. However, it was not clear if the production of Ethylene Dichloride and Vinyl Chloride Monomer, Ethylene Oxide, Acrylonitrile or Carbon Black takes place in Algeria.

4.3.9.3.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 439 Planned improvements for IPCC category 2.B.2 *Nitric Acid Production*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.8.c - 2.B.8.c	Investigation if the production of the following product took/takes place in Algeria: • Ethylene Dichloride and Vinyl Chloride Monomer • Ethylene Oxide, • Acrylonitrile, or • Carbon Black	AD	Accuracy Completeness Transparency	high

4.3.10 Fluorochemical Production (IPCC category 2.B.9)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.B.9	Fluorochemical Production	NA	-	NA	-	NA	-
2.B.9.a	By product emissions	NA	-	NA	-	NA	-
2.B.9.b	Fugitive Emissions	NA	-	NA	-	NA	-
A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.B.9 *Fluorochemical Production* does not exist in Algeria.

4.3.11 Other – Urea production (IPCC category 2.B.10)

4.3.11.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.B.10	Other						
2.B.10.a.	Hydrogen production	NO	-	NO	-	NO	-
2.B.10.b	Other - Urea production	✓	-	NO	-	NO	-
2.B.10.c	Other – not specified	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the process-related to CO_2 emissions estimations from urea production. Combustion re-related GHG emissions are allocated in 1.A.2.c Chemical industry.

Algeria has two ammonia plants where urea is produced in downstream by recovering CO_2 from ammonia production.

Urea production

Urea is produced commercially from synthetic ammonia and carbon dioxide, mainly in integrated chemical plants in downstream.

The urea production process consists of two main equilibrium reactions, with incomplete conversion of the reactants. The first is carbamate formation: the fast-exothermic reaction of liquid ammonia with gaseous carbon dioxide (CO_2) at high temperature and pressure to form ammonium carbamate (H2N-COONH4):

$$2NH_3 + CO_2 \leftrightarrows H_2N\text{-}COONH_4$$

The second is urea conversion - the slower endothermic decomposition of ammonium carbamate into urea and water:

$$H_2N\text{-}COONH_4 \leftrightarrows (NH_2)_2CO + H_2O$$

The overall conversion of NH3 and CO_2 to urea is exothermic, the reaction heat from the first reaction driving the second.

The CO_2 emissions from urea production were 0.0002 kt in 2013 and 0.0072 kt emissions in 2018, which is an increase of 3890 % during the period 2013 – 2018. The significant increase in CO_2 emissions are a consequence of the commissioning of two ammonia and urea production complex of Arzew respectively in 2014 and 2015 as part of the development and diversification of investment in the national energy sector

An overview of the urea production (IPCC sub-category 2.B.1) and related CO_2 emissions is provided in the following figure and table.

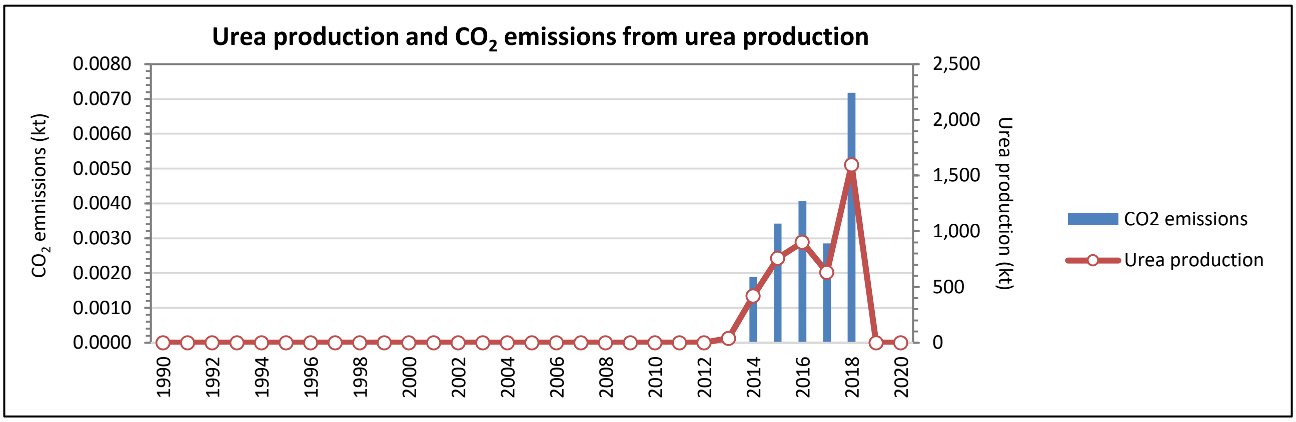

Figure 169 Activity data and CO_2 emissions from IPCC sub-category 2.B.10 Urea production

Table 440 Activity data and CO_2 emissions from Urea production (IPCC sub-category 2.B.10)

	Activity data			**CO_2 emissions**
Years	**Urea production capacity[454]**	**Urea production**	**Source of activity data**	
		kt		**kt**
1990		NO	US geological survey[455]	NO
1991		NO		NO
1992		NO		NO
1993		NO		NO
1994		NO		NO
1995		NO		NO
1996		NO		NO
1997		NO		NO
1998		NO		NO
1999		NO		NO
2000		NO		NO
2001		NO		NO
2002		NO		NO
2003		NO		NO
2004		NO		NO
2005		NO		NO
2006		NO		NO
2007		NO		NO
2008		NO		NO
2009		NO		NO
2010		NO		NO
2011		NO		NO
2012		NO		NO
2013		40.00		0.0002

---

[454] Please provide capacity data

[455] U.S. Geological Survey (several years): Algeria Minerals Yearbook. Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

	Activity data			CO_2 emissions
Years	Urea production capacity[454]	Urea production	Source of activity data	
		kt		kt
2014		420.00		0.0019
2015		760.00		0.0034
2016		902.00		0.0041
2017		633.00		0.0028
2018		1,596.00		0.0072
2019		NE	as of 2018	NE
2020		NE		NE
Trend				
1990 – 2020		NA		NA
2013 – 2018		3890%		3890%
2019 - 2020		NA		NA

4.3.11.2 Methodological issues

4.3.11.2.1 Choice of methods

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[456] has been applied:

Equation 3.1: CO_2 emissions from ammonia production – TIER 1

$$\boldsymbol{Emissions_{CO_2} = AP \times EF_{CO_2}}$$

Where:

Emissions $_{CO2}$ = CO_2 emission for urea production

AP = urea production (tonnes)

EF_{CO2} = default CO_2 emission factor for urea production (tonnes CO_2/tonne CO_2)

4.3.11.2.2 Activity data

The Tier 1 method requires data on national production of urea. For the years 2013 and 2018 activity data urea production was taken from US geological survey.

For the period 1990 – 2012 no data were available, thus the notation key 'NO' (not occurring) was used as it is not clear is urea production occurred in Algeria in this period.

For 2019-2020 no data were available, thus the notation key NE" (not estimated) was used, as it is assumed, that the urea production did not stopped after 2018.

The activity data are presented in Figure 169 and provided in Table above.

---

[456] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 3: Chemical Industry Emissions – 3.2.2.1 Choice of method

4.3.11.2.3 Emission factors

As no plant-level information is not available, it is *good practice* to use default factors. The average of the range provided in the 2006 IPCC guidelines was used.

Table 441 Default CO_2 emission factor for IPCC category 2.B.10 urea *production.*

Parameter		Unit	Value			Reference
			low	average	high	
EF_{CO2}	**default CO_2 emission factor**	tonnes CO_2/ tonne of urea produced	2	**4.5**	7	Box 3.3. 2006 IPCC GL. Vol. 3 IPPU. Chapter 3

4.3.11.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.B.10 *Urea production* are presented in the following table.

Table 442 Uncertainty for IPCC category 2.B.10 *Urea production.*

Uncertainty	N_2O	Reference
Activity data (AD)	7%	2006 IPCC GL, Vol. 3, IPPU Chap. 3.3.3.2
Emission factor (EF)	5%	Table 3.3 2006 IPCC GL, Vol. 3 IPPU, Chapter 3
Combined Uncertainty (U)	9%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.3.11.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[457] and
    - US geological survey[458]
    - FAO[459]
    - UN statistics[460]
- cross checks with other relevant sectors (2.B.1, 2.B.2, 1.A.2.c) are performed to avoid double counting or

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[457] https://www.ons.dz/spip.php?rubrique6andhttps://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[458] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[459] FAO – FAOSTAT – Land, Inuts and Sustainability – Inputs - Fertilizers by Product https://www.fao.org/faostat/en/#data/RFB

[460] United Nations Industrial Development Organization UNIDO - Statistical Databases INDSTAT
https://www.unido.org/researchers/statistical-databases

omissions.

4.3.11.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.B.10 *Urea production.*

Table 443 Recalculations done since NC in IPCC category 2.B.10 *Urea production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.B.10	No revisions were done as emissions were estimated the first time.		

4.3.11.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 444 Planned improvements for IPCC category 2.B.10 *Urea production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.10	Collection of plant specific activity data (1990-2020): • production capacity data per plant • urea production per plant	AD	Accuracy Completeness Consistency Transparency Comparability	high
2.B.10	Collection of amount of CO_2 used/recovered for downstream	AD	Accuracy	medium

4.4 Metal Industry (IPCC category 2.C)

The IPCC category 2.C comprises the production of various ferrous and non-ferrous producing industries, where GHG emissions are arising. In Algeria, steel, lead and zinc is produced.

An overview of the GHG emission from fuel combustion in IPCC sector 2.C *Metal Industry* is provided in the following figures and tables:

- annual GHG emissions;
- trend of the periods 1990 – 2020, 2005 – 2020, 2019 – 2020;

The greenhouse gas emissions from IPCC sector 2.C *Metal Industry* amounted to 9,903.75 kt CO_2 equivalents in 1990, 13,811.90 kt CO_2 equivalents in 2005 and 1,992.65 kt CO_2 equivalents in 2020.

The overall trend in GHG emissions from the IPCC sector 2.C *Metal Industry* shows a decrease by 79.9%from 1990 to 2020, 85.6% from 2005 to 2020 and increase by 16.3% from 2019 to 2020. In fact, Greenhouse gas emissions from IPCC 2.C sector *Metals Industry* peaked at 15 081.94 kt in 2002.

The decrease in emissions from IPCC category 2.C Iron and Steel industry is mainly due to the change of technology from production in blast furnace to production in electric arc furnace. Additionally, the lead production stopped in 2006. The emissions related to zinc production, which increased significantly until 2002, decreased as a result of stopped export of unrouged zinc.

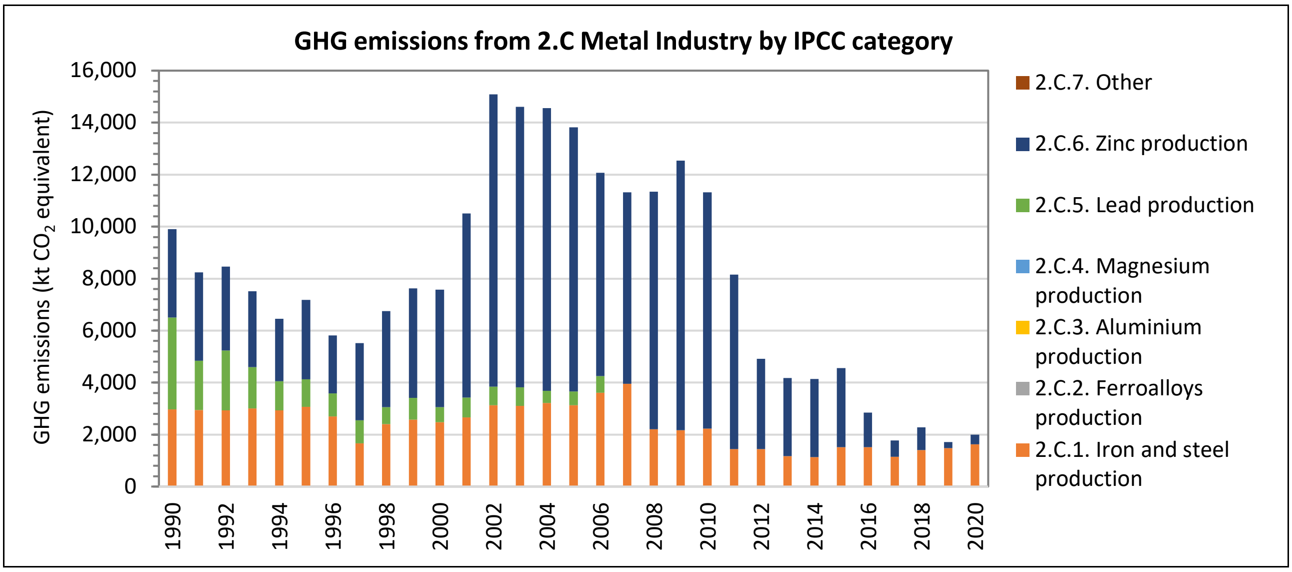
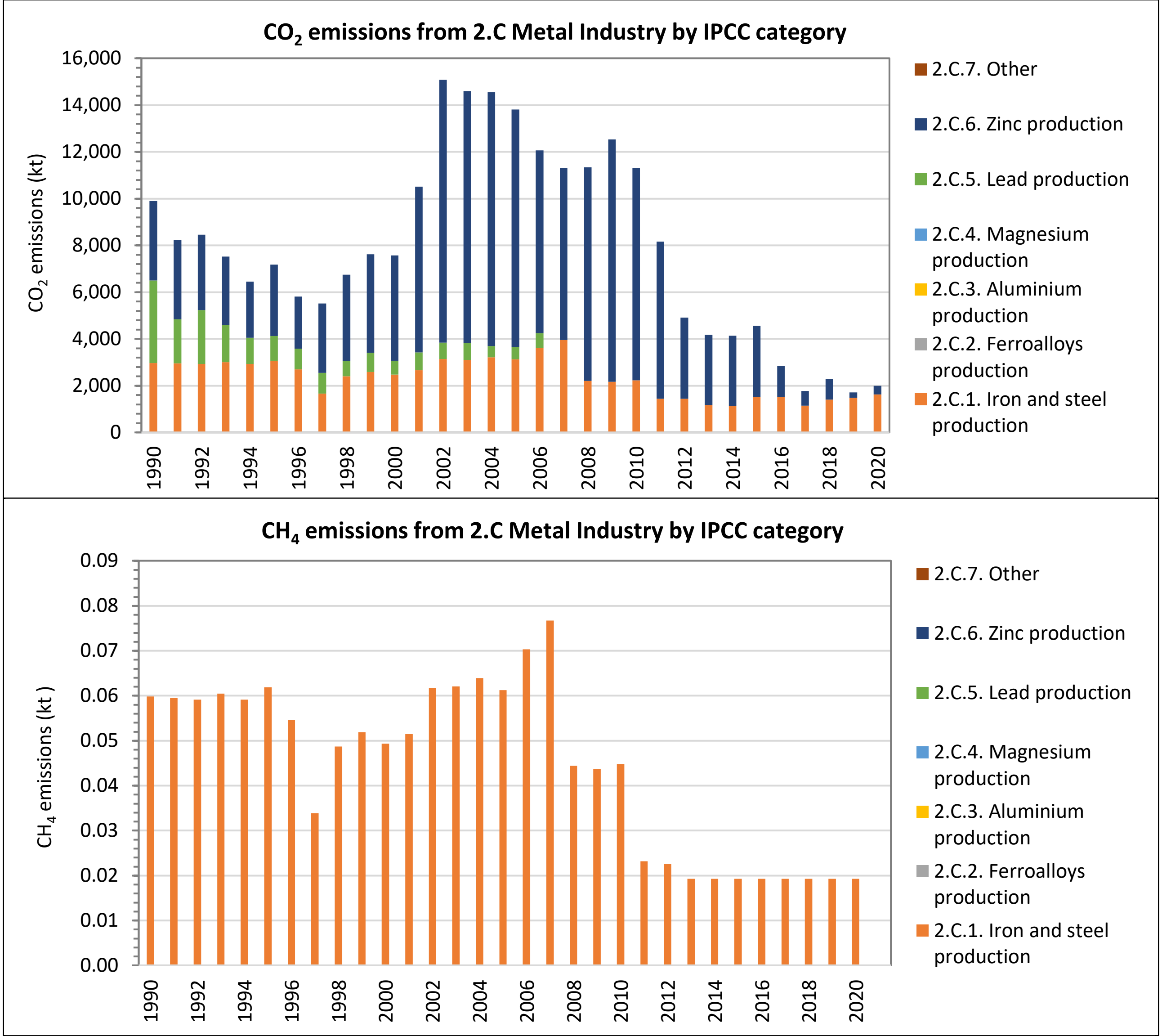


Figure 170 GHG Emissions from IPCC category 2.C *Metal Industry* by category



In Algeria, no N_2O emissions arise from IPCC category 2.C Metal Industry

Figure 171 Emissions from IPCC category 2.C *Metal Industry*

In 1990. the share in IPCC sector 2.C *Metal Industry* contributes with

- 30% the IPCC category 2.C.1. Iron and steel production
- 36% the IPCC category 2.C.5. Lead production
- 34% the IPCC category 2. 2.C.6. Zinc production

In 2020, the share in IPCC sector 2.C *Metal Industry* contribute with

- 82% the IPCC category 2.C.1. Iron and steel production
- 0% the IPCC category 2.C.5. Lead production
- 18 % the IPCC category 2. 2.C.6. Zinc production

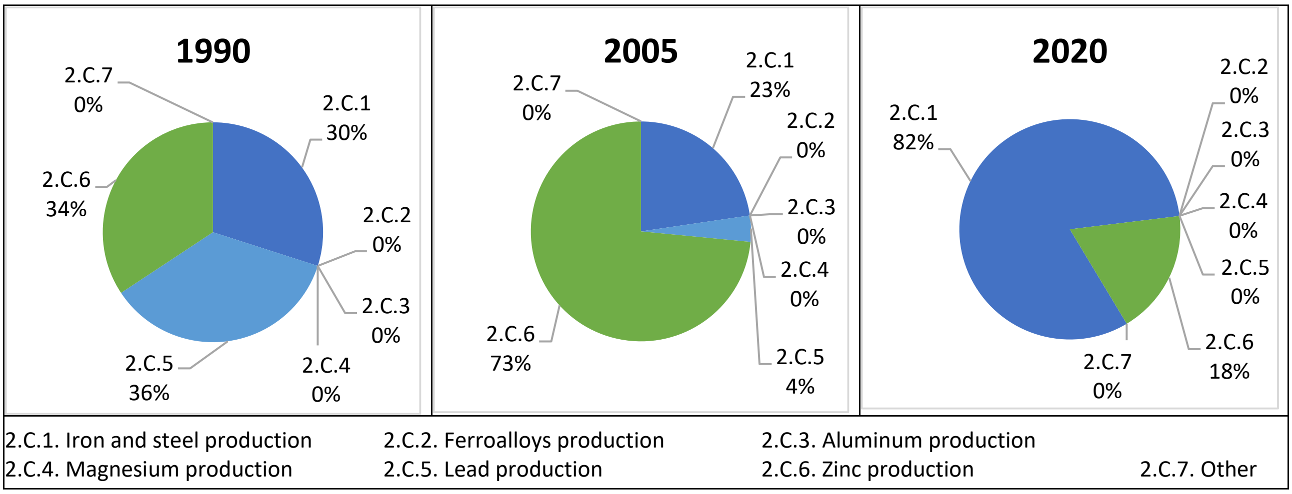


Figure 172 Share of greenhouse gases from IPCC category 2.C Metal Industry

Table 445 GHG Emissions by fuels from IPCC category 2.C *Metal Industry*

GHG	**2.C. Metal industry**	**2.C.1. Iron and steel production**	**2.C.2. Ferroalloys production**	**2.C.3. Aluminium production**	**2.C.4. Magnesium production**	**2.C.5. Lead production**	**2.C.6. Zinc production**	**2.C.7. Other (2.C.7.a. Rare earths production)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	9,903.75	2,966.75	NO	NO	NO	3,540.00	3,397.00	NO
1991	8,237.13	2,952.13	NO	NO	NO	1,888.00	3,397.00	NO
1992	8,461.75	2,935.75	NO	NO	NO	2,301.00	3,225.00	NO
1993	7,519.52	3,002.52	NO	NO	NO	1,593.00	2,924.00	NO
1994	6,457.70	2,928.70	NO	NO	NO	1,121.00	2,408.00	NO
1995	7,179.57	3,064.57	NO	NO	NO	1,062.00	3,053.00	NO
1996	5,817.55	2,696.55	NO	NO	NO	885.00	2,236.00	NO
1997	5,520.48	1,668.48	NO	NO	NO	885.00	2,967.00	NO
1998	6,752.39	2,405.39	NO	NO	NO	649.00	3,698.00	NO
1999	7,622.91	2,582.91	NO	NO	NO	826.00	4,214.00	NO
2000	7,578.00	2,473.00	NO	NO	NO	590.00	4,515.00	NO
2001	10,511.18	2,661.22	NO	NO	NO	767.00	7,082.96	NO
2002	15,081.94	3,135.46	NO	NO	NO	708.00	11,238.48	NO
2003	14,604.86	3,109.02	NO	NO	NO	708.00	10,787.84	NO
2004	14,553.59	3,217.64	NO	NO	NO	472.00	10,863.95	NO
2005	13,811.90	3,132.90	NO	NO	NO	531.00	10,148.00	NO
2006	12,063.00	3,606.06	NO	NO	NO	649.00	7,807.94	NO
2007	11,316.78	3,958.19	NO	NO	NO	NO	7,358.59	NO
2008	11,339.53	2,205.04	NO	NO	NO	NO	9,134.49	NO
2009	12,534.58	2,165.13	NO	NO	NO	NO	10,369.45	NO
2010	11,317.82	2,233.21	NO	NO	NO	NO	9,084.61	NO
2011	8,159.83	1,447.10	NO	NO	NO	NO	6,712.73	NO
2012	4,917.81	1,439.11	NO	NO	NO	NO	3,478.70	NO
2013	4,178.47	1,175.78	NO	NO	NO	NO	3,002.69	NO
2014	4,135.96	1,136.28	NO	NO	NO	NO	2,999.68	NO
2015	4,561.56	1,514.58	NO	NO	NO	NO	3,046.98	NO
2016	2,848.01	1,514.58	NO	NO	NO	NO	1,333.43	NO
2017	1,776.24	1,143.28	NO	NO	NO	NO	632.96	NO
2018	2,286.93	1,407.58	NO	NO	NO	NO	879.35	NO
2019	1,713.07	1,479.58	NO	NO	NO	NO	233.49	NO
2020	1,992.65	1,627.58	NO	NO	NO	NO	365.07	NO
Trend								
1990 - 2020	-79.9%	-45.1%	NA	NA	NA	NA	-89.3%	NA
2005 - 2020	-85.6%	-48.0%	NA	NA	NA	NA	-96.4%	NA
2019 - 2020	16.3%	10.0%	NA	NA	NA	NA	56.4%	NA

Table 446 CO_2 Emissions by fuels from IPCC category 2.C *Metal Industry*

CO_2	**2.C. Metal industry**	**2.C.1. Iron and steel production**	**2.C.2. Ferroalloys production**	**2.C.3. Aluminium production**	**2.C.4. Magnesium production**	**2.C.5. Lead production**	**2.C.6. Zinc production**	**2.C.7. Other (2.C.7.a. Rare earths production)**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	9,902.20	2,965.20	NO	NO	NO	3,540.00	3,397.00	NO
1991	8,235.58	2,950.58	NO	NO	NO	1,888.00	3,397.00	NO
1992	8,460.21	2,934.21	NO	NO	NO	2,301.00	3,225.00	NO
1993	7,517.95	3,000.95	NO	NO	NO	1,593.00	2,924.00	NO
1994	6,456.16	2,927.16	NO	NO	NO	1,121.00	2,408.00	NO
1995	7,177.96	3,062.96	NO	NO	NO	1,062.00	3,053.00	NO
1996	5,816.13	2,695.13	NO	NO	NO	885.00	2,236.00	NO
1997	5,519.60	1,667.60	NO	NO	NO	885.00	2,967.00	NO
1998	6,751.13	2,404.13	NO	NO	NO	649.00	3,698.00	NO
1999	7,621.56	2,581.56	NO	NO	NO	826.00	4,214.00	NO
2000	7,576.71	2,471.71	NO	NO	NO	590.00	4,515.00	NO
2001	10,509.84	2,659.88	NO	NO	NO	767.00	7,082.96	NO
2002	15,080.34	3,133.86	NO	NO	NO	708.00	11,238.48	NO
2003	14,603.25	3,107.41	NO	NO	NO	708.00	10,787.84	NO
2004	14,551.93	3,215.98	NO	NO	NO	472.00	10,863.95	NO
2005	13,810.31	3,131.31	NO	NO	NO	531.00	10,148.00	NO
2006	12,061.18	3,604.24	NO	NO	NO	649.00	7,807.94	NO
2007	11,314.79	3,956.20	NO	NO	NO	NO	7,358.59	NO
2008	11,338.37	2,203.88	NO	NO	NO	NO	9,134.49	NO
2009	12,533.44	2,163.99	NO	NO	NO	NO	10,369.45	NO
2010	11,316.66	2,232.05	NO	NO	NO	NO	9,084.61	NO
2011	8,159.23	1,446.50	NO	NO	NO	NO	6,712.73	NO
2012	4,917.22	1,438.52	NO	NO	NO	NO	3,478.70	NO
2013	4,177.97	1,175.28	NO	NO	NO	NO	3,002.69	NO
2014	4,135.46	1,135.78	NO	NO	NO	NO	2,999.68	NO
2015	4,561.06	1,514.08	NO	NO	NO	NO	3,046.98	NO
2016	2,847.51	1,514.08	NO	NO	NO	NO	1,333.43	NO
2017	1,775.74	1,142.78	NO	NO	NO	NO	632.96	NO
2018	2,286.43	1,407.08	NO	NO	NO	NO	879.35	NO
2019	1,712.57	1,479.08	NO	NO	NO	NO	233.49	NO
2020	1,992.15	1,627.08	NO	NO	NO	NO	365.07	NO
Trend								
1990 - 2020	*-79.9%*	*-45.1%*	*NA*	*NA*	*NA*	*NA*	*-89.3%*	*NA*
2005 - 2020	*-85.6%*	*-48.0%*	*NA*	*NA*	*NA*	*NA*	*-96.4%*	*NA*
2019 - 2020	*16.3%*	*10.0%*	*NA*	*NA*	*NA*	*NA*	*56.4%*	*NA*

Table 447 CH_4 Emissions by fuels from IPCC category 2.C *Metal Industry*

CH_4	**2.C. Metal industry**	**2.C.1. Iron and steel production**	**2.C.2. Ferroalloys production**	**2.C.3. Aluminium production**	**2.C.4. Magnesium production**	**2.C.5. Lead production**	**2.C.6. Zinc production**	**2.C.7. Other (2.C.7.a. Rare earths production)**
2.C.3	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.06	0.06	NO	NO	NO	NO		NO
1991	0.06	0.06	NO	NO	NO	NO		NO
1992	0.06	0.06	NO	NO	NO	NO		NO
1993	0.06	0.06	NO	NO	NO	NO		NO
1994	0.06	0.06	NO	NO	NO	NO		NO
1995	0.06	0.06	NO	NO	NO	NO		NO
1996	0.05	0.05	NO	NO	NO	NO		NO
1997	0.03	0.03	NO	NO	NO	NO		NO
1998	0.05	0.05	NO	NO	NO	NO		NO
1999	0.05	0.05	NO	NO	NO	NO		NO
2000	0.05	0.05	NO	NO	NO	NO		NO
2001	0.05	0.05	NO	NO	NO	NO		NO
2002	0.06	0.06	NO	NO	NO	NO		NO
2003	0.06	0.06	NO	NO	NO	NO		NO
2004	0.06	0.06	NO	NO	NO	NO		NO
2005	0.06	0.06	NO	NO	NO	NO		NO
2006	0.07	0.07	NO	NO	NO	NO		NO
2007	0.08	0.08	NO	NO	NO	NO		NO
2008	0.04	0.04	NO	NO	NO	NO		NO
2009	0.04	0.04	NO	NO	NO	NO		NO
2010	0.04	0.04	NO	NO	NO	NO		NO
2011	0.02	0.02	NO	NO	NO	NO		NO
2012	0.02	0.02	NO	NO	NO	NO		NO
2013	0.02	0.02	NO	NO	NO	NO		NO
2014	0.02	0.02	NO	NO	NO	NO		NO
2015	0.02	0.02	NO	NO	NO	NO		NO
2016	0.02	0.02	NO	NO	NO	NO		NO
2017	0.02	0.02	NO	NO	NO	NO		NO
2018	0.02	0.02	NO	NO	NO	NO		NO
2019	0.02	0.02	NO	NO	NO	NO		NO
2020	0.02	0.02	NO	NO	NO	NO		NO
Trend								
1990 - 2020	-67.74%	-67.74%	*NA*	*NA*	*NA*	*NA*		*NA*
2005 - 2020	-68.49%	-68.49%	*NA*	*NA*	*NA*	*NA*		*NA*
2019 - 2020	0.00%	0.00%	*NA*	*NA*	*NA*	*NA*		*NA*

From IPCC category 2.C Metal Industry. there are no N_2O emissions occurring.

4.4.1 Iron and Steel Production (IPCC category 2.C.1)

4.4.1.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.1	Iron and Steel Production						
2.C.1.a	Steel	√	-	NO	-	NO	-
2.C.1.b	Pig iron	√	-	NO	-	NO	-
2.C.1.c	Direct reduced iron	NO	-	NO	-	NO	-
2.C.1.d	Sinter	√	-	√	-	NO	-
2.C.1.e	Pellet	√	-	NO	-	NO	-
2.C.1.f.	Other	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The iron and steel industry is a highly material and energy-intensive industry. The production of iron and steel leads to emissions of carbon dioxide (CO_2) and methane (CH_4).

The iron and steel industry broadly consists of:

- Primary facilities that produce both iron and steel;
- Secondary steelmaking facilities;
- Iron production facilities; and
- Offsite production of metallurgical coke.

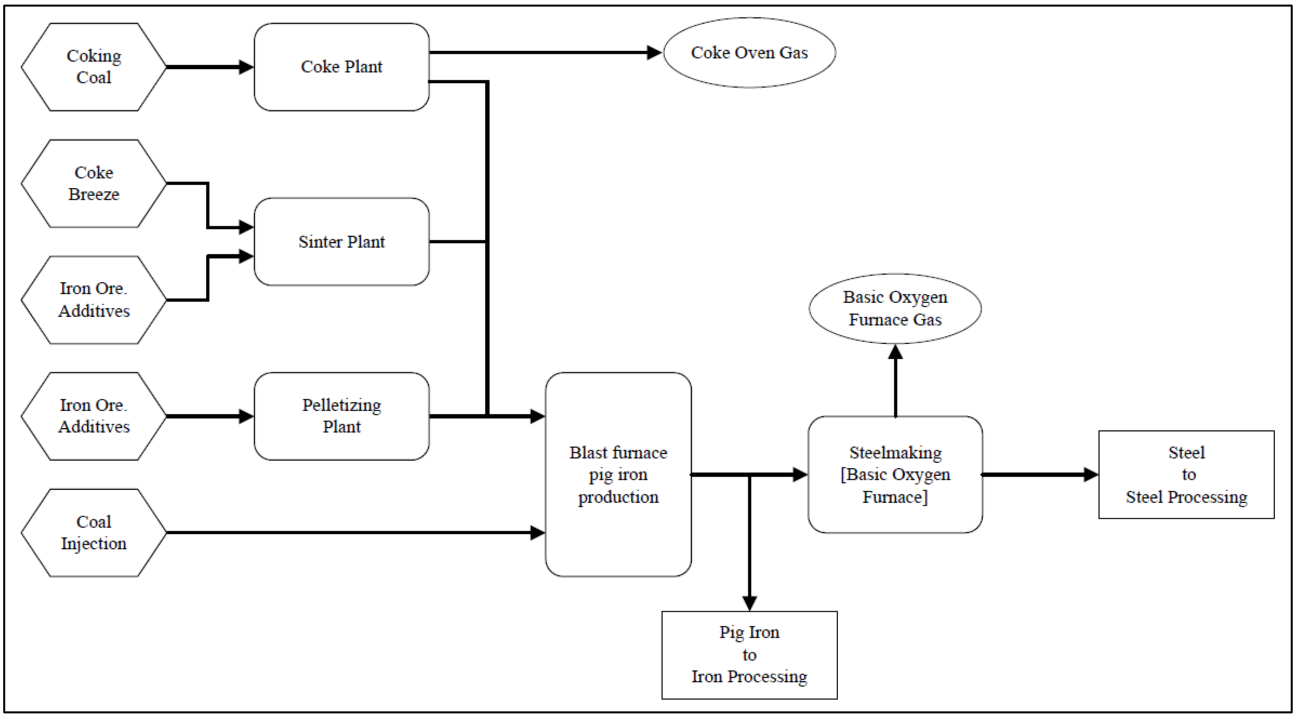


Figure 173 Figure 4.1 Illustration of main processes for integrated iron and steel[461]

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[461] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions Figure 4.8d (New) Energy or IPPU CO2 emissions allocation in an integrated iron and steel facility

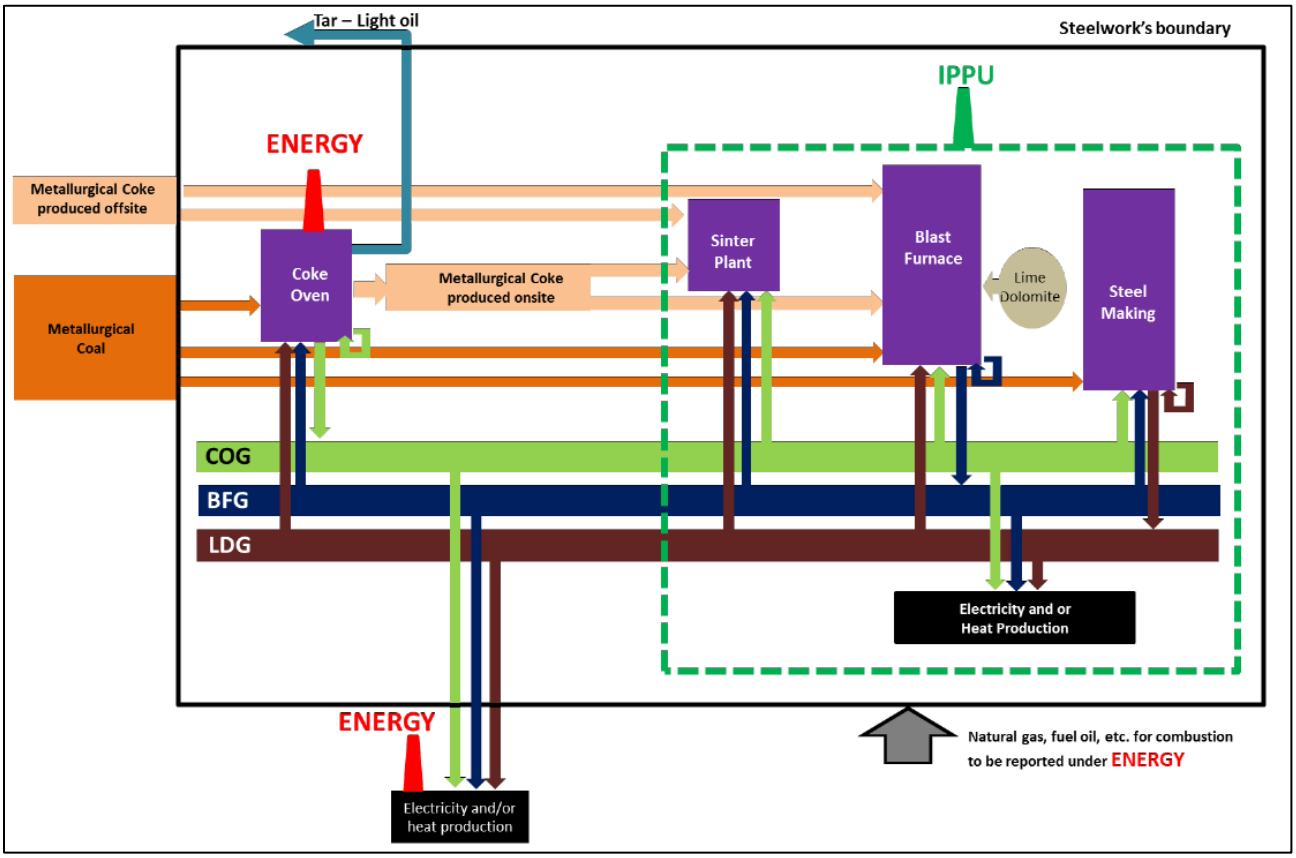

Figure 174 Energy or IPPU CO_2 emissions allocation in an integrated iron and steel facility.[462]

In Algeria the steel production comprise the manufacture of flat and long products such as steel coils and sheets, reinforcing bars and seamless tubes. The production of pig iron and (crude) steel takes place in the following units:

- raw material preparation and sintering units including pelletising
- coke oven coke including usage of coke oven coke gas
- 1 blast furnace (BOF) including usage of blast furnace gas (BFG)
- 2 oxygen steelworks
- 1 electric steel mill

The fuel combustion related GHG emissions from natural gas, coke oven gas, blast furnance gas and liquid fuels are reported in IPCC category 1.2.a Iron and Steel.

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[462] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume3: Industrial Processes and Product Use, Chapter 4: Metal Industry Emissions Figure 4.8d (New) Energy or IPPU CO2 emissions allocation in an integrated iron and steel facility

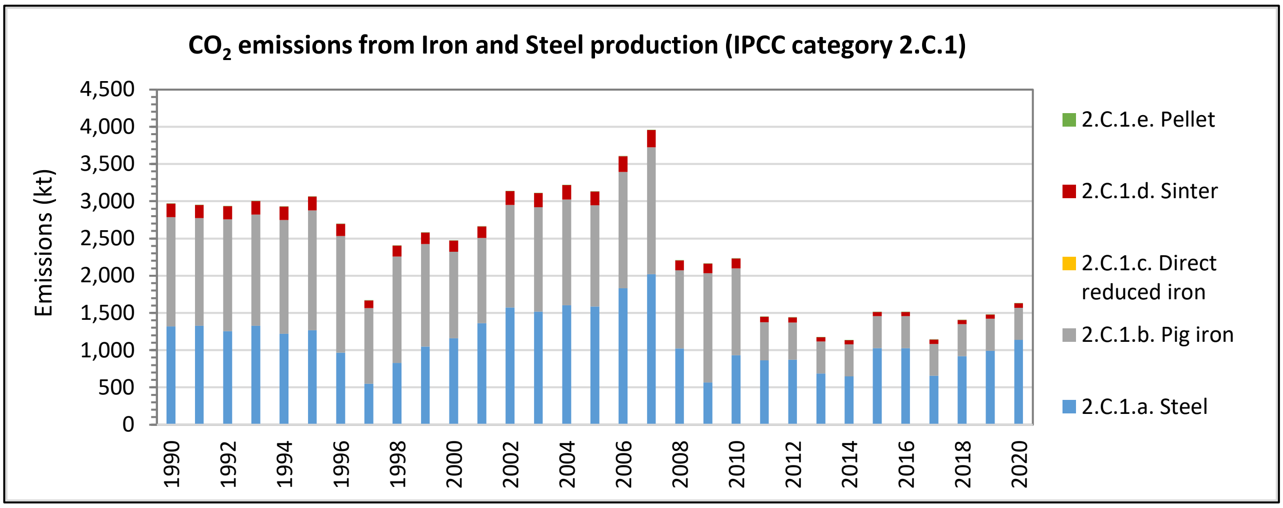

Figure 175 CO$_2$ emissions from IPCC category 2.C.1 Iron and Steel production 1990-2020

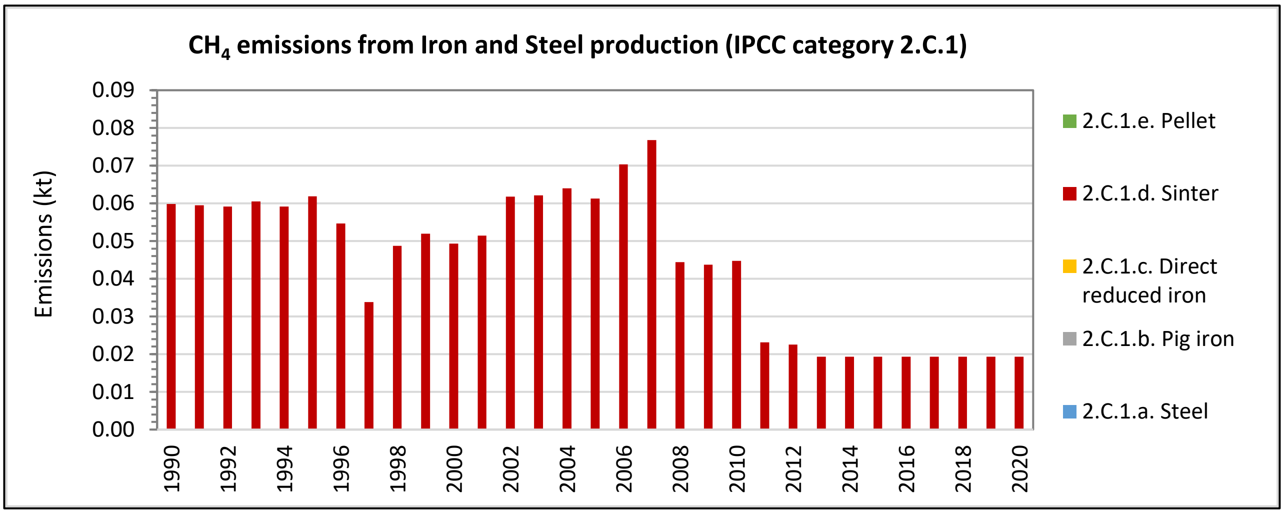

Figure 176 CH$_4$ emissions from IPCC category 2.C.1 Iron and Steel production 1990-2020

The CO$_2$ emissions reported for Iron and Steel production (IPCC category 2.C.1) were 2,965.20 kt CO$_2$ emissions in 1990 and 1,627.08 kt in 2020, which is a decrease of 45.1% during the period 1990 – 2020. Compared to 2005, CO$_2$ emissions decreased by 48 % from 3.131.31 kt.

Furthermore, CH$_4$ emissions resulting from Iron and Steel production (IPCC category 2.C.1) were estimated to 0.06 kt in 1990 and 0.019 kt in 2020, which is a decrease of 67.7% during the period 1990 – 2020, CH$_4$ emissions result from the sintering process.

The decrease by 42.86% in 2008, probably, due the decrease in demand caused by the global economic downturn.

Table 448 CO_2 emissions from Iron and Steel production (IPCC sub-category 2.C.1)

CO_2 emissions	**2.C.1**	**2.C.1.a**	**2.C.1.b**	**2.C.1.c**	**2.C.1.d**	**2.C.1.e**
	Iron and steel production	**Steel**	**Pig iron**	**Direct reduced iron**	**Sinter**	**Pellet**
		kt	**kt**	**kt**	**kt**	**kt**
1990	2,965.20	1,320.88	1,464.32	NO	179.50	0.49
1991	2,950.58	1,327.20	1,444.30	NO	178.54	0.54
1992	2,934.21	1,253.36	1,502.93	NO	177.38	0.54
1993	3,000.95	1,328.90	1,490.06	NO	181.43	0.55
1994	2,927.16	1,222.00	1,527.24	NO	177.38	0.54
1995	3,062.96	1,269.40	1,607.32	NO	185.68	0.56
1996	2,695.13	964.72	1,565.85	NO	164.06	0.50
1997	1,667.60	549.04	1,016.73	NO	101.53	0.31
1998	2,404.13	829.00	1,428.57	NO	146.11	0.44
1999	2,581.56	1,046.80	1,378.52	NO	155.76	0.47
2000	2,471.71	1,159.20	1,164.02	NO	148.04	0.45
2001	2,659.88	1,361.00	1,144.00	NO	154.41	0.47
2002	3,133.86	1,575.20	1,372.80	NO	185.29	0.56
2003	3,107.41	1,519.18	1,401.40	NO	186.26	0.57
2004	3,215.98	1,602.12	1,421.42	NO	191.86	0.58
2005	3,131.31	1,585.64	1,361.36	NO	183.75	0.56
2006	3,604.24	1,829.64	1,562.99	NO	210.97	0.64
2007	3,956.20	2,019.24	1,705.99	NO	230.27	0.70
2008	2,203.88	1,020.68	1,049.62	NO	133.18	0.40
2009	2,163.99	565.16	1,467.18	NO	131.25	0.40
2010	2,232.05	930.42	1,166.88	NO	134.34	0.41
2011	1,446.50	862.00	514.80	NO	69.49	0.21
2012	1,438.52	870.26	500.50	NO	67.56	0.21
2013	1,175.28	688.20	429.00	NO	57.90	0.18
2014	1,135.78	648.70	429.00	NO	57.90	0.18
2015	1,514.08	1,027.00	429.00	NO	57.90	0.18
2016	1,514.08	1,027.00	429.00	NO	57.90	0.18
2017	1,142.78	655.70	429.00	NO	57.90	0.18
2018	1,407.08	920.00	429.00	NO	57.90	0.18
2019	1,479.08	992.00	429.00	NO	57.90	0.18
2020	1,627.08	1,140.00	429.00	NO	57.90	0.18
Trend						
1990 – 2020	-45.1%	-13.7%	-70.7%	NA	-67.7%	-64.3%
2005 - 2020	-48.0%	-28.1%	-68.5%	NA	-68.5%	-68.5%
2019 - 2020	10.0%	14.9%	0.0%	NA	0.0%	0.0%

Table 449 CH_4 emissions from Iron and Steel production (IPCC sub-category 2.C.1)

CH_4 emissions	2.C.1	2.C.1.a	2.C.1.b	2.C.1.c	2.C.1.d	2.C.1.e
	Iron and steel production	Steel	Pig iron	Direct reduced iron	Sinter	Pellet
	kt	kt	kt	kt	kt	kt
1990	0.060	NE	NE	NO	0.060	NA
1991	0.060	NE	NE	NO	0.060	NA
1992	0.059	NE	NE	NO	0.059	NA
1993	0.060	NE	NE	NO	0.060	NA
1994	0.059	NE	NE	NO	0.059	NA
1995	0.062	NE	NE	NO	0.062	NA
1996	0.055	NE	NE	NO	0.055	NA
1997	0.034	NE	NE	NO	0.034	NA
1998	0.049	NE	NE	NO	0.049	NA
1999	0.052	NE	NE	NO	0.052	NA
2000	0.049	NE	NE	NO	0.049	NA
2001	0.051	NE	NE	NO	0.051	NA
2002	0.062	NE	NE	NO	0.062	NA
2003	0.062	NE	NE	NO	0.062	NA
2004	0.064	NE	NE	NO	0.064	NA
2005	0.061	NE	NE	NO	0.061	NA
2006	0.070	NE	NE	NO	0.070	NA
2007	0.077	NE	NE	NO	0.077	NA
2008	0.044	NE	NE	NO	0.044	NA
2009	0.044	NE	NE	NO	0.044	NA
2010	0.045	NE	NE	NO	0.045	NA
2011	0.023	NE	NE	NO	0.023	NA
2012	0.023	NE	NE	NO	0.023	NA
2013	0.019	NE	NE	NO	0.019	NA
2014	0.019	NE	NE	NO	0.019	NA
2015	0.019	NE	NE	NO	0.019	NA
2016	0.019	NE	NE	NO	0.019	NA
2017	0.019	NE	NE	NO	0.019	NA
2018	0.019	NE	NE	NO	0.019	NA
2019	0.019	NE	NE	NO	0.019	NA
2020	0.019	NE	NE	NO	0.019	NA
Trend						
1990 – 2020	-67.7%	NA	NA	NA	-67.7%	NA
2005 - 2020	-68.5%	NA	NA	NA	-68.5%	NA
2019 - 2020	0.0%	NA	NA	NA	0.0%	NA

4.4.1.2 Methodological issues

4.4.1.2.1 Choice of methods

For estimating the CO_2 and CH_4 emissions, the 2019 Refinements to the 2006 IPCC Guidelines Tier 1 approach[463] has been applied:

EQUATION 4.4
CO_2 EMISSIONS FROM IRON AND STEEL PRODUCTION (TIER 1)

$$\text{Iron \& Steel: } E_{CO_2,\, non-energy} = BOF \bullet EF_{BOF} + EAF \bullet EF_{EAF} + OHF \bullet EF_{OHF}$$

EQUATION 4.5
CO_2 EMISSIONS FROM PRODUCTION OF PIG IRON NOT PROCESSED INTO STEEL (TIER 1)

$$\text{Pig Iron Production: } E_{CO_2,\, non-energy} = IP \bullet EF_{IP}$$

EQUATION 4.6
CO_2 EMISSIONS FROM PRODUCTION OF DIRECT REDUCED IRON (TIER 1)

$$\text{Direct Reduced Iron: } E_{CO_2,\, non-energy} = DRI \bullet EF_{DRI}$$

EQUATION 4.7
CO_2 EMISSIONS FROM SINTER PRODUCTION (TIER 1)

$$\text{Sinter Production: } E_{CO_2,\, non-energy} = SI \bullet EF_{SI}$$

EQUATION 4.8
CO_2 EMISSIONS FROM PELLET PRODUCTION (TIER 1)

$$\text{Pellet Production: } E_{CO_2,\, non-energy} = P \bullet EF_{P}$$

EQUATION 4.8A (NEW)
CO_2 EMISSIONS FROM BFG AND LDG FLARING (TIER 1)

$$E_{CO_2,\, non-energy} = BFG \bullet (EF_{CO_2})_{BFG\ flaring} + LDG \bullet (EF_{CO_2})_{LDG\ flaring}$$

$$= BFG \bullet (R_{BFG\ flared} \bullet CC_{BFG} \bullet \frac{44}{12}) + LDG \bullet (R_{LDG\ flared} \bullet CC_{LDG} \bullet \frac{44}{12})$$

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[463] Source: 2006 IPCC Guidelines, Volume 2: Energy, Chapter 4: Metal Industry Emissions- 4.4.2 Methodological issues - Choice of method

Where:

$E_{CO2.\ non\text{-}energy}$ = emissions of CO_2 to be reported in IPPU Sector, tonnes

BOF = quantity of Basic Oxygen Furnace (BOF) crude steel produced, tonnes

EAF = quantity of Electric Arc Furnace (EAF) crude steel produced, tonnes

OHF = quantity of Open Hearth Furnace (OHF) crude steel produced, tonnes

IP = quantity of pig iron production not converted to steel, tonnes

DRI = quantity of Direct Reduced Iron produced nationally, tonnes

SI = quantity of sinter produced nationally, tonnes

P = quantity of pellet produced nationally, tonnes

EFx = emission factor, tonnes CO_2/tonne x produced

$(EFCO_2)_{BFG\ flaring}$ = emission factor, tonnes CO_2/tonnes of BFG produced

$(EFCO_2)_{LDG\ flaring}$ = emission factor, tonnes CO_2/tonnes of LDG produced

BFG = blast furnace gas produced nationally, tonnes

LDG = converter gas produced nationally, tonnes

RBFG flared = rate of BFG removed from the production steam and then flared. If this data is not available, a default value of 0.2 can be assumed (see Box 4.0)

RBFG flared = rate LDG removed from the production steam and then flared. If this data is not available, a default value of 1.0 can be assumed (see Box 4.0)

CCBFG = carbon content of blast furnace gas, tonnes C/tonne CCLDG = carbon content of converter gas, tonnes C/tonne

4.4.1.2.2 Choice of activity data

In Algeria, the steel production comprise the manufacture of flat and long products such as steel coils and sheets, reinforcing bars and seamless tubes. The production of pig iron and (crude) steel takes place in the following units:

- raw material preparation and sintering units including pelletising ;
- coke oven coke including usage of coke oven coke gas ;
- 1 blast furnace (BOF) including usage of blast furnace gas (BFG);
- 2 oxygen steelworks ;
- 1 electric steel mill.

See also the following chapter *Category-specific QA/QC and verification*.

Table 450 Activity data (AD) from Iron and Steel production (IPCC sub-category 2.C.1)

	For comparision		**Used data**						
Year	**Fonte Liquide en Poche**	**Acier Brut**	**Crude Steel production**			**Pig iron production**	**Direct reduced iron**	**Sinter production**	**Pellet production**
			Total	**Oxygen Blown Converters**	**Electric Arc Furnaces**				
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	1,037	767	836	836	0	930	NO	855	2,598
1991	879	797	840	840	0	925	NO	850	2,584
1992	930	768	842	787	55	919	NO	845	2,567
1993	925	798	865	838	27	940	NO	864	2,626
1994	919	772	800	770	30	919	NO	845	2,567
1995	962	781	830	800	30	962	NO	884	2,687
1996	851	590	654	605	49	850	NO	781	2,374
1997	526	361	398	341	57	526	NO	483	1,469
1998	757	581	600	515	85	757	NO	696	2,115
1999	807	675	760	650	110	807	NO	742	2,254
2000	762	689	840	720	120	767	NO	705	2,142
2001	895	861	950	850	100	800	NO	735	2,235
2002	959	991	1,090	985	105	960	NO	882	2,682
2003	1,026	964	1,051	950	101	965	NO	887	2,696
2004	977	978	1,014	1014	0	994	NO	914	2,777
2005	952	956	1,008	1003	5	952	NO	875	2,659
2006	1,092	983	1,158	1158	0	1,093	NO	1,005	3,053
2007	1,191	1,179	1,278	1278	0	1,193	NO	1,097	3,332
2008	No data provided	No data provided	646	646	0	690	NO	634	1,927
2009			542	334	208	680	NO	625	1,899
2010			689	576	113	696	NO	640	1,944
2011			550	545	5	360	NO	331	1,006
2012			557	550	7	350	NO	322	978
2013			440	435	5	300	NO	276	838
2014			415	410	5	300	NO	276	838
2015			650	650	0	300	NO	276	838
2016			650	650	0	300	NO	276	838
2017			415	415	0	300	NO	276	838
2018			2,000	400	1,600	300	NO	276	838
2019			2,400	400	2,000	300	NO	276	838
2020			4,000	300	3,700	300	NO	276	838
Trend									
1990 – 2020	NA	NA	378.5%	-64.1%		-67.7%	-67.7%	378.5%	-67.7%
2005 - 2020	NA	NA	296.8%			-68.5%	-68.5%	296.8%	-68.5%
2019 - 2020	NA	NA	66.7%		85.0%	0.0%	0.0%	66.7%	0.0%
Source	*ONS*		*Worldsteel*					*Calculated based on pig*	

	For comparision		Used data						
Year	Fonte Liquide en Poche	Acier Brut	Crude Steel production			Pig iron production	Direct reduced iron	Sinter production	Pellet production
			Total	Oxygen Blown Converters	Electric Arc Furnaces				
	kt	kt	kt	kt	kt	kt	kt	kt	kt
								iron production	

As no national data were available, the sinter production and pellet production were estimated using a default conversion factors which were taken from the Best Available Techniques (BAT) Reference Document for Iron and Steel Production[464].

Table 451 Default conversion factors used for estimating sinter production and pellet production

Conversion factors	Unit	Value	Source
Sinter production	sinter/ t pig iron	1,088	Best Available Techniques (BAT) Reference Document for Iron and Steel Production Table 6.1: Input data from blast furnaces in different EU member states
Pellet production	t pellet/ t pig iron	0,358	

4.4.1.2.3 Emission factors

Default emission factors for CO_2 and CH_4 were taken from 2019 Refinements of the IPCC 2006 Guidelines and are presented in the following table.

Table 452 CO_2 and CH_4 Emission factors TIER 1 for IPCC sub-category 2.C.1 Iron and steel

2.C.1. Iron and steel production	**CO_2**				**CH_4**			
	EF	**unit**	**type**	**Source**	**EF**	**unit**	**type**	
2.C.1.a. Steel - Oxygen Blown Converters	0.18	tonne CO_2 / tonne steel produced	D	Table 4.1B (new)	NA	-	-	-
2.C.1.a. Steel - Electric Arc Furnaces (EAF)	1.58	tonne CO_2 / tonne steel produced	D		NA	-	-	-
2.C.1.b. Pig iron	1.43	tonne CO_2 / tonne hot metal	D		NA	-	-	-
2.C.1.d. Sinter	0.21	tonne CO_2 / tonne sinter	D	Table 4.1A (new)	0.07	kg CH_4 / tonne sinter	D	Table 4.2 (updated)
2.C.1.e. Pellet	0.19	tonne CO_2 / tonne pellet produced	D		NA	-	-	-
2.C.1.f. Other - Flaring of BFG								
Source	**2019 Refinements to 2006 IPCC GL. Volume 3. Chapter 4**							
Note: D Default CS Country specific PS Plant specific IEF Implied emission factor								

4.4.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC sub-category 2.C.1 Iron and steel are presented in the following table.

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[464] European Union (2013): Best Available Techniques (BAT) Reference Document for Iron and Steel Production Industrial. Emissions Directive 2010/75/EU Integrated Pollution Prevention and Control
Available at 20.07.2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/IS_Adopted_03_2012.pdf

Table 453 Uncertainty for IPCC sub-category 2.C.1 Iron and steel.

	Uncertainties	**CO_2**	**CH_4**	**Source**
2.C.1.a. Steel - Oxygen Blown Converters	Activity data (AD)	10%	-	Table 4.4 (updated)
	Emission factor (EF)	10%	-	
	Combined Uncertainty (U)	**14%**	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
2.C.1.a. Steel - Electric Arc Furnaces (EAF)	Activity data (AD)	10%	-	Table 4.4 (updated)
	Emission factor (EF)	10%	-	
	Combined Uncertainty (U)	**14%**	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
2.C.1.b. Pig iron	Activity data (AD)	10%	-	Table 4.4 (updated)
	Emission factor (EF)	10%	-	
	Combined Uncertainty (U)	**14%**	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
2.C.1.d. Sinter	Activity data (AD)	10%	10%	Table 4.4 (updated)
	Emission factor (EF)	10%	400%	
	Combined Uncertainty (U)	**14%**	**400%**	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
2.C.1.e. Pellet	Activity data (AD)	10%	-	Table 4.4 (updated)
	Emission factor (EF)	10%	-	
	Combined Uncertainty (U)	**14%**	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
2.C.1.f. Other - Flaring of BFG	Activity data (AD)	10%	-	Table 4.4 (updated)
	Emission factor (EF)	10%	-	
	Combined Uncertainty (U)	**14%**	-	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$
Source: 2019 Refinements to 2006 IPCC GL. Volume 3. Chapter 4				
Overall Uncertainty				
2.C.1. Iron and steel production	**Combined Uncertainty (U)**	**35%**		
	$U_{2C1} = \sqrt{U_{2C1a}^2 + U_{2C1.b}^2 + U_{2C1d}^2 + U_{2C1e}^2}$			
Calculated based on 2019 Refinements to 2006 IPCC GL. Volume 3. Chapter 4				

The time-series are considered to be consistent.

4.4.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed:

- Checked of calculations by spreadsheets
    - consistent use of production statistics
    - documented sources,
    - use of units,
    - record keeping; use of write protection,
    - unique use of formulas; special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- time series consistency - plausibility checks of dips and jumps.
- cross checks with other relevant sectors (1.B.1, 1.A.2.a) are performed to avoid double counting or omissions;

- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[465] and
    - Worldsteel[466]
    - US geological survey[467]
    - UN statistics[468]
    - UNIDO - Statistical Databases INDSTAT[469].

In the following figure are the data presented, which were collected for the Crude steel production in Algeria from different sources. The data used for the GHG inventory are based on Worldsteel as these data were detailed and complete.

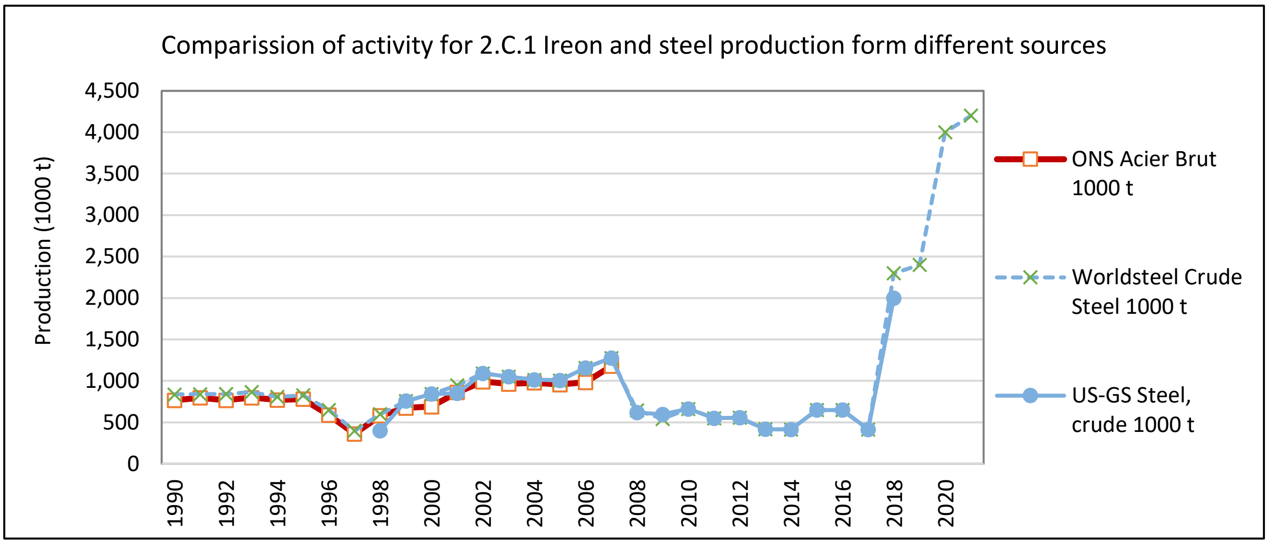

Figure 177 Activity data for 2.C.1 Ireon and steel production form different soureces

4.4.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category 2.C.1 *Iron and Steel Production*.

Table 454 Recalculations done since submission 2010 IPCC sub-category 2.C.1 *Iron and Steel Production*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.C.1	Application of methodology of 2006 IPCC Guidelines	method	Accuracy Comparability
2.C.1	Application of 2006 IPCC Guidelines	EF	Accuracy Comparability

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[465] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[466] Worldsteel Steel (several years): Statistical Yearbook;
Available (04.06.2022) on https://worldsteel.org/steel-topics/statistics/steel-statistical-yearbook/

[467] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[468] United Nations Statistics Division (UNSD) - Industrial Commodity Statistics Database UNdata | explorer

[469] United Nations Industrial Development Organization UNIDO - Statistical Databases INDSTAT
https://www.unido.org/researchers/statistical-databases

4.4.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 455 Planned improvement for IPCC sub-category 2.C.1 *Iron and Steel Production*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
2.C.1	Preparation of overview of processes and techniques including changes of the time and application of abatement technology applied in Algeria • Coke production • Sinter production • Pelletizing • Blast furnace – pig iron production • Steelmaking in Basic oxygen Firnanace (BOF) • Electric Arc Furnace (EAF) • Secondary iron production	AD	Transparency completeness	high
2.C.1	Application of TIER 2 or higher methodology			

2.C.1	Collection of plant specific data
	• National coke production using coal
	  ○ preparation of consistent and complete time series of import coal
	  ○ determination of coal characteristics
	• Coke used
	  ○ national production
	  ○ imports
	• Coke oven gas production, consumption and exhaust gases
	• Pig iron production in Blast oxygen furnace (BOF)
	• Blast oxygen furnace (BOF) gas production. consumption and exhaust gases
	• Steel production in
	  ○ Basic Oxygen Furnace (BOF)
	  ○ Electric Arc Furnace (EAF)
	• Fuel combustion data related to each processes			

2.C.1	Collection of plant specific data to prepare country specific Emission factor • material-specific carbon contents for iron and steel production (tonnes C/tonne) • exhaust gases from blast furnace gas and metallurgical coke production • Electrode consumption amounts			

4.4.2 Ferroalloys Production (IPCC category 2.C.2)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.2	Ferroalloys Production	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.C.2 *Ferroalloys Production* does not exist in Algeria.

4.4.3 Aluminum Production (IPCC category 2.C.3)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.3	Aluminium production	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

IPCC code	Description	HFC		PFC		SF_6	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.3	Aluminium production	NO	-	NO	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year); TA – Trend Assessment without LULUCF							

The IPCC category 2.C.3 *Aluminum Production* does not exist in Algeria.

4.4.4 Magnesium Production (IPCC category 2.C.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.4	Magnesium production	NO	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.C.4 *Magnesium Production* does not exist in Algeria.

4.4.5 Lead Production (IPCC category 2.C.5)

4.4.5.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.5	Lead Production	√	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the process-related CO_2 emissions estimations from Lead production. Combustion re-related GHG emissions are allocated in 1.A.2.b Non-ferrous metals.

In Algeria, the zinc production was done in a pyrometallurgical process involving the use of an Imperial Smelting Furnace. The process results in the production of lead and the release of non-energy CO_2 emissions.

In Algeria, the production of rough lead bullion from lead concentrates is done by direct smelting, which eliminates the sintering step. In the furnaces, the lead sulphide concentrates and secondary materials mix is charged directly to a furnace, then melted and oxidized.

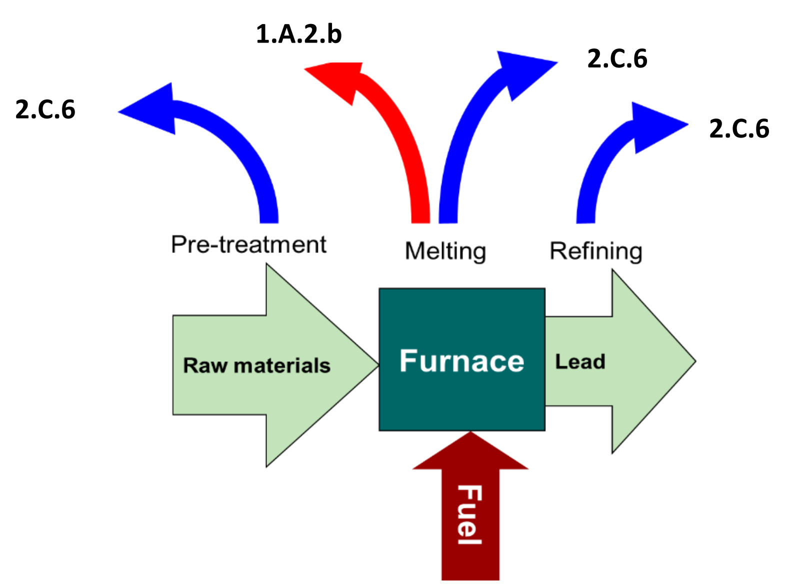

Figure 178 Process scheme for IPCC category 2.C.5 Lead production: thermal smelting zinc production process[470]

CO_2 emissions generated by *Lead production* were estimated to 3 540 Kt in 1990 and 649 kt emissions in 2006. In 2006 the lead production stopped.

An overview of the *Lead production* (IPCC sub-category 2.C.5) and related CO_2 emissions is provided in the following figure and table.

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[470] Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 2.C.5 Lead production, Figure 2.1

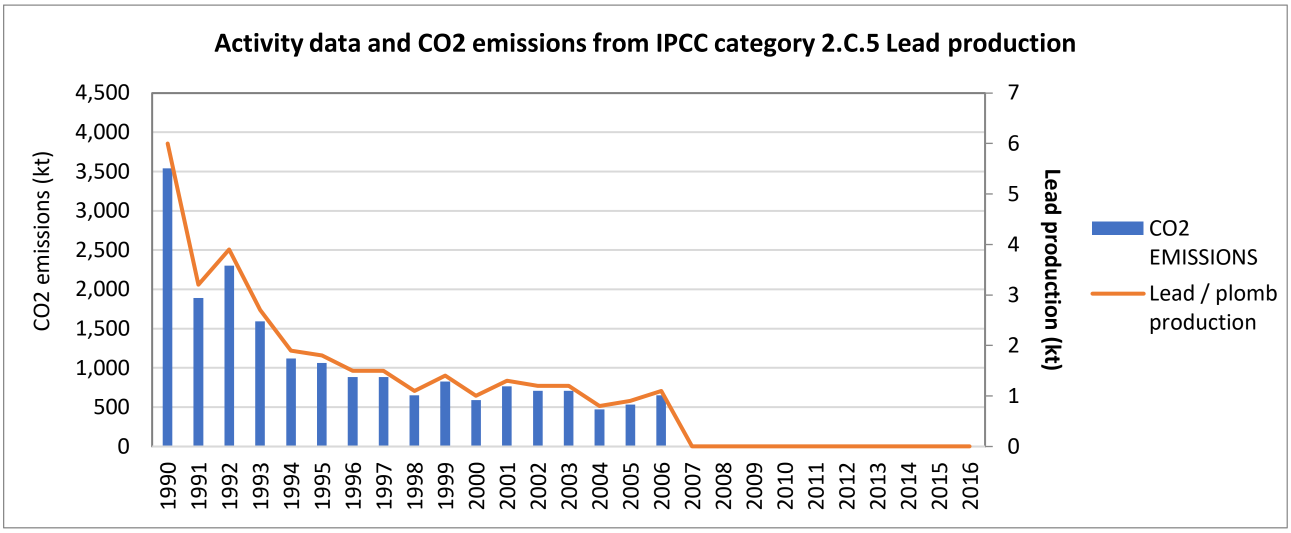

Figure 179 Activity data and CO_2 emissions from IPCC category 2.C.5 *Lead production*

Table 456 Activity data and CO_2 emissions from Lead production (IPCC category 2.C.5)

Years	**Lead production**	**CO_2 Emission factor**	**CO_2 emissions**
	tonnes	**tonnes CO_2/tonne Lead produced**	**kilotonnes (kt)**
1990	6,000.0	0.59	3,540.0
1991	3,200.0	0.59	1,888.0
1992	3,900.0	0.59	2,301.0
1993	2,700.0	0.59	1,593.0
1994	1,900.0	0.59	1,121.0
1995	1,800.0	0.59	1,062.0
1996	1,500.0	0.59	885.0
1997	1,500.0	0.59	885.0
1998	1,100.0	0.59	649.0
1999	1,400.0	0.59	826.0
2000	1,000.0	0.59	590.0
2001	1,300.0	0.59	767.0
2002	1,200.0	0.59	708.0
2003	1,200.0	0.59	708.0
2004	800.0	0.59	472.0
2005	900.0	0.59	531.0
2006	1,100.0	0.59	649.0
2007	NO	NO	NO
2008	NO	NO	NO
2009	NO	NO	NO
2010	NO	NO	NO
2011	NO	NO	NO
2012	NO	NO	NO

Years	**Lead production**	**CO_2 Emission factor**	**CO_2 emissions**
	tonnes	**tonnes CO_2/tonne Lead produced**	**kilotonnes (kt)**
2013	NO	NO	NO
2014	NO	NO	NO
2015	NO	NO	NO
2016	NO	NO	NO
2017	NO	NO	NO
2018	NO	NO	NO
2019	NO	NO	NO
2020	NO	NO	NO
Trend			
1990 – 2020	NA		NA
2005 – 2020	NA		NA
2019 - 2020	NA		NA

4.4.5.2 Methodological issues

4.4.5.2.1 Choice of methods

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[471] has been applied:

Equation 4.32: CO_2 emissions from Lead production – TIER 1

$$\boldsymbol{Emissions_{CO_2} = DS \times EF_{CO_2}}$$

Where:

Emissions $_{CO2}$ = CO_2 emission for lead production

DS = quantity of lead produced by Direct Smelting (tonnes)

EF_{CO2} = default CO_2 emission factor emission factor for Direct Smelting (tonne CO_2/tonne lead product)

In Algeria, lead was produced only by Direct Smelting. No lead production was done in Imperial Smelt Furnace (ISF) or by treatment of Secondary Raw Materials Production

4.4.5.2.2 Activity data

The Tier 1 method requires only the amount of lead produced in the country and if available, the process type. The lead production is performed as pyrometallurgical process in an Imperial Smelting Furnace.

Production data were taken from ONS. The activity data are presented in Figure and Table above.

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[471] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 4: Metal Industry Emissions – 4.6.2.1 Choice of method

4.4.5.2.3 Emission factors

If no plant-level information is available, it is *good practice* to use default factors. In Algeria, the Pyrometallurgical process in an Imperial Smelting Furnace was applied for lead production. Therefore, the CO_2 emissions factor of 0.59 tonne of CO_2/ tonne Lead was choosen.

Table 457 Default CO_2 emission factor for IPCC category 2.C.6 *Lead production.*

Process	Unit	EF_{CO2}	Reference
From Imperial Smelt Furnace (ISF) Production	tonne of CO_2/ tonne lead	0.59	TABLE 4.21 TIER 1 CO_2 emission factors for Lead production. 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
From Direct Smelting (DS) Production		0.25	
From Treatment of Secondary Raw Materials		0.2	
Default Emission Factor (80% ISF. 20% DS)		0.52	

4.4.5.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.C.5 *Lead production* are presented in the following table.

Table 458 Uncertainty for IPCC category 2.C.5 *Lead production.*

Uncertainty	CO_2	Reference
Activity data (AD)	10%	Table 4.23 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
Emission factor (EF)	20%	
Combined Uncertainty (U)	22%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.4.5.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[472] and
    - US geological survey[473]
    - UN statistics[474]

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[472] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[473] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[474] United Nations Industrial Development Organization UNIDO - Statistical Databases INDSTAT
https://www.unido.org/researchers/statistical-databases

- cross checks with other relevant sectors (1.A.2.b) are performed to avoid double counting or omissions.

4.4.5.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.C.5 *Lead production*.

Table 459 Recalculations done since NC in IPCC category 2.C.5 *Lead production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.C.5	No revisions were done as emissions were estimated the first time.		

4.4.5.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 460 Planned improvements for IPCC category 2.C.5 *Lead production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.C.5	Application of TIER 2 or higher methodology of 2006 IPCC GL	AD	Accuracy	medium
2.C.5	Preparation of country specific emission factor (CS EF) for TIER 2 methodology • Collection of total amount of reducing agents and other carbon containing process materials used for Lead production in the country or • facility-specific measured emissions data	AD	Accuracy Completeness Consistency Transparency Comparability	medium
2.C.1. 2.C.5. 2.C.6	Investigation on the metallurgical coke/coal reductant used in different processes to avoid double counting or omission.	AD	Accuracy Completeness Consistency Transparency	high
2.C.5	Investigation on type of furnace was used in the lead production	AD	Transparency	medium
2.C.5. 2.C.6	Investigation a simultaneous treatment of lead and zinc concentrates in the pyrometallurgical process involving the use of an Imperial Smelting Furnace toke place: the process results in the simultaneous production of lead and zinc and the release of non-energy CO_2 emissions. -> double counting	AD	Accuracy Transparency	medium

4.4.6 Zinc Production (IPCC category 2.C.6)

4.4.6.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.C.6	Zinc Production	√	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

This chapter includes the process-related CO_2 emissions estimations from zinc production. Combustion re-related GHG emissions are allocated in 1.A.2.b Non-ferrous metals.

The activities relevant for primary zinc production are:

- transport and storage of zinc ores;
- concentration of zinc ores;
- oxidation of zinc concentrates with air (roasting process);
- production of zinc by the electrochemical or the thermal process (in Algeria: themal processs);
- after-treatment of zinc.

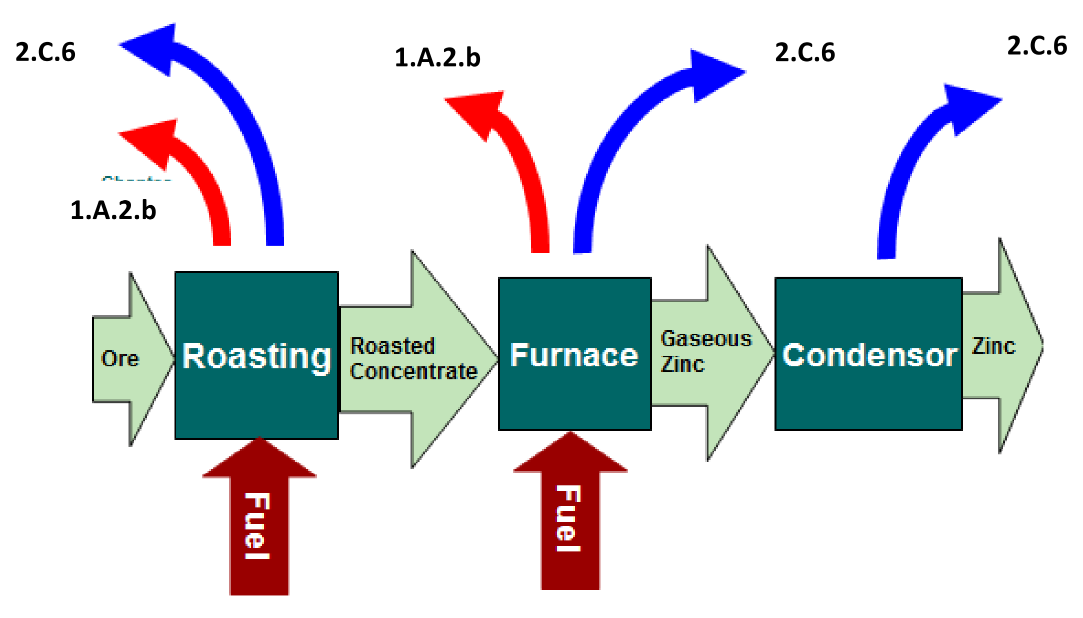

Figure 180 Process scheme for IPCC category 2.C.6 Zinc production: thermal smelting zinc production process[475]

In Algeria, the zinc production was done in a pyrometallurgical process involving the use of an Imperial Smelting Furnace. The process results in the production of lead and the release of non-energy CO_2 emissions. The zinc production was responsible for 3 397 CO_2 emissions in 1990 and for 365.07 kt CO_2 emissions in 2020, which is a decrease of 89.3% over the period 1990 – 2020. In 2005. CO_2 emissions from zinc production were amounted to 10 148 Kt which was a decrease of 96.4% compared to 2020. In 2019, CO_2 emissions resulting from zinc production were estimated to 233.49 Kt, which was an increase of 56.4% compared to 2020. The significant decrease in CO_2 emissions is a consequence of declining trend in zinc production.

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[475] Source: EMEP/EEA air pollutant emission inventory guidebook 2019, 2.C.6 Zinc production, Figure 2.2

An overview of the *zinc production* (IPCC sub-category 2.C.6) and related CO_2 emissions is provided in the following figure and table.

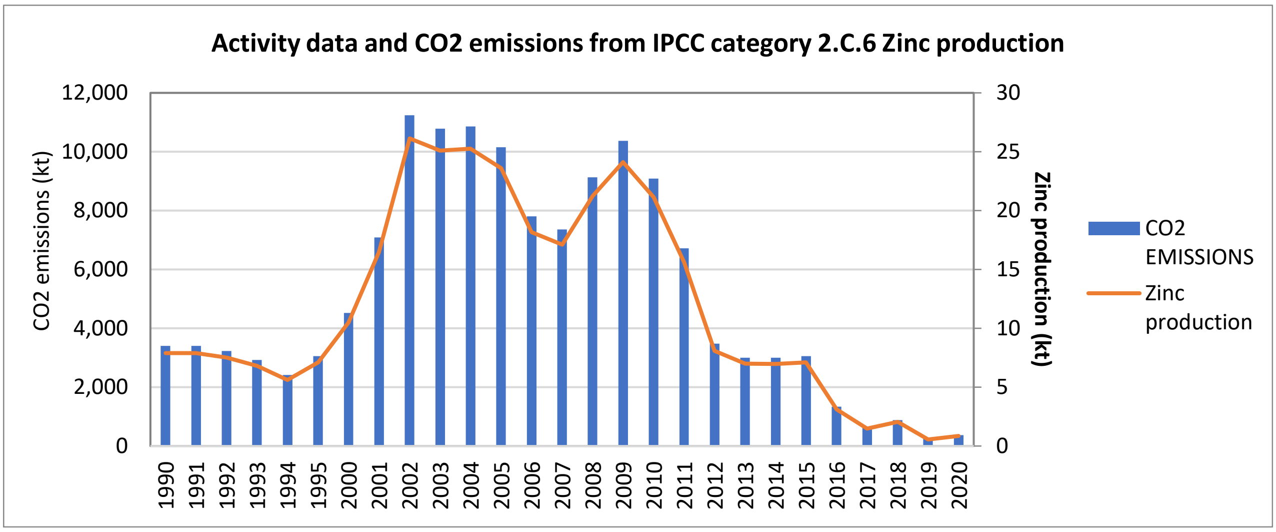

Figure 181 Activity data and CO_2 emissions from IPCC category 2.C.6 *Zinc production*

Table 461 Activity data and CO_2 emissions from Zinc production (IPCC category 2.C.6)

Years	Zinc production	CO_2 Emission factor	CO_2 emissions
	tonne	tonnes CO_2/tonne zinc produced	Kilotonne (kt)
1990	7,900	0.43	3,397.00
1991	7,900	0.43	3,397.00
1992	7,500	0.43	3,225.00
1993	6,800	0.43	2,924.00
1994	5,600	0.43	2,408.00
1995	7,100	0.43	3,053.00
1996	5,200	0.43	2,236.00
1997	6,900	0.43	2,967.00
1998	8,600	0.43	3,698.00
1999	9,800	0.43	4,214.00
2000	10,500	0.43	4,515.00
2001	16,472	0.43	7,082.96
2002	26,136	0.43	11,238.48
2003	25,088	0.43	10,787.84
2004	25,265	0.43	10,863.95
2005	23,600	0.43	10,148.00
2006	18,158	0.43	7,807.94
2007	17,113	0.43	7,358.59
2008	21,243	0.43	9,134.49

Years	Zinc production	CO_2 Emission factor	CO_2 emissions
	tonne	tonnes CO_2/tonne zinc produced	Kilotonne (kt)
2009	24,115	0.43	10,369.45
2010	21,127	0.43	9,084.61
2011	15,611	0.43	6,712.73
2012	8,090	0.43	3,478.70
2013	6,983	0.43	3,002.69
2014	6,976	0.43	2,999.68
2015	7,086	0.43	3,046.98
2016	3,101	0.43	1,333.43
2017	1,472	0.43	632.96
2018	2.045	0.43	879.35
2019	543	0.43	233.49
2020	849	0.43	365.07
Trend			
1990 – 2020	-89.3%		-89.3%
2005 – 2020	-96.4%		-96.4%
2019 - 2020	56.4%		56.4%

4.4.6.2 Methodological issues

4.4.6.2.1 Choice of methods

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[476] has been applied:

Equation 4.33: CO_2 emissions from zinc production – TIER 1

$$\boldsymbol{Emissions_{CO_2} = Zn \times EF_{CO_2}}$$

Where:

Emissions $_{CO2}$ = CO_2 emission for zinc production
Zn = quantity of zinc produced (tonnes)
EF_{CO2} = default CO_2 emission factor for zinc production (tonnes CO_2/tonne zinc produced)

4.4.6.2.2 Activity data

The Tier 1 method requires only the amount of zinc produced in the country, and if available, the process type. The Pyrometeallurgical process in an Imperial Smelting Furnace was applied for zinc production.

Production data were taken from ONS.

The activity data are presented in Figure and Table above.

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[476] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 4: Metal Industry Emissions – 4.7.2.1 Choice of method

4.4.6.2.3 Emission factors

If no plant-level information is available, it is *good practice* to use default factors. In Algeria the Pyrometallurgical process in an Imperial Smelting Furnace was applied for zinc production. Therefore, the CO_2 emissions factor of 0.43 tonne of CO_2/ tonne zinc was chosen.

Table 462 Default CO_2 emission factor for IPCC category 2.C.6 *Zinc production.*

Process	Unit	EF_{CO2}	Reference
Waelz Kiln	tonne of CO_2/ tonne zinc	3.66	TABLE 4.24 TIER 1 CO_2 emission factors for zinc production. 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
Pyrometallurgical (Imperial Smelting Furnace)	tonne of CO_2/ tonne zinc	0.43	
Electro-thermic	tonne of CO_2/ tonne zinc	Unknown	
Default Factor	tonne of CO_2/ tonne zinc	1.72	

4.4.6.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.C.6 *Zinc production* are presented in the following table.

Table 463 Uncertainty for IPCC category 2.C.6 *Zinc production.*

Uncertainty	CO_2	Reference
Activity data (AD)	10%	Table 4.25 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
Emission factor (EF)	50%	
Combined Uncertainty (U)	51%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are consistent as the capacity is used as activity data.

4.4.6.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic published by Office National des Statistiques (ONS)[477] and
    - US geological survey[478]
    - UN statistics[479]
- cross checks with other relevant sectors (1.A.2.b) are performed to avoid double counting or omissions.

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[477] https://www.ons.dz/spip.php?rubrique6 and https://www.ons.dz/IMG/pdf/CH8-ENERGIE.pdf; https://www.ons.dz/spip.php?rubrique127

[478] U.S. Geological Survey (several years): Algeria Minerals Yearbook.
Available (04.06.2022) on https://www.usgs.gov/search?keywords=Algeria%20Minerals%20Yearbook

[479] United Nations Industrial Development Organization UNIDO - Statistical Databases INDSTAT

4.4.6.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.C.6 *Zinc production*.

Table 464 Recalculations done since NC in IPCC category 2.C.6 *Zinc production.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.C.6	No revisions were done as emissions were estimated the first time.		

4.4.6.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 465 Planned improvements for IPCC category 2.C.5 *Lead production.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.C.6	Application of TIER 2 or higher methodology of 2006 IPCC GL	AD	Accuracy	high
2.C.6	Preparation of country specific emission factor (CS EF) for TIER 2 methodology • Collection of total amount of reducing agents and other carbon containing process materials used for zinc production in the country or • facility-specific measured emissions data	AD	Accuracy Completeness Consistency Transparency Comparability	high
2.C.1, 2.C.5, 2.C.6	Investigation on the metallurgical coke/coal reductant used in different processes to avoid double counting or omission.	AD	Accuracy Completeness Consistency Transparency	High
2.C.5, 2.C.6	Investigation a simultaneous treatment of lead and zinc concentrates in the pyrometallurgical process involving the use of an Imperial Smelting Furnace toke place: the process results in the simultaneous production of lead and zinc and the release of non-energy CO_2 emissions. -> double counting	AD	Accuracy Transparency	medium

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https://www.unido.org/researchers/statistical-databases

4.4.7 Other (IPCC category 2.C.7)

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.C.7	Other (please specify)	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC category 2.C.7 *Other* does not exist in Algeria.

4.5 Non-Energy Products from Fuels and Solvent Use (IPCC category 2.D)

The IPCC category 2.D comprises the non-energy products use such as lubricants, paraffin waxes, and bitumen/asphalt, as well as solvents uses where GHG emissions are arising.

The IPCC category 2.D <u>does not cover</u> emissions from the first use of fossil fuels as a product for primary purposes other than

i) combustion for energy purposes	accounted for in IPCC category • 1.A. Fuel Combustion activities
ii) use as feedstock or reducing agent	accounted for in IPCC category • 2.B. Chemical industry and • 2.C. Metal industry

IPCC code	**Description**	**CO_2**		**CH_4**		**N_2O**	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.D.1	Lubricant Use	✓	-	NA	-	NA	-
2.D.2	Paraffin Wax Use	NE	-	NA	-	NA	-
2.D.3	Solvent Use	NE		NE	-	NA	-
2.D.4	Other	NE	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

4.5.1 Lubricant Use (IPCC subcategory 2.D.1)

4.5.1.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.D.1	Lubricant Use	✓	-	NA	-	NA	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

Lubricants are mostly used in industrial and transportation applications. Lubricants are produced either at refineries through separation from crude oil or at petrochemical facilities. They can be subdivided into

(a) motor oils and industrial oils, and

(b) greases, which differ in terms of physical characteristics (e.g., viscosity), commercial applications. and environmental fate.

CO_2 emissions from Non-Energy Uses of Fossil Fuels identified as lubricants were estimated to 72.52 kt in 1990 and 62.5 kt CO_2 in 2020, which is a decrease of 16% over the period 1990 – 2020. In 2005, CO_2 emissions from lubricants use were amounted to 83.19 Kt which was a decrease of 24.9% compared to 2020. In 2019, CO_2 emissions resulting from lubricants use were estimated to 71.34 Kt, which was a decrease of 12.4% compared to 2020. The decrease in CO_2 emissions is the consequence of the decrease of the lubricants amount used in transportation following the restrictions applied to the road transport sector during the covid19 crisis.

Table 466 Activity data and CO_2 emissions from Lubricant Use (IPCC category 2.D.1)

Years	Lubricants	ODU factor	CO_2 emissions
	TJ	tonnes CO_2/tonne lubricants used	Kilotonne (kt)
1990	IE	0.2	IE
1991	IE	0.2	IE
1992	IE	0.2	IE
1993	IE	0.2	IE
1994	IE	0.2	IE
1995	IE	0.2	IE
1996	IE	0.2	IE
1997	IE	0.2	IE
1998	IE	0.2	IE
1999	IE	0.2	IE
2000	IE	0.2	IE
2001	IE	0.2	IE
2002	4,944.60	0.2	72.52
2003	5,278.26	0.2	77.41
2004	6,359.64	0.2	93.27
2005	5,672.22	0.2	83.19
2006	5,989.80	0.2	87.85

Years	Lubricants	ODU factor	CO_2 emissions
	TJ	tonnes CO_2/tonne lubricants used	Kilotonne (kt)
2007	5,748.60	0.2	84.31
2008	4,743.60	0.2	69.57
2009	5,471.22	0.2	80.24
2010	6,078.24	0.2	89.15
2011	4,715.46	0.2	69.16
2012	4,020.00	0.2	58.96
2013	4,341.60	0.2	63.68
2014	4,422.00	0.2	64.86
2015	4,663.20	0.2	68.39
2016	4,824.00	0.2	70.75
2017	3,899.40	0.2	57.19
2018	4,221.00	0.2	61.91
2019	4,864.20	0.2	71.34
2020	4,261.20	0.2	62.50
Trend			
1990 – 2020	NA	NA	NA
2005 – 2020	-24.9%	NA	-24.9%
2019 - 2020	-12.4%	NA	-12.4%

4.5.1.2 Methodological issues

4.5.1.2.1 Choice of methods

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[480] has been applied:

Equation 5.2: CO_2 emissions from lubricant use – *TIER 1*

$$\boldsymbol{Emissions_{CO_2} = (LC \times CC \times ODU) * \frac{44}{12}}$$

Where:

Emissions $_{CO2}$ = CO_2 emissions from lubricants, tonne CO_2

LC = consumption of lubricant, TJ

CC = carbon content of lubricant, tonne C/TJ (= kg C/GJ)

ODU = ODU factor for lubricant, fraction

44/12 = mass ratio of CO_2/C

4.5.1.2.2 Activity data

The amount of lubricants used for estimating the GHG emissions for the years:

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[480] Source: 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 4: Metal Industry Emissions – 4.7.2.1 Choice of method

- 2010 – 2020 are taken from the data provided by MEM [481].

The activity data are presented in the Table above.

4.5.1.2.3 Emission factors

If no plant-level information is available, it is *good practice* to use default factors. Therefore, the CO_2 emissions factor of 0.2 tonne of CO_2/ tonne lubricant used was chosen.

Table 467 Carbon content of lubricants and default oxidation fractions for lubricants.

	Lubricating oil (motor oil /industrial oils)	**Unit**	**Reference**
Default fraction in total lubricant	90	**(%)**	TABLE 5.2 Default oxidation fractions for lubricating oils, grease and lubricants in general. 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
ODU factor	0.2		
Carbon content	40.20	TJ/Mg	

4.5.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.D.1 *Lubricant Use* are presented in the following table.

Table 468 Uncertainty for IPCC category 2.D.1 Lubricant Use

Uncertainty	**CO_2**	**Reference**
Activity data (AD)	10%	Table 4.25 2006 IPCC GL. Vol. 3 IPPU. Chapter 4
Emission factor (EF)	50%	
Combined Uncertainty (U)	51%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent as the capacity is used as activity data.

4.5.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross checks with other relevant sectors (1.A) are performed to avoid double counting or omissions.

4.5.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.D.1 *Lubricant Use*.

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[481] Ministère de l'Énergie et des Mines (MEM): Bilan Énergétique National - several years https://www.energy.gov.dz/?article=bilan-energetique-national-du-secteur

Table 469 Recalculations done since NC in IPCC category 2.D.1 *Lubricant Use.*

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.D.1	No revisions were done as emissions were estimated the first time.		

4.5.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 470 Planned improvements for IPCC category 2.D.1 *Lubricant Use.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.D.1	Collection of activity data for the whole time series 1990 – 2020 and incorporation in the Energy balance	AD	Accuracy Transparency Completeness	Medium

4.5.2 Paraffin Wax Use (IPCC subcategory 2.D.2)

4.5.2.1 Category description

Waxes are used in a number of different applications. Paraffin waxes are used in applications such as:

- candles,
- board sizing,
- surfactants (as used in detergents) ,
- corrugated boxes,
- food production,
- paper coating,
- wax polishes,
- etc.

Emissions from the use of waxes derive primarily when the waxes or derivatives of paraffins are combusted during use (e.g., candles), and when they are incinerated with or without heat recovery or in wastewater treatment (for surfactants). In the cases of incineration and wastewater treatment, the emissions should be reported in the Energy or Waste Sectors, respectively.

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.D.2	Paraffin Wax Use	NE	-	NA	-	NA	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

4.5.2.2 Source-specific planned improvements for IPCC sub-category 2.D.2 Paraffin Wax Use

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 471 Planned improvement in IPCC category 2.D.2 *Paraffin Wax Use.*

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.D.2	Collection of activity data for the entire times series 19000- 2020 and incorporation in the national Energy balance	AD	Accuracy Transparency Completeness	Medium

4.5.3 Solvent Use (IPCC subcategory 2.D.3)

4.5.3.1 Category description

This chapter describes the methodology used for calculating air emissions from Solvent Use. Solvents are chemical compounds, which are used to dissolve substances as paint, glues, ink, rubber, plastic, pesticides or for cleaning purposes (degreasing). After application of these substances or other procedures of solvent use most of the solvents are released into air. Because solvents consist mainly of Non-Methane Volatile Organic Compounds (NMVOC). Besides the sources burning of fossil fuels, particularly for road transport and, energy production and distribution, solvent use is a major source for anthropogenic NMVOC emissions in Algeria. Once released into the atmosphere, NMVOCs react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2.

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.D.3	Solvent Use						
2.D.3.a	Domestic solvent use including fungicides	NE	-	NA	-	NA	-
2.D.3.b	Road paving with asphalt	NE	-	NA	-	NA	-
2.D.3.c	Asphalt roofing	NE	-	NA	-	NA	-
2.D.3.d	Coating applications	NE	-	NA	-	NA	-
2.D.3.e	Degreasing	NE	-	NA	-	NA	-
2.D.3.f	Dry cleaning	NE	-	NA	-	NA	-
2.D.3.g	Chemical products	NE	-	NA	-	NA	-
2.D.3.h	Printing	NE	-	NA	-	NA	-
2.D.3.i	Other solvent and product use	NE	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC subcategory 2.D.3 *Solvent Use* is not estimated due to lack of resources and data. The priority was given to categories with higher contribution to national total GHG emissions of Algeria. The subcategory 2.D.3 *Solvent Use* has high contribution to national total NMVOC emissions but is only a small source of CO_2 and GHG respectively.

As described in the 2006 IPCC Guidelines, Vol. 1, Chap. 7 (7.2.1.5 Carbon emitted in gases other than CO_2) and Vol. 3, Chap. 5 (5.5 Solvent use) Most of the carbon emitted in the form of non-CO_2 species eventually oxidized to CO_2 in the atmosphere and this amount can be estimated from the emissions estimates of the non-CO_2 gases, is the default fossil carbon content fraction of NMVOC 60 percent by mass.

Equation Calculating CO_2 inputs to the atmosphere from emissions of carbon-containing compounds

$$\text{From NMVOC: } \text{Inputs}_{CO2} = \text{Emissions}_{NMVOC} \bullet C \bullet 44/12$$

Where

Inputs_{CO2} = CO_2 emissions (Gg)

Emissions_{NMVOC} = estimation of NMVOC (Gg)

C = fraction carbon in NMVOC by mass (default = 0.6)

44/12 = conversion factor from C to CO_2

4.5.3.2 Source-specific planned improvements for IPCC sub-category 2.D.2 Solvent Use

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 472 Planned improvements for IPCC sub-category 2.D.3 Solvent use.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.D.3	Analysis of subcategories which are occurring in Algeria (see Table 473)	AD	Accuracy Transparency	High / Medium
2.D.3	Investigation of data on production, import and export of the solvents and solvent containing products for the recent years and for pillar years (e.g., 1990, 2005, 2020) (see Table 473)	AD	Accuracy Transparency	High / Medium

Table 473 Activity data needed for IPCC sub-category 2.D.3 Solvent use.

GHG source category	Subcategories	Activity data	
		TIER 1	TIER 2
2.D.3.a	**Domestic solvent use including fungicides**	kg/capita	
	• Agrochemical uses		kg solvent
	• Blowing agents		g/kg solvent
	• De-icing		g/kg solvent
	• Binder and release agents		g/kg solvent
	• Professional consumer cleaning		g/kg solvent
	• Industrial, professional and consumer coatings		g/kg solvent
	• Road and construction		g/kg solvent
	• Other consumer uses (households, aerosols, cosmetics)		g/kg solvent
	• Cosmetics and toiletries (general)		g/kg solvent
	• Cosmetics and toiletries (hair sprays)		g/kg solvent
	• Cosmetics and toiletries (toilet waters)		g/kg solvent
	• Cosmetics and toiletries (after shaves)		g/kg solvent
	• Cosmetics and toiletries (perfumes)		g/kg solvent
	• Cosmetics and toiletries (face care)		g/kg solvent
	• Cosmetics and toiletries (personal deodorants & antiperspirants)		g/kg solvent
	• Cosmetics and toiletries (body care)		g/kg solvent
	• Household products (all)		g/kg solvent
	• Household products (soaps: liquid or paste)		g/kg solvent
	• Household products (polishes and creams for floors)		g/kg solvent
	• Household products (show polishes and creams)		g/kg solvent
	• Car care products (all)		g/kg solvent
	• Car care products (antifreeze agents in windscreen wiper systems)		g/kg solvent
	• Do it yourself (DIY)/buildings (all)		g/kg solvent
	• Do it yourself (DIY)/buildings (adhesives)		g/kg solvent

GHG source category	**Subcategories**	**Activity data**	
		TIER 1	**TIER 2**
	• Do it yourself (DIY)/buildings (paint/varnish removers & solvents)		g/kg solvent
	• Do It Yourself (DIY)/buildings (sealants, filling agents)		g/kg solvent
	• Pesticides		g/kg solvent
2.D.3.b	Road paving with asphalt	g/Mg asphalt	g/Mg asphalt
2.D.3.c	Asphalt roofing (materials)	g/Mg shingle	g/Mg shingle
2.D.3.d	Coating applications	g/kg paint applied	
	• Coating applications		g/kg paint applied
	○ Decorative coating application		g/kg paint
	○ Industrial coating application		g/kg paint
	○ Other coating application		g/kg paint
	• Paint application		g/kg paint
	• Manufacture of automobiles		kg/car
	• Car repairing		g/kg paint
	• Construction and buildings		g/kg paint
	• Domestic use		g/kg paint
	• Coil coating		g/kg paint applied
	• Boat building		g/m2
	• Wood		g/kg paint applied
	• Other industrial paint application		g/kg paint
	• Other non-industrial paint application		g/kg paint
2.D.3.e	Degreasing	g/kg cleaning products	
	• Metal degreasing		g/kg cleaning products
	• Electronic components		kg/ton wafer
	• Other industrial cleaning		
2.D.3.f	Dry cleaning	g/kg textile treated	g/kg textiles cleaned
2.D.3.g	Chemical products	g/kg product	
	• Polyester processing		g/kg monomer used
	• Polyvinylchloride processing		
	• Polyurethane foam processing		g/kg foam processed
	• Polystyrene foam processing		g/kg polystyrene
	• Rubber processing		g/kg rubber produced
	• Pharmaceutical products manufacturing		g/kg solvents used
	• Paints manufacturing		g/kg product
	• Inks manufacturing		g/kg product
	• Glues manufacturing		g/kg product
	• Asphalt blowing		g/Mg asphalt
	• Adhesive, magnetic tapes, films and photographs manufacturing		g/m2
	• Textile finishing		kg/pair of shoes
	• Leather tanning		g/kg raw hid

GHG source category	Subcategories	Activity data	
		TIER 1	TIER 2
	- Other		g/kg tyres
2.D.3.h	Printing	g/kg ink	
	- Heat set offset		g/kg ink
	- Publication gravure		g/kg ink non diluted
	- Packaging, small flexography		g/kg ink ready to use
	- Packaging, large flexography		g/kg ink ready to use
	- Packaging, rotogravure		g/kg ink ready to use
2.D.3.i, 2.G	Other solvent and product use	kg/Mg product used	
	- Other use of solvents and related activities		g/kg solvent
	○ Glass wool enduction		g/t glass wool
	○ Mineral wool enduction		g/t mineral wool
	○ Fat, edible and non-edible oil extraction		g/kg seed
	○ Application of glues and adhesives		g/kg adhesives
	○ Preservation of wood		g/kg creosote or preservative
	○ Underseal treatment and conservation of vehicles		g/kg underseal agent
	○ Vehicles dewaxing		kg/car
	○ Other		Kg/ton deicing fluid used g/kg product
	- Use of HFC, N_2O, NH3, PFC & SF_6		
	○ Other		
	- Other product use		g/t product
	○ Use of fireworks		g/t product
	○ Use of tobacco		kg/Mg tobacco
	○ Use of shoes		g/pair
	○ Other		g/t product

4.5.4 Other (IPCC subcategory 2.D.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.D.4	Other	NE	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential							
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF							

The IPCC subcategory 2.D.4 *Other* does not exist in Algeria.

4.6 Electronics Industry (IPCC category 2.E)

This section describes GHG emissions resulting from gases used in manufacturing different types of electronic devices, the process used (or more roughly, process type (e.g., CVD or etch)), the brand of process tool used, and the implementation of emission reduction technology.

All activities of IPCC category 2.E Electronics Industry do not exist in Algeria.

4.6.1 Integrated Circuit or Semiconductor (IPCC category 2.E.1)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.E.1	Integrated Circuit or Semiconductor	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.E.1	Integrated Circuit or Semiconductor	NO	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.E.1 *Integrated Circuit or Semiconductor* does not exist in Algeria.

4.6.2 TFT Flat Panel Display (IPCC category 2.E.2)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.E.2	TFT Flat Panel Display	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**	**Estimated**	**Key Category**
2.E.2	TFT Flat Panel Display	NO	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.E.2 *TFT Flat Panel Display* does not exist in Algeria.

4.6.3 Photovoltaics (IPCC category 2.E.3)

IPCC code	Description	CO$_2$		CH$_4$		N$_2$O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.3	Photovoltaics	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF$_6$		NF$_3$	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.3	Photovoltaics	NO	-	NO	-	NO	-	NO	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.E.3 *Photovoltaics* does not exist in Algeria.

4.6.4 Heat Transfer Fluid (IPCC category 2.E.4)

IPCC code	Description	CO$_2$		CH$_4$		N$_2$O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.4	Heat Transfer Fluid	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF$_6$		NF$_3$	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.4	Heat Transfer Fluid	NO	-	NO	-	NO	-	NO	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.E.4 *Heat Transfer Fluid* does not exist in Algeria.

4.6.5 Other (IPCC category 2.E.5)

IPCC code	Description	CO$_2$		CH$_4$		N$_2$O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.5	Other	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF$_6$		NF$_3$	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.E.5	Other	NO	-	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.E.5 *Other* does not exist in Algeria.

4.7 Product Uses as Substitutes for Ozone Depleting Substances (IPCC category 2.F)

The IPCC category 2.F *Product Uses as Substitutes for Ozone Depleting Substances* (ODS) comprises HFC. PFC and SF$_6$ emissions from

- Refrigeration and Air Conditioning units (2.F.1) ,

- Foam Blowing Agents (2.F.2) ,
- Fire Protection applications and products (2.F.3) ,
- Aerosols (2.F.4) ,
- Solvents (2.F.5) ,
- Other applications (2.F.6).

All sub-categories are existing in Algeria but are currently not estimated due to lack of resources and (sufficient) data. Only emissions from 2.F.1.b Domestic refrigeration and 2.F.1.e Mobile air-conditioning were estimated.

4.7.1 Refrigeration and Air Conditioning units (IPCC category 2.F.1)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.a	Commercial refrigeration	✓	-	NO	-	NO	-	NO	-
2.F.1.b	Domestic refrigeration	✓	-	NO	-	NO	-	NO	-
2.F.1.c	Industrial refrigeration	NE	-	NO	-	NO	-	NO	-
2.F.1.d	Transport refrigeration	NE	-	NO	-	NO	-	NO	-
2.F.1.e	Mobile air-conditioning	✓	-	NO	-	NO	-	NO	-
2.F.1.f	Stationary air-conditioning	NE	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1 *Refrigeration and Air Conditioning* is estimated but the estimation of HFC. PFC and SF_6 emissions from use, maintaining and disposal of refrigerators, freezers and air-condition machines containing HFC, PFC and SF_6 is not complete.

4.7.1.1 Methodological issues 2.F - Choice of methods

For estimating the HFC emissions from IPCC subcategory 2.F.1.b. Domestic refrigeration and IPCC subcategory 2.F.1.e. Mobile air-conditioning, the 2019 refinements of the 2006 IPCC Guidelines Tier 1 approach[482] has been applied. However, the activity data are based on general assumptions.

Equation 7.10 Summary of sources of emissions

(2019 Refinement to 2006 IPCC GL, Vol. 3, Chap. 7)

$$\boldsymbol{Emissions_{total.t} = Emissions_{containers.t} + Emissions_{charge.t} + Emissions_{lifetime.t} + Emissions_{end\_of\_life.t}}$$

Where

Emissions $_{total}$ = total emissions of gas t

Emissions $_{containers,t}$ = emissions of gas t related to the management of refrigerant containers

Emissions $_{charge,t}$ = emissions of gas t related to the refrigerant charge: connection and disconnection of the refrigerant container and the new equipment to be charged

Emissions $_{lifetime,t}$ = annual emissions of gas t from the banks of refrigerants associated with the six sub-applications during operation (fugitive emissions and ruptures) and servicing

Emissions $_{end\_of\_life,t}$ = emissions of gas t at system disposal

Equation 7.11 Sources of emissions from management of containers

(2019 Refinement to 2006 IPCC GL. Vol. 3. Chap. 7)

$$\boldsymbol{Emissions_{containers.t} = RM_t + \frac{c}{100}}$$

Where

Emissions $_{containers.t}$ = emissions from all HFC containers in year t. kg

RMt = HFC market for new equipment and servicing of all refrigeration application. kg

c = emission factor of HFC container management of the current refrigerant market. percent

Equation 7.12 Sources of emissions from management of containers

(2019 Refinement to 2006 IPCC GL, Vol. 3, Chap. 7)

$$\boldsymbol{Emissions_{charge.t} = RM_t + \frac{k}{100}}$$

Where

Emissions $_{charge.t}$ = emissions during system manufacture/assembly in year t, kg

Mt = amount of HFC charged into new equipment in year t (per sub-application) , kg

k = emission factor of assembly losses of the HFC charged into new equipment (per sub-application), percent

Equation 7.13 Sources during equipment lifetime

(2019 Refinement to 2006 IPCC GL, Vol. 3,. Chap. 7)

$$\boldsymbol{Emissions_{lifetime,t} = B_t + \frac{x}{100}}$$

Where

Emissions $_{lifetime.t}$ = amount of HFC emitted during system operation in year t, kg

B_t = amount of HFC charged into new equipment in year t (per sub-application) , kg

x = annual emission rate (i.e., emission factor) of HFC of each sub-application bank during operation, accounting for average annual leakage and average annual emissions during servicing, percent

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[482] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances- 7.5.2.1 Methodological issues - Choice of method

4.7.1.2 Commercial refrigeration (IPCC subcategory 2.F.1.a)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.a	Commercial refrigeration	✓	-	NO	-	NO	-	NO	-

A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1.a *Commercial refrigeration* including different types of equipment, from vending machines to centralised refrigeration systems in supermarkets.

GHG Emissions from IPCC category 2.F.1.a *Commercial refrigeration* were only estimated 'from manufacturing' based on plant specific data. Emissions from 'stocks' and 'from Disposal' were not estimated due lack of data.

In 2018, the emissions of from IPCC category 2.F.1.a *Commercial refrigeration 'From manufacturing'* amounted to 5.96 t HCFC-123, 5.75 t HFC-32, 0.08 t HFC-134a, and 72.72 t R-410A. Applying the GWP of the 4th assessment report (4AR) for the different gases. 156.25 t CO_2 eq of HFC emissions result from the PCC category 2.F.1.a Commercial refrigeration 'From manufacturing'.

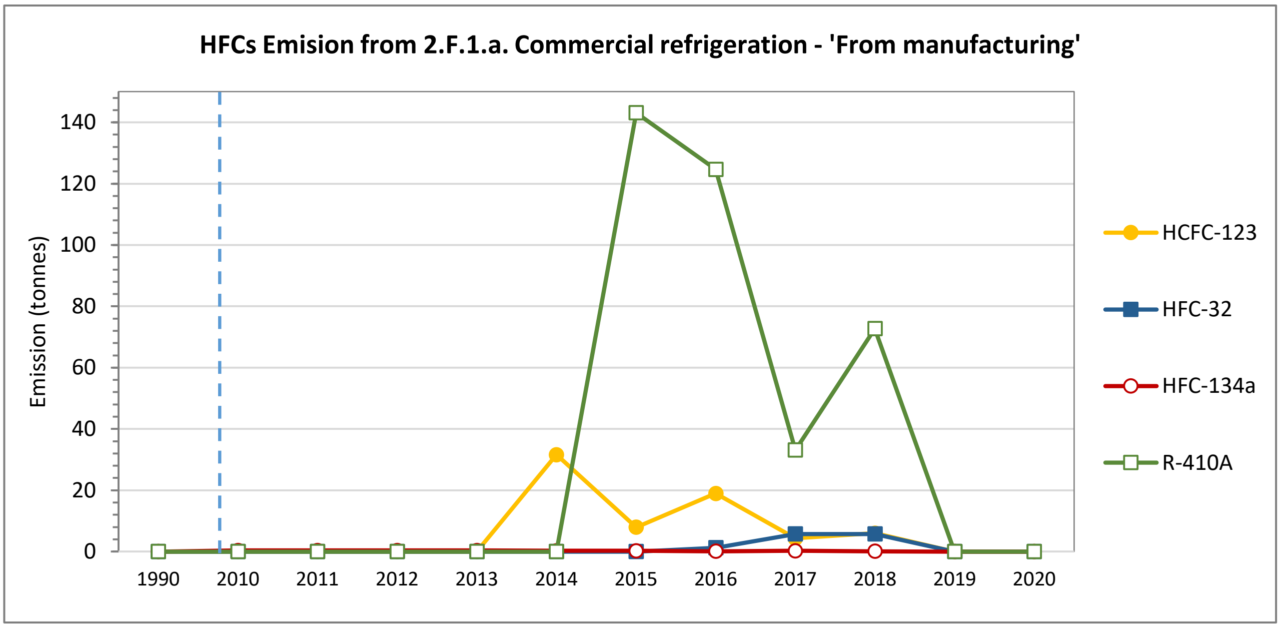

Figure 182 Emissions of HFC from IPCC category 2.F.1.a *Domestic refrigeration 'From manufacturing'*

Table 474 Activity data and Emissions of HFC-134 from IPCC category 2.F.1.a *Commercial refrigeration*

	ACTIVITY DATA				**EMISSIONS**			
	Filled into new manufactured products				**From manufacturing**			
	HCFC-123	**HFC-32**	**HFC-134a**	**R-410A**	**HCFC-123**	**HFC-32**	**HFC-134a**	**R-410A**
	tonne	**tonne**	**tonne**		**tonne**	**tonne**	**tonne**	**tonne**
1990	NO	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO	NO
1994	NO	NO	NO	NO	NO	NO	NO	NO
1995	NO	NO	NO	NO	NO	NO	NO	NO
1996	NO	NO	NO	NO	NO	NO	NO	NO
1997	NO	NO	NO	NO	NO	NO	NO	NO
1998	NO	NO	NO	NO	NO	NO	NO	NO
1999	NO	NO	NO	NO	NO	NO	NO	NO
2000	NO	NO	NO	NO	NO	NO	NO	NO
2001	NO	NO	NO	NO	NO	NO	NO	NO
2002	NO	NO	NO	NO	NO	NO	NO	NO
2003	NO	NO	NO	NO	NO	NO	NO	NO
2004	NO	NO	NO	NO	NO	NO	NO	NO
2005	NO	NO	NO	NO	NO	NO	NO	NO
2006	NO	NO	NO	NO	NO	NO	NO	NO
2007	NO	NO	NO	NO	NO	NO	NO	NO
2008	NO	NO	NO	NO	NO	NO	NO	NO
2009	NO	NO	NO	NO	NO	NO	NO	NO
2010	NO	NO	0.59	NO	NO	NO	0.35	NO
2011	NO	NO	0.59	NO	NO	NO	0.35	NO
2012	NO	NO	0.59	NO	NO	NO	0.35	NO
2013	NO	NO	0.59	NO	NO	NO	0.35	NO
2014	52.64	NO	0.40	NO	31.58	NO	0.24	NO
2015	13.16	NO	0.37	238.56	7.90	NO	0.22	143.14
2016	31.58	2.06	0.14	207.77	18.95	1.23	0.08	124.66
2017	7.20	9.59	0.40	55.18	4.32	5.75	0.24	33.11
2018	9.94	9.59	0.14	121.19	5.96	5.75	0.08	72.72
2019	NE	NE	NE	NE	NE	NE	NE	NE
2020	NE	NE	NE	NE	NE	NE	NE	NE
Trend								
1994 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*

4.7.1.2.1 Methodological issues - Choice of activity data

(A) Activity data - Filled into new manufactured products

The activity data of the amount of HCFC-123, HFC-32, HFC-134a, and R-410A filled into new manufactured products were collected from five different plants: CONDOR, SAIDAL, ENIEM, INDUS CHIM and SNVI.
It is not clear, if in the period before 2014 HCFC-123, HFC-32 and R-410A were filled into new manufactured products. This will be investigated (see chapter planned improvements).

4.7.1.2.1.1 Choice of emission factors

For default factors and applied factors, calculated from the range provided, for amount of charge, lifetime, emission factor and end-of-Life emissions were taken from 2019 Refinement to the 2006 IPCC Guidelines. TABLE 7.9 (UPDATED) and are presented in the following table.

Table 475 GHG Emission factor TIER 1 for IPCC category 2.F.1.a *Commercial refrigeration*

Sub-application	**Charge**	**Lifetimes (years)**	**Emission Factors**		**End-of-Life Emission**		
Factor in Equation	**(M)**	**(d)**	**(k)**	**(x)**	**(hrec,d)**	**(p)**	
			At Time of Charge	**Annual loss, Operating Lifetime**	**Recovery Efficiency**	**Initial Charge Remaining**	**EF release**
Unit	**kg**		**% of initial charge/year**	**%**	**%**	**%**	**%**
Domestic Refrigeration	$0.05 \le M \le 0.5$	$12 \le d \le 20$	$0.2 \le k \le 1$	$0.1 \le x \le 0.5$	$0 < rec,d < 70$	$0 < p < 80$	
Applied factor	-	-	*0.60*	-	-	-	-
Note					*It is assumed that no recovery took place and no charge raimed in the unit.*		

4.7.1.2.2 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.F.1.a *Commercial refrigeration* are presented in the following table.

Table 476Uncertainty for IPCC category 2.F.1.a *Commercial refrigeration.*

Uncertainty	**Charge**	**Lifetimes**	**At Time of Charge**	
Activity data (AD)	95%	-		based on 2019 Refinements to the 2006 IPCC GL, Vol. 3, Chap.7.5.3 and Table 7.8
Emission factor (EF)			36%	based Table 2.13
Combined Uncertainty (U)	102%			$U_{total} = \sqrt{U_{AD1}^2+U_{AD2}^2 + U_{EF1}^2 + U_{EF2}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period.

4.7.1.2.3 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series) ,
  - documented sources,

  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation,
- time series consistency - plausibility checks of dips and jumps.

4.7.1.2.4 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.F.1.a *Commercial refrigeration*.

Table 477 Recalculations done since NC in IPCC category 2.F.1.a *Commercial refrigeration*

source category	Revisions of data	Type of revision	Type of improvement
2.F.1.a	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.a	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability

4.7.1.2.5 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 478 Planned improvements for IPCC sub-category 2.F.1.a *Commercial refrigeration*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1.a	In-depth analysis of data on historic and current equipment ⇨ Containing fluids / gases ⇨ Container size ⇨ Life time ⇨ usage pattern ⇨ maintenance ⇨ disposal ⇨ recovery	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.a	In-depth analysis of production, import & export of commodities of HS code 8418 ‘Refrigerator and freezer’ ⇨ Containing fluids / gases ⇨ Container size	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.a	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[483] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High

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[483] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

4.7.1.3 Domestic refrigeration (IPCC subcategory 2.F.1.b

4.7.1.3.1 Category description

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.b	Domestic refrigeration	✓	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1.b *Domestic refrigeration* includes different types of equipment used in households.

In 2020. the emissions of HFC-134-a from IPCC category 2.F.1.b *Domestic refrigeration* amounted to 2.45 kt from stocks and 633.92 kt from disposal.

The overall trend in HFC-134-a emissions from the IPCC category 2.F.1.b *Domestic refrigeration* shows an increase by 448.9% from *stocks* form 1994 to 2020 which is due to high demand of refrigerator and freezer. However, a decrease by 27.6% from 2005 to 2020 and by 6.4% from 2019 to 2020 could be observed which is due to the retirement of refrigerators and freezer after 16 years lifetime. Additionally in 2016 the ban of HFC-134a in refrigerators and freezer became into force. The bank increased, as in the period 1993 and 2020 step by step all households were equipped with refrigerators and freezer. An assumption was that in 2020 about 99% of the Algerian households have a refrigerator and a freezer. The bank decreased after 2009 when the first refrigerator and a freezer were replaced.

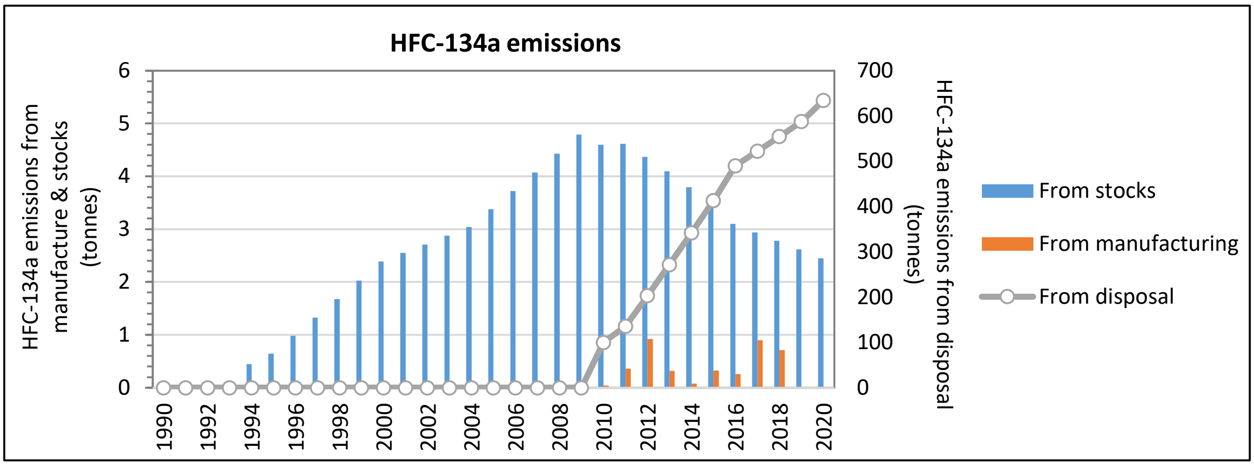

Figure 183 HFC-134a emissions from IPCC sub-category 2.F.1.b Domestic refrigeration

Table 479 Activity data and Emissions of HFC-134 from IPCC category 2.F.1.b *Domestic refrigeration*

	ACTIVITY DATA			**HFC-134 EMISSIONS**			**RECOVERY**
HFC-134	**Filled into new manufactured products**	**In operating systems** (average annual stocks)	**Remaining in products at decommis-sioning**	**From manufacturing**	**From stocks**	**From disposal**	
	tonne	**tonne**	**tonne**	**tonne**	**tonne**	**tonne**	**tonne**
1990	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO
1994	NO	89.21	NO	NO	0.45	NO	NO
1995	NO	128.90	NO	NO	0.64	NO	NO
1996	NO	196.23	NO	NO	0.98	NO	NO
1997	NO	264.82	NO	NO	1.32	NO	NO
1998	NO	334.69	NO	NO	1.67	NO	NO
1999	NO	405.82	NO	NO	2.03	NO	NO
2000	NO	478.23	NO	NO	2.39	NO	NO
2001	NO	509.94	NO	NO	2.55	NO	NO
2002	NO	542.19	NO	NO	2.71	NO	NO
2003	NO	574.97	NO	NO	2.87	NO	NO
2004	NO	608.29	NO	NO	3.04	NO	NO
2005	NO	675.99	NO	NO	3.38	NO	NO
2006	NO	744.77	NO	NO	3.72	NO	NO
2007	NO	814.61	NO	NO	4.07	NO	NO
2008	NO	885.52	NO	NO	4.43	NO	NO
2009	NO	957.50	NO	NO	4.79	NO	NO
2010	67.00	919.43	100.12	0.04	4.60	100.12	NO
2011	598.00	922.97	135.58	0.36	4.61	135.58	NO
2012	1.541.00	873.91	203.02	0.92	4.37	203.02	NO
2013	534.00	819.14	271.74	0.32	4.10	271.74	NO
2014	125.00	758.57	341.72	0.08	3.79	341.72	NO
2015	536.00	692.13	412.98	0.32	3.46	412.98	NO
2016	427.00	619.72	490.16	0.26	3.10	490.16	NO
2017	1.500.00	588.01	522.09	0.90	2.94	522.09	NO
2018	1.181.00	555.76	554.56	0.71	2.78	554.56	NO
2019	NO	522.98	587.57	NE	2.61	587.57	NO
2020	NO	489.66	633.92	NE	2.45	633.92	NO
Trend							
1990 - 2020	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
1994 - 2020	*NA*	*448.9%*	*NA*	*NA*	*448.9%*	*NA*	*NA*
2005 - 2020	*NA*	*-27.6%*	*NA*	*NA*	*-27.6%*	*NA*	*NA*
2019 - 2020	*NA*	*-6.4%*	*7.9%*	*NA*	*-6.4%*	*7.9%*	*NA*

4.7.1.3.2 Methodological issues - Choice of activity data

(B) Activity data - Filled into new manufactured products

The activity data of the amount of HFC-134a filled into new manufactured products were collected from five different plants: CONDOR, SAIDAL, ENIEM, INDUS CHIM and SNVI.

(C) Activity data

- In operating systems (average annual stocks)
- Remaining in products at decommissioning

In the following figure and table are the steps presented which are done to prepare the activity data ‘Annual bank of HFC-134a’ for the Domestic refrigeration.

Step 1: number of households

The activity data for population were taken from ONS.

The Information on number of households are also taken from ON except for 2018 – 2020 which were taken from UNstat.

ONS (2014)[484]: Enquête sur les dépenses de consommation et le niveau de vie des ménages 2011 - Dépenses de consommation des ménages algériens en 2011. TAB.8 : Répartition et structure des ménages par dispersion en 2000 et 2011.

UNstat (2022)[485]: Household size and composition 2022: Average household size (number of members) (number of members): 4.94

Step 2: Number of refrigarators and freezer

For 2008 and 2011, the Information on number of Refrigarators are also taken from ON except for 2018 – 2020 which were taken from Global Data Lab (and modified)[486].

ONS (2014): Enquête sur les dépenses de consommation et le niveau de vie des ménages 2011 - Dépenses de consommation des ménages algériens en 2011. Tab. 6 : Taux d’équipement des ménages algériens en 2008 et 2011.

Tab. 10 : Structure des biens d’équipement selon l’année d’acquisition

Step 3: Information on the use of cooling agents

HFC 134a	1994 - 2015	Since 2016 imports and production forbidden	2010 – 2015: Share is based on expert judgment
R600a	2010 onwards	Not covered under UNFCCC reporting	
R744 (CO_2)		Not used	

Step 4: Average charge of a refrigerator or freezer and lifetime of unit

An ‘average’ charge of a refrigerator or freezer is estimated: 0.120 kg/unit. Information is taken from TABLE 7.9 (UPDATED), 2019 Refinement to the 2006 IPCC Guidelines[487]

Step 5: Cumulative sum See following table

Step 6: Domestic refrigeration- BANK of HFC-134a

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[484] https://www.ons.dz/IMG/pdf/consfinal_1_.pdf

[485] https://population.un.org/household/#/countries/

[486] https://globaldatalab.org/areadata/table/fridge/DZA+MAR+TUN/?levels=1

[487] Source: 2019 Refinement to the 2006 IPCC GL, Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances- 7.5.2.1 Methodological issues - Table 7.9 (updated) Default estimates1 for charge, lifetime and emission factors for refrigeration and air-conditioning systems

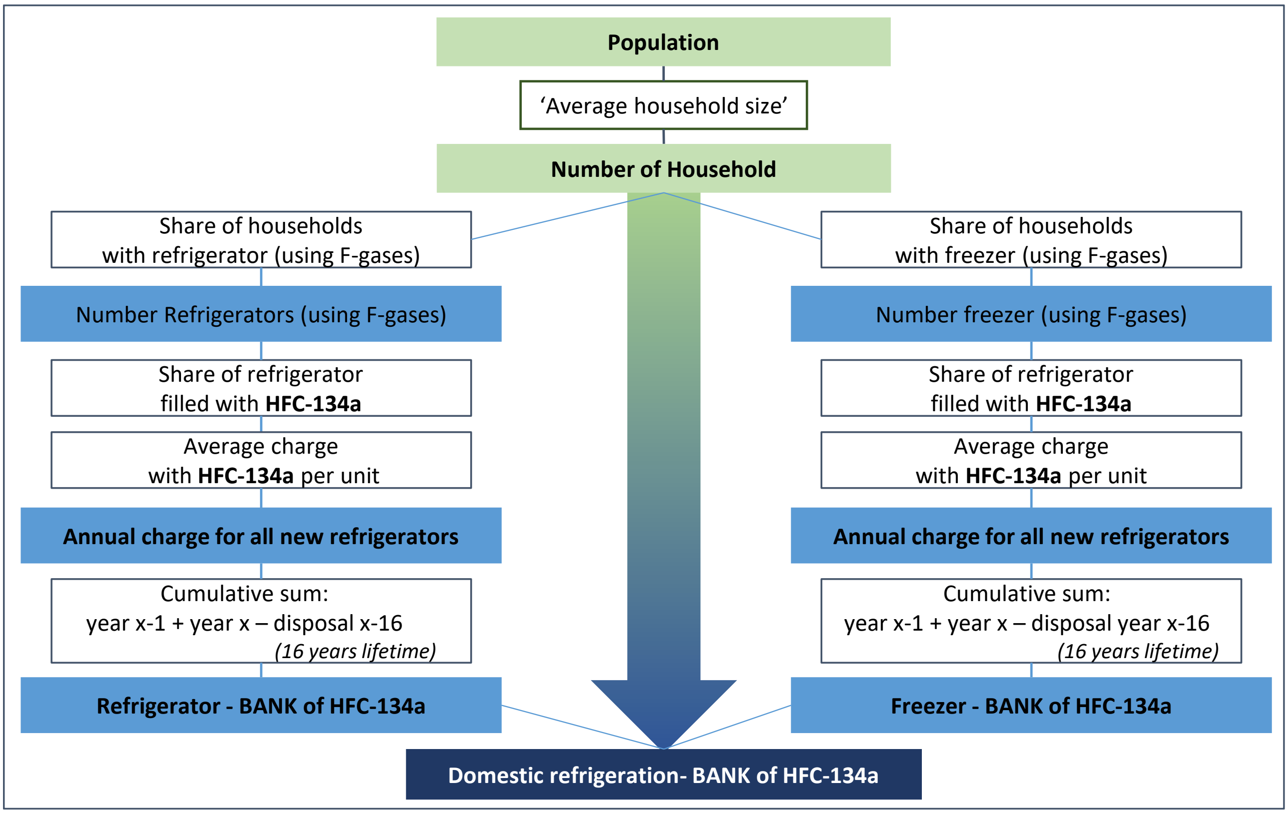

Figure 184 Overview on preparion the the activity data from IPCC category 2.F.1.b *Domestic refrigeration*

Table 480 Cumulative sum of BANK of HFC-134a from IPCC category 2.F.1.b *Domestic refrigeration*

	01. January XXXX BANK of HFC-134a	**+**	**Charge BANK of HFC-134a**	**-**	***Lifetime 16 years* Disposal/retirement**	**=**	**31.12. Year XXXX BANK of HFC-134a**
1994	0	+	74,341			=	74,341
1995	74,341	+	28,782			=	103,123
1996	103,123	+	60,653			=	163,776
↓							
2009	670,932	+	44,565			=	715,498
2010	715,498	+	31,632	-	74,341	=	672,789
2011	672,789	+	26,724	-	103,123	=	670,731
↓							
2014	561,417	+	3,765	-	64,102	=	502,230
2015	502,230	+	1,886	-	65,251	=	440,014
2016	440,014		0	-	19,788	=	374,763
↓							
2030	5,651	+	0	-	3,765	=	1,886
2031	1,886	+	0	-	1,886	=	0

Table 481 Activity data (1): Population, number of households and Number of Refrigerator and Freezer

Years	Population	Households	Source	Share of households with refrigerator (using F-gases)	Refrigerator (using F-gases)	Share of households with Freezer (using F-gases)	Freezer (using F-gases)	Source
	1000	1000			number		number	
1990	25,022	3,800	ONS	0%	-	0%	-	
1991	25,643	3,883	inter-polation					
1992	26,271	3,965						
1993	26,894	4,048						
1994	27,496	4,130		15.0%	619,505	3%	123,901	Based on
1995	28,060	4,213		20.0%	842,508	5%	210,627	
1996	28,566	4,295		inter-polation	1,321,518	inter-polation	261,003	inter-polation
1997	29,045	4,378			1,800,528		311,379	
1998	29,507	4,460			2,279,537		361,756	
1999	29,965	4,543			2,758,547		412,132	
2000	30,416	4,625	ONS 2014	70%	3,237,557	10%	462,508	ONS 2014
2001	30,879	4,774	inter-polation	inter-polation	3,497,411	inter-polation	648,284	inter-polation
2002	31,357	4,923			3,757,265		834,060	
2003	31,848	5,071			4,017,119		1,019,836	
2004	32,364	5,220			4,276,973		1,205,612	
2005	32,906	5,369			4,536,827		1,391,388	
2006	33,481	5,518			4,796,681		1,577,164	
2007	34,096	5,666			5,056,536		1,762,940	
2008	34,591	5,815	ONS 2014		5,316,390		1,948,716	
2009	35,268	5,965	inter-polation		5,576,244		2,134,492	
2010	35,978	6,115			5,836,098		2,320,268	
2011	36,717	6,265	ONS 2014	97.3%	6,095,952	40%	2,506,044	ONS 2014
2012	37,495	6,582	inter-polation	inter-polation	6,107,786	inter-polation	2,645,269	inter-polation
2013	38,297	6,582			6,119,620		2,784,493	
2014	39,114	6,582			6,131,454		2,923,718	
2015	39,963	6,582			6,143,288		3,062,943	
2016	40,836	6,582			6,155,123		3,202,167	
2017	41,721	6,582			6,166,957		3,341,392	
2018	42,578	8,482	Calculation based on UNstat 2022		6,178,791		3,480,617	
2019	43,424	8,790			6,190,625		3,619,841	
2020	43,850	8,877		99.0%	6,202,459	60%	3,759,066	Expert judgment

Years	**Population**	**Households**	**Source**	**Share of households with refrigerator (using F-gases)**	**Refrigerator (using F-gases)**	**Share of households with Freezer (using F-gases)**	**Freezer (using F-gases)**	**Source**
	1000	**1000**			**number**		**number**	
Trend								
1990 – 2020		*133.6%*			*NA*		*NA*	
1994 – 2020		*114.9%*			*901.2%*		*2,933.9%*	
2005 – 2020		*65.3%*			*36.7%*		*170.2%*	
2019 - 2020		*1.0%*			*0.2%*		*3.8%*	
Source	*ONS*	*ONS and Interpolation*			calculated		calculated	

ONS 2014: Enquête sur les dépenses de consommation et le niveau de vie des ménages 2011 - Dépenses de consommation des ménages algériens en 2011. TAB.8 : Répartition et structure des ménages par dispersion en 2000 et 2011 :
https://www.ons.dz/IMG/pdf/consfinal_1_.pdf

UNstat: 2022: Household size and composition 2022: Average household size (number of members) (number of members): 4.94
https://population.un.org/household/#/countries/
⇒ Number of Households based on calculation: ‘Population in 2018’ divided by ‘Average household size’

Table 482 Activity data (2): Annual numbers of new Refrigerator and Freezer in the country

1	2	3	4	5	6	7	8	9
Years	**Refrigerator (using F-gases)**	**Annual change**	**New refrigerator for exchange**	**Annual number of new refrigerators**	**Freezer (using F-gases)**	**Annual change**	**New Freezer for exchange**	**Annual number of new Freezer**
	number	**number**	**number**	**number**	**number**			
			2% of Refrigerator				2% of Freezer	
1990	NO	NO	NO	NO	NO	NO	NO	NO
1991								
1992								
1993								
1994	619,505	619,505		**619,505**	123,901	123,901		**123,901**
1995	842,508	223,003	16,850	**239,853**	210,627	86,726	4,213	**90,939**
1996	1,321,518	479,010	26,430	**505,440**	261,003	50,376	5,220	**55,596**
1997	1,800,528	479,010	36,011	**515,020**	311,379	50,376	6,228	**56,604**
1998	2,279,537	479,010	45,591	**524,600**	361,756	50,376	7,235	**57,611**
1999	2,758,547	479,010	55,171	**534,181**	412,132	50,376	8,243	**58,619**
2000	3,237,557	479,010	64,751	**543,761**	462,508	50,376	9,250	**59,626**
2001	3,497,411	259,854	69,948	**329,802**	648,284	185,776	12,966	**198,742**
2002	3,757,265	259,854	75,145	**334,999**	834,060	185,776	16,681	**202,457**
2003	4,017,119	259,854	80,342	**340,197**	1,019,836	185,776	20,397	**206,173**
2004	4,276,973	259,854	85,539	**345,394**	1,205,612	185,776	24,112	**209,888**
2005	4,536,827	259,854	90,737	**350,591**	1,391,388	185,776	27,828	**213,604**
2006	4,796,681	259,854	95,934	**355,788**	1,577,164	185,776	31,543	**217,319**
2007	5,056,536	259,854	101,131	**360,985**	1,762,940	185,776	35,259	**221,035**
2008	5,316,390	259,854	106,328	**366,182**	1,948,716	185,776	38,974	**224,750**
2009	5,576,244	259,854	111,525	**371,379**	2,134,492	185,776	42,690	**228,466**
2010	5,836,098	259,854	116,722	**376,576**	2,320,268	185,776	46,405	**232,181**
2011	6,095,952	259,854	121,919	**381,773**	2,506,044	185,776	50,121	**235,897**
2012	6,107,786	11,834	122,156	**133,990**	2,645,269	139,225	52,905	**192,130**
2013	6,119,620	11,834	122,392	**134,227**	2,784,493	139,225	55,690	**194,915**
2014	6,131,454	11,834	122,629	**134,463**	2,923,718	139,225	58,474	**197,699**
2015	6,143,288	11,834	122,866	**134,700**	3,062,943	139,225	61,259	**200,484**
2016	6,155,123	11,834	123,102	**134,937**	3,202,167	139,225	64,043	**203,268**
2017	6,166,957	11,834	123,339	**135,173**	3,341,392	139,225	66,828	**206,053**
2018	6,178,791	11,834	123,576	**135,410**	3,480,617	139,225	69,612	**208,837**
2019	6,190,625	11,834	123,812	**135,647**	3,619,841	139,225	72,397	**211,621**
2020	6,202,459	11,834	124,049	**135,883**	3,759,066	139,225	75,181	**214,406**
Trend								
1990 – 2020	*NA*			***NA***	*NA*			***NA***
1994 – 2020	*901.2%*			***901.2%***	*2,933.9%*			***2,933.9%***
2005 – 2020	*36.7%*			***36.7%***	*170.2%*			***170.2%***
2019 - 2020	*0.2%*			***0.2%***	*3.8%*			***3.8%***

Table 483 Activity data (3): Refrigerators - Annual bank of HFC-134a

Years	**Refrigerator (using F-gases)**	**Share of refrigerator filled with**			**Annual charge with HFC-134a**	**Refrigerators - Annual BANK of HFC-134a**
		HFC-134a	**R600a***	**CO_2 (R744)***		
	number	**%**	**%**	**%**	**kg**	**kg**
					filled 0.12 kg per unit based on IPCC default[488]	
1990	NO				NO	NO
1991						
1992						
1993						
1994	619,505	100%	0%	0%	74,341	74,341
1995	239,853	100%	0%	0%	28,782	103,123
1996	505,440	100%	0%	0%	60,653	163,776
1997	515,020	100%	0%	0%	61,802	225,578
1998	524,600	100%	0%	0%	62,952	288,530
1999	534,181	100%	0%	0%	64,102	352,632
2000	543,761	100%	0%	0%	65,251	417,883
2001	329,802	50%	0%	0%	19,788	437,671
2002	334,999	50%	0%	0%	20,100	457,771
2003	340,197	50%	0%	0%	20,412	478,183
2004	345,394	50%	0%	0%	20,724	498,907
2005	350,591	100%	0%	0%	42,071	540,978
2006	355,788	100%	0%	0%	42,695	583,672
2007	360,985	100%	0%	0%	43,318	626,990
2008	366,182	100%	0%	0%	43,942	670,932
2009	371,379	100%	0%	0%	44,565	715,498
2010	376,576	70%	30%	0%	31,632	672,789
2011	381,773	58%	42%	0%	26,724	670,731
2012	133,990	47%	53%	0%	7,503	617,582
2013	134,227	35%	65%	0%	5,638	561,417
2014	134,463	23%	77%	0%	3,765	502,230
2015	134,700	12%	88%	0%	1,886	440,014
2016	134,937	0%	100%	0%		374,763
2017	135,173	0%	100%	0%		354,974
2018	135,410	0%	100%	0%		334,875
2019	135,647	0%	100%	0%		314,463
2020	135,883	0%	100%	0		293,739
Trend						
1990 – 2020	*NA*					*NA*
1994 – 2020	*901.2%*					*295.1%*
2005 – 2020	*36.7%*					*-45.7%*
2019 - 2020	*0.2%*					*-6.6%*

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[488] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances- 7.5.2.1 Methodological issues - Choice of method. TABLE 7.9 (UPDATED) Default estimates1 for charge, lifetime and emission factors for refrigeration and air-conditioning systems

Table 484 Activity data (4): Freezer - Annual bank of HFC-134a

Years	**Freezer (using F-gases)**	**Share of freezer filled with**			**Annual charge with HFC-134a**	**Freezer - Annual BANK of HFC-134a**
		HFC-134a	**R600a***	**CO_2 (R744)***		
	number	**%**	**%**	**%**	**kg**	**kg**
					filled 0.12 kg per unit based on IPCC default[489]	
1990	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO
1994	123,901	100%	0%	0%	14,868	14,868
1995	90,939	100%	0%	0%	10,913	25,781
1996	55,596	100%	0%	0%	6,672	32,452
1997	56,604	100%	0%	0%	6,792	39,245
1998	57,611	100%	0%	0%	6,913	46,158
1999	58,619	100%	0%	0%	7,034	53,192
2000	59,626	100%	0%	0%	7,155	60,348
2001	198,742	50%	0%	0%	11,925	72,272
2002	202,457	50%	0%	0%	12,147	84,419
2003	206,173	50%	0%	0%	12,370	96,790
2004	209,888	50%	0%	0%	12,593	109,383
2005	213,604	100%	0%	0%	25,632	135,016
2006	217,319	100%	0%	0%	26,078	161,094
2007	221,035	100%	0%	0%	26,524	187,618
2008	224,750	100%	0%	0%	26,970	214,588
2009	228,466	100%	0%	0%	27,416	242,004
2010	232,181	70%	30%	0%	19,503	246,639
2011	235,897	58%	42%	0%	16,513	252,239
2012	192,130	47%	53%	0%	10,759	256,327
2013	194,915	35%	65%	0%	8,186	257,721
2014	197,699	23%	77%	0%	5,536	256,343
2015	200,484	12%	88%	0%	2,807	252,116
2016	203,268	0%	100%	0%	NO	244,961
2017	206,053	0%	100%	0%	NO	233,036
2018	208,837	0%	100%	0%	NO	220,889
2019	211,621	0%	100%	0%	NO	208,518
2020	214,406	0%	100%	0%	NO	195,925
Trend						
1990 – 2020	*NA*					*NA*
1994 – 2020	*2,933.9%*					*1,217.8%*
2005 – 2020	*170.2%*					*45.1%*
2019 - 2020	*3.8%*					*-6.0%*

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[489] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances- 7.5.2.1 Methodological issues - Choice of method. TABLE 7.9 (UPDATED) Default estimates1 for charge, lifetime and emission factors for refrigeration and air-conditioning systems

4.7.1.3.2.1 Choice of emission factors

For default factors and applied factors, calculated from the range provided, for amount of charge, lifetime, emission factor and end-of-Life emissions were taken from 2019 Refinement to the 2006 IPCC Guidelines. TABLE 7.9 (UPDATED) and are presented in the following table.

Table 485 GHG Emission factor TIER 1 for IPCC category 2.F.1.b Domestic refrigeration

Sub-application	**Charge**	**Lifetimes (years)**	**Emission Factors**		**End-of-Life Emission**		
Factor in Equation	**(M)**	**(d)**	**(k)**	**(x)**	**(hrec,d)**	**(p)**	
			At Time of Charge	**Annual loss. Operating Lifetime**	**Recovery Efficiency**	**Initial Charge Remaining**	**EF release**
Unit	**kg**		**% of initial charge/year**	**%**	**%**	**%**	**%**
Domestic Refrigeration	$0.05 \leq M \leq 0.5$	$12 \leq d \leq 20$	$0.2 \leq k \leq 1$	$0.1 \leq x \leq 0.5$	$0 < rec,d < 70$	$0 < p < 80$	
Applied factor	*0.120*	*16*	*0.6%*	*0.5%*	*NA*	*NA*	*100%*
Note					*It is assumed that no recovery took place and no charge raimed in the unit.*		

4.7.1.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.F.1.b *Domestic refrigeration* are presented in the following table.

Table 486 Uncertainty for IPCC category 2.F.1.b Domestic refrigeration.

Uncertainty	**Charge**	**Lifetimes**	**Annual loss. Operating Lifetime**	**EF release**	
Activity data (AD)	82%	25%			based on 2019 Refinements to the 2006 IPCC GL, Vol. 3, Chap.7.5.3 and Table 7.8
Emission factor (EF)			67%	100%	based Table 2.13
Combined Uncertainty (U)	148%				$U_{total} = \sqrt{U_{AD1}^2 + U_{AD2}^2 + U_{EF1}^2 + U_{EF2}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period.

4.7.1.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series) ,
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,

  - quick-control checks for data consistency through all steps of calculation.
- time series consistency - plausibility checks of dips and jumps.

4.7.1.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.F.1.b *Domestic refrigeration*.

Table 487 Recalculations done since NC in IPCC category 2.F.1.b Domestic refrigeration

source category	Revisions of data	Type of revision	Type of improvement
2.F.1.b	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.b	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability
2.F.1.b	Revision of activity data using surrogate data instead of import information	AD	Accuracy

4.7.1.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 488 Planned improvements for IPCC sub-category 2.F.1.b *Domestic refrigeration*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1	In-depth analysis of (a) data on historic and current equipment (b) production, import & export of commodities of • HS code 8415 'Air-condition' • HS code 8418 'Refrigerator and freezer'	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	In-depth analysis of (a) data on historic and current equipment (b) production, import & export of commodities of • Containing fluids / gases • Container size • Life time • usage pattern • maintenance • disposal	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	Analysis of mobile air-conditioning units/equipment	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	Application of methodology (TIER 2 or higher) of 2006 IPCC Guidelines and 2019 Refinements to the 2006 IPCC Guidelines	AD	Accuracy Transparency	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.5 Refrigeration and air conditioning) Page 7.43.		Completeness Comparability Consistency	

4.7.1.4 Industrial refrigeration (IPCC subcategory 2.F.1.c)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.c	Industrial refrigeration	NE	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1.c *Industrial refrigeration* includes chillers, cold storage, and industrial heat pumps used in the food processing and beverage industry, petrochemical and other industries.

GHG Emissions from IPCC category 2.F.1.c *Industrial refrigeration* were not estimated due lack of data.

4.7.1.4.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 489 Planned improvements for IPCC sub-category 2.F.1.c *Industrial refrigeration*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1.c	In-depth analysis of data on historic and current equipment used in in industries ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal ⇨ recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.c	In-depth analysis of production, import & export of relevant applicants and vehicles ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.c	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[490] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High

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[490] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

4.7.1.5 Transport refrigeration (IPCC subcategory 2.F.1.d)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.d	Transport refrigeration	NE	-	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NE -not estimated, NA -not applicable, C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.F.1.d *Transport* includes equipment and systems used in refrigerated trucks, containers, reefers, and wagons.

GHG Emissions from IPCC category 2.F.1.d *Transport* were not estimated due lack of data.

4.7.1.5.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 490 Planned improvements for IPCC sub-category 2.F.1.d *Transport*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1.d	In-depth analysis of data on historic and current equipment, applicants and vehicles, railcars and ships ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal ⇨ recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.d	In-depth analysis of production, import & export of commodities of HS code 8418 'Refrigerator and freezer' ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.d	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[491] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High

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[491] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

4.7.1.6 Mobile air-conditioning (IPCC subcategory 2.F.1.e)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.e	Mobile air-conditioning	✓	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1.e *Mobile air-conditioning* includes used in passenger cars, truck cabins, buses, and trains.

In 2020, the emissions of HFC-134-a from IPCC category 2.F.1.e *Mobile air-conditioning* amounted to 191.45kt from stocks and 15.57 kt from disposal.

The overall trend in HFC-134-a emissions from the IPCC category 2.F.1.e *Mobile air-conditioning* shows an increase by 550,380.2% *From stocks* during the period from 1994 to 2020 which is due to high demand and use of mobile air-conditioning. However, an increase by 1,052.1% from 2005 to 2020 and by 9.9% from 2019 to 2020.

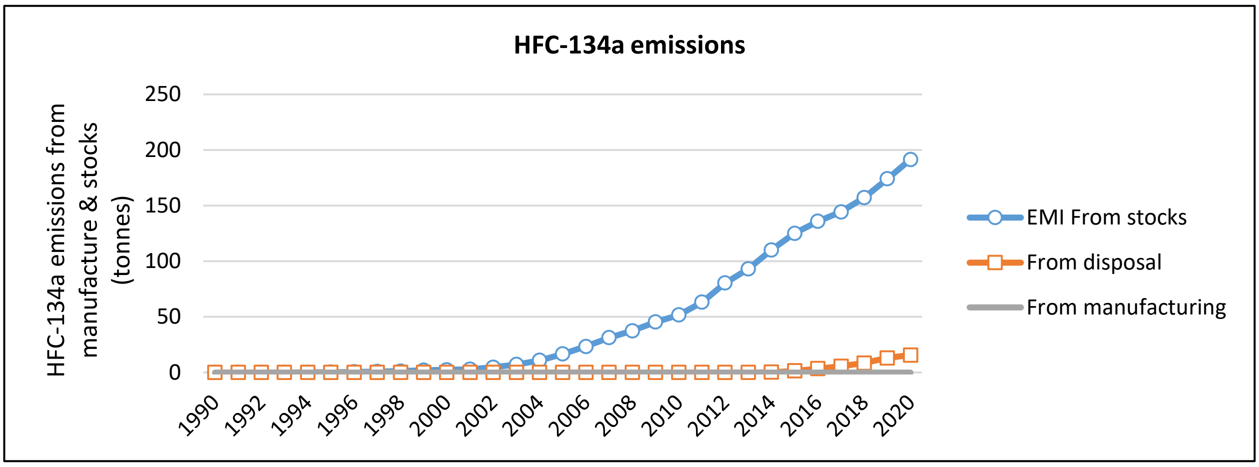

Figure 185 HFC-134a emissions from IPCC sub-category 2.F.1.e *Mobile air-conditioning*

Table 491 Activity data and Emissions of HFC-134 from IPCC category 2.F.1.e *Mobile air-conditioning*

	ACTIVITY DATA			**HFC-134 EMISSIONS**			**RECOVERY**
HFC-134	**Filled into new manufactured products**	**In operating systems** (average annual stocks)	**Remaining in products at decommis-sioning**	**From manufacturing**	**From stocks**	**From disposal**	
	tonne	**tonne**	**tonne**	**tonne**	**tonne**	**tonne**	**tonne**
1990	NO	NO	NO	NO	NO	NO	NO
1991	NO	NO	NO	NO	NO	NO	NO
1992	NO	NO	NO	NO	NO	NO	NO
1993	NO	NO	NO	NO	NO	NO	NO
1994	NO	0.23	NO	NO	0.03	NO	NO
1995	NO	1.40	NO	NO	0.21	NO	NO
1996	NO	3.36	NO	NO	0.50	NO	NO
1997	NO	5.56	NO	NO	0.83	NO	NO
1998	NO	8.42	NO	NO	1.26	NO	NO
1999	NO	13.08	NO	NO	1.96	NO	NO
2000	NO	15.57	NO	NO	2.34	NO	NO
2001	NO	18.82	NO	NO	2.82	NO	NO
2002	NO	31.56	NO	NO	4.73	NO	NO
2003	NO	47.85	NO	NO	7.18	NO	NO
2004	NO	71.98	NO	NO	10.80	NO	NO
2005	NO	110.78	NO	NO	16.62	NO	NO
2006	NO	155.67	NO	NO	23.35	NO	NO
2007	NO	208.90	NO	NO	31.34	NO	NO
2008	NO	249.73	NO	NO	37.46	NO	NO
2009	NO	302.44	NO	NO	45.37	NO	NO
2010	NO	344.95	NO	NO	51.74	NO	NO
2011	NO	420.68	NO	NO	63.10	NO	NO
2012	NO	536.14	NO	NO	80.42	NO	NO
2013	NO	620.75	NO	NO	93.11	NO	NO
2014	NO	733.99	0.23	NO	110.10	0.23	NO
2015	NO	833.62	1.40	NO	125.04	1.40	NO
2016	NO	905.54	3.36	NO	135.83	3.36	NO
2017	NO	962.50	5.56	NO	144.38	5.56	NO
2018	NO	1,047.51	8.42	NO	157.13	8.42	NO
2019	NO	1,160.83	13.08	NO	174.13	13.08	NO
2020	NO	1,276.33	15.57	NO	191.45	15.57	NO
Trend							
1990- 2020	NA	NA	NA	NA	NA	NA	NA
1994 - 2020	NA	550,380.2%	NA	NA	550,380.2%	NA	NA
2005 - 2020	NA	1052.1%	NA	NA	1052.1%	NA	NA
2019 - 2020	NA	9.9%	19.0%	NA	9.9%	19.0%	NA

4.7.1.6.1 Methodological issues - Choice of activity data

(D) Activity data - Filled into new manufactured products

It was assumed that no HFC-134a gas was filled into new manufactured products.

(E) Activity data
- In operating systems (average annual stocks)
- Remaining in products at decommissioning

In the following figure and table are the steps presented which are done to prepare the activity data 'Annual bank of HFC-134a' for the equipment of mobile air-conditioning.

Step 1: number of vehicles
The activity data of the vehicle fleet was taken from ONS (several years): Parc national automobile.[492]
Step 2: Estimation of share of vehicles with air-conditioning

Type Of Vehicle	1994	2000	2020
Passenger Vehicle	1%	20.0%	80%
Truck	1%	5.0%	35%
Van	1%	5.0%	50%
Bus-Coach	1%	10.0%	30%
Road Tractor	1%	5.0%	60%
Agricultural Tractor	0%	0.0%	3%
Special Vehicle	1%	20.0%	90%

Step 3: Information on the use of cooling agents

It is assumed that only the HFC-134a gas was filled in vehicle, which were completely imported.

Step 4: Average charge of a air-conditioning and lifetime of unit

An 'average' charge of a refrigerator or freezer is estimated: 0.120 kg/unit. Information is taken from TABLE 7.9 (UPDATED). 2019 Refinement to the 2006 IPCC Guidelines[493]

Step 5: Cumulative sum See following table

Step 6: Mobile air-conditioning - BANK of HFC-134a

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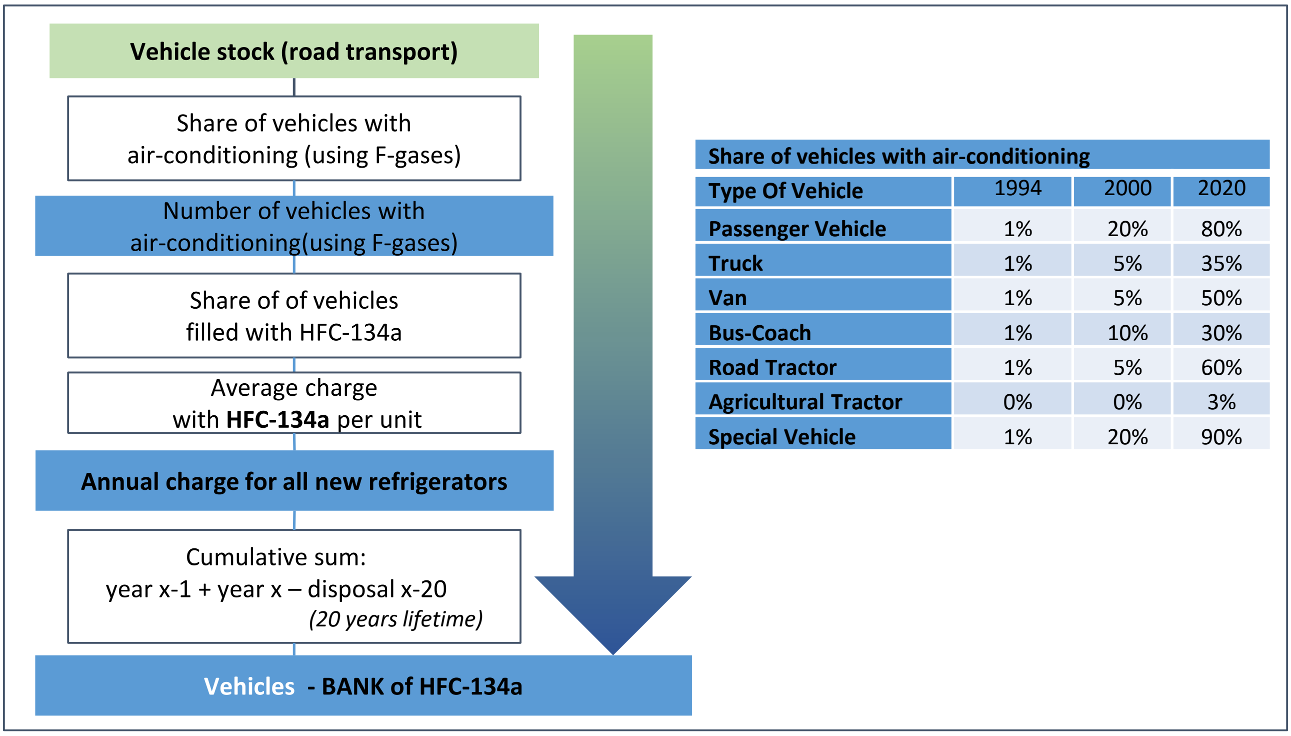
[492] https://www.ons.dz/spip.php?rubrique228-+

[493] Source: 2019 Refinement to the 2006 IPCC GL, Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances- 7.5.2.1 Methodological issues - Table 7.9 (updated) Default estimates1 for charge, lifetime and emission factors for refrigeration and air-conditioning systems



Share of vehicles with air-conditioning			
Type Of Vehicle	1994	2000	2020
Passenger Vehicle	1%	20%	80%
Truck	1%	5%	35%
Van	1%	5%	50%
Bus-Coach	1%	10%	30%
Road Tractor	1%	5%	60%
Agricultural Tractor	0%	0%	3%
Special Vehicle	1%	20%	90%

Figure 186 Overview on preparation the activity data for IPCC category 2.F.1.e *Mobile air-conditioning*

4.7.1.6.1.1 Choice of emission factors

For default factors and applied factors, calculated from the range provided, for amount of charge, lifetime, emission factor and end-of-Life emissions were taken from 2019 Refinement to the 2006 IPCC Guidelines, TABLE 7.9 (UPDATED) and are presented in the following table.

Table 492 GHG Emission factor TIER 1 for IPCC category 2.F.1.e *Mobile air-conditioning*

Sub-application	**Charge**	**Lifetimes (years)**	**Emission Factors**		**End-of-Life Emission**		
Factor in Equation	**(M)**	**(d)**	**(k)**	**(x)**	**(hrec,d)**	**(p)**	
			At Time of Charge	**Annual loss, Operating Lifetime**	**Recovery Efficiency**	**Initial Charge Remaining**	**EF release**
Unit	**kg**		**% of initial charge/year**	**%**	**%**	**%**	**%**
Mobile A/C general road transport	$0.5 \le M \le 2$	$12 \le d \le 20$	$0.2 \le k \le 1$	$0.1 \le x \le 0.5$	$0 < rec,d < 70$	$0 < p < 80$	
Applied factor	0.60	20	NO	15%	NA	NO	100%
Note					*It is assumed that no recovery took place and no charge raimed in the unit.*		

4.7.1.6.2 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.F.1.e *Mobile air-conditioning* are presented in the following table.

Table 493 Uncertainty for IPCC category 2.F.1.e *Mobile air-conditioning.*

Uncertainty	**Charge**	**Lifetimes**	**Annual loss, Operating Lifetime**	**EF release**	
Activity data (AD)	65%	28%			based on 2019 Refinements to the 2006 IPCC GL, Vol. 3, Chap.7.5.3 and Table 7.8
Emission factor (EF)			33%	100%	based Table 2.13
Combined Uncertainty (U)	137%				$U_{total} = \sqrt{U_{AD1}^2 + U_{AD2}^2 + U_{EF1}^2 + U_{EF2}^2}$

The time-series are considered to be consistent as the same methodology is applied to the whole period.

4.7.1.6.3 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of energy balance data (preparation of a time series) ,
    - documented sources,
    - use of units and conversion factors,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping. use of write protection,
    - unique use of formulas. special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- time series consistency - plausibility checks of dips and jumps.

4.7.1.6.4 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.F.1.e *Mobile air-conditioning*.

Table 494 Recalculations done since NC in IPCC category 2.F.1.e *Mobile air-conditioning*

source category	**Revisions of data**	**Type of revision**	**Type of improvement**
2.F.1.e	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.e	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability
2.F.1.e	Revision of activity data using surrogate data instead of import information	AD	Accuracy

4.7.1.6.5 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 495 Planned improvements for IPCC sub-category 2.F.1.e Mobile air-conditioning.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1.e	In-depth analysis of data on historic and current equipment used in vehicles of the road transport, trains, ships, planes and off-road vehicles ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal ⇨ recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.e	In-depth analysis of production, import & export of relevant applicants and vehicles ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.e	In-depth analysis of second hand market	AD	Accuracy Transparency	High
2.F.1.e	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High

4.7.1.7 Stationary air-conditioning (IPCC subcategory 2.F.1.f)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.1	Refrigeration and Air Conditioning								
2.F.1.f	Stationary air-conditioning	NE	-	NO	-	NO	-	NO	-

A '✓' indicates emissions from this sub-category have been estimated, Notation keys: IE -included elsewhere NE -not estimated, NA -not applicable, C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.1.f *Stationary air-conditioning* includes air-to-air systems, heat pumps, and chillers for building and residential applications.

GHG Emissions from IPCC category 2.F.1.f *Stationary air-conditioning* were not estimated due lack of data.

4.7.1.7.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 496 Planned improvements for IPCC sub-category 2.F.1.f *Stationary air-conditioning*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.1.f	In-depth analysis of data on historic and current equipment and application ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal ⇨ recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.f	In-depth analysis of production, import & export of commodities of HS code 8415 'Air-condition' ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.f	In-depth analysis of second hand market	AD	Accuracy Transparency	High
2.F.1.f	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High

4.7.2 Foam Blowing Agents (IPCC category 2.F.2)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.2	Foam Blowing Agents	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.2	Foam Blowing Agents	NE	-	NE	-	NE	-	NE	-

A '✓' indicates emissions from this sub-category have been estimated, Notation keys: IE -included elsewhere NE -not estimated, NA -not applicable, C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.2 *Foam Blowing Agents* is not estimated (NE) were not estimated due lack of data.

4.7.2.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 497 Planned improvements for IPCC sub-category 2.F.2 Foam Blowing Agents.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.2	Analysis of Foam Blowing Agents, e.g., • the amount of chemical used in foam manufacturing in a country and not subsequently exported • the amount of chemical contained in foam imported	AD	Accuracy Transparency Completeness Comparability	High
2.F.2	Investigation on applications • Polyurethane – Integral Skin / Polyurethane – Continuous Panel / Discontinuous Panel / Appliance / Injected / etc. • One Component Foam (OCF) • Extruded Polystyrene (XPS) • Phenolic – Discontinuous Block / Discontinuous Laminate	AD	Accuracy Transparency Completeness Comparability	High
2.F.2	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.4 FOAM BLOWING AGENTS) Page 7.32.	AD	Accuracy Transparency Completeness Comparability	High

4.7.3 Fire Protection (IPCC category 2.F.3)

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.3	Fire Protection	NE	-	NE	-	NE	-	NE	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.F.3 *Fire Protection* is not estimated (NE) were not estimated due lack of data.

4.7.3.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 498 Planned improvements for IPCC sub-category 2.F.3 Fire Protection.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.3	Investigation of import and use of fire protection products and fire protection equipment	AD	Accuracy Transparency Completeness	High
2.F.3	Application of methodology of 2006 IPCC Guidelines. Volume 3: Industrial Processes and Product Use.	AD	Accuracy Transparency	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.6 FIRE PROTECTION) Page 7.61.		Completeness Comparability	

4.7.4 Aerosols (IPCC category 2.F.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.4	Aerosols	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.4	Aerosols	NE	-	NE	-	NE	-	NE	-

A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.4 *Aerosols* is not estimated (NE) were not estimated due lack of data..

4.7.4.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 499 Planned improvements for IPCC sub-category 2.F.4 Aerosols.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.4	Investigation of • Domestic aerosol production • Imported aerosol production	AD	Accuracy Transparency Completeness	High
2.F.4	Investigation of the use and consumption (by chemical composition) of products containing HFC and/or PFC for cleaning: (i) Metered Dose Inhalers (MDIs); (ii) Personal Care Products (e.g., hair care, deodorant, shaving cream); (iii) Household Products (e.g., air-fresheners, oven and fabric cleaners); (iv) Industrial Products (e.g., special cleaning sprays such as those for operating electrical contact, lubricants, pipe-freezers); (v) Other General Products (e.g., silly string, tyre inflators, klaxons).	AD	Accuracy Transparency Completeness	High
2.F.4	Application of methodology of 2006 IPCC Guidelines. Volume 3: Industrial Processes and Product Use. Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.3 AEROSOLS (PROPELLANTS AND SOLVENTS)) Page 7.28.	AD	Accuracy Transparency Completeness Comparability	High

4.7.5 Solvents (IPCC category 2.F.5)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.5	Solvents	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.5	Solvents	NE	-	NE	-	NE	-	NE	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.F.5 *Solvents* includes the use of solvents containing HFC and/or PFC for cleaning (i) Precision Cleaning. (ii) Electronics Cleaning. (iii) Metal Cleaning. (iv) Deposition applications).

The IPCC category 2.F.5 *Solvents* is not estimated (NE) due lack of data.

4.7.5.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 500 Planned improvements for IPCC sub-category 2.F.5 Solvents.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.5	Investigation of the use and consumption (by chemical composition) of solvents containing HFC and/or PFC products for (i) Precision Cleaning, (ii) Electronics Cleaning, (iii) Metal Cleaning, (iv) Deposition applications).	AD	Accuracy Transparency Completeness	High
2.F.5	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.3 AEROSOLS (PROPELLANTS AND SOLVENTS) Page 7.28.	AD	Accuracy Transparency Completeness Comparability	High

4.7.6 Other Application (IPCC category 2.F.6)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.6	Other Application	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.F.6	Other Application	NE	-	NE	-	NE	-	NE	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.F.6 *Other Application* is not estimated (NE) due lack of data.

4.7.6.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 501 Planned improvements for IPCC sub-category 2.F.6 Other Application.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.F.6	Investigation of the use and consumption (by chemical composition) of various products containing HFC and/or PFC	AD	Accuracy Transparency Completeness	High
2.F.6	Application of methodology of 2006 IPCC Guidelines, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.7 OTHER APPLICATIONS) Page 7.66.	AD	Accuracy Transparency Completeness Comparability	High

4.8 Other Product Manufacture and Use (IPCC category 2.G)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G	Other product manufacture and use						
2.G.1	Electrical equipment	NA	-	NA	-	NA	-
2.G.2	SF_6 and PFCs from other product use	NA	-	NA	-	NA	-
2.G.3	N_2O from product uses	NA	-	NA	-	NE	-
2.G.4	Other	NO	-	NO	-	NO	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G	Other product								

IPCC code	Description		CO_2		CH_4		N_2O		
			Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	
	manufacture and use								
2.G.1	Electrical equipment	NA	-	NE	-	✓	LA, TA	NO	-
2.G.2	SF_6 and PFCs from other product use	NA	-	NE	-	NE	-	NO	-
2.G.3	N_2O from product uses	NA	-	NA	-	NA	-	NA	-
2.G.4	Other	NO	-	NO	-	NO	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

The IPCC category 2.G *Other Product Manufacture and Use* comprises

- PFC and SF_6 emissions from Electrical Equipment (2.G.1) ,
- PFC and SF_6 emissions from Other Product Uses (2.G.2) ,
- N_2O emissions from Product Uses (2.G.3).

Whereas the emissions from category 2.G.1 were estimated, the emissions from IPCC categories 2.G.2 and 2.G.3 were not estimated due to lack of resources and data.

4.8.1 Electrical Equipment (IPCC category 2.G.1)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.1	Electrical Equipment						
2.G.1.a	Manufacture of Electrical Equipment	NA	-	NA	-	NA	-
2.G.1.b	Use of Electrical Equipment	NA	-	NA	-	NA	-
2.G.1.c	Disposal of Electrical Equipment	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.1	Electrical Equipment						LA, TA		
2.G.1.a	Manufacture of Electrical Equipment	NA	-	NO	-	NO	-	NO	-
2.G.1.b	Use of Electrical Equipment	NA	-	NE	-	✓	-	NO	-
2.G.1.c	Disposal of Electrical Equipment	NA	-	NE	-	✓	-	NO	-

A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

This section describes SF_6 and PFC emissions resulting from the manufacture, use and disposal of electrical equipment.

The IPCC category 2.G.1.a *Manufacture of Electrical Equipment* does not existed in Algeria: it is assumed that no manufacture of electrical equipment, which was filled with PFC and/or SF_6 in country, took place.

PFC emissions from IPCC category 2.G.1.b *Use of Electrical Equipment* and 2.G.1.c *Disposal of Electrical Equipment* were not estimated and the notation key NE was used. But it may also be that this source does not occur in Algeria. In this case, the notation key will be changed to not occurring (NO).

SF_6 emissions from IPCC category 2.G.1.b *Use of Electrical Equipment* and 2.G.1.c *Disposal of Electrical Equipment* were estimated.

The use of SF_6-filled electrical equipment was assumed to have occurred since 1970. As described in the 2006 IPCC Guidelines, SF_6 is used for electrical insulation and current interruption in equipment used in the transmission and distribution of electricity. Emissions occur at each phase of the equipment life cycle, including manufacturing, installation, use, servicing, and disposal. Most of the SF_6 used in electrical equipment is used in gas insulated switchgear and substations (GIS) and in gas circuit breakers (GCB), though some SF_6 is used in high voltage gas-insulated lines (GIL) , outdoor gas-insulated instrument transformers and other equipment.

In the following figure, an overview of a typical applicants of an electric power transmission and distribution system is illustrated.

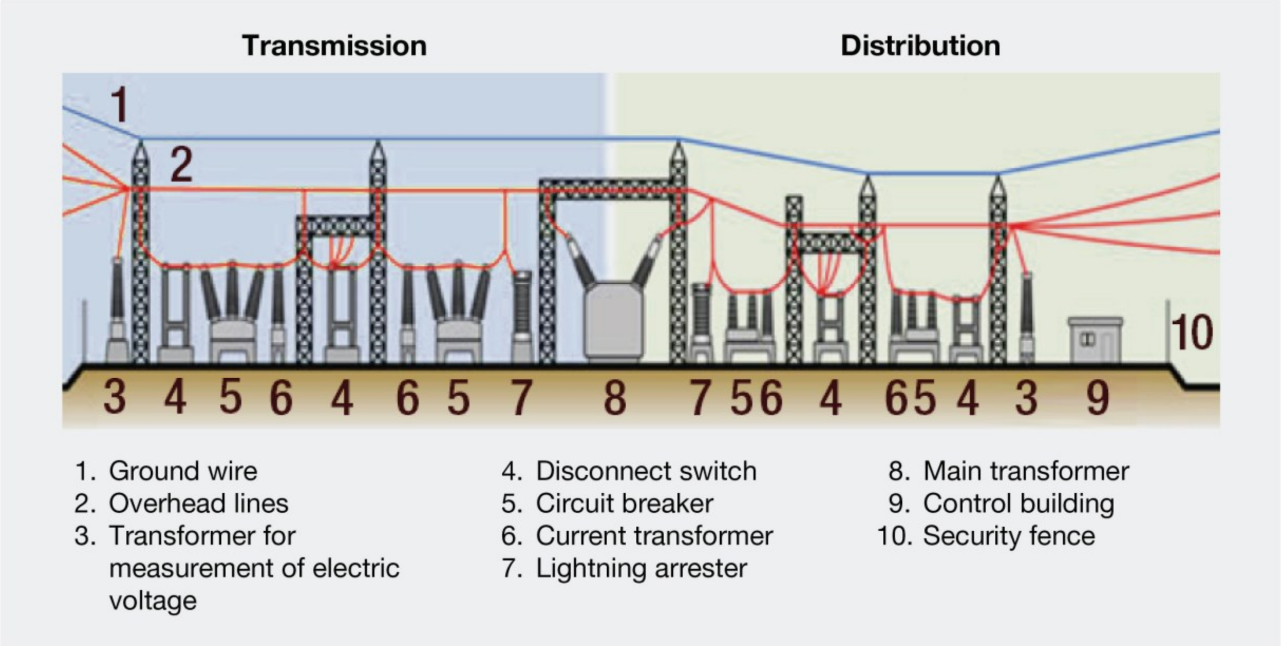


Figure 187 **Typical applicants of an electric power transmission and distribution system**.[494]

Furthermore and as described in the 2006 IPCC Guidelines, the electrical applications can be divided into two categories of containments: sealed pressure systems, mainly used in distribution systems and closed pressure systems, mainly used in transmission equipments.

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[494] Source: US EPA (2018): Overview of SF_6 Emissions Sources and Reduction Options in Electric Power Systems August 2018
Available on 20.06.2022: https://www.epa.gov/sites/default/files/2018-08/documents/12183_SF6_partnership_overview_v20_release_508.pdf

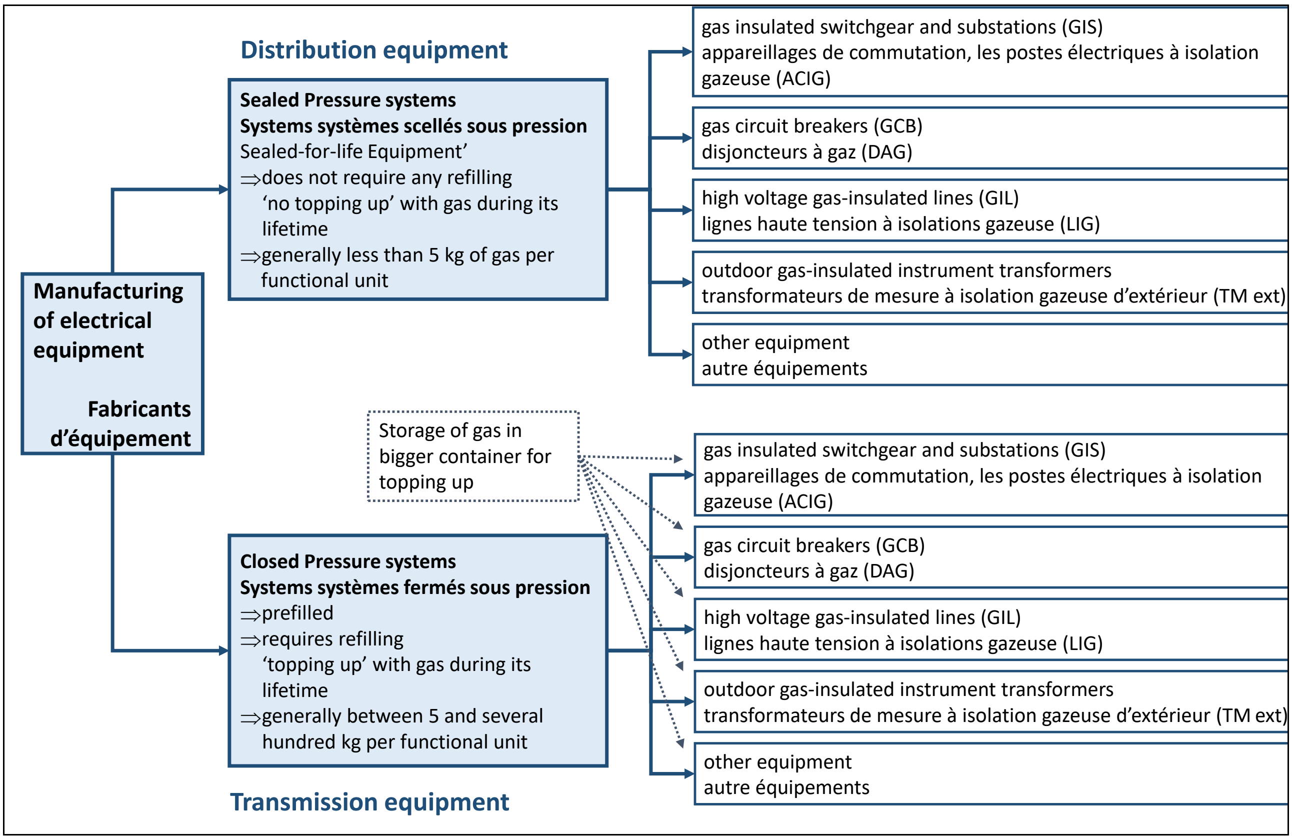


Figure 188 **Electrical applications divided according to the containment**

An overview of the emission of SF_6 from the use of disposal of electrical equipment filled with SF_6 in IPCC category 2.G.1 *Electrical Equipment* is provided in the following figure and table.

The SF_6 emissions from IPCC category 2.G.1 *Electrical Equipment* amounted to 0.007 kt SF_6 in 1990, 0.05 kt SF_6 in 2005, and 1.58 kt SF_6 in 2020.
The overall trend in GHG emissions from the IPCC category 2.G.1 *Electrical Equipment* shows an increase by 22813% % from 1990 to 2020, an increase by 3029% from 2005 to 2020, a increase by 23% from 2019 to 2020.

The overall increasing trend of emissions is result of rising electricity production due to increased demand by Energy industries. Manufacturing industries and construction, households and commercial, public and private institutions.

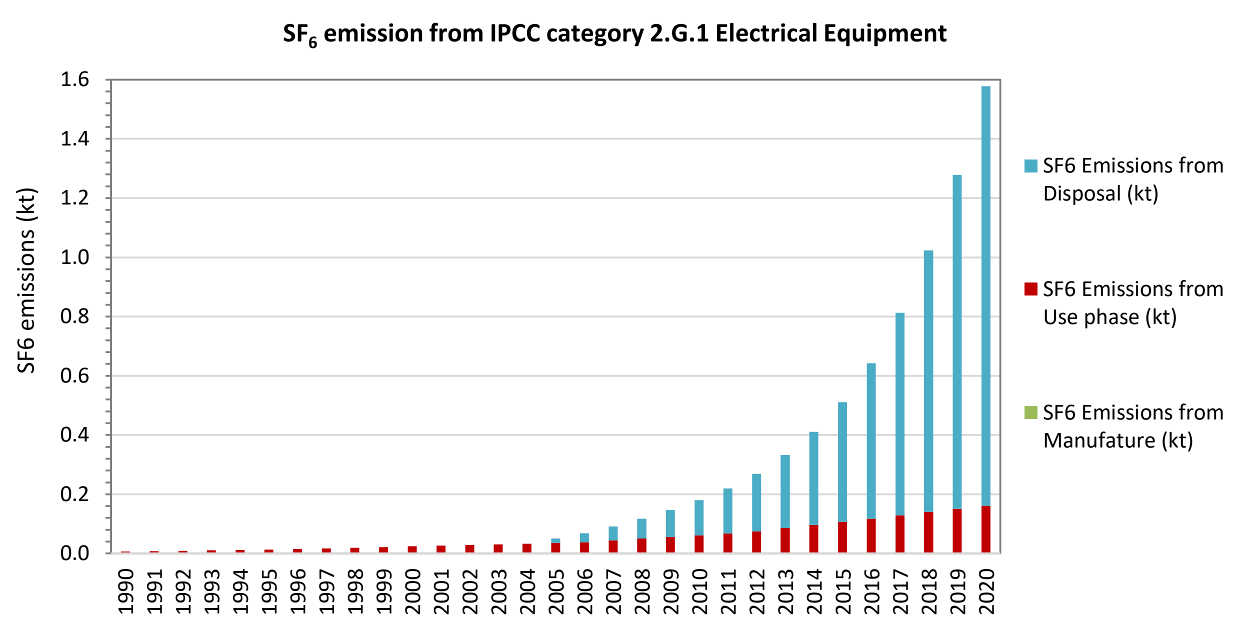


Figure 189 Emissions from IPCC category 2.G.1 *Electrical Equipment* and Electricity production in Algeria

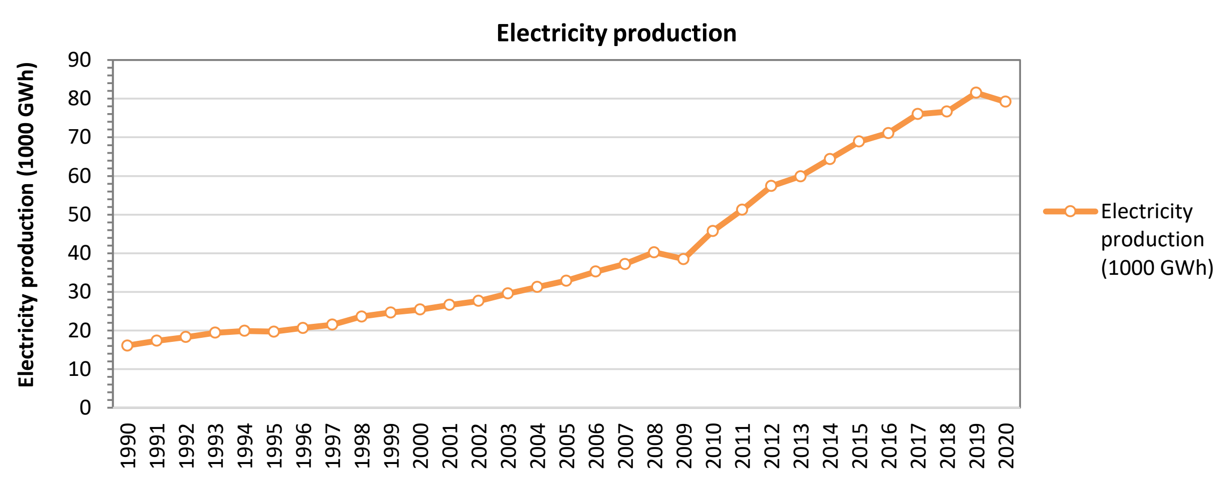


Figure 190 Electricity production

Table 502 SF_6 and PFC emissions from IPCC category 2.G.1 *Electrical Equipment*

	SF_6				**PFC**			
	2.G.1	**2.G.1.a**	**2.G.1.b**	**2.G.1.c**	**2.G.1**	**2.G.1.a**	**2.G.1.b**	**2.G.1.c**
	Electrical Equipment	**Manufacture of Electrical Equipment**	**Use of Electrical Equipment**	**Disposal of Electrical Equipment**	**Electrical Equipment**	**Manufacture of Electrical Equipment**	**Use of Electrical Equipment**	**Disposal of Electrical Equipment**
	t	**t**	**t**	**t**	**t**	**t**	**t**	**t**
1990	0.007	NO	0.007	NO	NE	NO	NE	NE
1991	0.008	NO	0.008	NO	NE	NO	NE	NE
1992	0.009	NO	0.009	NO	NE	NO	NE	NE
1993	0.010	NO	0.010	NO	NE	NO	NE	NE
1994	0.012	NO	0.012	NO	NE	NO	NE	NE
1995	0.013	NO	0.013	NO	NE	NO	NE	NE
1996	0.015	NO	0.015	NO	NE	NO	NE	NE
1997	0.017	NO	0.017	NO	NE	NO	NE	NE
1998	0.019	NO	0.019	NO	NE	NO	NE	NE
1999	0.021	NO	0.021	NO	NE	NO	NE	NE
2000	0.024	NO	0.024	NO	NE	NO	NE	NE
2001	0.026	NO	0.026	NO	NE	NO	NE	NE
2002	0.028	NO	0.028	NO	NE	NO	NE	NE
2003	0.030	NO	0.030	NO	NE	NO	NE	NE
2004	0.033	NO	0.033	NO	NE	NO	NE	NE
2005	0.050	NO	0.036	0.014	NE	NO	NE	NE
2006	0.068	NO	0.039	0.030	NE	NO	NE	NE
2007	0.092	NO	0.044	0.047	NE	NO	NE	NE
2008	0.118	NO	0.050	0.068	NE	NO	NE	NE
2009	0.146	NO	0.056	0.091	NE	NO	NE	NE
2010	0.180	NO	0.061	0.119	NE	NO	NE	NE
2011	0.219	NO	0.067	0.152	NE	NO	NE	NE
2012	0.268	NO	0.075	0.194	NE	NO	NE	NE
2013	0.332	NO	0.086	0.246	NE	NO	NE	NE
2014	0.411	NO	0.097	0.314	NE	NO	NE	NE
2015	0.511	NO	0.107	0.404	NE	NO	NE	NE
2016	0.643	NO	0.118	0.525	NE	NO	NE	NE
2017	0.812	NO	0.129	0.683	NE	NO	NE	NE
2018	1.024	NO	0.141	0.883	NE	NO	NE	NE
2019	1.278	NO	0.151	1.127	NE	NO	NE	NE
2020	1.578	NO	0.161	1.417	NE	NO	NE	NE
Trend								
1990 - 2020	22,813%	22,813%	NA	2,239%	NA	NA	NA	NA
2005 - 2020	3,029%	3,029%	NA	345%	NA	NA	NA	NA
2019 - 2020	23%	23%	NA	7%	NA	NA	NA	NA

4.8.1.1 Methodological issues

4.8.1.1.1 Choice of methods

EQUATION 8.3 TIER 1 TOTAL EMISSIONS

$$\begin{aligned} \mathit{Total\ Emissions} = & \sum \mathit{Equipment\ Manufacturing\ Emissions} \\ & + \sum \mathit{Equipment\ Installation\ Emissions} \\ & + \sum \mathit{Equipment\ Use\ Emissions} \\ & + \sum \mathit{Equipment\ Disposal\ and\ Final\ Use\ Emissions} \\ & + \sum \mathit{Emissions\ from\ SF_6\ Recycling\ and\ Destruction} \end{aligned}$$

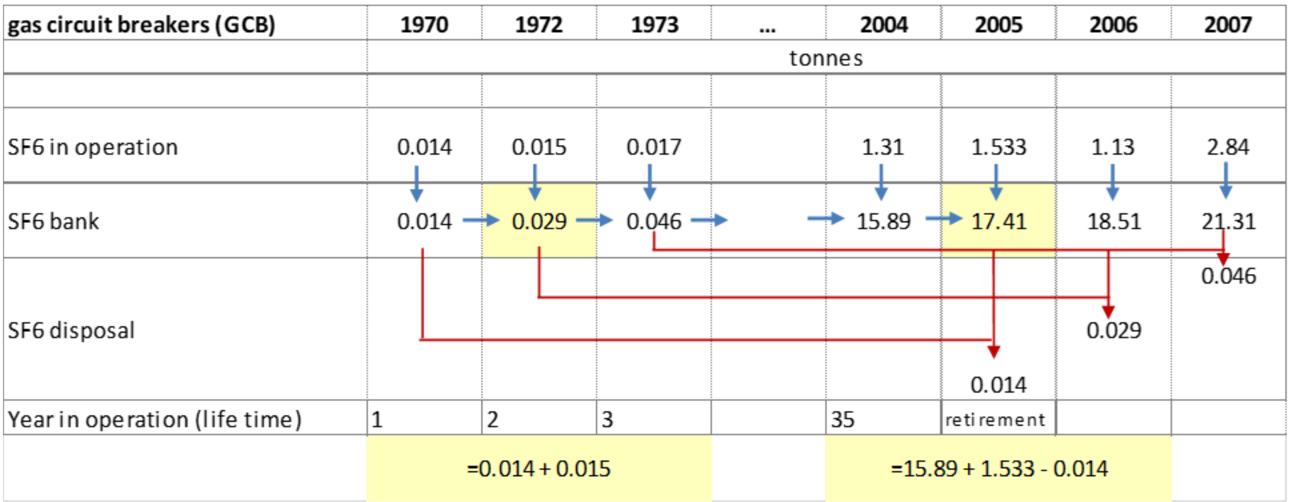
Where:

Equipment Manufacturing Emissions at the facility level can be estimated by Equations 8.4A and 8.4B. *Equipment Installation Emissions* at the facility level can be estimated by Equations 8.5A and 8.5B. *Equipment Use Emissions* at the facility level can be estimated by Equations 8.6A and 8.6B.

Equipment Disposal and Final Use Emissions at the facility level can be estimated by Equations 8.7A and 8.7B.

Emissions from SF_6 Recycling and Destruction at the facility level can be estimated by Equations 8.8 and 8.9.

In the following figure the way how the bank is estimated is presented.



gas circuit breakers (GCB)	1970	1972	1973	...	2004	2005	2006	2007
	tonnes							
SF6 in operation	0.014	0.015	0.017		1.31	1.533	1.13	2.84
SF6 bank	0.014	0.029	0.046		15.89	17.41	18.51	21.31
SF6 disposal						0.014	0.029	0.046
Year in operation (life time)	1	2	3		35	retirement		
	=0.014 + 0.015				=15.89 + 1.533 - 0.014			

Figure 191 General overview on preparation the bank for operation/use and disposal/retirement

4.8.1.1.2 Activity data

In the following map the structure of the electricity generation, transmission and distribution network in Algeria is presented. However, it was only possible to collect activity data from electrical equipment - gas circuit breakers (GCB) - used for distribution. Activity data from electrical equipment used for transmission was not available.

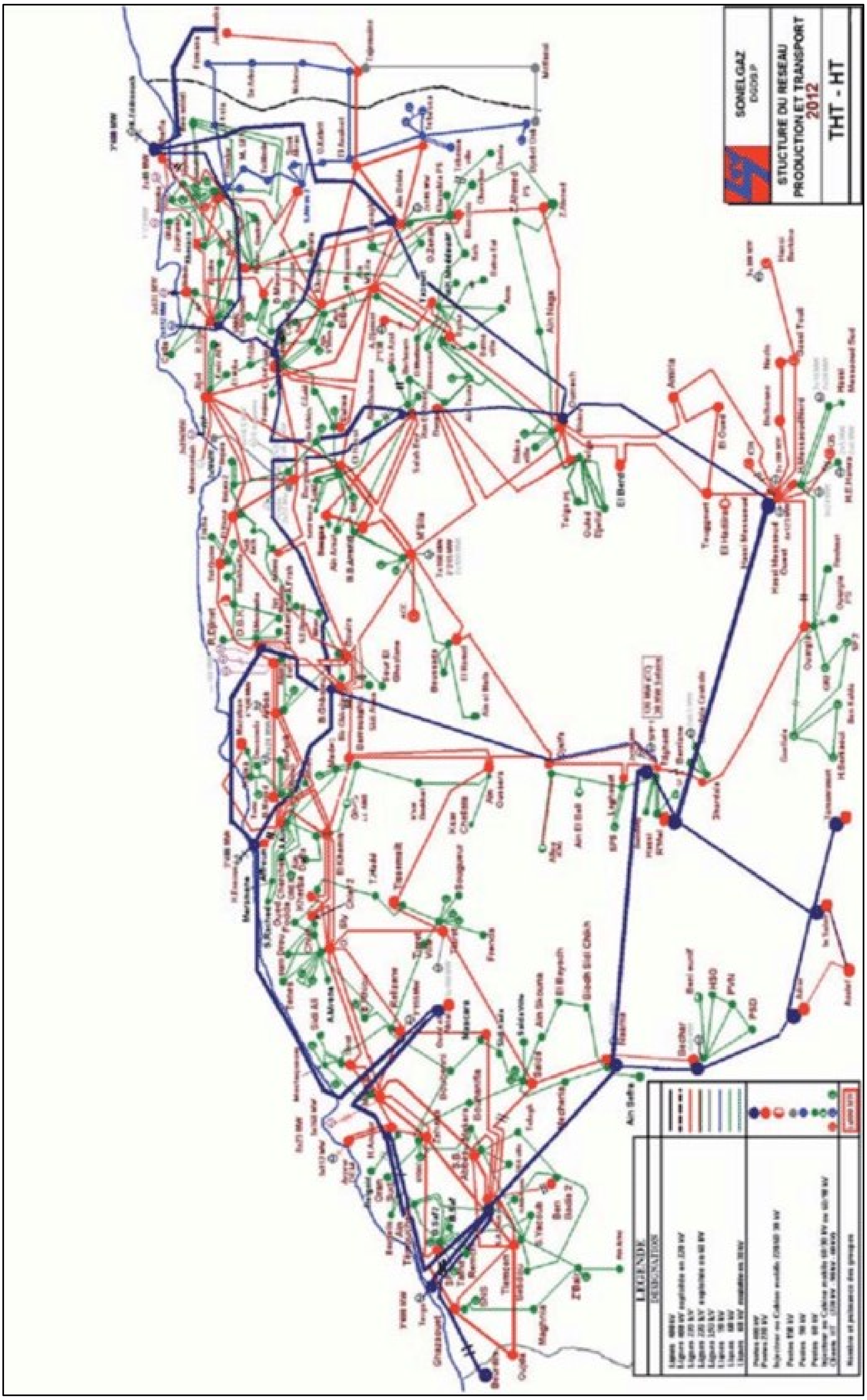


Figure 192 Structure of the electricity generation, transmission and distribution network; Source Sonelgaz (2012)[495]

Table 503 Activity data for IPCC category 2.G.1 *Electrical Equipment - SF_6 in electrical equipment in use and annual stock*

	SF_6 in Electrical equipment in use and annual stock									
gas circuit breakers (GCB)	**GCB - Equipment in operation**	**source**	**Bank - in operation**	**GCB - Equipment servicing / maintance**	**source**	**Bank servicing / maintance**	**GCB - Equipment storage**	**source**	**Bank - storage**	**Bank Equipment used in Distribution (MV)**
	tonnes		**tonnes**			**tonnes**	**tonnes**		**tonnes**	**tonnes**
1990	0.47	Extrapolatiion using the electricity production as surrogate data	3.31	0.00	Assuming 1% of SF_6 in equipment (as of 2007)	0.03	0.01	Assuming 3% of SF_6 in equipment (3 % Average of 2005-2012)	0.10	**3.44**
1991	0.51		3.82	0.01		0.04	0.02		0.11	**3.98**
1992	0.56		4.39	0.01		0.04	0.02		0.13	**4.56**
1993	0.62		5.00	0.01		0.05	0.02		0.15	**5.21**
1994	0.68		5.69	0.01		0.06	0.02		0.17	**5.91**
1995	0.75		6.43	0.01		0.06	0.02		0.19	**6.69**
1996	0.82		7.25	0.01		0.07	0.02		0.22	**7.54**
1997	0.90		8.16	0.01		0.08	0.03		0.24	**8.48**
1998	0.99		9.15	0.01		0.09	0.03		0.27	**9.51**
1999	1.09		10.24	0.01		0.10	0.03		0.31	**10.65**
2000	1.50	Sonelgaz	11.73	0.01		0.12	0.04		0.35	**12.20**
2001	0.85		12.58	0.01		0.13	0.03		0.38	**13.08**
2002	0.95		13.53	0.01		0.14	0.03		0.41	**14.08**
2003	1.05		14.58	0.01		0.15	0.03		0.44	**15.16**
2004	1.31		15.89	0.01		0.16	0.04		0.48	**16.53**
2005	1.53		17.41	0.02		0.17	0.02	Sonelgaz	0.49	**18.08**
2006	1.13		18.51	0.01		0.19	0.07		0.56	**19.26**
2007	2.84		21.31	0.02	Sonelgaz	0.20	0.06		0.62	**22.14**
2008	3.04		24.28	0.00		0.20	0.06		0.68	**25.16**
2009	2.62		26.82	0.00		0.20	0.06		0.73	**27.75**
2010	2.86		29.56	0.02		0.22	0.06		0.79	**30.57**
2011	3.09		32.51	0.02		0.24	0.06		0.84	**33.59**
2012	3.89		36.21	0.03		0.27	0.06		0.89	**37.37**
2013	5.63		41.60	0.03		0.30	0.06		0.94	**42.84**
2014	5.63		46.93	0.03		0.33	0.06		0.99	**48.25**
2015	5.50		52.04	0.04		0.36	0.06		1.04	**53.44**
2016	5.74		57.28	0.04		0.39	0.06		1.08	**58.75**
2017	5.85		62.47	0.43		0.82	0.18		1.24	**64.54**
2018	6.58		68.20	0.06		0.87	0.10		1.32	**70.39**
2019	5.96		73.08	0.04		0.90	0.10		1.39	**75.37**
2020	6.43		78.15	0.05		0.94	0.10		1.44	**80.53**
Trend										
1990 - 2020	1280%		2261%	964%		2728%	583%		1354%	**2239%**
2005 - 2020	320%		349%	224%		438%	431%		192%	**345%**
2019 - 2020	8%		7%	24%		4%	-5%		4%	**7%**

Table 504 Activity data for IPCC category 2.G.1 *Electrical Equipment* - SF_6 in Manufacture of electrical equipment and in disposed electrical equipment filled with SF_6 and annual Electricity production

	Manufacture	**Disposal**	**Revocery**	**Electricity production**
	tonnes	**tonnes**		**1000 GWh**
1990	NO	0.10	NO	16.10
1991	NO	0.11	NO	17.35
1992	NO	0.13	NO	18.29
1993	NO	0.15	NO	19.42
1994	NO	0.17	NO	19.89
1995	NO	0.19	NO	19.71
1996	NO	0.22	NO	20.65
1997	NO	0.24	NO	21.49
1998	NO	0.27	NO	23.62
1999	NO	0.31	NO	24.65
2000	NO	0.35	NO	25.41
2001	NO	0.38	NO	26.62
2002	NO	0.41	NO	27.65
2003	NO	0.44	NO	29.57
2004	NO	0.48	NO	31.25
2005	NO	0.49	NO	32.88
2006	NO	0.56	NO	35.23
2007	NO	0.62	NO	37.20
2008	NO	0.68	NO	40.24
2009	NO	0.73	NO	38.50
2010	NO	0.79	NO	45.73
2011	NO	0.84	NO	51.22
2012	NO	0.89	NO	57.40
2013	NO	0.94	NO	59.89
2014	NO	0.99	NO	64.38
2015	NO	1.04	NO	68.90
2016	NO	1.08	NO	71.09
2017	NO	1.24	NO	76.02
2018	NO	1.32	NO	76.66
2019	NO	1.39	NO	81.53
2020	NO	1.44	NO	79.20
Trend				
1990 - 2020	*NA*			*392%*
2005 - 2020	*NA*			*141%*
2019 - 2020	*NA*			*-3%*

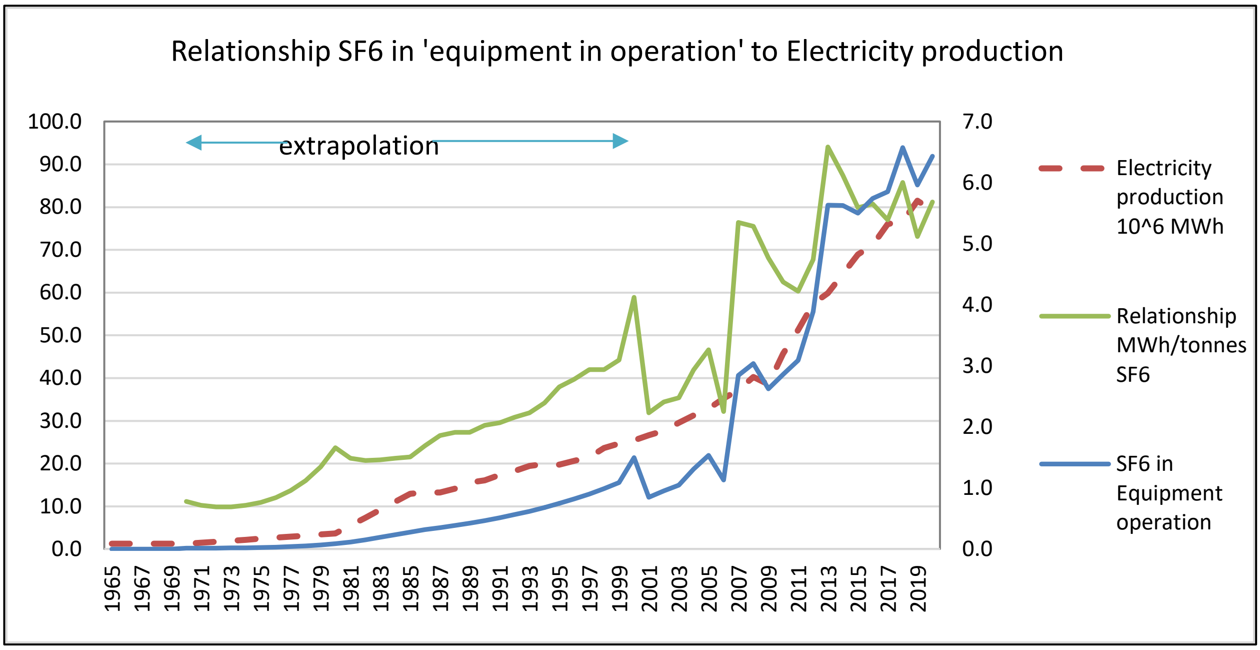


Figure 193 Extrapolation using electricity production as surrogate data.

4.8.1.1.3 Emission factors

The default emission factors for SF_6 for sealed pressure electrical equipment (MV switchgear) containing SF_6 were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 505 Default Emission factor for SF_6 for Sealed pressure electrical equipment (MV switchgear) containing SF_6 for IPCC category 2.G.1 *Electrical Equipment*

SF_6 emission factor	**Manufacturing**		**Use** Includes leakage. major failures / arc faults and maintenance losses		**Disposal**					
	Fraction SF_6 consumption by manufacturers		**Fraction per year of all equipment installed / in operation**		**Lifetime (years)**		**Fraction of charge remaining at retirement**		**Fraction of Disposed Equipment**	
	EF	**type**	**EF**	**type**	**EF**	**type**	**EF**	**type**	**EF**	**type**
Europe	0.07	D	0.002	00000D	35	D	0.93	D	1	D
Note:										
D Default		CS Country specific		PS Plant specific		IEF Implied emission factor				

It is assumed, that no recovery and/or recycling took place. The entire fraction of the SF_6 charge remaining at retirement is released to atmosphere at the stage of disposal.

4.8.1.2 Description of any flexibility applie

No flexibility was applied. (This item is not valid for reporting under the convention)

4.8.1.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 2.G.1 *Electrical Equipment* are presented in the following table.

Table 506 Uncertainty for IPCC category 2.G.1 *Electrical Equipment.*

Uncertainty	**SF_6**			
	Use phase	Disposal	**2.G.1 Electrical Equipment**	**Reference:** 2006 IPCC GL. Vol. 3. Chap. 8
Activity data (AD)	100%	-		Based on Chap. 8.2.3
Lifetime (years)	-	40%		Table 8.5
Emission factor (EF)	±20%	5%		Table 8.5
Combined Uncertainty (U)	102%	40%	110%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are consistent as the same methodology is applied to the whole period.

4.8.1.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - consistent use of energy balance data (preparation of a time series),
  - documented sources,
  - use of units and conversion factors,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection.
  - unique use of formulas, special cases are documented/highlighted.
  - quick-control checks for data consistency through all steps of calculation.
- time series consistency - plausibility checks of dips and jumps.

4.8.1.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 2.G.1 *Electrical Equipment*.

Table 507 Recalculations done since NC in IPCC category 2.G.1 *Electrical Equipment*

source category	**Revisions of data**	**Type of revision**	**Type of improvement**
2.G.1	Application of 2006 IPCC Guidelines methodology	method	Comparability
2.G.1	Use of emission factor of 2006 IPCC	EF	Comparability
2.G.1	Extrapolation using surrogate data for preparation the time-series 1970-2020	AD	Accuracy Transparency Completeness

4.8.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 508 Planned improvements for IPCC category 2.G.1 *Electrical Equipment*.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.G.1.a	Identification of ‘Electrical Equipment Manufacture sector’ and relevant manufactures, equipment remakers and servicing companies, importers, exporters and distributers related to • Manufacture of ▪ gas insulated switchgear (GIS) , ▪ gas circuit breakers (GCB) , ▪ high voltage gas-insulated lines (GIL), ▪ outdoor gas-insulated instrument transformers, ▪ reclosers, ▪ switches, and ▪ ring main units of both types /differentiated to **sealed and closed pressure systems**, resp. up to and above 52kV ▪ other equipment including but not limited to cast resin instrument transformers and certain types of bushings using SF_6 either as gas for the casting process or as a blowing agent; • Manufacturer of gas-insulated power transformers (GIT) *The SF_6 distribution chain from producers and distributors to manufacturing facilities.*	AD	Completeness Transparency	High
2.G.1.a	• Collection of activity data ’SF_6 consumption’ and compilation of time series 1970 – 2020 from identified stakeholders of the ‘Electrical Equipment Manufacture sector’ using information on • purchases of SF_6. • their returns of SF_6 to chemical producers, and • changes in their inventory of SF_6 in containers. • Performing completeness checks by including information from chemical producers and/or distributors on their sales to equipment manufacturers (less any returns). • Ensure confidentiality for single stakeholder but also for entire ‘Electrical Equipment Manufacture sector’ • Ensure data collection (practicability) for future years	AD	Completeness Transparency Comparability Accuracy	High
2.G.1.a	Preparation of plant or country specific emission factor for pillar years • Emission factors for the Tier 2 method are generally developed on the basis of data collected from representative manufacturers and utilities that track emissions by life cycle stage, essentially using the Tier 3, pure mass-balance method at their facilities for at least one year.	EF	Completeness Transparency Comparability Accuracy	High
2.G.1.a	Estimation emission of SF_6 from ‘Electrical Equipment Manufacture sector’	Meth	Completeness Transparency Comparability	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.G.1.a	Investigation of PFC used in 'Electrical Equipment Manufacture in the country. If yes, • Collect annual, country-wide consumption of PFC by equipment manufacturers • *Manufacture sector comprises (see above)* • Estimation of esmissions from 2.G.1.a *(see above)*	AD	Completeness Transparency	High
2.G.1.a	Investigation of electrical equipment manufacturers using PFC were in the country. If yes, • Annual, country-wide consumption of PFC by equipment manufacturers Estimation of emissions from 2.G.1.a	AD	Completeness Transparency	High
2.G.1.a	Investigation of electrical equipment manufacturers using PFC were in the country Collection of activity data for PFC The IPCC category 2.G.1.a Manufacture of Electrical Equipment does not existed in Algeria: it is assumed that no manufacture of electrical equipment, which was filled with PFC and/or SF6 in country, took place. Annual, country-wide consumption of PFC by equipment manufacturers	AD	Accuracy Transparency Completeness	High

4.8.2 SF_6 and PFCs from Other Product Uses (IPCC category 2.G.2)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.2	SF_6 and PFCs from Other Product Uses						
2.G.2.a	Military Applications	NA	-	NA	-	NA	-
2.G.2.b	Accelerators						
2.G.2.b.i	University and Research Particle Accelerators	NA	-	NA	-	NA	-
2.G.2.b.ii	Industrial and Medical Particle Accelerators	NA	-	NA	-	NA	-
2.G.2.c	Other	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.2	SF_6 and PFCs from Other Product Uses								
2.G.2.a	Military Applications	NO	-	NO	-	NE	-	NO	-
2.G.2.b	Accelerators								
2.G.2.b.i	University and Research Particle Accelerators	NO	-	NO	-	NE	-	NO	-
2.G.2.b.ii	Industrial and Medical Particle Accelerators	NO	-	NO	-	NE	-	NO	-
2.G.2.c	Other	NO	-	NO	-	NE	-	NO	-

A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE - included elsewhere NE - not estimated. NA - not applicable. C – confidential

LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF

Emissions from IPCC category 2.G.2 SF6 and PFCs from Other Product Uses are not estimated due to lack of resources and data.

4.8.2.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 509 Planned improvements for IPCC sub-category 2.G.2 SF_6 and PFCs from Other Product Use.

GHG source & sink category	**Planned improvement**		**Type of improvement**		**Priority**
2.G.2	Analysis of production, import and export of ‘other products’ containing SF_6 and PFCs, e.g., • SF_6 and PFCs used in military applications • SF_6 used in sound-proof windows • SF_6 used in shoes		AD	Accuracy Transparency Completeness Comparability	High
2.G.2	Estimation of SF_6 and PFCs emissions from use of ‘other products’ containing SF_6 and PFCs according to 2006 IPCC Guidelines, Vol. 3, Chapter 8: Other Product Manufacture and Use (8.3 Use of SF_6 and PFCs in other products)		AD	Accuracy Transparency Completeness Comparability	High

4.8.3 N_2O from Product Uses (IPCC category 2.G.3)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.3	N_2O from Product Uses						
2.G.3.a	Medical Applications	NA	-	NA	-	NE	-
2.G.3.b	Propellant for pressure and aerosol products	NA	-	NA	-	NE	-
2.G.3.c	Other	NA	-	NA	-	NE	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.3	N_2O from Product Uses								
2.G.3.a	Medical Applications	NA	-	NA	-	NA	-	NA	-
2.G.3.b	Propellant for pressure and aerosol products	NA	-	NA	-	NA	-	NA	-
2.G.3.c	Other	NA	-	NA	-	NA	-	NA	-
A '✓' indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The emissions from IPCC category 2.G.3 *N_2O from Product Uses* are not estimated due to lack of resources and data.

4.8.3.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 510 Planned improvements for IPCC sub-category 2.G.3 N_2O from Product Use.

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.G.3	Estimation of N_2O emissions from the use of products containing N_2O applying Tier 1 of 2006 IPCC Guidelines, Vol. 3. Chapter 8: Other Product Manufacture and Use (N_2O from product uses)	AD	Accuracy Transparency Completeness Comparability	High

4.8.4 Other (IPCC category 2.G.4)

IPCC code	Description	CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.4	Other	NA	-	NA	-	NA	-

IPCC code	Description	HFC		PFC		SF_6		NF_3	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.G.4	Other	NO	-	NO	-	NO	-	NO	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.G.4 *Other* does not exist in Algeria.

4.9 Other (IPCC category 2.H)

The IPCC category 2.H comprises activities withing Pulp and paper as well as Food and drink industry, where GHG emissions are arising. These industries emit only process related GHGs of biogenic origin and those have not been accounted for according to the guidelines.

4.9.1 Pulp and Paper Industry (IPCC category 2.H.1)

IPCC code	Description	Fossil CO_2		Biogenic CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.H.1	Pulp and Paper Industry	NA	-	NE	-	NA	-	NA	-
A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.H.1 *Pulp and Paper Industry* exists in Algeria. Pulp and paper industry emit only process related GHGs of biogenic origin and those have not been accounted for according to the 2006 IPCC guidelines. Relevant GHG emission from fuel combustion activities in *Pulp and Paper Industry* are reported in IPCC category 1.A.2 *Manufacturing Industries and Construction - Pulp, Paper and Print* (IPCC sub-category 1.A.2.d).

4.9.2 Food and Beverages Industry (IPCC category 2.H.2)

IPCC code	Description	Fossil CO_2		Biogenic CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.H.2	Food and Beverages Industry	NA	-	NE	-	NA	-	NA	-
A ‘✓’ indicates emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.D.2 *Food and Beverages Industry* does not exist in Algeria. Food and Beverages Industry emit only process related GHGs of biogenic origin and those have not been accounted for according to the 2006 IPCC guidelines. Relevant GHG emission from fuel combustion activities in *Food and Beverages Industry* are reported in IPCC category 1.A.2 *Manufacturing Industries and Construction* under IPCC category 1.A.2.e *Food Processing, Beverages and Tobacco*.

4.9.3 Other (IPCC category 2.H.3)

IPCC code	Description	Fossil CO_2		Biogenic CO_2		CH_4		N_2O	
		Estimated	Key Category	Estimated	Key Category	Estimated	Key Category	Estimated	Key Category
2.H.3	Other (please specify)	NA	-	NE	-	NA	-	NA	-
A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere. NE -not estimated. NA -not applicable. C – confidential									
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF									

The IPCC category 2.H.3 *Other* does not exist in Algeria.

5 Agriculture (IPCC sector 3)

5.1 Overview of the sector

This chapter includes information on description of methodologies used for estimating GHG emissions as well as references to activity data and emission factors reported under IPCC Sector 3 Agriculture for the period 1990 to 2020.

GHG emissions from this sector comprise emissions from the following categories:

IPCC Code	Description	CO_2	CH_4	N_2O
3.A	Enteric Fermentation	NA	✓	NA
3.B	Manure Management	NA	✓	✓
3.C	Rice Cultivation	NA	NO	NA
3.D	Agricultural soils			
3.D.a	Direct N_2O emissions from managed soils	NA	NA	✓
3.D.b	Indirect N_2O Emissions from managed soils	NA	NA	NE
3.E	Prescribed burning of savannas	NO*	NO	NO
3.F	Field burning of agricultural residues	✓*	✓	✓
3.G	Liming	NO	NA	NA
3.H	Urea application	✓	NA	NA
3.I	Other carbon-containing fertilizers	NO	NA	NA
3.J	Other (please specify)	NO	NO	NO

A '✓' indicates: emissions from this sub-category have been estimated.

* CO_2 from biomass burning are not accounted in this categories

Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential

5.1.1 Emission trends

In the period 1990 to 2020 GHG emissions from the Agriculture Sector increased by 74.3 % from 11,230.85 kt CO_2 equivalents in 1990 to 19,575.24 kt CO_2 equivalents in 2020. In the period 2005 to 2020 GHG emissions from the IPCC sector 3 Agriculture increased by 44.4 % from 13,558.66 kt CO_2 equivalents in 2005 to 19,575.24 kt CO_2 equivalents in 2020. The increase of emissions is mainly caused by increasing emissions from *Enteric Fermentation and Manure Management* (IPCC subcategory 3.A and 3.B) due to growing number of livestock due to numbers imported and the increasing intensive livestock farming with high milk and meat production according to the National strategy for improving food security and agricultural development implemented by the government and the instauration of the new collecting data system in the Ministry of agriculture also since 2000 and Agricultural Soils (IPCC subcategory 3.D).

In the period 2019 to 2020 GHG emissions from the Agriculture Sector increased by 1.7% from 19,241.69 kt CO_2 eq in 2019 to 19,575.24 kt CO_2 eq in 2020. In 2018 the import of livestock was stopped due to diseases and later the worldwide pandemic.

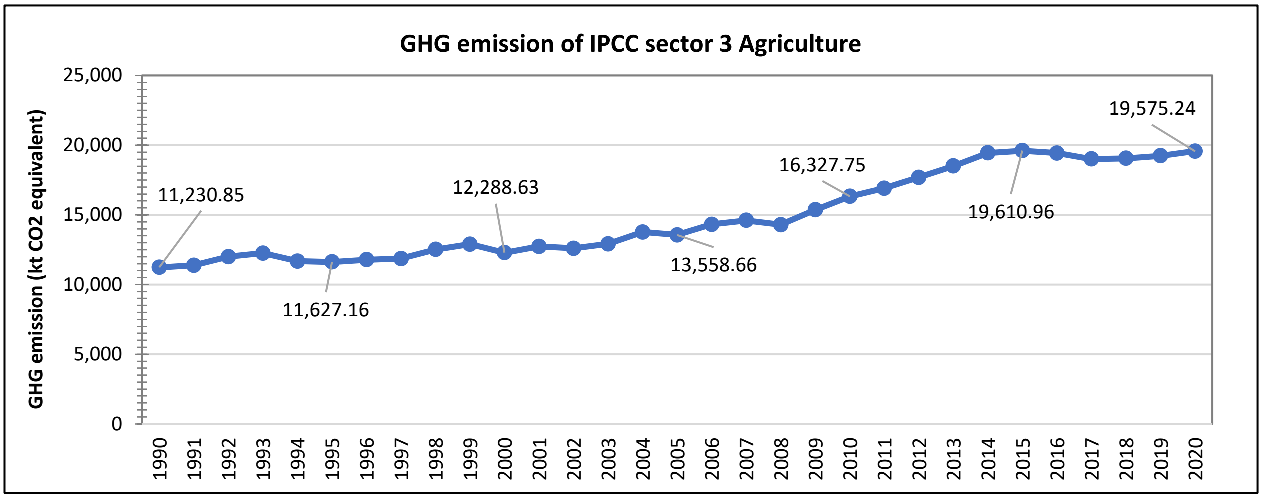


Figure 194 Trend of GHG emissions from 1990 – 2020 for sector Agriculture

Emissions from the Agriculture Sector is one of important source of GHGs in Algeria:

- in 1990 about 11.6% of the total national GHG (without LULUCF) emissions arose from the sector Agriculture, and 4.77 % of total CO_2 in 2010, whereas N_2O and CH_4 emissions were about 78.2 % and 26.5 %, respectively.
- in 2005 about 9.1% of the total national GHG emissions arose from the sector Agriculture, whereas 74.7 % and 19.7 % of emissions were from N_2O and CH_4 respectively.
- in 2020 about 8.9 % of the total national GHG emissions arose from the sector Agriculture, whereas 72.8 % and 26.5 % of emissions were from N_2O and CH_4 respectively.

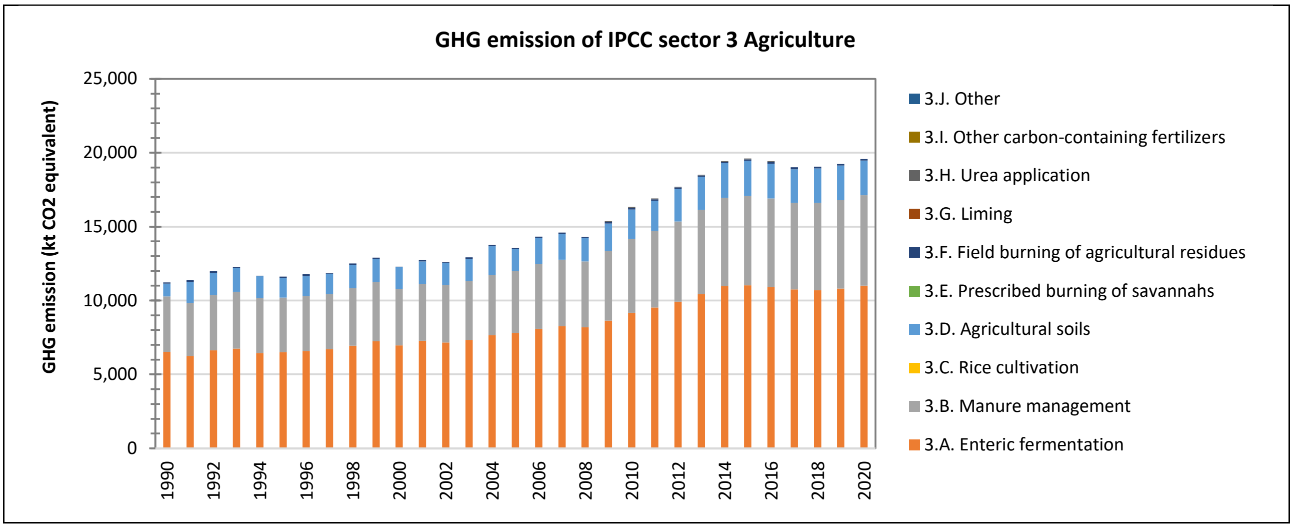


Figure 195 Total GHG emissions by category of IPCC sector 3 Agriculture (1990-2020)

The most important sources of GHGs in the Agriculture Sector is IPCC subcategory 3.A *Enteric Fermentation*. With regards to CH_4 emission, also the source IPCC subcategory 3.A *Enteric Fermentation* was the primary source. With regards to N_2O emission, the source IPCC subcategory 3.B *Manure management* was the primary source.

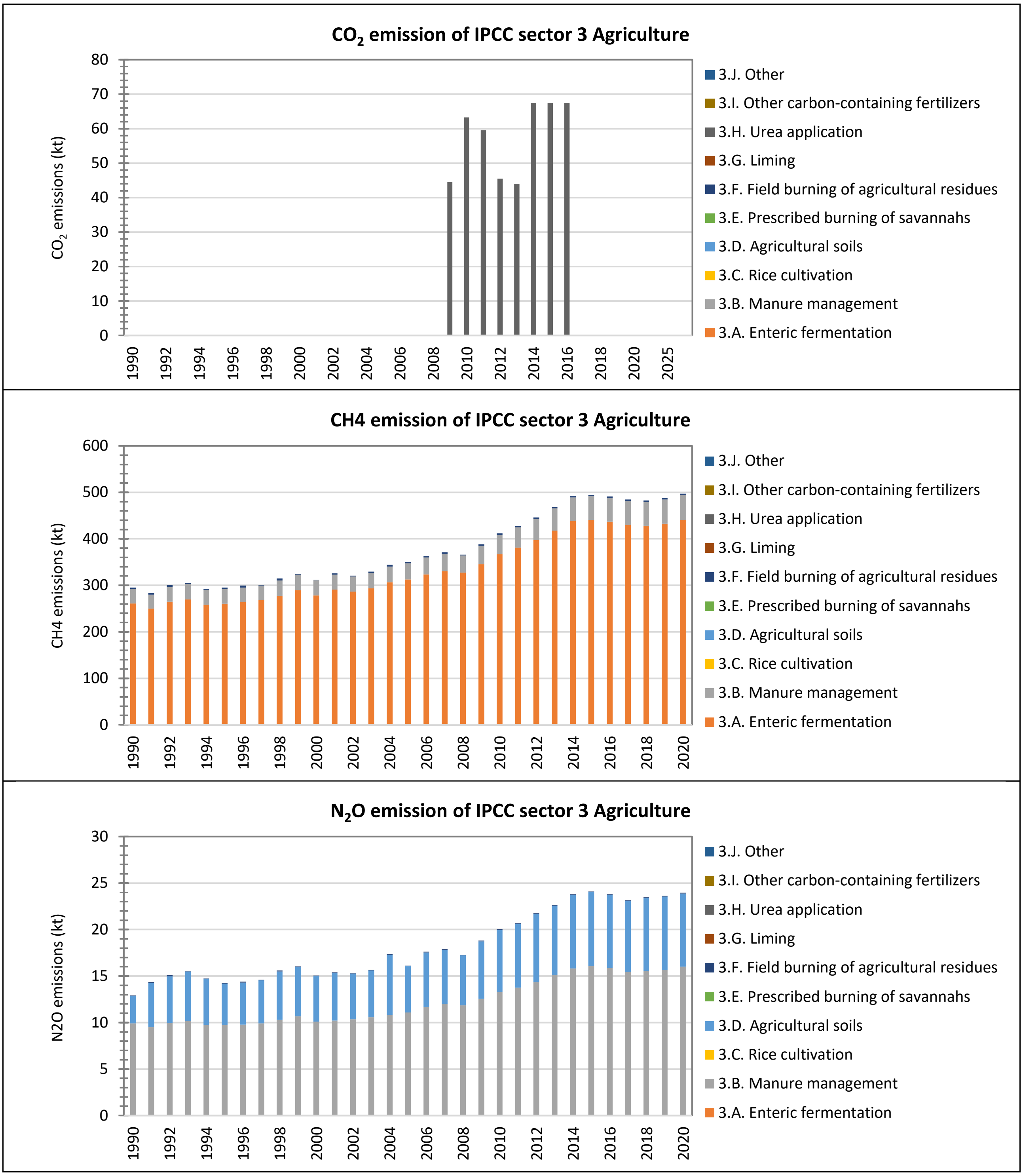


Figure 196 Emissions by category of IPCC sector 3 Agriculture

Table 511 Emissions from IPCC sector 3 Agriculture: 1990-2020

GHG emissions	**TOTAL GHG**	**CO_2**	**CH_4**	**N_2O**	**CH_4**	**N_2O**
	kt CO_2 equivalent	**kt**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt**	**kt**
1990	11,230.85	NE	7,381.08	3,849.77	295.24	12.92
1991	11,377.41	NE	7,098.79	4,278.62	283.95	14.36
1992	12,002.50	NE	7,510.12	4,492.38	300.40	15.08
1993	12,258.14	NE	7,620.63	4,637.51	304.83	15.56
1994	11,680.50	NE	7,293.96	4,386.54	291.76	14.72
1995	11,627.16	NE	7,375.67	4,251.49	295.03	14.27
1996	11,777.04	NE	7,484.43	4,292.62	299.38	14.40
1997	11,862.36	NE	7,516.71	4,345.66	300.67	14.58
1998	12,514.68	NE	7,863.08	4,651.59	314.52	15.61
1999	12,897.41	NE	8,119.40	4,778.01	324.78	16.03
2000	12,288.63	NE	7,801.06	4,487.57	312.04	15.06
2001	12,738.10	NE	8,141.98	4,596.13	325.68	15.42
2002	12,594.68	NE	8,023.11	4,571.57	320.92	15.34
2003	12,917.22	NE	8,241.74	4,675.48	329.67	15.69
2004	13,773.12	NE	8,597.94	5,175.17	343.92	17.37
2005	13,558.66	NE	8,754.85	4,803.81	350.19	16.12
2006	14,319.76	NE	9,073.40	5,246.36	362.94	17.61
2007	14,600.43	NE	9,269.88	5,330.55	370.80	17.89
2008	14,300.68	NE	9,152.80	5,147.88	366.11	17.27
2009	15,359.38	44.53	9,705.34	5,609.51	388.21	18.82
2010	16,327.75	63.27	10,294.07	5,970.41	411.76	20.03
2011	16,907.35	59.50	10,692.33	6,155.52	427.69	20.66
2012	17,696.15	45.47	11,155.00	6,495.68	446.20	21.80
2013	18,506.06	44.00	11,711.31	6,750.75	468.45	22.65
2014	19,442.91	67.47	12,287.95	7,087.50	491.52	23.78
2015	19,610.96	67.47	12,359.07	7,184.43	494.36	24.11
2016	19,437.17	67.47	12,275.32	7,094.38	491.01	23.81
2017	19,014.28	NE	12,113.80	6,900.48	484.55	23.16
2018	19,054.22	NE	12,061.76	6,992.46	482.47	23.46
2019	19,241.69	NE	12,196.71	7,044.98	487.87	23.64
2020	19,575.24	NE	12,433.64	7,141.61	497.35	23.97
Trend						
1990 - 2020	74.3%	NA	68.5%	85.5%	68.5%	85.5%
2005 - 2020	44.4%	NA	42.0%	48.7%	42.0%	48.7%
2019 - 2020	1.7%	NA	1.9%	1.4%	1.9%	1.4%

Table 512 GHG Emissions from IPCC sector 3 Agriculture by categories

	3	3.A	3.B	3.C	3.D	3.E	3.F	3.G	3.H	3.I	3.J
GHG	**Agriculture**	**Enteric fermentation**	**Manure management**	**Rice cultivation**	**Agricultural soils**	**Prescribed burning of savannahs**	**Field burning agricultural residues**	**Liming**	**Urea application**	**Other carbon-containing fertilizers**	**Other**
	kt CO_2 equivalent										
1990	11,230.85	6,523.74	3,747.65	NA	872.95	NA	86.50	NO	NE	NA	NA
1991	11,377.41	6,245.40	3,590.06	NA	1,416.49	NA	125.46	NO	NE	NA	NA
1992	12,002.50	6,617.61	3,768.34	NA	1,487.43	NA	129.12	NO	NE	NA	NA
1993	12,258.14	6,737.64	3,859.99	NA	1,589.49	NA	71.02	NO	NE	NA	NA
1994	11,680.50	6,458.42	3,702.41	NA	1,473.06	NA	46.62	NO	NE	NA	NA
1995	11,627.16	6,514.52	3,687.49	NA	1,331.41	NA	93.75	NO	NE	NA	NA
1996	11,777.04	6,595.88	3,698.37	NA	1,349.72	NA	133.07	NO	NE	NA	NA
1997	11,862.36	6,698.23	3,739.87	NA	1,383.94	NA	40.31	NO	NE	NA	NA
1998	12,514.68	6,935.69	3,897.75	NA	1,552.81	NA	128.43	NO	NE	NA	NA
1999	12,897.41	7,237.19	4,014.45	NA	1,577.37	NA	68.40	NO	NE	NA	NA
2000	12,288.63	6,963.58	3,821.04	NA	1,466.63	NA	37.37	NO	NE	NA	NA
2001	12,738.10	7,271.54	3,845.32	NA	1,534.59	NA	86.65	NO	NE	NA	NA
2002	12,594.68	7,167.77	3,889.16	NA	1,470.97	NA	66.77	NO	NE	NA	NA
2003	12,917.22	7,337.03	3,972.70	NA	1,502.45	NA	105.04	NO	NE	NA	NA
2004	13,773.12	7,660.08	4,073.68	NA	1,930.70	NA	108.65	NO	NE	NA	NA
2005	13,558.66	7,812.72	4,184.90	NA	1,477.98	NA	83.06	NO	NE	NA	NA
2006	14,319.76	8,089.87	4,394.16	NA	1,741.31	NA	94.42	NO	NE	NA	NA
2007	14,600.43	8,258.17	4,509.90	NA	1,730.81	NA	101.56	NO	NE	NA	NA
2008	14,300.68	8,187.72	4,454.97	NA	1,605.50	NA	52.49	NO	NE	NA	NA
2009	15,359.38	8,635.15	4,728.35	NA	1,839.10	NA	112.25	NO	44.53	NA	NA
2010	16,327.75	9,172.44	4,994.96	NA	1,996.13	NA	100.95	NO	63.27	NA	NA
2011	16,907.35	9,532.42	5,190.02	NA	2,034.07	NA	91.34	NO	59.50	NA	NA
2012	17,696.15	9,931.82	5,414.63	NA	2,196.03	NA	108.21	NO	45.47	NA	NA
2013	18,506.06	10,439.89	5,691.68	NA	2,234.75	NA	95.74	NO	44.00	NA	NA
2014	19,442.91	10,968.58	5,969.75	NA	2,348.47	NA	88.64	NO	67.47	NA	NA
2015	19,610.96	11,018.95	6,051.84	NA	2,377.80	NA	94.91	NO	67.47	NA	NA
2016	19,437.17	10,916.70	5,998.89	NA	2,334.82	NA	119.30	NO	67.47	NA	NA
2017	19,014.28	10,751.56	5,866.21	NA	2,272.45	NA	124.05	NO	NE	NA	NA
2018	19,054.22	10,697.05	5,905.53	NA	2,341.85	NA	109.79	NO	NE	NA	NA
2019	19,241.69	10,805.37	5,977.82	NA	2,345.90	NA	112.60	NO	NE	NA	NA
2020	19,575.24	10,998.49	6,124.74	NA	2,349.92	NA	102.10	NO	NE	NA	NA
Trend											
1990 - 2020	74.3%	68.6%	63.4%	NA	169.2%	NA	18.0%	NA	NA	NA	NA
2005 - 2020	44.4%	40.8%	46.4%	NA	59.0%	NA	22.9%	NA	NA	NA	NA
2019 - 2020	1.7%	1.8%	2.5%	NA	0.2%	NA	-9.3%	NA	NA	NA	NA

Table 513 CO_2 Emissions from IPCC sector 3 Agriculture by categories

	3	**3.A**	**3.B**	**3.C**	**3.D**	**3.E**	**3.F**	**3.G**	**3.H**	**3.I**	**3.J**
CO_2	**Agriculture**	**Enteric fermentation**	**Manure management**	**Rice cultivation**	**Agricultural soils**	**Prescribed burning of savannahs**	**Field burning agricultural residues**	**Liming**	**Urea application**	**Other carbon-containing fertilizers**	**Other**
	kt CO_2										
1990	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1991	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1992	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1993	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1994	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1995	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1996	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1997	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1998	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
1999	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2000	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2001	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2002	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2003	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2004	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2005	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2006	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2007	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2008	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2009	44.53	NA	NA	NA	NA	NA	NA	NO	44.53	NA	NA
2010	63.27	NA	NA	NA	NA	NA	NA	NO	63.27	NA	NA
2011	59.50	NA	NA	NA	NA	NA	NA	NO	59.50	NA	NA
2012	45.47	NA	NA	NA	NA	NA	NA	NO	45.47	NA	NA
2013	44.00	NA	NA	NA	NA	NA	NA	NO	44.00	NA	NA
2014	67.47	NA	NA	NA	NA	NA	NA	NO	67.47	NA	NA
2015	67.47	NA	NA	NA	NA	NA	NA	NO	67.47	NA	NA
2016	67.47	NA	NA	NA	NA	NA	NA	NO	67.47	NA	NA
2017	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2018	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2019	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
2020	NE	NA	NA	NA	NA	NA	NA	NO	NE	NA	NA
Trend											
1990 - 2020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2005 - 2020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2019 - 2020	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 514 CH_4 Emissions from IPCC sector 3 Agriculture by categories

	3	**3.A**	**3.B**	**3.C**	**3.D**	**3.E**	**3.F**	**3.G**	**3.H**	**3.I**	**3.J**
CH_4	**Agriculture**	**Enteric fermentation**	**Manure management**	**Rice cultivation**	**Agricultural soils**	**Prescribed burning of savannahs**	**Field burning agricultural residues**	**Liming**	**Urea application**	**Other carbon-containing fertilizers**	**Other**
	kt CH_4										
1990	295.24	260.95	31.65	NO	NO	NO	2.64	NO	NA	NO	NO
1991	283.95	249.82	30.30	NO	NO	NO	3.83	NO	NO	NO	NO
1992	300.40	264.70	31.76	NO	NO	NO	3.95	NO	NO	NO	NO
1993	304.83	269.51	33.15	NO	NO	NO	2.17	NO	NO	NO	NO
1994	291.76	258.34	32.00	NO	NO	NO	1.42	NO	NO	NO	NO
1995	295.03	260.58	31.58	NO	NO	NO	2.86	NO	NO	NO	NO
1996	299.38	263.84	31.48	NO	NO	NO	4.07	NO	NO	NO	NO
1997	300.67	267.93	31.51	NO	NO	NO	1.23	NO	NO	NO	NO
1998	314.52	277.43	33.17	NO	NO	NO	3.92	NO	NO	NO	NO
1999	324.78	289.49	33.20	NO	NO	NO	2.09	NO	NO	NO	NO
2000	312.04	278.54	32.36	NO	NO	NO	1.14	NO	NO	NO	NO
2001	325.68	290.86	32.17	NO	NO	NO	2.65	NO	NO	NO	NO
2002	320.92	286.71	32.17	NO	NO	NO	2.04	NO	NO	NO	NO
2003	329.67	293.48	32.98	NO	NO	NO	3.21	NO	NO	NO	NO
2004	343.92	306.40	34.19	NO	NO	NO	3.32	NO	NO	NO	NO
2005	350.19	312.51	35.15	NO	NO	NO	2.54	NO	NO	NO	NO
2006	362.94	323.59	36.46	NO	NO	NO	2.89	NO	NO	NO	NO
2007	370.80	330.33	37.37	NO	NO	NO	3.10	NO	NO	NO	NO
2008	366.11	327.51	37.00	NO	NO	NO	1.60	NO	NO	NO	NO
2009	388.21	345.41	39.38	NO	NO	NO	3.43	NO	NO	NO	NO
2010	411.76	366.90	41.78	NO	NO	NO	3.08	NO	NO	NO	NO
2011	427.69	381.30	43.61	NO	NO	NO	2.79	NO	NO	NO	NO
2012	446.20	397.27	45.62	NO	NO	NO	3.31	NO	NO	NO	NO
2013	468.45	417.60	47.93	NO	NO	NO	2.93	NO	NO	NO	NO
2014	491.52	438.74	50.07	NO	NO	NO	2.71	NO	NO	NO	NO
2015	494.36	440.76	50.70	NO	NO	NO	2.90	NO	NO	NO	NO
2016	491.01	436.67	50.70	NO	NO	NO	3.65	NO	NO	NO	NO
2017	484.55	430.06	50.70	NO	NO	NO	3.79	NO	NO	NO	NO
2018	482.47	427.88	51.23	NO	NO	NO	3.35	NO	NO	NO	NO
2019	487.87	432.21	52.21	NO	NO	NO	3.44	NO	NO	NO	NO
2020	497.35	439.94	54.29	NO	NO	NO	3.12	NO	NO	NO	NO
Trend											
1990 - 2020	68.5%	68.6%	71.5%	NA	NA	NA	18.0%	NA	NA	NA	NA
2005 - 2020	42.0%	40.8%	54.5%	NA	NA	NA	22.9%	NA	NA	NA	NA
2019 - 2020	1.9%	1.8%	4.0%	NA	NA	NA	-9.3%	NA	NA	NA	NA

Table 515 N_2O Emissions from IPCC sector 3 Agriculture by categories

	3	3.A	3.B	3.C	3.D	3.E	3.F	3.G	3.H	3.I	3.J
N_2O	**Agriculture**	**Enteric fermentation**	**Manure management**	**Rice cultivation**	**Agricultural soils**	**Prescribed burning of savannahs**	**Field burning agricultural residues**	**Liming**	**Urea application**	**Other carbon-containing fertilizers**	**Other**
	kt N_2O										
1990	12.92	NA	9.92	NO	2.93	NO	0.07	NA	NA	NA	NA
1991	14.36	NA	9.51	NO	4.75	NO	0.10	NA	NA	NA	NA
1992	15.08	NA	9.98	NO	4.99	NO	0.10	NA	NA	NA	NA
1993	15.56	NA	10.17	NO	5.33	NO	0.06	NA	NA	NA	NA
1994	14.72	NA	9.74	NO	4.94	NO	0.04	NA	NA	NA	NA
1995	14.27	NA	9.72	NO	4.47	NO	0.07	NA	NA	NA	NA
1996	14.40	NA	9.77	NO	4.53	NO	0.11	NA	NA	NA	NA
1997	14.58	NA	9.91	NO	4.64	NO	0.03	NA	NA	NA	NA
1998	15.61	NA	10.30	NO	5.21	NO	0.10	NA	NA	NA	NA
1999	16.03	NA	10.69	NO	5.29	NO	0.05	NA	NA	NA	NA
2000	15.06	NA	10.11	NO	4.92	NO	0.03	NA	NA	NA	NA
2001	15.42	NA	10.20	NO	5.15	NO	0.07	NA	NA	NA	NA
2002	15.34	NA	10.35	NO	4.94	NO	0.05	NA	NA	NA	NA
2003	15.69	NA	10.56	NO	5.04	NO	0.08	NA	NA	NA	NA
2004	17.37	NA	10.80	NO	6.48	NO	0.09	NA	NA	NA	NA
2005	16.12	NA	11.09	NO	4.96	NO	0.07	NA	NA	NA	NA
2006	17.61	NA	11.69	NO	5.84	NO	0.07	NA	NA	NA	NA
2007	17.89	NA	12.00	NO	5.81	NO	0.08	NA	NA	NA	NA
2008	17.27	NA	11.85	NO	5.39	NO	0.04	NA	NA	NA	NA
2009	18.82	NA	12.56	NO	6.17	NO	0.09	NA	NA	NA	NA
2010	20.03	NA	13.26	NO	6.70	NO	0.08	NA	NA	NA	NA
2011	20.66	NA	13.76	NO	6.83	NO	0.07	NA	NA	NA	NA
2012	21.80	NA	14.34	NO	7.37	NO	0.09	NA	NA	NA	NA
2013	22.65	NA	15.08	NO	7.50	NO	0.08	NA	NA	NA	NA
2014	23.78	NA	15.83	NO	7.88	NO	0.07	NA	NA	NA	NA
2015	24.11	NA	16.05	NO	7.98	NO	0.08	NA	NA	NA	NA
2016	23.81	NA	15.88	NO	7.83	NO	0.09	NA	NA	NA	NA
2017	23.16	NA	15.43	NO	7.63	NO	0.10	NA	NA	NA	NA
2018	23.46	NA	15.52	NO	7.86	NO	0.09	NA	NA	NA	NA
2019	23.64	NA	15.68	NO	7.87	NO	0.09	NA	NA	NA	NA
2020	23.97	NA	16.00	NO	7.89	NO	0.08	NA	NA	NA	NA
Trend											
1990 - 2020	85.5%	NA	61.3%	NA	169.2%	NA	18.0%	NA	NA	NA	NA
2005 - 2020	48.7%	NA	44.2%	NA	59.0%	NA	22.9%	NA	NA	NA	NA
2019 - 2020	1.4%	NA	2.0%	NA	0.2%	NA	-9.3%	NA	NA	NA	NA

5.1.2 Agricultural data collected and used

The original data provider for the national and international agricultural data were the Ministry of Agriculture and Rural Development (MADR)[496] and Statistical Office of Algeria (ONS) [497]. However, the agricultural data used and presented in this inventory are taken from the following national and international sources:

Statistiques agricoles [498]	The official statistics (several years) of MADR provides information on • usable land area and cultivated land area • crop production, crop yield of agricultural products • fruit and vegetable cultivated land area • fruit area and production by province • area and production of wheat, barley, maize etc • annual livestock numbers • livestock production by type
Données Statistiques - L'Agriculture[499]	The official statistics (several years) of ONS provides information on • usable land area and cultivated land area • crop production, crop yield of agricultural products • fruit and vegetable cultivated land area • fruit area and production by province • area and production of wheat, barley, maize etc • annual livestock numbers
FAO agricultural data base[500]	The FAO agricultural data base (FAOSTAT) provides worldwide harmonized data (FAO AGRICULTURE STATISTICAL SYSTEM 2001). The FAO data base provides data for the entire time series 1990 – 2020, provided by and for Algeria. Some data are based on estimates done by FAO.

The results of these QA/QC checks are presented in the following chapters under "Source-specific QA/QC and verification".

5.1.3 National Circumstances

Algeria is the largest country in North Africa covering an area of 238,174,100 ha (2,381,741 km^2) with a width of 1622 km and a length of 2000 km. This big extent combined with geological and geographical characteristics as well as factors climates of the country show from North to South a series of ecosystems, sheltering a diversity of habitats and a diversity of species, ranging from island and marine ecosystems, with a coastal ecosystem fringe, passing through forest and mountain ecosystems, followed by the steppe ecosystems, then the Saharan ecosystem and including the humid ecosystem which is found in these different ecosystems. In 2020, 17.4% of the national area was Agricultural land and about 0.8% Forest land. The agricultural land is divided in Cropland (3.6% of national area) and Land under permanent meadows and pastures (13.8% of national area).

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[496] Available (03. May 2022) on https://madr.gov.dz/

[497] Available (03. May 2020) on https://www.ons.dz/

[498] Available (03. May 2022) on n https://madr.gov.dz/Statistiques agricoles

[499] Available (03. May 2022) on https://www.ons.dz/spip.php?rubrique346; https://www.ons.dz/spip.php?rubrique306

[500] Available (03. May 2022) on http://www.fao.org/statistics/en/

Table 516 Land use: Agricultural land by category and Forest land

	A=B+E	B=*c*+*d*	*c*	*d*	E	F	**Share in Total land area**			
	Agriculture	**Cropland**	***Arable land*** *(Land with temporary crops / fallow)*	***Land under permanent crops***	**Land under perm. meadows and pastures**	**Forest land**	**Agriculture**	**Cropland**	**Land under perm. meadows and pastures**	**Forest land**
	1000 ha									
1990	38,676	7,635	*7,081*	*554*	31,041	1,667	16.2%	3.2%	13.0%	0.7%
1991	38,622	7,806	*7,260*	*546*	30,816	1,658	16.2%	3.3%	12.9%	0.7%
1992	38,865	8,094	*7,562*	*532*	30,771	1,649	16.3%	3.4%	12.9%	0.7%
1993	38,862	8,064	*7,533*	*531*	30,798	1,641	16.3%	3.4%	12.9%	0.7%
1994	39,640	8,006	*7,477*	*529*	31,634	1,632	16.6%	3.4%	13.3%	0.7%
1995	39,649	8,029	*7,519*	*510*	31,620	1,623	16.6%	3.4%	13.3%	0.7%
1996	39,636	8,040	*7,521*	*519*	31,596	1,614	16.6%	3.4%	13.3%	0.7%
1997	39,690	8,159	*7,650*	*509*	31,531	1,605	16.7%	3.4%	13.2%	0.7%
1998	39,826	8,174	*7,661*	*513*	31,652	1,597	16.7%	3.4%	13.3%	0.7%
1999	39,731	8,192	*7,673*	*519*	31,539	1,588	16.7%	3.4%	13.2%	0.7%
2000	40,021	8,192	*7,662*	*530*	31,829	1,579	16.8%	3.4%	13.4%	0.7%
2001	40,109	8,163	*7,583*	*580*	31,946	1,613	16.8%	3.4%	13.4%	0.7%
2002	39,855	8,206	*7,547*	*659*	31,649	1,647	16.7%	3.4%	13.3%	0.7%
2003	39,906	8,245	*7,504*	*741*	31,661	1,681	16.8%	3.5%	13.3%	0.7%
2004	41,145	8,296	*7,493*	*803*	32,849	1,715	17.3%	3.5%	13.8%	0.7%
2005	41,211	8,363	*7,511*	*852*	32,848	1,749	17.3%	3.5%	13.8%	0.7%
2006	41,181	8,378	*7,470*	*908*	32,803	1,782	17.3%	3.5%	13.8%	0.7%
2007	41,252	8,390	*7,469*	*921*	32,862	1,816	17.3%	3.5%	13.8%	0.8%
2008	41,309	8,400	*7,489*	*911*	32,909	1,850	17.3%	3.5%	13.8%	0.8%
2009	41,380	8,399	*7,493*	*906*	32,981	1,884	17.4%	3.5%	13.8%	0.8%
2010	41,374	8,411	*7,502*	*909*	32,963	1,918	17.4%	3.5%	13.8%	0.8%
2011	41,388	8,421	*7,502*	*919*	32,967	1,926	17.4%	3.5%	13.8%	0.8%
2012	41,398	8,431	*7,507*	*924*	32,968	1,933	17.4%	3.5%	13.8%	0.8%
2013	41,432	8,435	*7,496*	*939*	32,996	1,941	17.4%	3.5%	13.9%	0.8%
2014	41,431	8,439	*7,469*	*970*	32,992	1,948	17.4%	3.5%	13.9%	0.8%
2015	41,456	8,462	*7,462*	*1,000*	32,994	1,956	17.4%	3.6%	13.9%	0.8%
2016	41,360	8,418	*7,404*	*1,013*	32,943	1,956	17.4%	3.5%	13.8%	0.8%
2017	41,335	8,483	*7,471*	*1,013*	32,852	1,943	17.4%	3.6%	13.8%	0.8%
2018	41,359	8,517	*7,505*	*1,012*	32,842	1,930	17.4%	3.6%	13.8%	0.8%
2019	41,359	8,517	*7,505*	*1,012*	32,842	1,939	17.4%	3.6%	13.8%	0.8%
2020	41,359	8,517	*7,505*	*1,012*	32,842	1,949	17.4%	3.6%	13.8%	0.8%
1990 - 2020	6.9%	11.6%	*6.0%*	*82.7%*	5.8%	16.9%	NA	NA	NA	NA
2005 - 2020	0.4%	1.8%	*-0.1%*	*18.8%*	0.0%	11.5%	NA	NA	NA	NA
2019 - 2020	0.0%	0.0%	*0.0%*	*0.0%*	0.0%	0.5%	NA	NA	NA	NA

Source: FAOstat; http://www.fao.org/statistics/en/

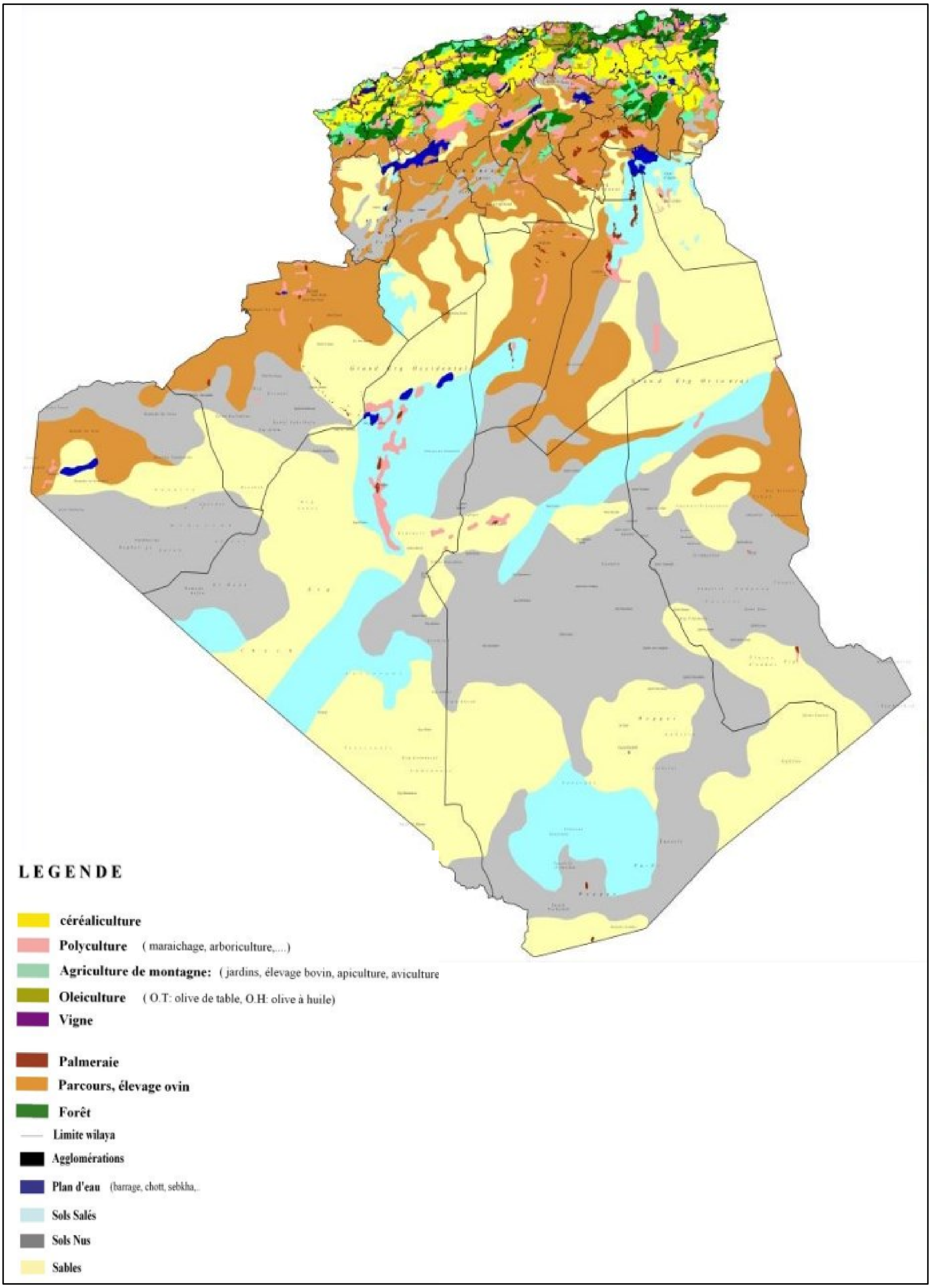

Figure 197 Carte Agricole de l`Algérie

5.2 Enteric fermentation (IPCC category 3.A)

This section describes the estimation of methane emissions resulting from enteric fermentation from livestock. As described in the 2006 IPCC Guidelines (Volume 4, Chapter 10) methane is produced in herbivores (plant eaters) as a by-product of enteric fermentation, a digestive process by which carbohydrates are broken down by micro-organisms into simple molecules for absorption into the bloodstream. The amount of methane that is released depends on the type of digestive tract, age, and weight of the animal, and the quality and quantity of the feed consumed. Ruminant livestock are major sources of methane with moderate amounts produced from non-ruminant livestock:

- main ruminant livestock are cattle, buffalo, goats, sheep, deer and camels;
- non-ruminant livestock are horses, mules and asses;

Methane is produced by the fermentation of feed within the animal's digestive system. Generally, the higher the feed intake, the higher the methane emission. Although, the extent of methane production may also be affected by the composition of the diet. Feed intake is positively related to animal size, growth rate, and production (e.g., milk production, wool growth, or pregnancy).

To reflect the variation in emission rates among animal species, the population of animals are divided into subgroups, and an emission rate per animal is estimated for each subgroup.

Natural wild ruminants are not considered in the derivation of a country’s emission estimate. Emissions should only be considered from animals under domestic management (e.g., farmed deer, elk, and buffalo).

Cattle in Algeria are classified into three types: indigenous populations called local cattle (BLL), imported breeds called modern dairy cattle (BLM) and the products of crossbreeding called improved local cattle (BLA).

Cattle farms are mainly located in the northern fringe of the country, in the Tell and the high plains

The herd of local breeds ensures only 20% of the national production[501]. Indeed, the production levels of these animals are very low, the milk production is 3 to 4 liters per day for 6 months or an average of 595 kg per lactation.

The local cattle belong to a single group called Brune de l'Atlas which is subdivided into 6 secondary breeds (Guelmoise - Cheurfa - Setifienne - Chelifienne - Djerba - Kabyle and Chouia).

Bovin Laitier Amélioré (BLA), covers the various cattle populations, resulting from multiple crossings, between the local breed Brune de l'Atlas and its variants on the one hand, and various breeds imported, these animals constitute 42% to 43% of the total national herd, and ensure about 40% of the total production of cow milk.

The Imported cattle known as modern dairy cattle (BLM) are made up of imported breeds, these animals represent 9 to 10% of the national workforce, and ensure about 40% of the total production of cow's milk, the imported breeds are mainly represented by the Prim'Holstein breed, the Montbeliarde breed[502].

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[501] Available (Bencherif A., 2001. Stratégies des acteurs de la filière lait en Algérie : Etats des lieux et problématiques. Série B, Etudes et Recherches, n°32, 25-45.

[501] Caractéristiques de l’élevage bovin laitier en Algérie, DENNA Mohammed Lamine DERGHAL Saif Eddine,(sept2021), Université 8 Mai 1945 Guelma.

5.2.1 Category description

IPCC code	description	CO_2		CH_4		N_2O	
		Estimated	Key Category	estimated	Key category	estimated	Key category
3.A.1	**Enteric Fermentation**						
3.A.1.a	Cattle	NA	NA	**Option B**	LA 1990, LA 2020	NA	NA
3.A.1.a.i	Mature dairy cattle	NA	NA	✓ TIER 2		NA	NA
3.A.1.a.ii	Other mature cattle	NA	NA	✓ TIER 2		NA	NA
3.A.1.a.iiI	Growing cattle	NA	NA	✓ TIER 2		NA	NA
3.A.1.a.iv	Other	NA	NA	NO		NA	NA
3.A.2.a	Sheep	NA	NA		LA 1990, LA 2020, TA	NA	NA
3.A.2.a.i	Mature Sheep	NA	NA	✓TIER 1		NA	NA
3.A.2.a.ii	Growing Sheep (lambs)	NA	NA	✓TIER 1		NA	NA
3.A.3	Swine	NA	NA	NO	NA	NA	NA
3.A.4	Other Livestock						
3.A.4.a	Buffalo	NA	NA	NO	NA	NA	NA
3.A.4.b	Camels	NA	NA	✓ TIER 1	-	NA	NA
3.A.4.c	Deer	NA	NA	NO	NA	NA	NA
3.A.4.d	Goats	NA	NA	✓ TIER 1	LA 2020	NA	NA
3.A.4.e	Horses	NA	NA	✓ TIER 1	-	NA	NA
3.A.4.f	Mules and Asses	NA	NA	✓ TIER 1	TA	NA	NA
3.A.4.g	Poultry	NA	NA	NA	NA	NA	NA
3.A.4.h	Other						
3.A.4.h.i	Rabbit	NA	NA	NA	NA	NA	NA
3.A.4.h.ii	Reindeer	NA	NA	NO	NA	NA	NA
3.A.4.h.iii	Ostrich	NA	NA	NO	NA	NA	NA
3.A.4.h.iv	Fur-bearing animals	NA	NA	NO	NA	NA	NA
3.A.4.h.v	Other	NA	NA	NO	NA	NA	NA
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
LA – Level Assessment (in year); TA – Trend Assessment							

In 2020, this source category was responsible for 23.5% of the total methane emissions estimated for Algeria. It represented 5.0% of the total GHG emissions in CO_2eq (excluding LULUCF).

In the period 1990 – 2020 the CH_4 emissions increased by 68.6% and in the period 2005 – 2020 the CH_4 emissions increased by 40.8% mainly due to increase number of livestock. Cattle are the most significant source of methane because of their high numbers, large size and ruminant digestive system, followed by sheep and goats. An overview of the methane emissions resulting IPCC category 3.A *Enteric Fermentation* is provided in the following figure and tables. The significant drop is mainly due to statistical revisions.

Table 517 CH_4 Emissions from IPCC category 3.A Enteric Fermentation by sub-categories

CH_4 emissions	3.A.1	3.A.1.a	3.A.1.a.i	3.A.1.a.ii	3.A.1.a.iii	3.A.2	3.A.3	3.A.4	3.A.4.a	3.A.4.b	3.B.4.c	3.A.4.d	3.A.4.e	3.A.4.f	3.A.4.g	3.A.4.h
	Enteric Fermentation	**Cattle**	**Mature dairy cattle**	**Other mature cattle**	**Growing cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Deer**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	**260.95**	69.67	39.63	18.47	11.56	135.68	NO	55.60	NO	5.63	NO	44.50	1.48	3.99	NA	NO
1991	**249.82**	64.41	35.35	17.87	11.19	129.50	NO	55.91	NO	5.80	NO	44.72	1.38	3.99	NA	NO
1992	**264.70**	68.62	42.36	16.15	10.11	135.87	NO	60.21	NO	5.25	NO	49.95	1.31	3.69	NA	NO
1993	**269.51**	68.18	43.70	15.05	9.42	143.10	NO	58.23	NO	5.26	NO	48.30	1.19	3.48	NA	NO
1994	**258.34**	66.32	43.66	13.93	8.72	136.79	NO	55.23	NO	5.24	NO	45.79	1.11	3.08	NA	NO
1995	**260.58**	67.96	46.85	12.98	8.13	132.65	NO	59.97	NO	5.81	NO	50.04	1.08	3.05	NA	NO
1996	**263.84**	67.01	47.04	12.28	7.69	134.67	NO	62.16	NO	6.26	NO	52.11	0.94	2.86	NA	NO
1997	**267.93**	67.99	46.80	13.03	8.16	133.30	NO	66.64	NO	6.94	NO	56.19	0.83	2.68	NA	NO
1998	**277.43**	70.95	46.68	14.93	9.35	137.61	NO	68.87	NO	7.10	NO	58.62	0.83	2.32	NA	NO
1999	**289.49**	83.36	50.55	20.18	12.63	137.91	NO	68.22	NO	10.12	NO	55.11	0.79	2.20	NA	NO
2000	**278.54**	75.24	45.19	18.48	11.57	135.06	NO	68.24	NO	10.77	NO	54.48	0.79	2.20	NA	NO
2001	**290.86**	87.73	53.02	21.33	13.37	132.62	NO	70.51	NO	11.29	NO	56.33	0.76	2.13	NA	NO
2002	**286.71**	82.41	54.61	17.11	10.70	130.77	NO	73.52	NO	11.49	NO	59.05	0.84	2.15	NA	NO
2003	**293.48**	84.80	54.49	18.76	11.55	134.19	NO	74.49	NO	11.64	NO	59.85	0.86	2.15	NA	NO
2004	**306.40**	88.67	56.44	20.26	11.96	140.25	NO	77.49	NO	12.56	NO	62.11	0.80	2.01	NA	NO
2005	**312.51**	87.79	56.22	19.72	11.85	144.97	NO	79.75	NO	12.35	NO	64.62	0.77	2.01	NA	NO
2006	**323.59**	89.70	57.89	19.92	11.89	150.39	NO	83.51	NO	13.19	NO	67.58	0.78	1.95	NA	NO
2007	**330.33**	90.57	58.16	20.47	11.95	154.52	NO	85.23	NO	13.40	NO	69.08	0.85	1.90	NA	NO
2008	**327.51**	90.82	57.86	20.86	12.10	152.92	NO	83.77	NO	13.57	NO	67.52	0.82	1.85	NA	NO
2009	**345.41**	93.42	59.90	21.37	12.14	164.10	NO	87.89	NO	13.85	NO	71.32	0.81	1.91	NA	NO

CH$_4$ emissions	**3.A.1**	**3.A.1.a**	**3.A.1.a.i**	**3.A.1.a.ii**	**3.A.1.a.iii**	**3.A.2**	**3.A.3**	**3.A.4**	**3.A.4.a**	**3.A.4.b**	**3.B.4.c**	**3.A.4.d**	**3.A.4.e**	**3.A.4.f**	**3.A.4.g**	**3.A.4.h**
	Enteric Fermentation	**Cattle**	**Mature dairy cattle**	**Other mature cattle**	**Growing cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Deer**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
2010	**366.90**	97.41	62.66	21.84	12.90	175.33	NO	94.16	NO	14.44	NO	77.17	0.79	1.76	NA	NO
2011	**381.30**	100.71	65.14	22.77	12.81	183.92	NO	96.67	NO	14.66	NO	79.40	0.80	1.81	NA	NO
2012	**397.27**	103.22	66.78	22.73	13.70	193.15	NO	100.90	NO	15.65	NO	82.70	0.83	1.72	NA	NO
2013	**417.60**	107.19	69.88	23.30	14.01	203.73	NO	106.68	NO	15.82	NO	88.39	0.81	1.65	NA	NO
2014	**438.74**	114.50	74.01	25.72	14.77	213.19	NO	111.05	NO	16.31	NO	92.34	0.76	1.65	NA	NO
2015	**440.76**	116.13	73.19	27.26	15.68	215.52	NO	109.11	NO	16.66	NO	90.25	0.76	1.43	NA	NO
2016	**436.67**	112.56	70.47	27.21	14.87	215.71	NO	108.40	NO	17.44	NO	88.82	0.81	1.33	NA	NO
2017	**430.06**	102.68	64.55	24.63	13.51	217.68	NO	109.70	NO	17.57	NO	90.14	0.84	1.14	NA	NO
2018	**427.88**	98.27	62.00	23.52	12.75	220.22	NO	109.39	NO	19.20	NO	88.35	0.83	1.01	NA	NO
2019	**432.21**	97.14	61.70	22.99	12.46	225.24	NO	109.84	NO	19.19	NO	88.72	0.90	1.02	NA	NO
2020	**439.94**	94.63	60.09	22.40	12.14	236.94	NO	108.37	NO	20.02	NO	88.35	NE	NE	NA	NO
Trend																
1990 - 2020	**68.6%**	35.8%	51.6%	21.3%	5.0%	74.6%	NA	94.9%	NA	255.4%	NA	98.6%	NA	NA	NA	NA
2005 - 2020	**40.8%**	7.8%	6.9%	13.6%	2.5%	63.4%	NA	35.9%	NA	62.1%	NA	36.7%	NA	NA	NA	NA
2019 - 2020	**1.8%**	-2.6%	-2.6%	-2.5%	-2.5%	5.2%	NA	-1.3%	NA	4.3%	NA	-0.4%	NA	NA	NA	NA

5.2.2 Methodological issues

5.2.2.1 Choice of methods

According to the 2019 Refinement to the 2006 IPCC Guidelines, the method for estimating methane emission from enteric fermentation requires three basic steps:

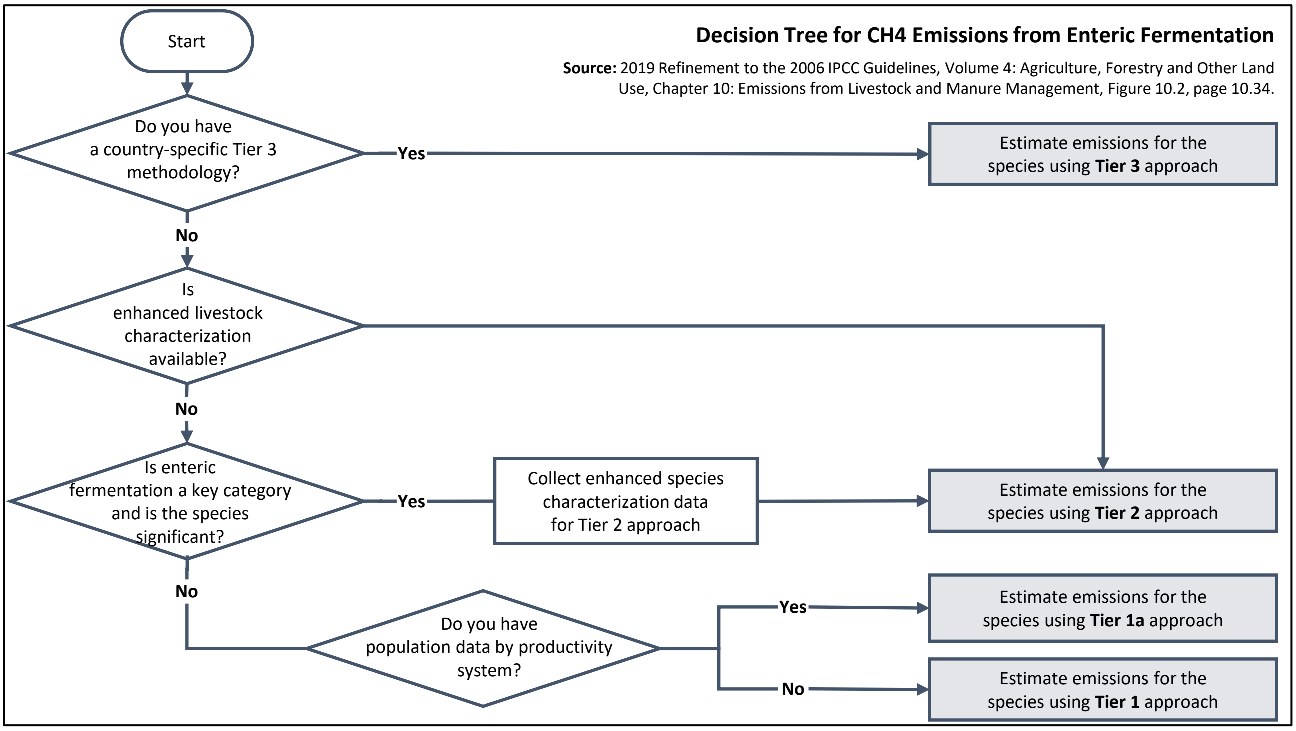
Step 1: Animal population and productivity system
Divide the livestock population into subgroups and characterize each subgroup (as described in Section 10.2. of Volume 4: AFOLU of the 2019 Refinement to the 2006 IPCC Guidelines). The subgroups are presented in chapter 5.2.2.2.

Step 2: Estimate emission factors for each subgroup in terms of kilograms of methane per animal per year.

Step 3: Multiply the subgroup emission factors by the subgroup populations to estimate subgroup emission, and sum across the subgroups to estimate total emission.

These three steps can be performed at varying levels of detail and complexity.

It is *good practice* to choose the method for estimating CH_4 emissions from enteric fermentation according to the decision tree.



Decision Tree for CH4 Emissions from Enteric Fermentation

Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 10: Emissions from Livestock and Manure Management, Figure 10.2, page 10.34.

Figure 198 Decision Tree for CH_4 Emissions from Enteric Fermentation

For estimating the CH_4 emissions from livestock the Tier 1, Tier 1a and Tier 2 approach of the 2019 Refinements to the IPCC Guidelines have been applied:

- TIER 1 approach: goats, camel, horse, mules and asses
- TIER 1a approach: sheep
- TIER 2 approach: cattle

Tier 1 approach was applied for the livestock categories goats, camels, horses, mules and asses. Tier 1 is a simplified approach that relies on default emission factors drawn from the literature.

Equation 10.19: CH_4 emissions from enteric fermentation from a livestock category

(2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10) [517]

$$Emissions_{CH4} = \sum_{(P)} Livestock_{\ category} \times \left(\frac{Emission\ Factor_T}{10^6}\right)$$

Where:

Emissions $_{CH4}$ = CH_4 emissions (Gg CH_4)
Livestock $_{category}$ = number of head of livestock species / category T
Emission factor $_T$ = emission factor for the defined livestock population and the productivity system P, in kg CH_4 head^{-1} yr^{-1}.
T = species/category of livestock

Tier 1a approach was applied for the livestock categories sheep. The Tier 1a approach, which is an advanced Tier 1 method, was applied where differentiated production systems with coexistence of low and high productivity systems was available.

Equation 10.19: CH_4 emissions from enteric fermentation from a livestock category
(2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10) [517]

$$Emissions_{CH4} = \sum_{(P)} Livestock_{\ category} \times \left(\frac{Emission\ Factor_T}{10^6}\right)$$

Where:

Emissions $_{CH4}$ = CH_4 emissions (Gg CH_4)
Livestock $_{category}$ = number of head of livestock species / category T
Emission factor $_T$ = emission factor for the defined livestock population and the productivity system P, in kg CH_4 head^{-1} yr^{-1}.
T = species/category of livestock
P = productivity system, either high or low productivity

Tier 2 approach was applied for the livestock categories cattle. This more complex approach that required detailed country-specific data on gross energy intake and methane conversion factors for specific livestock categories. It is *good practice* to apply Tier 2 method if enteric fermentation is a key source category for the animal category that represents a large portion of the country's total emissions.

Equation 10.19(updated): CH_4 emissions from enteric fermentation from a livestock category
(2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10) [517]

$$Emissions_{CH4} = \sum_{(P)} Livestock_{\ category} \times \left(\frac{CS\ Emission\ Factor_T}{10^6}\right)$$

Where:

Emissions $_{CH4}$ = CH_4 emissions (Gg CH_4)
Livestock $_{category}$ = number of head of livestock species / category T
CS Emission factor $_T$ = country specific emission factor (CS) for the defined livestock population and the productivity system P, in kg CH_4 head^{-1} yr^{-1}.
T = species/category of livestock
P = productivity system, either high or low productivity

A more complex approach that requires detailed country-specific data on gross energy intake and methane conversion factors for specific livestock categories. The Tier 2 method should be used if enteric fermentation is a key source category for the animal category that represents a large portion of the country's total emissions.

5.2.2.2 Choice of activity data

As described in Chapter 5.1.2 above, the original data provider for the national and international agricultural data is the Ministry of Agriculture and Rural Development[503]. and Statistical Office of Algeria (ONS) The agricultural data used and presented in this inventory are taken from the following national and international sources: FAO agricultural data base[504]

The agricultural statistics provided annually by the Ministry of Agriculture and Rural Development / Directorate of Information Systems, Statistics and Forecasting are developed from data collected from the Directions of Agricultural Services of the wilayas (D.S.A). They are obtained through exhaustive surveys or by sampling, carried out at the level of the communes by the agents of the statistical services.

The duly filled-in forms for each wilaya are sent to the Directorate of Agricultural Statistics (MADR), which carries out consistency checks to avoid double counting of interwilaya transhumance.

Also, an exhaustive general census of agriculture is carried out every ten years by the ministry of Agriculture and Rural Development.

Cattle (IPCC category 3.A.1.a)

The number of **cattle** increased significantly by 25 % in the period 1990 – 2020 and increased by 9.7% in the period 2005 – 2020. The number of **dairy cattle** decreased significantly by 2.7% in the period 2019- 2020.

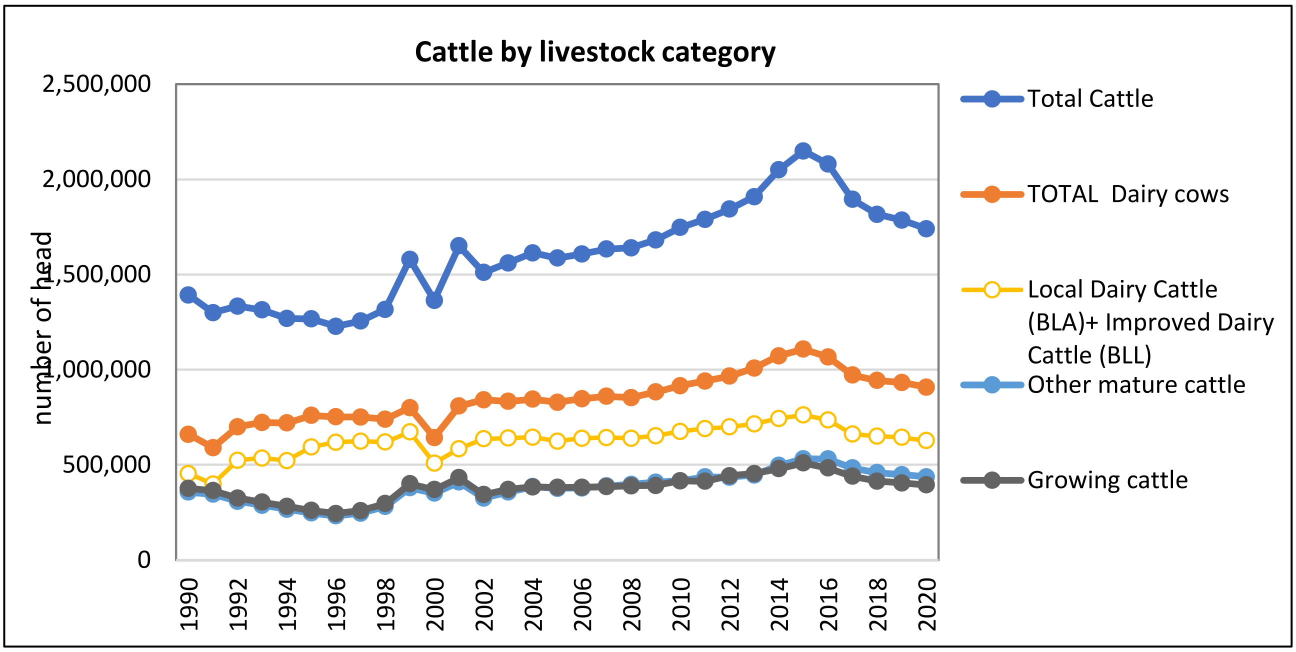


Figure 199 **Cattle population by livestock category and its trend 1990–2020**

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[503] Available MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B". Plusieurs années. Alger.
Available (03. May 2022) on https://madr.gov.dz/Statistiques agricoles
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B" 2019. Alger. Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2019.pdf
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B" 2018. Alger. Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2018.pdf
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B" 2017. Alger. Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2017-.pdf
MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B" 2016. Alger. Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2016.pdf

[504] Available (03. Januar 2020) on http://www.fao.org/statistics/en/

Table 518 Cattle: livestock population by category and its trend 1990–2020

	3.A.1.a	**3.A.1.a.i**			**3.A.1.a.ii**			**3.A.1.a.iii**			
	Total cattle	**Dairy Cows total)**	**Dairy Cattle Modern (BLM)**	**local dairy cattle (bla) + improved dairy cattle (BLL)**	**Other mature cattle**	**Heifers**	**Bulls**	**Growing cattle**	**Veaux/ Calves (- 12 months)**	**Velles/ Calves (- 12 months)**	**Source**
	heads	**heads**	**heads**	**heads**	**heads**	**heads**	**heads**	**heads**	**heads**	**heads**	
1990	1,392,700	660,000	206,000	454,000	356,526	178,919	56,189	376,174	174,366	201,808	FAO
1991	1,300,180	590,000	190,807	399,194	345,568	173,420	54,462	364,612	169,007	195,605	FAO
1992	1,333,730	700,000	175,613	524,387	308,368	154,751	48,599	325,362	150,814	174,549	FAO
1993	1,313,820	722,267	186,807	535,461	287,845	144,452	45,365	303,708	140,776	162,932	FAO
1994	1,269,130	720,000	198,000	522,000	267,202	134,093	42,111	281,928	130,681	151,247	FAO
1995	1,266,620	760,000	165,535	594,465	246,517	123,712	38,851	260,103	120,564	139,539	FAO
1996	1,227,940	752,000	133,070	618,930	231,589	116,220	36,499	244,351	113,263	131,088	FAO
1997	1,255,410	750,910	126,835	624,075	245,486	123,194	38,689	259,014	120,060	138,955	FAO
1998	1,317,240	740,000	120,600	619,400	280,880	140,957	44,267	296,360	137,370	158,989	FAO
1999	1,579,653	799,888	127,598	672,290	379,427	190,412	59,798	400,338	185,567	214,771	FAO
2000	1,363,764	643,184	134,596	508,588	350,748	175,480	55,295	369,832	171,532	198,300	MADR
2001	1,650,928	808,637	223,587	585,050	409,999	203,972	63,009	432,292	202,453	229,839	MADR
2002	1,510,770	841,630	204,770	636,860	325,370	165,200	52,540	343,770	157,600	186,170	MADR
2003	1,560,545	833,224	192,364	640,860	356,820	179,684	55,022	370,501	172,385	198,116	MADR
2004	1,613,700	844,500	199,165	645,335	385,330	194,780	58,790	383,870	180,630	203,240	MADR
2005	1,586,070	828,830	204,240	624,590	376,290	189,120	58,710	380,950	182,510	198,440	MADR
2006	1,607,890	847,640	207,740	639,900	378,000	193,960	55,730	382,250	182,770	199,480	MADR
2007	1,633,810	859,970	216,340	643,630	389,260	198,780	55,040	384,580	183,590	200,990	MADR
2008	1,640,730	853,523	214,485	639,038	397,653	201,033	59,322	389,554	187,759	201,795	MADR
2009	1,682,433	882,282	229,929	652,353	408,733	205,409	61,426	391,418	187,245	204,173	MADR
2010	1,747,700	915,400	239,776	675,624	416,403	212,323	62,263	415,897	202,097	213,800	MADR
2011	1,790,140	940,690	249,990	690,700	436,191	218,382	65,392	413,259	202,113	211,146	MADR
2012	1,843,930	966,097	267,139	698,958	434,955	220,627	63,476	442,878	216,220	226,658	MADR
2013	1,909,455	1,008,575	293,856	714,719	446,783	226,907	67,325	454,097	221,667	232,430	MADR
2014	2,049,652	1,072,512	328,901	743,611	497,072	246,758	77,453	480,068	234,951	245,117	MADR
2015	2,149,549	1,107,800	346,657	761,143	531,796	254,600	87,157	509,953	249,732	260,221	MADR
2016	2,081,306	1,066,625	331,061	735,564	531,087	253,236	82,539	483,594	231,594	252,000	MADR
2017	1,895,126	971,663	310,122	661,541	483,514	225,660	75,720	439,949	213,692	226,257	MADR
2018	1,816,280	942,828	291,891	650,937	458,936	218,963	69,712	414,516	200,011	214,505	MADR
2019	1,786,351	932,875	288,810	644,065	448,440	213,955	68,118	405,036	195,437	209,599	extrapolation
2020	1,740,183	908,409	281,235	627,174	437,037	208,515	66,386	394,737	190,467	204,270	
trend											
1990 - 2020	25.0%	37.6%	36.5%	38.1%	22.6%	16.5%	18.1%	4.9%	9.2%	1.2%	
2005 - 2020	9.7%	9.6%	37.7%	0.4%	16.1%	10.3%	13.1%	26.2%	3.6%	4.4%	
2019 - 2020	2.7%	2.7%	2.7%	2.7%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	

5.2.2.2.1 Sheep (IPCC category 3.A.2.a) and Goats (IPCC category 3.A.4.d)

The number of **sheep** increased significantly by 74.6 % in the period 1990 – 2020 and by 63.4% in the period 2005 – 2020. The number of Mature sheep increased by 100% during the period 1990 – 2020; this increase is due to the agricultural development program and importation.

In 2019-2020 the number of sheep decreased by -4.9% due to the stop of importation since 2018

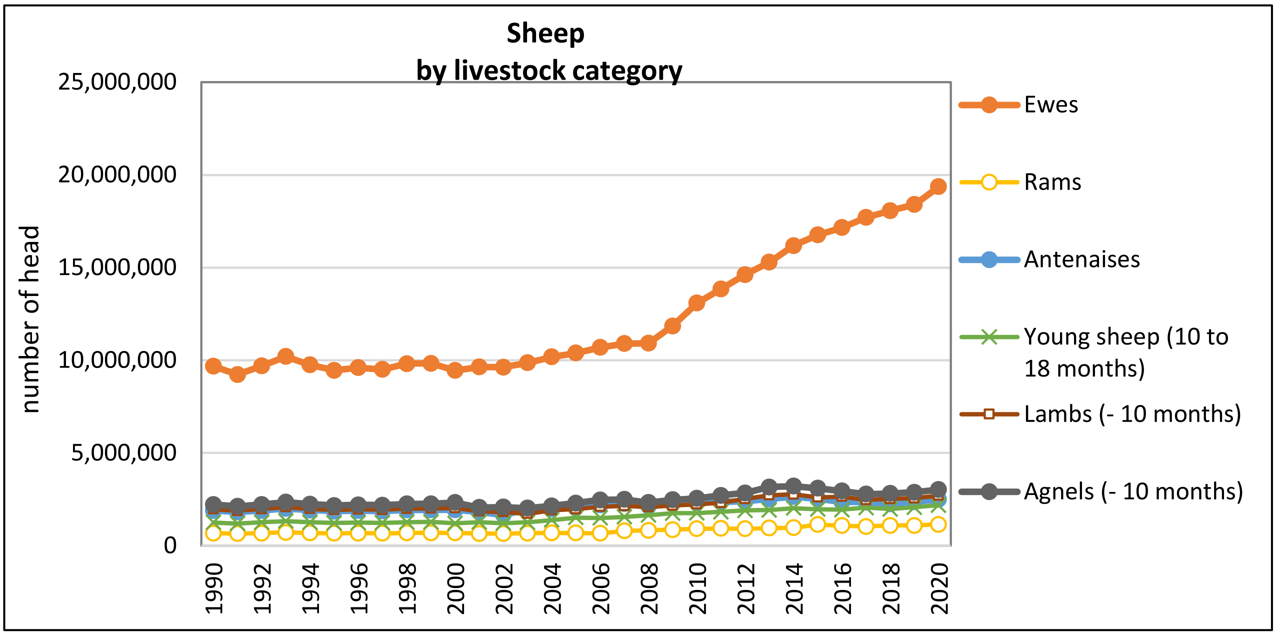

Figure 200 **Sheep population and its trend 1990–2020**

The number of **goats** increased significantly by 98.6 % in the period 1990 – 2020 and increased by 36.7% in the period 2005 – 2020, an increase of 0.4% was noted during the period 2019-2020.

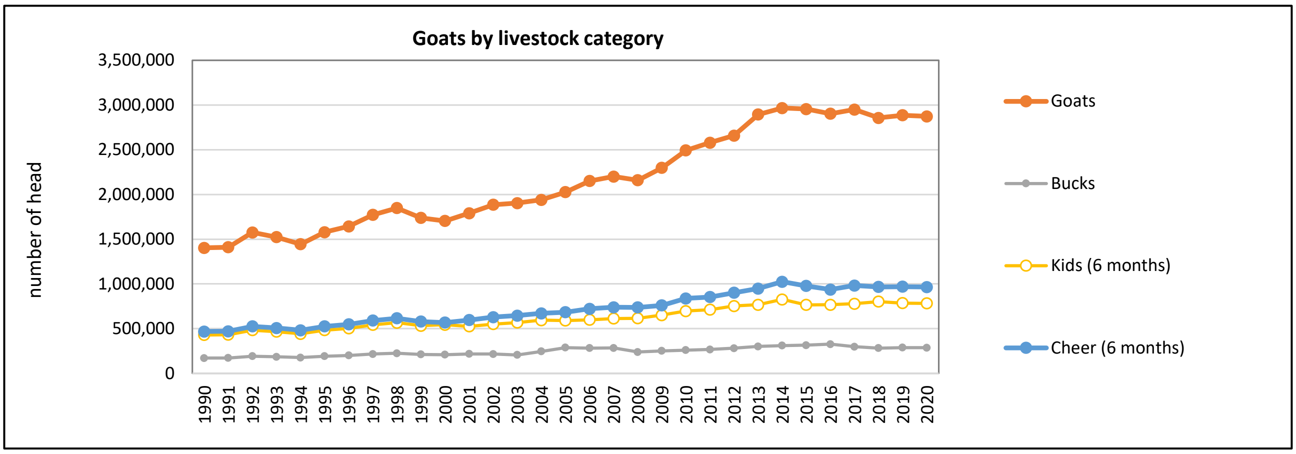

Figure 201 **Goats by livestock category and its trend 1990–2020**

Table 519 Sheep: livestock population category and its trend 1990–2020

	3.A.2.a	**3.A.2.a.i**	**3.A.2.a.ii**				**3.A.2.b.ii**			
	Total Sheep	**Ewes**	**Other Mature sheep**	**Rams**	**Antenaises**	**Young sheep (10 to 18 months)**	**Growing Sheep**	**Lambs (- 10 months)**	**Agnels (- 10 months)**	**Source**
	heads									
1990	17,697,270	9,677,057	3,833,054	678,027	1,901,249	1,253,778	4,187,159	1,968,987	2,218,173	FAO
1991	16,891,180	9,236,279	3,658,463	647,144	1,814,649	1,196,670	3,996,439	1,879,301	2,117,137	
1992	17,722,800	9,691,017	3,838,583	679,005	1,903,992	1,255,586	4,193,199	1,971,827	2,221,373	
1993	18,664,640	10,206,026	4,042,576	715,089	2,005,175	1,322,312	4,416,038	2,076,615	2,339,423	
1994	17,841,840	9,756,110	3,864,366	683,566	1,916,780	1,264,020	4,221,364	1,985,071	2,236,293	
1995	17,301,560	9,460,679	3,747,347	662,866	1,858,737	1,225,743	4,093,534	1,924,960	2,168,574	
1996	17,565,400	9,604,949	3,804,492	672,975	1,887,082	1,244,435	4,155,959	1,954,315	2,201,644	
1997	17,387,000	9,507,398	3,765,852	666,140	1,867,916	1,231,796	4,113,749	1,934,466	2,179,283	
1998	17,948,940	9,814,673	3,887,563	687,669	1,928,286	1,271,607	4,246,704	1,996,987	2,249,717	
1999	17,988,480	9,836,294	3,896,127	689,184	1,932,534	1,274,409	4,256,059	2,001,386	2,254,673	
2000	17,615,928	9,446,310	3,815,503	679,930	1,934,250	1,201,323	4,354,115	2,034,261	2,319,854	MADR
2001	17,298,786	9,642,077	3,746,680	657,831	1,817,451	1,271,398	3,910,029	1,851,665	2,058,364	
2002	17,057,250	9,631,900	3,526,180	646,210	1,667,400	1,212,570	3,899,170	1,815,200	2,083,970	
2003	17,502,790	9,860,400	3,891,560	677,170	1,959,160	1,255,230	3,750,830	1,724,100	2,026,730	
2004	18,293,300	10,184,770	4,048,340	685,630	1,980,860	1,381,850	4,060,190	1,912,190	2,148,000	MADR
2005	18,909,110	10,396,250	4,242,900	688,730	2,041,760	1,512,410	4,269,960	1,972,780	2,297,180	
2006	19,615,730	10,696,580	4,353,450	664,200	2,196,590	1,492,660	4,565,700	2,095,350	2,470,350	
2007	20,154,890	10,899,540	4,616,260	795,300	2,267,600	1,553,360	4,639,090	2,147,915	2,491,175	
2008	19,946,150	10,924,626	4,620,476	825,258	2,147,324	1,647,894	4,401,048	2,076,824	2,324,224	
2009	21,404,584	11,852,024	4,910,589	866,328	2,298,473	1,745,788	4,641,971	2,166,002	2,475,969	
2010	22,868,770	13,086,963	4,998,480	909,548	2,330,495	1,758,437	4,783,327	2,232,144	2,551,183	
2011	23,989,330	13,848,690	5,121,120	933,260	2,364,357	1,823,503	5,019,520	2,312,654	2,706,866	
012	25,194,105	14,620,905	5,204,062	907,252	2,394,680	1,902,130	5,369,138	2,521,700	2,847,438	
2013	26,572,980	15,297,185	5,395,578	949,903	2,524,842	1,920,833	5,880,217	2,718,003	3,162,214	
2014	27,807,734	16,191,021	5,637,716	964,715	2,647,301	2,025,700	5,978,997	2,764,239	3,214,758	
2015	28,111,773	16,764,901	5,638,569	1,140,071	2,536,478	1,962,020	5,708,303	2,609,498	3,098,805	
2016	28,135,986	17,161,321	5,379,404	1,077,429	2,364,899	1,937,076	5,595,261	2,644,434	2,950,827	
2017	28,393,602	17,709,588	5,440,062	1,035,247	2,351,131	2,053,684	5,243,951	2,463,095	2,780,856	
2018	28,723,994	18,075,234	5,313,781	1,086,265	2,251,831	1,975,685	5,334,979	2,523,382	2,811,597	
2019	29,378,561	18,405,530	5,531,824	1,091,089	2,367,918	2,072,816	5,441,207	2,564,712	2,876,495	extra-polation
2020	30,905,560	19,362,188	5,819,349	1,147,800	2,490,995	2,180,554	5,724,023	2,698,017	3,026,006	
Trend										
1990 - 2020	74.6%	100.1%	51.8%	69.3%	31.0%	73.9%	36.7%	37.0%	36.4%	
2005 - 2020	63.4%	86.2%	37.2%	66.7%	22.0%	44.2%	34.1%	36.8%	31.7%	
2019 - 2020	-4.9%	-4.9%	-4.9%	-4.9%	-4.9%	-4.9%	-4.9%	-4.9%	-4.9%	

Table 520 Goats: livestock population by category and its trend 1990–2020

	3.A.4.d							**Source**
	Total Goats	**Mature Goats**	**Goats**	**Bucks**	**Growing Goats**	**Kids (6 months)**	**Cheer (6 months)**	
	1000 heads	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	
1990	2,471,990	1,574,243	1,403,362	170,881	897,747	430,015	467,731	FAO
1991	2,484,540	1,582,236	1,410,487	171,749	902,304	432,199	470,106	
1992	2,775,130	1,767,293	1,575,456	191,837	1,007,837	482,748	525,089	
1993	2,683,310	1,708,819	1,523,329	185,489	974,491	466,776	507,716	
1994	2,543,790	1,619,968	1,444,123	175,845	923,822	442,505	481,317	
1995	2,779,790	1,770,260	1,578,102	192,159	1,009,530	483,559	525,971	
1996	2,894,770	1,843,483	1,643,376	200,107	1,051,287	503,560	547,726	
1997	3,121,500	1,987,872	1,772,092	215,780	1,133,628	543,001	590,627	
1998	3,256,580	2,073,896	1,848,778	225,118	1,182,684	566,499	616,185	
1999	3,061,660	1,949,764	1,738,121	211,644	1,111,896	532,592	579,304	
2000	3,026,731	1,913,298	1,704,947	208,351	1,113,433	544,702	568,731	MADR
2001	3,129,400	2,007,608	1,790,374	217,234	1,121,792	525,572	596,220	
2002	3,280,540	2,100,650	1,884,890	215,760	1,179,890	551,400	628,490	
2003	3,324,740	2,110,940	1,904,120	206,820	1,213,800	567,730	646,070	
2004	3,450,580	2,185,770	1,940,180	245,590	1,264,810	594,200	670,610	
2005	3,589,880	2,315,370	2,027,100	288,270	1,274,510	590,050	684,460	
2006	3,754,590	2,433,310	2,151,340	281,970	1,321,280	599,070	722,210	
2007	3,837,860	2,485,225	2,200,645	284,580	1,352,635	613,325	739,310	
2008	3,751,360	2,397,824	2,159,576	238,248	1,353,536	616,571	736,965	
2009	3,962,120	2,550,660	2,298,611	252,049	1,411,460	650,834	760,626	
2010	4,287,300	2,753,245	2,492,855	260,390	1,534,055	696,615	837,440	
2011	4,411,020	2,845,468	2,578,950	266,518	1,565,552	712,186	853,366	
2012	4,594,525	2,939,598	2,658,890	280,708	1,654,927	753,390	901,537	
2013	4,910,700	3,195,223	2,894,480	300,743	1,715,477	767,611	947,866	
2014	5,129,839	3,277,900	2,967,407	310,493	1,851,939	827,303	1,024,636	
2015	5,013,950	3,270,642	2,955,766	314,876	1,743,308	765,588	977,720	
2016	5,915,700	3,229,323	2,903,147	326,176	1,705,378	767,835	937,543	
2017	5,007,894	3,247,114	2,949,646	297,468	1,760,780	778,076	982,704	
2018	4,908,485	3,138,661	2,856,327	282,334	1,769,824	803,098	966,726	
2019	4,929,069	3,173,914	2,885,762	288,152	1,755,155	786,147	969,008	Extra-polation
2020	4,908,168	3,160,455	2,873,525	286,930	1,747,713	782,814	964,899	
Trend								
1990 - 2020	98.6%	100.8%	104.8%	67.9%	94.7%	82.0%	106.3%	
2005 - 2020	36.7%	36.5%	41.8%	-0.5%	37.1%	32.7%	41.0%	
2019 - 2020	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%	

5.2.2.2.2 Horses, Mules and Asses (IPCC category 3.A.4.e and 3.A.4.f))

The number of **Horses** decreased by 41.5% during the period 1990 – 2020. During The period 2005-2020 it increased by 12.9%.

Mules and Asses decreased significantly by -74.7% in the period 1990 – 2020 and by -49.7 % in the period 2005 – 2020. Horses, mules and asses are for transportation, hauling agricultural products to market but also conveying of farmyard manure, soil and for other purposes.

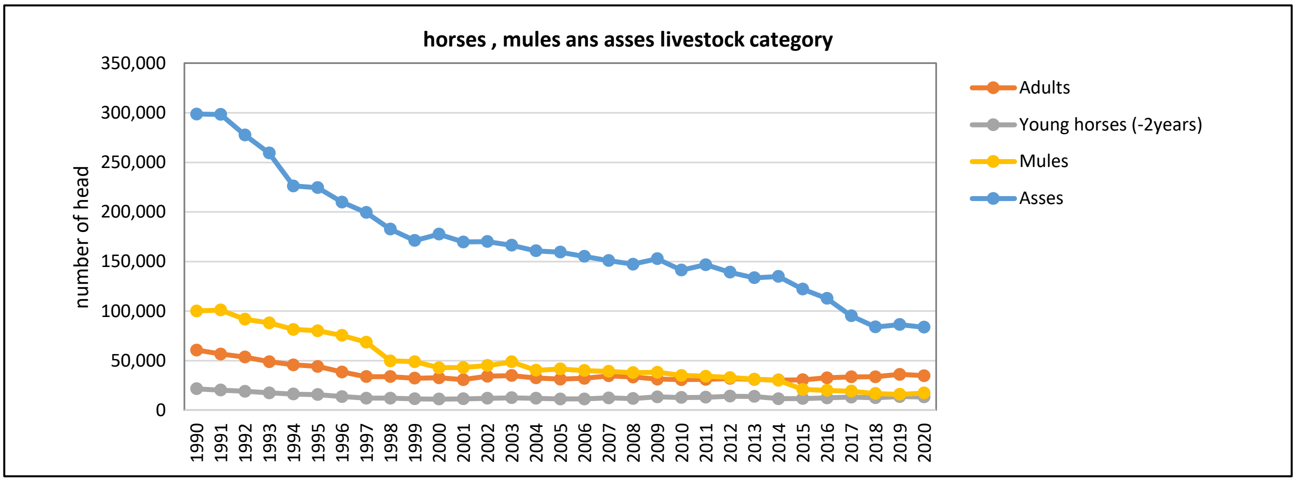

Figure 202 **Horses, mules and asses: population and its trend 1990–2020**

Table 521 Camel, Horses, Mules & Assess: livestock population by category and its trend 1990–2020

	3.A.4.b	**3.A.4.b.i**	**3.A.4.b.ii**	**3.A.4.e**	**3.A.4.f**	**3.A.4.f.i**	**3.A.4.f.ii**	**Source**
	Total Camel	**Camels**	**Other camels**	**Total Horses**	**Total Mules & Assess**	**Mules**	**Asses**	
	1000 heads	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	**1000 heads**	
1990	122,450	69,695	52,755	82,260	398,960	100,180	298,780	FAO
1991	126,270	71,869	54,401	76,940	399,400	101,010	298,390	
1992	114,300	65,056	49,244	72,800	369,300	91,780	277,520	
1993	114,380	65,101	49,279	66,510	347,610	88,140	259,470	
1994	114,120	64,953	49,167	62,160	307,710	81,440	226,270	
1995	126,350	71,914	54,436	60,000	304,520	80,080	224,440	
1996	136,000	77,407	58,593	52,370	285,500	75,500	210,000	
1997	150,870	85,870	65,000	45,990	268,170	68,740	199,430	
1998	154,310	87,828	66,482	45,980	232,310	49,690	182,620	
1999	220,000	125,217	94,783	43,828	220,050	48,900	171,150	
2000	234,170	127,846	106,324	43,828	220,306	42,753	177,553	MADR
2001	245,484	145,420	100,064	42,342	212,777	43,120	169,657	
2002	249,690	148,400	101,290	46,430	215,290	45,120	170,170	
2003	253,050	150,960	102,090	47,530	215,190	48,810	166,380	
2004	273,140	160,990	112,150	44,590	201,190	40,350	160,840	
2005	268,560	156,470	112,090	42,642	201,030	41,620	159,410	
2006	286,670	170,170	116,500	43,570	195,300	40,080	155,220	
2007	291,360	173,825	117,535	47,040	190,040	39,160	150,880	
2008	295,085	176,884	118,201	45,285	185,170	37,830	147,340	
2009	301,118	179,223	121,895	44,803	191,090	38,297	152,793	
2010	313,990	186,062	127,928	43,650	176,395	35,120	141,275	
2011	318,755	186,550	132,205	44,200	181,085	34,255	146,830	
2012	340,140	200,284	139,856	46,235	172,170	33,000	139,170	
2013	344,015	197,830	146,185	45,035	165,055	31,410	133,645	
2014	354,465	203,824	150,641	42,010	165,110	30,190	134,920	
2015	362,265	204,049	158,216	42,366	143,019	20,913	122,106	
2016	379,094	213,987	165,107	44,991	132,829	19,983	112,846	
2017	381,882	207,884	173,998	46,841	114,423	19,247	95,176	
2018	417,322	250,404	166,918	46,356	100,859	16,808	84,051	
2019	417,167	238,701	178,466	49,911	102,428	15,997	86,431	extrapolated
2020	435,214	249,028	186,186	48,147	101,035	17,305	83,730	
Trend								
1990 - 2020	255.4%	257.3%	252.9%	-41.5%	-74.7%	-82.7%	-72.0%	
2005 - 2020	62.1%	59.2%	66.1%	12.9%	-49.7%	-56.8%	-46.1%	
2019 - 2020	-4.1%	-4.1%	-4.1%	3.7%	1.4%	-7.6%	3.2%	

5.2.2.2.3 Poultry (IPCC category 3.A.4.g)

The number of Total Poultry increased by 87.3 % in the period 1990 – 2020 and increased by 10.9 % in the period 2005 – 2020. The Total poultry includes chickens (broilers), chickens' layers (hens) hens, turkey, Ducks, ducks and geese.

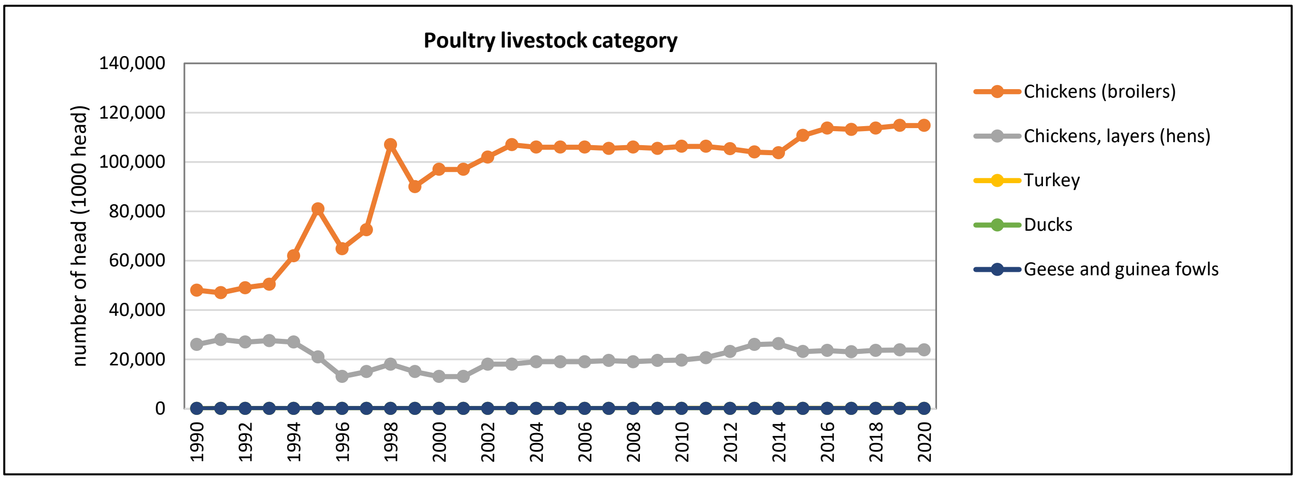

Figure 203 Poultry livestock population and its trend 1990–2020

Table 522 Poultry: livestock population by category and its trend 1990–2020

	3.A.4.b Total Poultry	**3.A.4.b.i Chickens (broilers)**	**3.A.4.b.ii Chickens, layers (hens)**	**3.A.4.e Turkey**	**3.A.4.f Other poultry**	**3.A.4.f.i Ducks**	**3.A.4.f.ii Geese**	**Source**
	1000 Head	**1000 Head**	**1000 Head**	**1000 Head**	**1000 Head**	**1000 Head**	**1000 Head**	
1990	74,107	48,000	26,000	47	60	39	21	Estimated by (Fao)
1991	75,113	47,000	28,000	50	63	41	22	
1992	76,118	49,000	27,000	52	66	43	23	
1993	78,121	50,400	27,600	52	69	45	24	
1994	89,124	62,000	27,000	55	69	45	24	
1995	102,126	81,000	21,000	57	69	45	24	
1996	77,962	64,834	13,000	59	69	45	24	
1997	87,629	72,500	15,000	60	69	45	24	
1998	125,131	107,000	18,000	62	69	45	24	
1999	105,133	90,000	15,000	64	69	45	24	
2000	110,135	97,000	13,000	66	69	45	24	
2001	110,137	97,000	13,000	68	69	45	24	
2002	120,139	102,000	18,000	70	69	45	24	
2003	125,139	107,000	18,000	70	69	45	24	
2004	125,139	106,000	19,000	70	69	45	24	
2005	125,139	106,000	19,000	70	69	45	24	
2006	125,139	106,000	19,000	70	69	45	24	
2007	125,139	105,500	19,500	70	69	45	24	
2008	125,139	106,000	19,000	70	69	45	24	
2009	125,141	105,500	19,500	70	71	46	25	
2010	126,155	106,331	19,669	80	75	48	27	
2011	127,164	106,352	20,648	85	79	50	29	
2012	128,672	105,368	23,132	87	85	55	30	
2013	130,185	104,000	26,000	90	95	60	35	
2014	130,185	103,700	26,300	90	95	60	35	
2015	134,052	110,729	23,137	90	96	60	36	
2016	137,423	113,692	23,543	91	97	60	37	
2017	136,401	113,207	23,000	96	98	62	36	
2018	137,583	113,778	23,615	92	98	62	36	
2019	138,770	114,804	23,776	93	97	61	36	
2020	138,772	114,804	23,776	94	98	62	36	
Trend								
1990 - 2020	87.3%	139.2%	-8.6%	100.0%	63.3%	59.0%	71.4%	
2005 - 2020	10.9%	8.3%	25.1%	34.3%	42.0%	37.8%	50.0%	
2019 - 2020	0.0%	0.0%	0.0%	-1.1%	-1.0%	-1.6%	0.0%	

5.2.2.2.4 Other animal

The following animals are not occurring (NO) in Algeria.

Swine	IPCC category 3.A.3	Not occuring
Buffalo	IPCC category 3.A.4.a	Not occuring
Deer	IPCC category 3.A.4.c	Not occuring
Reindeer	IPCC category 3.A.4.h.ii	Not occuring
Ostrich	IPCC category 3.A.4.h.iii	Not occuring
Fur-bearing animals	IPCC category 3.A.4.h.iv	Not occuring
Other	IPCC category 3.A.4.h.v	Not occuring

5.2.2.3 Choice of emission factors

For estimating the CH_4 emissions from the livestock categories sheep, goats, camel, horses and mules and asses, the TIER 1 and TIER 1A approach of the 2019 Refinement to 2006 IPCC Guidelines has been applied and the default emission factors methane (CH_4) were taken.

Table 523 Tier 1 and Tier 1A Emission Factor for livestock for 3.A Enteric Fermentation

Livestock		**Enteric fermentation emission factors for tier 1 method**		
		EF	**Type**	**liveweight**
		(kg CH_4 head-1 yr-1)		**kg**
Sheep	high productivity systems	9	**D**	**40**
	low productivity systems	5		**31**
Goats		9	**D**	50 kg
Camels		46	**D**	570 kg
Horses		18	**D**	550 kg
Mules and Ases		10	**D**	570 kg
Note: D Default CS Country specific				
Source: 2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10 Table 10.10 (updated): Enteric fermentation emission factors for tier 1 method				

For estimating the CH_4 emissions from the livestock categories cattle, the TIER 2 approach of the 2019 Refinement to 2006 IPCC Guidelines has been applied. The country specific emission factors for methane (CH_4) is estimated using the following equation.

Equation 10.21 (updated): CH_4 emission factors for enteric fermentation from a livestock category (2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10)[517]

$$\boldsymbol{Emission\ factor_T = \frac{GE \times \frac{Y_m}{100} \times 365}{55.65}}$$

Where:

EF = emission factor, kg CH_4 head-1 yr-1

GE = gross energy intake, MJ head-1 day-1

Ym = methane conversion factor, per cent of gross energy in feed converted to methane

energy content of methane = 55.65 (MJ/kg CH_4)

The GE is estimated based on the following equation:

Equation 10.16 (updated): gross energy for cattle/buffalo

(2019 Refinement to 2006 IPCC GL, Vol. 4, Chap. 10)[517]

$$GE = \frac{\left(\frac{NE_m + NE_a + NE_l + NE_{work} + NE_p}{REM}\right) + \left(\frac{NE_g}{REM}\right)}{DE}$$

Where:

Parameter	Description	Equations
GE	= gross energy, MJ day-1	
NE_m	= net energy required by the animal for maintenance (MJ day-1)	
NE_a	= net energy for animal activity (MJ day-1)	10.4 and 10.5
NE_l	= net energy for lactation (MJ day-1)	10.8, 10.9, 10.10
NE_{work}	= net energy for work (MJ day-1)	10.11
NE_p	= net energy required for pregnancy (MJ day-1)	10.13
REM	= ratio of net energy available in a diet for maintenance to digestible energy	10.14
NE_g	= net energy needed for growth (MJ day-1)	10.6, 10.7
REG	= ratio of net energy available for growth in a diet to digestible energy consumed	10.15
DE	= digestibility of feed expressed as a fraction of gross energy (digestible energy/gross energy)	

In the following table is provided an exemplary calculation of CH_4 emissions from Enteric fermentation (TIER 2) from dairy cattle.

Table 524 Exemplary calculation of CH_4 from 3.A.1.a.i Dairy cattle applying Tier 2 methodology

Parameter	**Parameter description**	**Unit**	**Formula**	**Source**	**Year 2020**
Mat$_{Cow-High}$	Mature Dairy Cow High Productivity Systems	#	-	Bovin Laitier Moderne (BLM)	206,000
W (=MW)	Live Weight	kg	-	Middle East, High PS[505], TABLE 10A.5 (new) Default values for live weights for animal categories, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.104	510
BW	Calf birth weight	kg	0.266xW^0.79	Equation 7 - IPCC Ref Man 1996[506]	36.63
WG	Average Daily Weight Gain	kg/day	-	TABLE 10A.1 Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.104	NA
AMiY	Annual Milk Yield	kg/cow/year	4250x1.03	Chapter 3.3, Caractéristiques de l'élevage bovin laitier en Algérie, 2021	1,223.3
DMiY	Daily Milk Yield	kg/cow/day	AMiY/365		3.35
Fat	Fat Content of Milk	%	-	Table 2, Nutritional and hygienic quality of raw milk intended for consumption in the region of Guelma, Algeria[507]	3.72%
DE	Digestible Energy	%	-	Table 10.2, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.21	78.5%
C$_{FI}$	Coefficients for calculating NE_m	MJ/day/kg	-	Table 10.4, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.21	0.386
NE$_m$	Net Energy for Maintenance	MJ/day	C_{Fi}xW^0.75	Equation 10.3, Chap. 10, Vol. 4, 2006 IPCC Guidelines	41.43
C$_a$	Activity Coefficient	#	-	Table 10.5, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.21	0.00
NE$_a$	Net Energy for Activity	MJ/day	C_a x NE_m	Equation 10.4, Chap. 10, Vol. 4, 2006 IPCC Guidelines	0.00
C	Constants for conversion	#	-	Equation 10.6, Chap. 10, Vol. 4, 2006 IPCC Guidelines	NA
NE$_g$	Net Energy for Growth	MJ/day	22.02x(BW/CxMW)^0.75x(WG)^1.097	Equation 10.6, Chap. 10, Vol. 4, 2006 IPCC Guidelines	NA
NE$_l$	Net Energy for Lactation	MJ/day	DMiYx(1.47+0.4xFat)	Equation 10.8, Chap. 10, Vol. 4, 2006 IPCC Guidelines	4.98
NE$_w$	Net Energy for Draft Power (Work)	MJ/day	0.10xNEmxhours worked per day	Equation 10.11, Chap. 10, Vol. 4, 2006 IPCC Guidelines	NO
NE$_{wool}$	Net Energy for wool	MJ/day	0.10xNEmxhours worked per day	Equation 10.12, Chap. 10, Vol. 4, 2006 IPCC Guidelines	NA
C$_{pregnancy}$	Pregnancy coefficient	#	-	Table 10.7, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL,	0.08
NE$_p$	Net Energy for Pregnancy	MJ/day	$C_{Pregnany}$ x NE_m	Equation 10.13, Chap. 10, Vol. 4, 2006 IPCC Guidelines	3.31

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[505] High PS and Low PS refer to high- and low productivity systems

[506] Revised 1996 IPCC Guidelines: Reference Manual, Agriculture, page 4.19

[507] A. Bousbia, S. Boudalia, Y. Gueroui, B. Belaize, S. Meguelati, M. Amrouchi, R. Ghebache, B. Belkheir and M. Benidir (2018): Nutritional and hygienic quality of raw milk intended for consumption in the region of Guelma. ASIAN JOURNAL OF DAIRY AND FOOD RESEARCH. Asian J. Dairy & Food Res, Print ISSN:0971-4456 / Online ISSN:0976-0563. DOI: 10.18805/ajdfr.DR-123

Parameter	**Parameter description**	**Unit**	**Formula**	**Source**	**Year 2020**
REM (NEma/DE)	Ratio of Net Energy in a Diet for Maintenance to Digestible Energy Consumed	#	1.123-(4.092x10^-3xDE)+(1.126x10^-5xDE^2)-(25.4/DE)	Equation 10.14, Chap. 10, Vol. 4, 2006 IPCC Guidelines	0.55
REG (NEga/DE)	Ratio of Net Energy Available for Growth in a Diet to Digestible Energy Consumed	#	1.164-(5.160x10^-3xDE)+(1.308x10^-5xDE^2)-(37.4/DE)	Equation 10.15, Chap. 10, Vol. 4, 2006 IPCC Guidelines	0.36
GE	Gross Energy Intake (average)	MJ/day	{[(NEm+NEa+NEl+NEw+NEp)/REM]+[NEg/REG]}/(DE/100)	Equation 10.16, Chap. 10, Vol. 4, 2006 IPCC Guidelines	115.65
Y_m	CH_4 conversion rate (average)	%		TABLE 10.12, Chap. 10, Vol. 4, 2019 Ref to 2006 IPCC GL, page 10.45	6.0%
EF - CH_4	Emission Factor - CH_4	kg CH_4/ head/ year	(GExYmx365)/55.65	Equation 10.21, Chap. 10, Vol. 4, 2006 IPCC Guidelines	45.51
CH_4 Emi	CH_4 Emissions (Tier 2)	kt CH_4	L x IEF_{CH4} x 10^-6		9.38
M	Method	-	-	-	T2
EF used	EF used	-	-	-	CS
	2006 IPCC Guidelines		2019 Ref to 2006 IPCC GL		

The following figure shows the comparison of emission estimate using country specific emission factor and IPCC default emission factors.

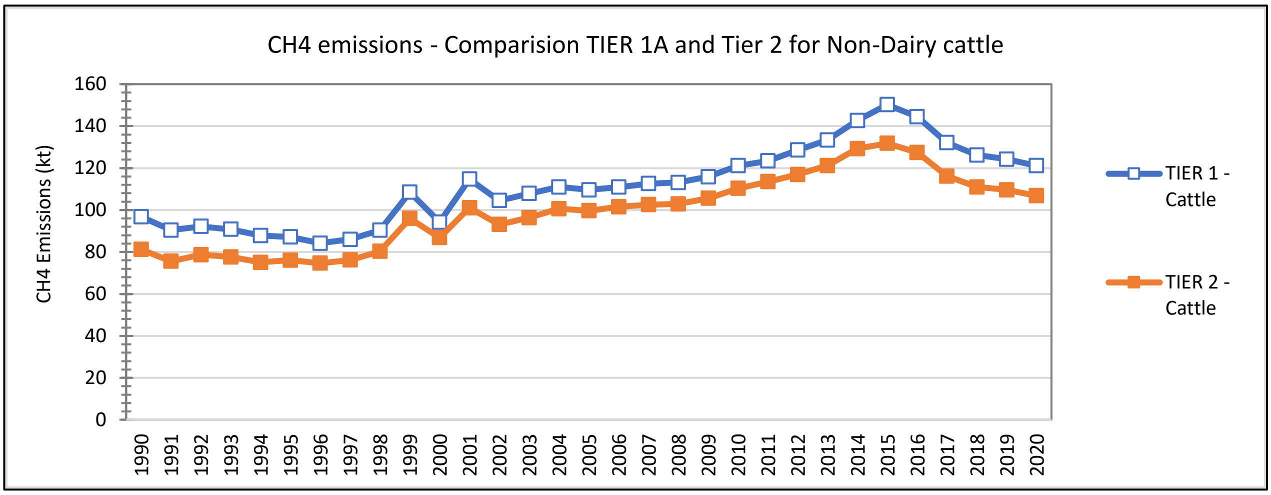

Figure 204 Comparison of emission estimate using country specific emission factor and IPCC default emission factors for cattle.

5.2.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 3.A.1 Enteric Fermentation are presented in the following table.

Table 525 Uncertainty for IPCC sub-category 3.A.1 Enteric Fermentation.

Uncertainty	**Cattle**	**Buffalo, sheep, goats, camels, horses, mules and asses**	**Reference**
	CH_4	**CH_4**	**2006 IPCC GL, Vol. 4, Chap. 10**
Activity data: Livestock	20%	20%	Chapter 10.2.3
Activity data: Feed digestibility (DE%)	20%	-	Chapter 10.2.3
Emission factor	20%	40%	Chapter 10.3.4
Combined Uncertainty	35%	45%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent with the data reported by agricultural data is the Ministry of Agriculture and Rural Development (MARD) and FAO. The break in the time series is due to change in statistical methodology.

5.2.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
- consistent use of livestock data (statistical yearbook and FAO stat- Live Animals),
- documented sources,
- use of units,
- strictly defined interfaces between spreadsheets/calculation modules,
- unique structure of sheets which do the same,
- record keeping, use of write protection, unique use of formulas, special cases are documented/highlighted,
- quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources:
    - national statistic (Ministry of Agriculture and Rural Development (MARD)
    - scientifique researchs and
    - international statistics (FAO)
- consistency and completeness checks are performed; time series consistency - plausibility checks of dips and jumps.

5.2.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 3.A.1 Enteric Fermentation.

Table 526 Recalculations done in IPCC sub-category 3.A.1 Enteric Fermentation

GHG source & sink category	Revisions of data since last NC and GHG inventory submission	Type of revision	Type of improvement
3.A.1	Application of 2006 IPCC Guidelines and 2019 refinement	Method	Accurency Comparability
3.A.1	use of default emission factor of 2019 refinement to the 2006 IPCC Guidelines and	EF	Accurency Comparability
3.A.1.a.	split of cattle in dairy in BLM. BLL and BLA for TIER 2	AD	Accurency Comparability

5.2.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 527 Planned improvements for IPCC sub-category 3.A.1 Enteric Fermentation

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.A	Correction of technical mistakes in calculation	AD, EF	Completeness	high
3.A. 3.B. 3.D.	Husbandry and Management Practice with consideration • characteristics of Livestock Husbandry for the whole time series: ○ breed, ○ age distribution, ○ weight ○ milk wool yield, ○ wool yield, ○ working hours • characteristics of manure management practice: ○ stall / housed and Housing period ○ pasture/range/paddock (flat/hilly) ○ grazing large areas (flat/hilly) ○ daily spread ○ solid storage ○ dry lot ○ liquid/slurry with/without natural crust cover ○ uncovered anaerobic lagoon ○ pit storage below animal confinements ○ anaerobic digester ○ burned for fuel ○ cattle and swine deep bedding ○ composting ○ aerobic treatment	AD	Accuracy Consistency Comparability Transparency Completeness	high
3.A. 3.B.	Manure management by temperature for sheep, goats, horses, mules, and asses, and poultry	AD	Accuracy Comparability Transparency	medium
3.A.2	Estimation of methane emissions applying TIER 2 approach as these sub-categories are key categories	method	Transparency Comparability	high
3.A.1.j 3.B.	Survey and/or research on Livestock which is not included in current statistics: e.g., buffalo, fur bearing	AD	Completeness	Medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.D	animals			

5.3 Manure management (IPCC category 3.B)

5.3.1 Category description

IPCC code	description	CO_2		CH_4		N_2O	
		Estimated	Key Category	estimated	Key category	estimated	Key category
3.B.2	**Manure Management**						
3.B.2.a	**Cattle**	NA	-	✓	Without LULUCF: LA 1990, TA With LULUCF: LA 1990,	✓	-
3.B.2.a.i	**Dairy cows**	NA	-	✓	(yes, see cattle)	✓	-
3.B.2.a.ii	**Other cattle**	NA	-	✓	(yes, see cattle)	✓	-
3.B.2.b	**Buffalo**	NA	-	NO		NO	-
3.B.2.c	**Sheep**	NA	-	✓		✓	-
3.B.2.d	**Goats**	NA	-	✓		✓	-
3.B.2.e	**Camels**	NA	-	✓	-	✓	-
3.B.2.f	**Horses**	NA	-	✓	-	✓	-
3.B.2.g	**Mules and Asses**	NA	-	✓	-	✓	-
3.B.2.h	**Swine**	NA	-	NO	-	NO	-
3.B.2.i	**Poultry**	NA	-	✓	-	✓	-
3.B.2.i.i	**Laying hens**	NA	-	IE	-	IE	-
3.B.2.i.ii	**Broilers**	NA	-	IE	-	IE	-
3.B.2.i.iii	**Turkeys**	NA	-	IE	-	IE	-
3.B.2.i.iv	**Other poultry**	NA	-	IE	-	IE	-
3.B.2.j	**Other (rabbit)**	NA	-	NE	-	NE	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
LA – Level Assessment (in year); TA – Trend Assessment							

An overview of the methane emissions resulting IPCC category 3.B *Manure Management* is provided in the following tables.

In the period 1990 – 2020 the CH_4 emissions increased by 71.5% from 31.65 kt CH_4 to 54.29 kt CH_4, and in the period 2005 – 2020 the CH_4 emissions increased by 40.8% from 35.15 kt CH_4 to 54.29 kt CH_4 mainly due to increase number of livestock. Sheep are the most significant source of methane because of their high numbers, large size and ruminant digestive system, followed by cattle and goats. An overview of the methane emissions resulting IPCC category 3.A *Enteric Fermentation* is provided in the following tables.

Table 528 CH$_4$ Emissions from IPCC category 3.B Enteric Fermentation by sub-categories

CH$_4$ emissions	3.B.1	3.B.1.a	3.B.1.a.	3.B.1.b.	3.B.2	3.B.3	3.B.4	3.B.4.a	3.B.4.b.	3.B.4.c.	3.B.4.d.	3.B.4.e.	3.B.4.f.	3.B.4.g	3.B.4.h
	Enteric Fermentation	**Cattle**	**Dairy cattle**	**Non-dairy cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Deer**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**		**kt**	**kt**	**kt**	**kt**	**kt**
1990	**31.65**	2.05	1.32	0.73	26.55	NO	3.05	NO	0.24	NO	0.84	0.13	0.36	1.48	NO
1991	**30.30**	1.89	1.18	0.71	25.34	NO	3.08	NO	0.24	NO	0.84	0.13	0.36	1.50	NO
1992	**31.76**	2.03	1.40	0.63	26.58	NO	3.14	NO	0.22	NO	0.94	0.12	0.33	1.52	NO
1993	**33.15**	2.04	1.44	0.59	28.00	NO	3.12	NO	0.22	NO	0.91	0.11	0.31	1.56	NO
1994	**32.00**	1.99	1.44	0.55	26.76	NO	3.25	NO	0.22	NO	0.86	0.10	0.28	1.78	NO
1995	**31.58**	2.03	1.52	0.51	25.95	NO	3.60	NO	0.24	NO	0.95	0.10	0.27	2.04	NO
1996	**31.48**	1.98	1.50	0.48	26.35	NO	3.15	NO	0.26	NO	0.98	0.09	0.26	1.56	NO
1997	**31.51**	2.01	1.50	0.50	26.08	NO	3.42	NO	0.29	NO	1.06	0.08	0.24	1.75	NO
1998	**33.17**	2.06	1.48	0.58	26.92	NO	4.19	NO	0.30	NO	1.11	0.08	0.21	2.50	NO
1999	**33.20**	2.38	1.60	0.78	26.98	NO	3.84	NO	0.42	NO	1.04	0.07	0.20	2.10	NO
2000	**32.36**	1.98	1.29	0.70	26.42	NO	3.95	NO	0.45	NO	1.03	0.07	0.20	2.20	NO
2001	**32.17**	2.22	1.62	0.61	25.95	NO	4.00	NO	0.47	NO	1.06	0.07	0.19	2.20	NO
2002	**32.17**	2.32	1.68	0.64	25.59	NO	4.27	NO	0.48	NO	1.12	0.08	0.19	2.40	NO
2003	**32.98**	2.33	1.67	0.67	26.25	NO	4.39	NO	0.49	NO	1.13	0.08	0.19	2.50	NO
2004	**34.19**	2.30	1.69	0.61	27.44	NO	4.45	NO	0.52	NO	1.17	0.07	0.18	2.50	NO
2005	**35.15**	2.29	1.66	0.64	28.36	NO	4.49	NO	0.52	NO	1.22	0.07	0.18	2.50	NO
2006	**36.46**	2.46	1.70	0.76	29.42	NO	4.58	NO	0.55	NO	1.28	0.07	0.18	2.50	NO
2007	**37.37**	2.52	1.72	0.80	30.23	NO	4.62	NO	0.56	NO	1.30	0.08	0.17	2.50	NO
2008	**37.00**	2.49	1.71	0.79	29.92	NO	4.59	NO	0.57	NO	1.28	0.07	0.17	2.50	NO
2009	**39.38**	2.60	1.76	0.83	32.11	NO	4.67	NO	0.58	NO	1.35	0.07	0.17	2.50	NO

CH_4 emissions	3.B.1	3.B.1.a	3.B.1.a.	3.B.1.b.	3.B.2	3.B.3	3.B.4	3.B.4.a	3.B.4.b.	3.B.4.c.	3.B.4.d.	3.B.4.e.	3.B.4.f.	3.B.4.g	3.B.4.h
	Enteric Fermentation	Cattle	Dairy cattle	Non-dairy cattle	Sheep	Swine	Other livestock	Buffalo	Camels	Deer	Goats	Horses	Mules and asses	Poultry	Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt		kt	kt	kt	kt	kt
2010	**41.78**	2.66	1.83	0.83	34.30	NO	4.81	NO	0.60	NO	1.46	0.07	0.16	2.52	NO
2011	**43.61**	2.73	1.88	0.85	35.98	NO	4.89	NO	0.61	NO	1.50	0.07	0.16	2.54	NO
2012	**45.62**	2.81	1.93	0.88	37.79	NO	5.02	NO	0.65	NO	1.56	0.08	0.15	2.57	NO
2013	**47.93**	2.92	2.02	0.90	39.86	NO	5.16	NO	0.66	NO	1.67	0.07	0.15	2.60	NO
2014	**50.07**	3.11	2.15	0.96	41.71	NO	5.25	NO	0.68	NO	1.74	0.07	0.15	2.60	NO
2015	**50.70**	3.26	2.22	1.04	42.17	NO	5.28	NO	0.70	NO	1.70	0.07	0.13	2.68	NO
2016	**50.70**	3.15	2.13	1.01	42.20	NO	5.35	NO	0.73	NO	1.68	0.07	0.12	2.75	NO
2017	**50.70**	2.76	1.94	0.82	42.59	NO	5.34	NO	0.73	NO	1.70	0.08	0.10	2.73	NO
2018	**51.23**	2.76	1.89	0.87	43.09	NO	5.39	NO	0.80	NO	1.67	0.08	0.09	2.75	NO
2019	**52.21**	2.72	1.87	0.85	44.07	NO	5.43	NO	0.80	NO	1.68	0.08	0.09	2.78	NO
2020	**54.29**	2.65	1.82	0.83	46.36	NO	5.28	NO	0.84	NO	1.67	NE	NE	2.78	NO
Trend															
1990 - 2020	71.5%	29.0%	37.6%	13.4%	74.6%	NA	73.0%	NA	255.4%	NA	98.6%	NA	NA	87.3%	NA
2005 - 2020	54.5%	15.4%	9.6%	30.7%	63.4%	NA	17.6%	NA	62.1%	NA	36.7%	NA	NA	10.9%	NA
2019 - 2020	4.0%	-2.6%	-2.6%	-2.6%	5.2%	NA	-2.7%	NA	4.3%	NA	-0.4%	NA	NA	0.0%	NA

Table 529 CH_4 Emissions from IPCC category 3.B Enteric Fermentation by sub-categories

N_2O emissions	3.B.1	3.B.1.a	3.B.1.a.	3.B.1.b.	3.B.2	3.B.3	3.B.4	3.B.4.a	3.B.4.b.	3.B.4.c.	3.B.4.d.	3.B.4.e.	3.B.4.f.	3.B.4.g	3.B.4.h
	Enteric Fermentation	**Cattle**	**Dairy cattle**	**Non-dairy cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Deer**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**		**kt**	**kt**	**kt**	**kt**	**kt**
1990	**9.92**	2.64	1.26	1.38	5.48	NO	**1.80**	NO	0.04	NO	1.47	0.0007	0.22	0.08	NO
1991	**9.51**	2.47	1.13	1.34	5.23	NO	**1.81**	NO	0.05	NO	1.47	0.0007	0.22	0.08	NO
1992	**9.98**	2.53	1.34	1.19	5.49	NO	**1.96**	NO	0.04	NO	1.64	0.0007	0.20	0.08	NO
1993	**10.17**	2.49	1.38	1.11	5.78	NO	**1.90**	NO	0.04	NO	1.59	0.0006	0.19	0.08	NO
1994	**9.74**	2.41	1.38	1.03	5.52	NO	**1.81**	NO	0.04	NO	1.51	0.0006	0.17	0.09	NO
1995	**9.72**	2.41	1.45	0.95	5.36	NO	**1.96**	NO	0.05	NO	1.65	0.0005	0.16	0.10	NO
1996	**9.77**	2.33	1.44	0.90	5.44	NO	**2.00**	NO	0.05	NO	1.72	0.0005	0.15	0.08	NO
1997	**9.91**	2.39	1.43	0.95	5.38	NO	**2.14**	NO	0.05	NO	1.85	0.0004	0.14	0.09	NO
1998	**10.30**	2.50	1.41	1.09	5.56	NO	**2.24**	NO	0.06	NO	1.93	0.0004	0.13	0.13	NO
1999	**10.69**	3.00	1.53	1.47	5.57	NO	**2.12**	NO	0.08	NO	1.81	0.0004	0.12	0.11	NO
2000	**10.11**	2.54	1.23	1.31	5.46	NO	**2.11**	NO	0.08	NO	1.79	0.0004	0.12	0.11	NO
2001	**10.20**	2.68	1.55	1.14	5.35	NO	**2.17**	NO	0.09	NO	1.85	0.0004	0.11	0.11	NO
2002	**10.35**	2.81	1.61	1.20	5.27	NO	**2.27**	NO	0.09	NO	1.94	0.0004	0.12	0.12	NO
2003	**10.56**	2.85	1.59	1.26	5.41	NO	**2.31**	NO	0.09	NO	1.97	0.0004	0.12	0.13	NO
2004	**10.80**	2.76	1.61	1.15	5.66	NO	**2.38**	NO	0.10	NO	2.05	0.0004	0.11	0.13	NO
2005	**11.09**	2.78	1.58	1.20	5.85	NO	**2.46**	NO	0.10	NO	2.13	0.0004	0.11	0.13	NO
2006	**11.69**	3.05	1.62	1.43	6.07	NO	**2.56**	NO	0.10	NO	2.23	0.0004	0.11	0.13	NO
2007	**12.00**	3.15	1.64	1.50	6.24	NO	**2.61**	NO	0.10	NO	2.27	0.0004	0.10	0.13	NO
2008	**11.85**	3.11	1.63	1.48	6.18	NO	**2.56**	NO	0.11	NO	2.22	0.0004	0.10	0.13	NO
2009	**12.56**	3.25	1.69	1.57	6.62	NO	**2.69**	NO	0.11	NO	2.35	0.0004	0.10	0.13	NO

N_2O emissions	3.B.1	3.B.1.a	3.B.1.a.	3.B.1.b.	3.B.2	3.B.3	3.B.4	3.B.4.a	3.B.4.b.	3.B.4.c.	3.B.4.d.	3.B.4.e.	3.B.4.f.	3.B.4.g	3.B.4.h
	Enteric Fermentation	**Cattle**	**Dairy cattle**	**Non-dairy cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Deer**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**		**kt**	**kt**	**kt**	**kt**	**kt**
2010	**13.26**	3.32	1.75	1.57	7.06	NO	**2.88**	NO	0.11	NO	2.54	0.0004	0.10	0.13	NO
2011	**13.76**	3.40	1.80	1.60	7.40	NO	**2.96**	NO	0.11	NO	2.61	0.0004	0.10	0.13	NO
2012	**14.34**	3.50	1.85	1.65	7.77	NO	**3.07**	NO	0.12	NO	2.72	0.0004	0.09	0.13	NO
2013	**15.08**	3.62	1.93	1.69	8.20	NO	**3.26**	NO	0.12	NO	2.91	0.0004	0.09	0.13	NO
2014	**15.83**	3.86	2.05	1.82	8.58	NO	**3.39**	NO	0.13	NO	3.04	0.0004	0.09	0.13	NO
2015	**16.05**	4.08	2.12	1.96	8.66	NO	**3.32**	NO	0.13	NO	2.97	0.0004	0.08	0.14	NO
2016	**15.88**	3.95	2.04	1.91	8.66	NO	**3.27**	NO	0.14	NO	2.92	0.0004	0.07	0.14	NO
2017	**15.43**	3.40	1.86	1.55	8.72	NO	**3.31**	NO	0.14	NO	2.97	0.0004	0.06	0.14	NO
2018	**15.52**	3.45	1.80	1.65	8.82	NO	**3.25**	NO	0.15	NO	2.91	0.0004	0.05	0.14	NO
2019	**15.68**	3.39	1.78	1.61	9.02	NO	**3.27**	NO	0.15	NO	2.92	0.0005	0.06	0.14	NO
2020	**16.00**	3.30	1.74	1.57	9.49	NO	**3.21**	NO	0.16	NO	2.91	0.0000	0.00	0.14	NO
Trend															
1990 - 2020	*61.3%*	*25.0%*	*37.6%*	*13.4%*	*73.2%*	*NA*	*78.1%*	NA	255.4%	NA	98.6%	NA	NA	87.3%	NA
2005 - 2020	*44.2%*	*18.7%*	*9.6%*	*30.7%*	*62.2%*	*NA*	*30.3%*	NA	62.1%	NA	36.7%	NA	NA	10.9%	NA
2019 - 2020	2.0%	-2.6%	-2.6%	-2.6%	5.2%	NA	-1.9%	NA	4.3%	NA	-0.4%	NA	NA	0.0%	NA

This section describes the estimation of methane and nitrous oxide emissions resulting during the storage and treatment of manure, and from manure deposited on pasture. The term 'manure' is used here collectively to include both dung and urine (i.e., the solids and the liquids) produced by livestock. The following figure shows a schematic overview of manure management practices.

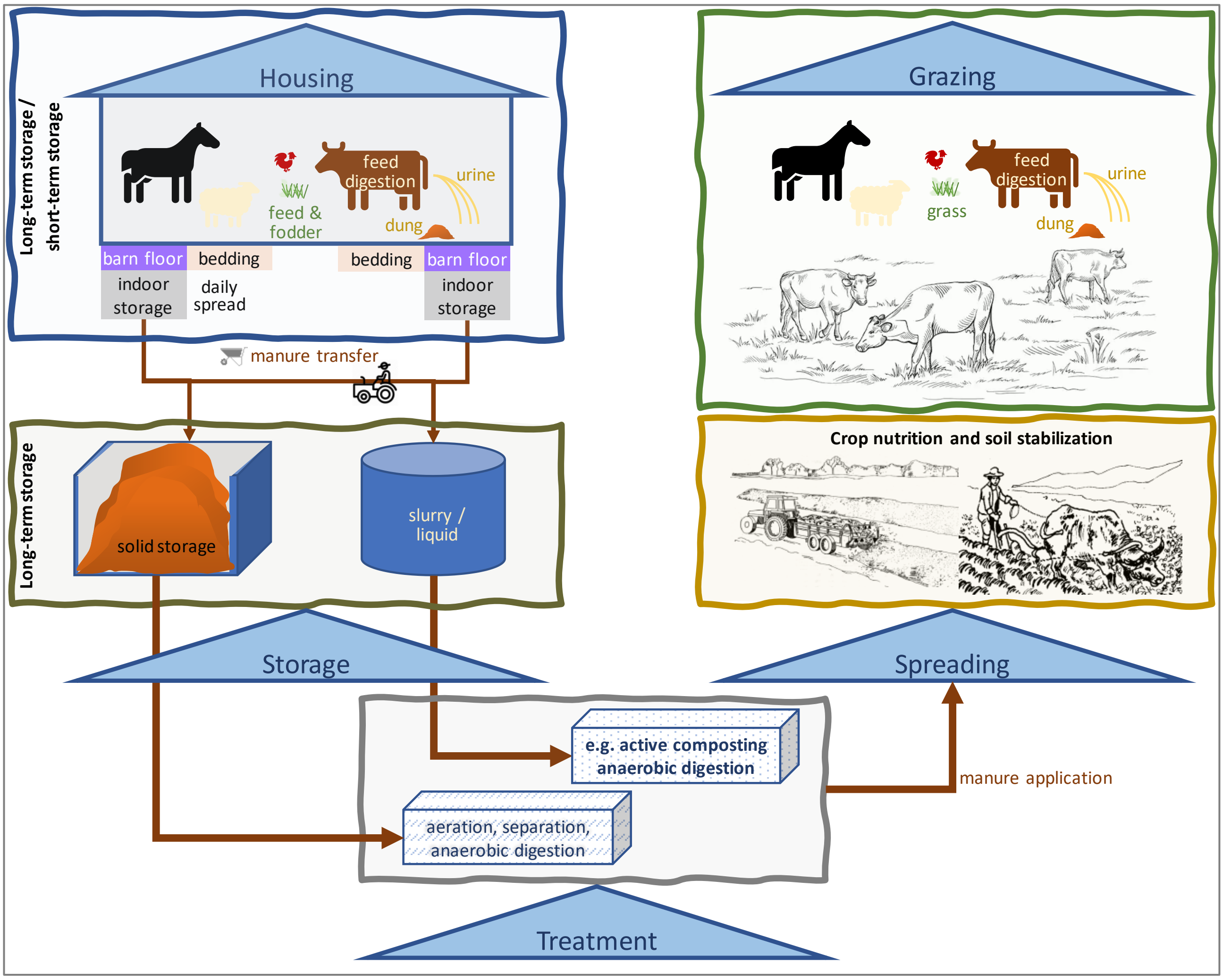

Figure 205 Schematic overview of manure management practices

As described in the Refinement 2019 to 2006 IPCC Guidelines (Volume 4, Chapter 10.4) methane (CH_4) is produced during decomposition of manure under anaerobic conditions (i.e., in the absence of oxygen), during storage and treatment. These conditions occur most readily when large numbers of animals are managed in a confined area (e.g., dairy farms, beef feedlots, and swine and poultry farms), and where manure is disposed of in liquid-based systems.

The main factors affecting CH_4 emissions are:

- the amount of manure produced:
- depending on the rate of waste production per animal and the number of animals
- the portion of the manure that decomposes anaerobically
- depending on how the manure is managed.
- when manure is stored or treated as a liquid (e.g., in lagoons, ponds, tanks, or pits), it decomposes anaerobically and can produce a significant quantity of CH_4. The temperature and the retention time of the storage unit greatly affect the amount of methane produced.

when manure is handled as a solid (e.g., in stacks or piles) or when it is deposited on pastures and rangelands, it tends to decompose under more aerobic conditions and less CH_4 is produced.

In the following table are the different manure management systems and their definitions presented. The table below provides information regarding the manure management system (MMS) in Algeria as used in the inventory.

Table 530 Definitions of manure management system

System	**Definition**	**National Manure Management System**				
		Bovins (BLA +BLL+BLM)	**Sheep/ Goats**	**camels**	**Horses /mules /ases**	**poultry**
Pasture/Range/Paddock (PRP)	The manure from pasture and range grazing animals is allowed to lie as deposited, and is not managed.	X	X	X	X	
Daily spread	Manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion	X				
Solid storage	The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation. Solid stores can be covered or compacted. In some cases, bulking agent or additives are added.	X				
Solid storage covered /compacted	Similar to solid storage, but the manure pile is a) covered with a plastic sheet to reduce the surface of manure exposed to air and/or b) compacted to increase the density and reduce the free air space within the material.					X
Solid storage - Bulking agent addition	Specific materials (bulking agents) are mixed with the manure to provide structural support. This allows the natural aeration of the pile, thus enhancing decomposition. (e.g., sawdust, straw, coffee husks, maize stover)					
Solid storage - Additives	The addition of specific substances to the pile in order to reduce gaseous emissions. Addition of certain compounds such as attapulgite, dicyandiamide or mature compost have shown to reduce N_2O emissions; while phosphogypsum reduce CH_4 emissions					
Dry lot	A paved or unpaved open confinement area without any significant vegetative cover. Dry lots do not require the addition of bedding to control moisture. Manure may be removed periodically and spread on fields.				X	
Liquid/Slurry	Manure is stored as excreted or with some minimal addition of water or bedding material in tanks or ponds outside the animal housing. Manure is removed and spread on fields once or more in a calendar year. Manure is agitated before removal from the tank/ponds to ensure that most of the VS are removed from the tank.	X				X
Uncovered anaerobic lagoon	A type of liquid storage system designed and operated to combine waste stabilization and storage. Lagoons have a lower depth and a much larger surface compared to liquid slurry stores. Anaerobic lagoons are designed with varying lengths of storage (up to a year or greater), depending on the climate region, the volatile solids loading rate, and other operational factors. The supernatant water from the lagoon may be recycled as flush water or used to irrigate and fertilise fields.					X
Pit storage below animal confinements	Collection and storage of manure usually with little or no added water typically below a slatted floor in an enclosed animal confinement facility, usually for periods less than one year. Manure may be pumped out of the storage to a secondary storage tank multiple times in one year, or stored and applied directly to fields. It is assumed that VS removal rates on tank emptying are >90%.					X
Anaerobic digester Digesters of high quality	Animal manure with and without straw are collected and anaerobically digested in a containment vessel. Co-digestion with other waste or energy crops may occur.					

System		**Definition**	**National Manure Management System**				
			Bovins (BLA +BLL+BLM)	**Sheep/ Goats**	**camels**	**Horses /mules /ases**	**poultry**
Pasture/Range/Paddock (PRP)		The manure from pasture and range grazing animals is allowed to lie as deposited, and is not managed.	X	X	X	X	
	and low leakage	Digesters are designed, constructed and operated according to industrial technology standard for waste stabilization by the microbial reduction of complex organic compounds to CO_2 and CH_4. Biogas is captured and used as a fuel. Digestate is stored either in open storage, in covered storage with no leakage control, or in gas tight storage with gas recovery or flaring.					
	Digesters with high leakage	Animal manure with and without straw are collected and anaerobically digested in covered lagoon. Digesters are used for waste stabilization by the microbial reduction of complex organic compounds to CO_2 and CH_4 openly, covered, or gas tightly. Biogas is captured and flared or used as a fuel. After anaerobic digestion, digestate is stored either					
Burned for fuel		The dung and urine are excreted on fields. The sun dried dung cakes are burned for fuel					
Deep bedding		As manure accumulates, bedding is continually added to absorb moisture over a production cycle and possibly for as long as 6 to 12 months. This manure management system also is known as a bedded pack manure management system and may be combined with a dry lot or pasture. Manure may undergo periods where animals are present and are actively mixing the manure, or periods in which the pack is undisturbed.					
Composting	in- vessel	Composting, typically in an enclosed channel, with forced aeration and continuous mixing.					
	Static pile	Composting in piles with forced aeration but no mixing, with runoff/leaching containment.					
		Composting in piles with forced aeration but no mixing, without runoff/leaching containment.					
	Intensive windrow	Composting in windrows with regular (at least daily) turning for mixing and aeration runoff/leaching containement.					
		Composting in windrows with regular (at least daily) turning for mixing and aeration no runoff/leaching containement.					
	Composting passive windrow	Composting in windrows with infrequent turning for mixing and aeration, with runoff/leaching.					
		Composting in windrows with infrequent turning for mixing and aeration, with runoff/leaching.					
Poultry manure with litter		Similar to cattle and swine deep bedding except usually not combined with a dry lot or pasture. Typically used for all poultry breeder flocks, for alternative systems for layers and for the production of meat type chickens (broilers) and other fowl. Litter and manure are left in place with added bedding during the poultry production cycle and cleaned between poultry cycles, typically 5 to 9 weeks in productive systems and greater in lower productivity systems.					
Poultry manure without litter		May be similar to open pits in enclosed animal confinement facilities or may be designed and operated to dry the manure as it accumulates. The latter is known as a high-rise manure management system and is a form of passive windrow composting when designed and operated properly. Some intensive poultry farms installed the manure belt under the cage, where the manure is dried inside housing.					
Aerobic treatment		The biological oxidation of manure collected as a liquid with either forced or natural aeration. Natural aeration is limited to aerobic and facultative ponds and wetland systems and is due primarily to photosynthesis. Hence, these systems typically become anoxic during periods without sunlight.					

System	**Definition**	**National Manure Management System**				
		Bovins (BLA +BLL+BLM)	**Sheep/ Goats**	**camels**	**Horses /mules /ases**	**poultry**
Pasture/Range/Paddock (PRP)	The manure from pasture and range grazing animals is allowed to lie as deposited, and is not managed.	X	X	X	X	
For more information and detailed background information please check the Refinement 2019 to 2006 IPCC Guidelines						
Source: Refinement 2019 to 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10 Emissions from Livestock and Manure Management - sub-chapter 10.4.3 choice of activity data. Table 10.18 (updated) Definitions of manure management systems. Page 10.72 , 10.73.						

As described in the 2006 IPCC Guidelines (Volume 4, Chapter 10.5) nitrous oxide (N_2O) is produced, directly and indirectly, during the storage and treatment of manure before it is applied to land or otherwise used for feed, fuel, or construction purposes.

Direct N_2O emissions occur via combined nitrification and denitrification of nitrogen contained in the manure. The emission of N_2O from manure during storage and treatment depends on the nitrogen and carbon content of manure, and on the duration of the storage and type of treatment. Nitrification (the oxidation of ammonia nitrogen to nitrate nitrogen) is a necessary prerequisite for the emission of N_2O from stored animal manures. Nitrification is likely to occur in stored animal manures provided there is a sufficient supply of oxygen. Nitrification does not occur under anaerobic conditions. Nitrites and nitrates are transformed to N_2O and dinitrogen (N2) during the naturally occurring process of denitrification, an anaerobic process.

Indirect emissions result from volatile nitrogen losses that occur primarily in the forms of ammonia and NOx. The fraction of excreted organic nitrogen that is mineralized to ammonia nitrogen during manure collection and storage depends primarily on time, and to a lesser degree temperature. Simple forms of organic nitrogen such as urea (mammals) and uric acid (poultry) are rapidly mineralized to ammonia nitrogen, which is highly volatile and easily diffused into the surrounding air. Nitrogen losses begin at the point of excretion in houses and other animal production areas (e.g., milk parlors) and continue through on-site management in storage and treatment systems (i.e., manure management systems). Nitrogen is also lost through runoff and leaching into soils from the solid storage of manure at outdoor areas, in feedlots a d where animals are grazing in pastures.

The CH_4 emissions generated by manure in the

system ‘buildings housing livestock, manure stores or yards’ are reported under

⇒ 3.B Manure Management

system ‘manure handling and storage’ are reported under

⇒ 3.B Manure Management

The N_2O emissions generated by manure in the system ‘pasture, range, and paddock’ occur directly and indirectly from the soil, and are therefore reported under the category

⇒ 3.D.a Direct N_2O emissions from managed soils

⇒ 3.D.a.2 Organic N fertilizers

⇒ 3.D.a.2.a Animal manure applied to soils

⇒ 3.D.b IndirectN_2O Emissions from managed soils

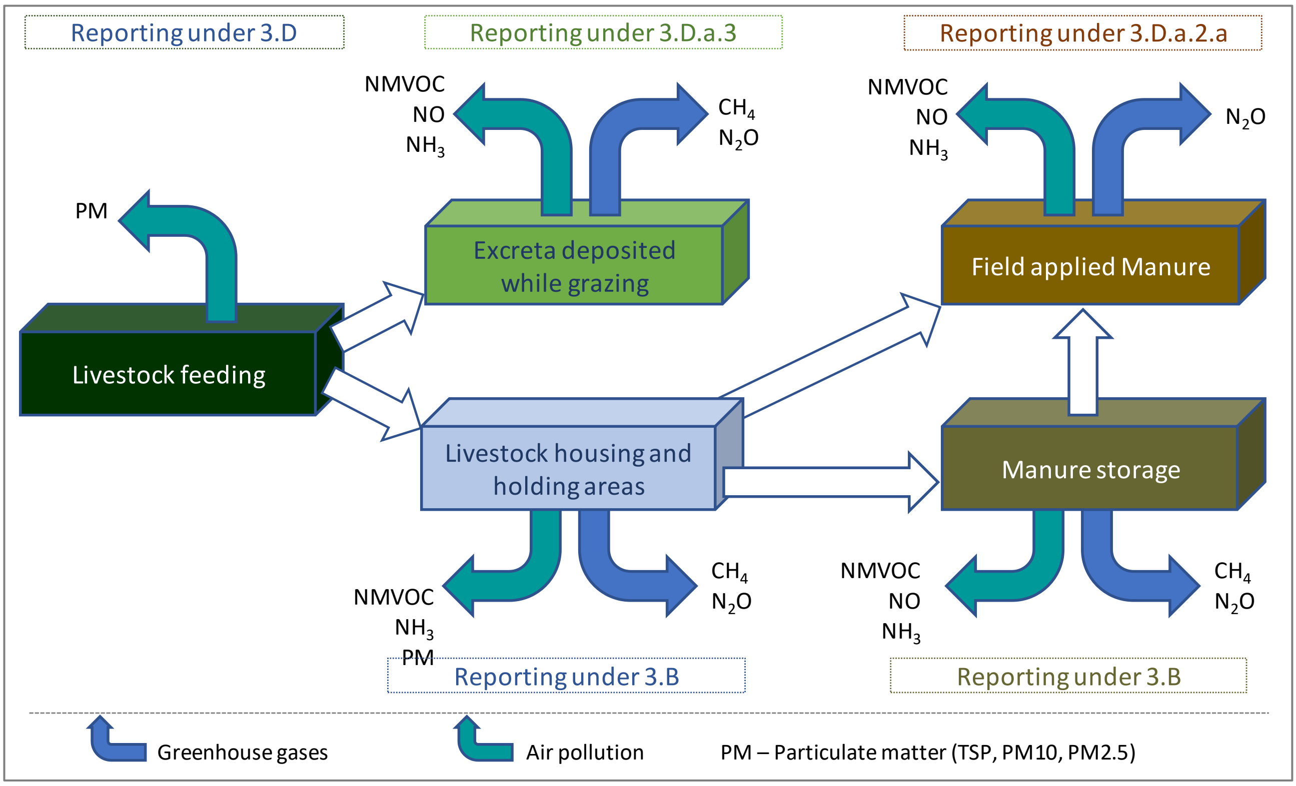

Figure 206 Scheme for emissions resulting from livestock feeding, livestock excreta and manure management

Table 531 CH_4 Emissions from IPCC category 3.B manure management by sub-categories

CH_4 emissions	**3.B.1**	**3.B.1.a**	**3.B.1.a.**	**3.B.1.b.**	**3.B.2**	**3.B.3**	**3.B.4**	**3.B.4.a**	**3.B.4.b.**	**3.B.4.d.**	**3.B.4.e.**	**3.B.4.f.**	**3.B.4.g**	**3.B.4.h**
	manure management	**Cattle**	**Dairy cattle**	**Non-dairy cattle**	**Sheep**	**Swine**	**Other livestock**	**Buffalo**	**Camels**	**Goats**	**Horses**	**Mules and asses**	**Poultry**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	**31.65**	2.05	1.32	0.73	26.55	NO	55.60	NO	5.63	44.50	1.48	3.99	NA	NO
1991	**30.30**	1.89	1.18	0.71	25.34	NO	55.91	NO	5.80	44.72	1.38	3.99	NA	NO
1992	**31.76**	2.03	1.40	0.63	26.58	NO	60.21	NO	5.25	49.95	1.31	3.69	NA	NO
1993	**33.15**	2.04	1.44	0.59	28.00	NO	58.23	NO	5.26	48.30	1.19	3.48	NA	NO
1994	**32.00**	1.99	1.44	0.55	26.76	NO	55.23	NO	5.24	45.79	1.11	3.08	NA	NO
1995	**31.58**	2.03	1.52	0.51	25.95	NO	59.97	NO	5.81	50.04	1.08	3.05	NA	NO
1996	**31.48**	1.98	1.50	0.48	26.35	NO	62.16	NO	6.26	52.11	0.94	2.86	NA	NO
1997	**31.51**	2.01	1.50	0.50	26.08	NO	66.64	NO	6.94	56.19	0.83	2.68	NA	NO
1998	**33.17**	2.06	1.48	0.58	26.92	NO	68.87	NO	7.10	58.62	0.83	2.32	NA	NO
1999	**33.20**	2.38	1.60	0.78	26.98	NO	68.22	NO	10.12	55.11	0.79	2.20	NA	NO
2000	**32.36**	1.98	1.29	0.70	26.42	NO	68.24	NO	10.77	54.48	0.79	2.20	NA	NO
2001	**32.17**	2.22	1.62	0.61	25.95	NO	70.51	NO	11.29	56.33	0.76	2.13	NA	NO
2002	**32.17**	2.32	1.68	0.64	25.59	NO	73.52	NO	11.49	59.05	0.84	2.15	NA	NO
2003	**32.98**	2.33	1.67	0.67	26.25	NO	74.49	NO	11.64	59.85	0.86	2.15	NA	NO
2004	**34.19**	2.30	1.69	0.61	27.44	NO	77.49	NO	12.56	62.11	0.80	2.01	NA	NO
2005	**35.15**	2.29	1.66	0.64	28.36	NO	79.75	NO	12.35	64.62	0.77	2.01	NA	NO
2006	**36.46**	2.46	1.70	0.76	29.42	NO	83.51	NO	13.19	67.58	0.78	1.95	NA	NO
2007	**37.37**	2.52	1.72	0.80	30.23	NO	85.23	NO	13.40	69.08	0.85	1.90	NA	NO
2008	**37.00**	2.49	1.71	0.79	29.92	NO	83.77	NO	13.57	67.52	0.82	1.85	NA	NO
2009	**39.38**	2.60	1.76	0.83	32.11	NO	87.89	NO	13.85	71.32	0.81	1.91	NA	NO

CH$_4$ emissions	3.B.1	3.B.1.a	3.B.1.a.	3.B.1.b.	3.B.2	3.B.3	3.B.4	3.B.4.a	3.B.4.b.	3.B.4.d.	3.B.4.e.	3.B.4.f.	3.B.4.g	3.B.4.h
	manure management	Cattle	Dairy cattle	Non-dairy cattle	Sheep	Swine	Other livestock	Buffalo	Camels	Goats	Horses	Mules and asses	Poultry	Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2010	**41.78**	2.66	1.83	0.83	34.30	NO	94.16	NO	14.44	77.17	0.79	1.76	NA	NO
2011	**43.61**	2.73	1.88	0.85	35.98	NO	96.67	NO	14.66	79.40	0.80	1.81	NA	NO
2012	**45.62**	2.81	1.93	0.88	37.79	NO	100.90	NO	15.65	82.70	0.83	1.72	NA	NO
2013	**47.93**	2.92	2.02	0.90	39.86	NO	106.68	NO	15.82	88.39	0.81	1.65	NA	NO
2014	**50.07**	3.11	2.15	0.96	41.71	NO	111.05	NO	16.31	92.34	0.76	1.65	NA	NO
2015	**50.70**	3.26	2.22	1.04	42.17	NO	109.11	NO	16.66	90.25	0.76	1.43	NA	NO
2016	**50.70**	3.15	2.13	1.01	42.20	NO	108.40	NO	17.44	88.82	0.81	1.33	NA	NO
2017	**50.70**	2.76	1.94	0.82	42.59	NO	109.70	NO	17.57	90.14	0.84	1.14	NA	NO
2018	**51.23**	2.76	1.89	0.87	43.09	NO	109.39	NO	19.20	88.35	0.83	1.01	NA	NO
2019	**52.21**	2.72	1.87	0.85	44.07	NO	109.84	NO	19.19	88.72	0.90	1.02	NA	NO
2020	**54.29**	2.65	1.82	0.83	46.36	NO	108.37	NO	20.02	88.35	NE	NE	NA	NO
Trend														
1990 - 2020	*71.5%*	*29.0%*	*37.6%*	*13.4%*	*74.6%*	*NA*	*73.0%*	*NA*	*255.4%*	*98.6%*	*NA*	*NA*	*NA*	*NA*
2005 - 2020	*54.5%*	*15.4%*	*9.6%*	*30.7%*	*63.4%*	*NA*	*17.6%*	*NA*	*62.1%*	*36.7%*	*NA*	*NA*	*NA*	*NA*
2019 - 2020	*4.0%*	*-2.6%*	*-2.6%*	*-2.6%*	*5.2%*	*NA*	*-2.7%*	*NA*	*4.3%*	*-0.4%*	*NA*	*NA*	*NA*	*NA*

5.3.2 Methodological issues

5.3.2.1 Choice of methods

For estimating the

- The CH_4 emissions from all livestock the 2006 IPCC Guidelines Tier 1 approach[508] has been applied.
- direct and indirect N_2O emissions from all livestock the 2006 IPCC Guidelines Tier 1 approach[509] has been applied.

TIER 1 approach – methane emissions

Tier 1 is simplified method that only requires livestock population data by animal species/category and climate region or temperature, in combination with IPCC default emission factors, to estimate emissions. Because some emissions from manure management systems are highly temperature dependent, it is good practice to estimate the average annual temperature associated with the locations where manure is managed.

Equation 10.22: CH_4 emissions from manure management from a livestock category

$$\boldsymbol{Emissions_{CH4} = Livestock_{\ category} \times \left(\frac{Emission\ Factor_T}{10^6}\right)}$$

Where:

Emissions $_{CH4}$ = CH_4 emissions (Gg CH_4)
Livestock $_{category}$ = number of head of livestock species / category T
Emission factor $_T$ = default emission factor for a defined livestock population (kg CH_4 $head^{-1}$).
T = species/category of livestock

Finally, the total emissions from the species/category of livestock was estimated applying the following equation:

Total emissions from livestock manure management

$$\boldsymbol{Emissions_{CH4\ manure} = \sum_i emissions_i}$$

Where:

Emissions $_{CH4\ manure}$ = total CH_4 emissions from Manure Management (Gg CH_4)
Emission $_i$ = emissions for the i^{th} livestock categories and subcategories.

TIER 1 approach – Direct N_2O emissions from Manure Management

The Tier 1 method entails multiplying the total amount of N excretion (from all livestock species/categories) in each type of manure management system by an emission factor for that type of manure management system (*see below Equation 10.25*). Emissions are then summed over all manure management systems. The Tier 1 method is applied using IPCC default N_2O emission factors, default nitrogen excretion data, and default manure management system data.

Equation 10.25: Direct N_2O emissions from Manure Management

$$\boldsymbol{Emissions_{N2O} = \left[\sum_S \left[\sum_T \left(N_T \times\ Nex_{(T)} \times\ MS_{(T,S)}\right)\right] \times EF_{3(S)}\right] \times \frac{44}{28}}$$

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[508] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10 Emissions from Livestock and Manure Management, sub-chap 10.4.1 Choice of method

[509] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10 Emissions from Livestock and Manure Management, sub-chap 10.5.1 Choice of method

Where:

$N_2O_{D(mm)}$ = direct N_2O emissions from Manure Management in the country (kg N_2O)
$N_{(T)}$ = number of head of livestock species/category T in the country
$Nex_{(T)}$ = annual average N excretion per head of species/category T in the country (kg N / animal)
$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S in the country, dimensionless
$EF_{3(S)}$ = emission factor for direct N_2O emissions from manure management system S in the country (kg N_2O-N/kg N in manure management system S)
S = manure management system
T = species/category of livestock
44/28 = conversion of $(N_2O\text{-}N)_{(mm)}$ emissions to $N_2O_{(mm)}$ emissions

Following the guidance provided in the 2006 IPCCC guidelines (Volume 4, Chapter 10.5.1) the following five steps were used to estimate direct N_2O emissions from Manure Management:

Step 1: Collect population data from the Livestock Population Characterization;

Step 2: Use default values or develop the annual average nitrogen excretion rate per head (Nex(T)) for each defined livestock species/category T;

Step 3: Use default values or determine the fraction of total annual nitrogen excretion for each livestock species/category T that is managed in each manure management system S ($MS_{(T,S)}$);

Step 4: Use default values or develop N_2O emission factors for each manure management system S (EF3(S));

Step 5: For each manure management system type S, multiply its emission factor ($EF_{3(S)}$) by the total amount of nitrogen managed (from all livestock species/categories) in that system, to estimate N_2O emissions from that manure management system. Then sum over all manure management systems.

There may be losses of nitrogen in other forms (e.g., ammonia and NOx) as manure is managed on site. Nitrogen in the volatilized form of ammonia may be deposited at sites downwind from manure handling areas and contribute to indirect N_2O emissions (see below).

TIER 1 approach – Indirect N_2O emissions from Manure Management

The Tier 1 calculation of N volatilization in forms of NH_3 and NO_x from manure management systems is based on multiplication of the amount of nitrogen excreted (from all livestock categories) and managed in each manure management system by a fraction of volatilized nitrogen (see below Equation 10.26). Nitrogen (N) losses are then summed over all manure management systems.

The Tier 1 method was applied using

- default nitrogen excretion data,
- default manure management system data and
- default fractions of N losses from manure management systems due to volatilization.

Equation 10.26: Nitrogen (N) losses due to volatilization from manure management

$$\boldsymbol{N_{volatilzation-MMS}} = \left[\sum_{\boldsymbol{S}}\left[\sum_{\boldsymbol{T}}\left(\boldsymbol{N_T} \times \boldsymbol{Nex_{(T)}} \times \boldsymbol{MS_{(T,S)}}\right) \times \left(\frac{\boldsymbol{Frac_{GasMS}}}{\boldsymbol{100}}\right)_{(\boldsymbol{T},\boldsymbol{S})}\right]\right]$$

Where:

$N_{volatilization\text{-}MMS}$ = amount of manure nitrogen that is lost due to volatilization of NH_3 and NOx (kg N)
$N_{(T)}$ = number of head of livestock species/category T in the country

$Nex_{(T)}$ = annual average N excretion per head of species/category T in the country (kg N / animal)

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S in the country, dimensionless

$Frac_{GasMS}$ = percent of managed manure nitrogen for livestock category T that volatilizes as NH_3 and NO_x in the manure management system S (%)

The indirect N_2O emissions from volatilisation of N in forms of NH_3 and NOx ($N_2O_{G(mm)}$) are estimated using the following equation:

Equation 10.27: Indirect N_2O emissions due to volatilization of N from manure management

$$\boldsymbol{Indirect\ emissions\ N_2O}_{\boldsymbol{manure\ management}} = (\boldsymbol{N}_{\text{volatilization}-\text{MMS}} \times \boldsymbol{EF_4}) \times \frac{\mathbf{44}}{\mathbf{28}}$$

Where:

$N_2O_{G(mm)}$ = indirect N_2O emissions due to volatilization of N from Manure Management in the country (kg N_2O)

EF_4 = emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces (kg N_2O-N (kg NH3-N + NOx-N volatilised)$^{-1}$
with default value 0.01 kg N_2O-N (kg NH3-N +NOx-N volatilised)$^{-1}$

5.3.2.2 Choice of activity data

As described in Chapter **Erreur ! Source du renvoi introuvable.** above, the original data provider for the n ational and international agricultural data is the Ministry of Agriculture and Rural Development (MARD) and Statistical Office of Algeria (ONS)[510]. The agricultural data used and presented in this inventory are taken from the following national and international sources: FAO agricultural data base[511]

Detailed data and relevant description are provided in Chapter 5.2.2.2.

5.3.2.3 Choice of emission factors

Default emission factors for methane (CH_4)

The default emission factors for methane (CH_4) were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 532 Emission factors for Tier 1 for IPCC sub-category 3.B Manure Management

Livestock	**CH_4 emission factor by average annual temperature (°C) (kg/head per year)**		**Region / average annual temperature**	**Source**
	EF	**type**	**EF**	
Dairy Cows	2	D	Middle East: 25° temperate	**2006 IPCC Guidelines Vol. 4, Chap. 10 (10.4.2)** Table 10.14 Manure management methane emission factors by temperature (page 10.38ff)
Other Cattle	1	D		
Sheep	0.15	D	Developing countries / Temperate (15 to 25°C) temperate	**2006 IPCC Guidelines Vol. 4, Chap. 10 (10.4.2)** Table 10.15 Manure management methane emission factors by temperature (page 10.47)
Goats	0.17	D		
Horses	1.64	D		
Mules and Asses	0.9	D		

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[510] Available (03. May 2022) on https://www.ons.dz/

[511] Available (03. January 2022) on http://www.fao.org/statistics/en/

Livestock	**CH_4 emission factor by average annual temperature (°C) (kg/head per year)**		**Region / average annual temperature**	**Source**
	EF	**type**	**EF**	
Poultry	0.02	D		
Horses	1.64	D		
Note: D Default				

Nitrous oxide (N_2O) - Annual average nitrogen excretion rates ($Nex_{(T)}$)

The TIER 1 Annual average nitrogen excretion rates ($Nex_{(T)}$) was calculated according to Equation 10.30 of 2006 IPCC GL[512] and are presented in the following table.

Equation 10.30: Annual N excretion rates (2006 IPCC GL, Vol. 4, Chap. 10)

$$Nex_{(T)} = N_{rate(T)} \times \frac{TAM}{1000} \times 365$$

Where:

$Nex_{(T)}$ = annual N excretion for livestock category T (kg N $animal^{-1}$ yr^{-1})

$N_{rate(T)}$ = default N excretion rate (kg N (1000 kg animal mass)$^{-1}$ day^{-1})

$TAM_{(T)}$ = typical animal mass for livestock category T (kg $animal^{-1}$)

Annual average nitrogen excretion rate $N_{rate(T)}$

Annual nitrogen excretion rates should be determined for each livestock category defined by the livestock population characterization. As no country specific nitrogen excretion rate $N_{rate(T)}$ were available, the default N excretion rates were used. They are presented in the following table.

The direct N_2O emissions are exemplarily calculated in the following table below. (direct N_2O emissions) applying the default emission factors for direct N_2O emissions from manure management (see Table 533).

Table 533 Default emission factors for direct N_2O emissions from manure management

System	**Definition**	**EF_3 [kg N_2O-N (kg Nitrogen excreted)$^{-1}$]**
Pasture/Range/ Paddock	The manure from pasture and range grazing animals is allowed to lie as it is, and is not managed.	NA
Daily spread	Manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion. N_2O emissions during storage and treatment are assumed to be zero. N_2O emissions from land application are covered under the Agricultural Soils category.	0
Solid storage	The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation.	0.005

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[512] 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10 Emissions from Livestock and Manure Management, sub-chap 10.5.2 Choice of emission factors. Equation 10.30. page 10.57.

System	**Definition**		**EF$_3$ [kg N$_2$O-N (kg Nitrogen excreted)$^{-1}$]**
Dry lot	A paved or unpaved open confinement area without any significant vegetative cover where accumulating manure may be removed periodically. Dry lots are most typically found in dry climates but also are used in humid climates.		0.02
Liquid/Slurry	Manure is stored as excreted or with some minimal addition of water to facilitate handling and is stored in either tanks or earthen ponds.	With natural crust cover	0.005
		Without natural crust cover	0
Uncovered anaerobic lagoon	Anaerobic lagoons are designed and operated to combine waste stabilization and storage. Lagoon supernatant is usually used to remove manure from the associated confinement facilities to the lagoon. Anaerobic lagoons are designed with varying lengths of storage (up to a year or greater), depending on the climate region, the volatile solids loading rate, and other operational factors. The water from the lagoon may be recycled as flush water or used to irrigate and fertilize fields.		0
Pit storage below animal confinements	Collection and storage of manure usually with little or no added water typically below a slatted floor in an enclosed animal confinement facility.		0.002
Remark: Direct and indirect N$_2$O emissions associated with the manure deposited on agricultural soils and pasture, range, paddock systems are treated under 3.D N$_2$O emissions from managed soils.			

Source: 2006 IPCC Guidelines, Vol. 4, Chap. 10, sub-chap. 10.5.3 Choice of emission factors, Table 10.21 Default emission factors for direct N$_2$O emissions from manure management; page 10.62.

In Algeria it is not common to use dung as fuel. When estimating the Nex$_{(T)}$ for animals whose manure is classified in the manure management system burned for fuel, it should be kept in mind that the dung is burned and the urine stays in the field. As a rule of thumb, 50% of the nitrogen excreted is in the dung and 50% is in the urine. The default emission factors for direct N$_2$O emissions from Manure Management are provided in the following table.

5.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 3.B *Manure management* are presented in the following table.

Table 534 Uncertainty for IPCC sub-category 3.B Manure management.

Uncertainty	**CH$_4$**		**N$_2$O**		**N$_2$O**		**Reference**
	cattle	**Other livestock**	**cattle**	**Other livestock**	**cattle**	**Other livestock**	2006 IPCC GL, Vol. 4, Chap. 10
Activity data: Livestock	20%	20%	20%	20%	20%	20%	Chapter 10.2.3
Activity data: Manure Management System Usage	25%	10%	25%	10%	25%	10%	Chapter 10.4.4
Emission factor	30%						Chapter 10.4.4
Emission factor (direct emission)			30%				Chapter 10.4.4
Emission factor (indirect emission)					50%	50%	Chapter 10.4.4
Combined Uncertainty	44%	37%	44%	37%	55%	55%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

5.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of livestock data (statistical yearbook and FAO stat- Live Animals),
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources: national statistic (ONS, Agricultural Census 2003) and international statistics (FAO)
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- consistency and completeness checks are performed;
- time series consistency - plausibility checks of dips and jumps.

5.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 3.B *Manure management*.

Table 535 Recalculations done in IPCC sub-category 3.B *Manure management*

GHG source & sink category	Revisions of data ⇒ submission 2020	Type of revision	Type of improvement
3.B	application of 2006 IPCC Guidelines	method	Comparability
3.B	use of CH_4 default emission factor of 2006 IPCC Guidelines	EF	Comparability
3.B	use of N_2O default emission factor (direct emission) of 2006 IPCC Guidelines	EF	Comparability
3.B	use of N_2O default emission factor (indirect emission) of 2006 IPCC Guidelines	EF	Comparability

5.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 536 Planned improvements for IPCC sub-category 3.B *Manure management*

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
3.A.2	Correction of technical mistakes in calculation	AD, EF	Completeness	high
3.A. 3.B. 3.D.	Husbandry and Management Practice with consideration • characteristics of Livestock Husbandry for the whole time series: ○ breed, ○ age distribution, ○ weight ○ milk wool yield, ○ wool yield, ○ working hours • characteristics of manure management practice: ○ stall / housed and Housing period ○ pasture/range/paddock (flat/hilly) ○ grazing large areas (flat/hilly) ○ daily spread ○ solid storage ○ dry lot ○ liquid/slurry with/without natural crust cover ○ uncovered anaerobic lagoon ○ pit storage below animal confinements ○ anaerobic digester ○ burned for fuel ○ cattle and swine deep bedding ○ composting ○ aerobic treatment	AD	Accuracy Consistency Comparability Transparency Completeness	high
3.A. 3.B.	Manure management by temperature for sheep, goats, horses, mules, and asses, and poultry	AD	Accuracy Comparability Transparency	medium
3.A.2	Estimation of methane emissions applying TIER 2 approach as these sub-categories are key categories	method	Transparency Comparability	high
3.A.1.j 3.B. 3.D	Survey and/or research on Livestock which is not included in current statistics: e.g., buffalo, fur bearing animals	AD	Completeness	Medium
3.B	Survey and/or research on VS excretion rates		Accuracy	medium

5.4 Rice cultivation (IPCC category 3.C)

The IPCC category 3.C Rice cultivation does not exist in Algeria.

5.5 Agricultural soils (IPCC category 3.D)

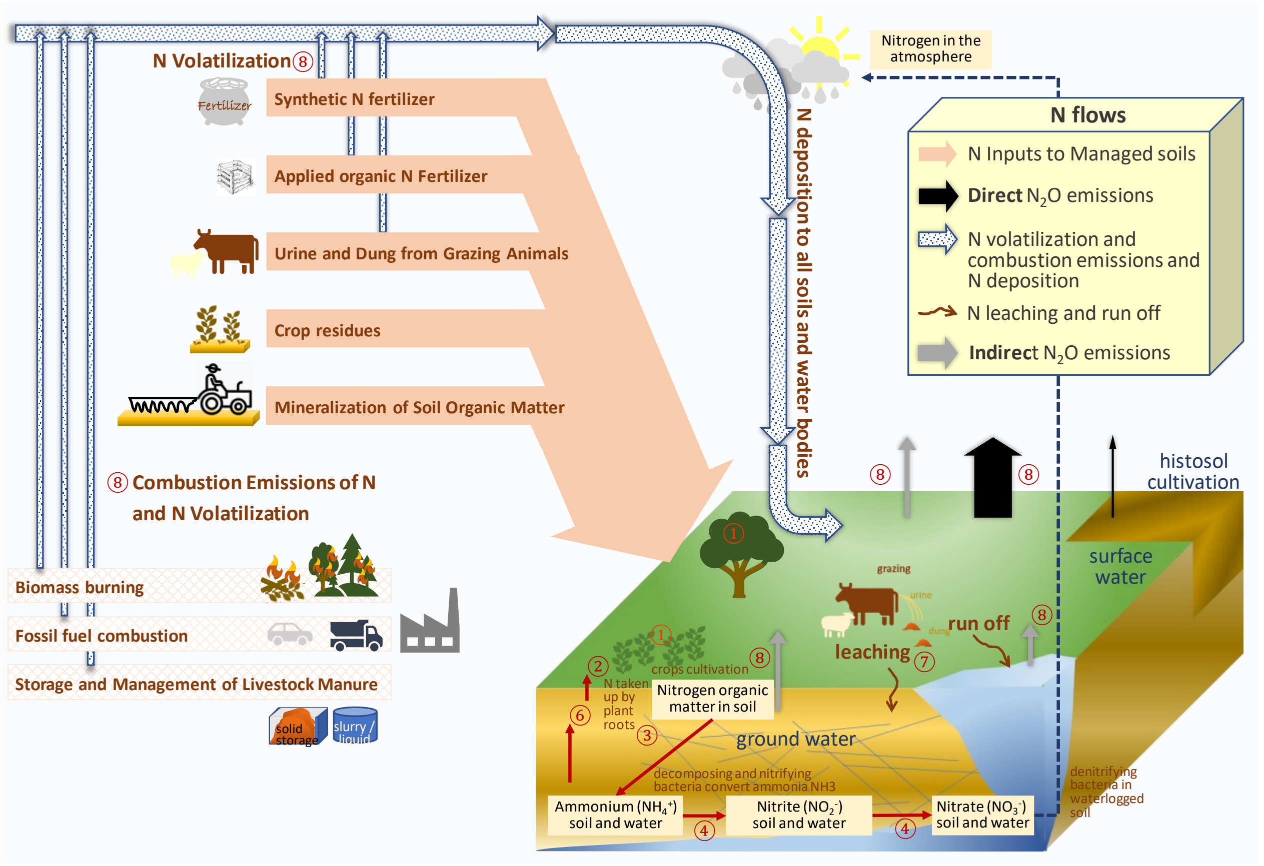
This section describes the estimation of nitrous oxide emissions from managed soils due to nitrogen input, including indirect N_2O emissions from additions of N to land due to deposition and leaching. As defined in 2006 IPCC GL, Vol. 4, Chap. 1.1 managed land is land where human interventions and practices have been applied to perform production, ecological or social functions. The emissions of N_2O that result from anthropogenic N inputs or N mineralization occur through both:

- direct pathway: directly from the soils to which the N is added/released

- indirect pathways: (i) following volatilization of NH_3 and NO_x from managed soils and from fossil fuel combustion and biomass burning, and the subsequent redeposition of these gases and their products NH_4^+ and NO_3^- to soils and waters; and

  (ii) after leaching and runoff of N, mainly as NO_3^-, from managed soils.

The principal pathways are illustrated in the following figure. Direct emissions of N_2O from managed soils are estimated separately from indirect emissions, though using a common set of activity data.



The nitrogen cycle: (1) uptake of nitrogen by plants from the atmosphere: (2) uptake of ammonium and nitrate by plants from soil and water: nitrogen-fixing bacteria in humus and in root nodules of leguminous plants (3) ammonification, (4) nitrification, (5) denitrification, (6) nitrate immobilization by soil sorption, (7) nitrate leaching from the soil, (8) release of ammonia (NH3), gaseous nitrogen and nitrous oxide to the atmosphere.

Figure 207 **Schematic diagram illustrating the sources and pathways of N that result in direct and indirect N_2O emissions from soils and waters**

Source: After (1) 2006 IPCC Guidelines, Volume 4, Chapter 11, Figure 11.1, page 11.8. and
(2) Bednarek, A.; Szklarek, S. & Zalewski, M. (2014): Nitrogen pollution removal from areas of intensive farming—comparison of various denitrification biotechnologies. In: Ecohydrology & Hydrobiology 14 (2014) 132–141.

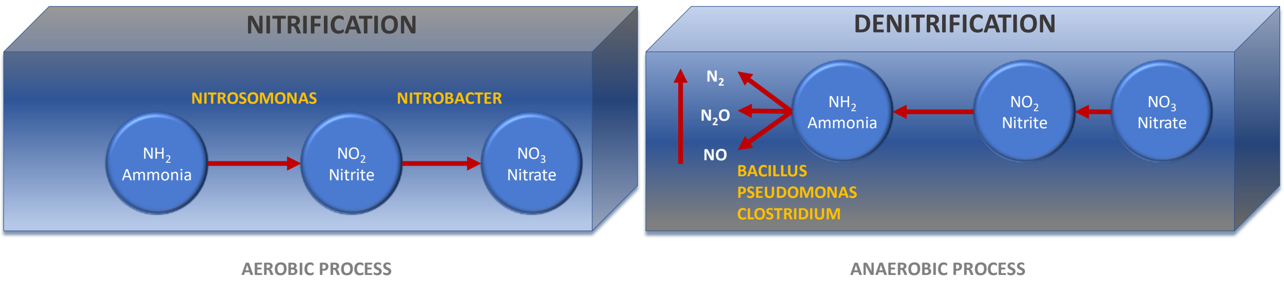


Figure 208 **Nitrification and Denitrification**

As described in Chapter 5.3 and in Figure 206 the N_2O emissions generated by manure in the

- system “livestock housing and holding areas” and “manure storage” are reported under the category
  - ⇒ 3.B Manure management
- system ‘pasture, range, and paddock’ occur directly and indirectly from the soil, and are therefore reported under the category
  - ⇒ 3.D.a *Direct N_2O emissions from managed soils*
    - ⇒ 3.D.a.2 *Organic N fertilizers*
      - ⇒ *3.D.a.2.a Animal manure applied to soils*
  - ⇒ 3.D.b *IndirectN_2O Emissions from managed soils*

Beyond that further ‘man-made’ nitrogen applied to the soil are synthetic fertilizer application, crop residues, and mineralization of soil organic matter. Through nitrogen vitalization and combustion emissions of N from fossil fuels from all nitrogen sources a ‘nitrogen stock in the atmosphere’ is formed also depending of the amount and characteristics of the N-inputs.

The deposition of nitrogen (N) to soils and water bodies result from

- Nitrogen vitalization from
  - synthetic fertilizer application
  - application of organic N fertilizer
  - urine and dung from grazing animals
  - crop residues
  - mineralization of soil organic matter
- Nitrogen vitalization and combustion emission of N from
  - biomass burning
  - fossil fuel combustion
  - storage and management of livestock manure

5.5.1 Category description

IPCC code	Description	Description	CO_2		CH_4		N_2O	
			Estimated	Key Category	estimated	Key category	estimated	Key category
3.D	**Agricultural soils**							
3.D.1	**Direct N_2O emissions from managed soils**			-		-		-
3.D.1.a	Inorganic N fertilizers	N input from application of inorganic fertilizers to cropland and grassland	NA	-	NA	-	✓	-
3.D.1.b	Organic N fertilizers	N input from organic N fertilizers to cropland and grassland	NA	-	NA	-	✓	-
3.D.1.b.i	Animal manure applied to soils	N input from manure applied to soils	NA	-	NA	-	✓	-
3.D.1.b.ii	Sewage sludge applied to soils	N input from sewage sludge applied to soils	NA	-	NA	-	NE	-
3.D.1.b.iii	Other organic fertilizers applied to soils	N input from application of other organic fertilizers	NA	-	NA	-	✓	-
3.D.1.b	Urine and dung deposited by grazing animals	N excretion on pasture, range and paddock	NA	-	NA	-	✓	-
3.D.1.a	Crop residues	N in crop residues returned to soils	NA	-	NA	-	✓	-
3.D.1.e	Mineralization/ immobiliza-tion associated with loss/gain of soil organic matter	N in mineral soils that is mineralized in association with loss of soil C	NA	-	NA	-	NO	-
3.D.1.f	Cultivation of organic soils	Area of cultivated organic soils (i.e, histosols)	NA	-	NA	-	NO	-
3.D.1.g	Other		NA	-	NA	-	NO	
3.D.b	**Indirect N_2O Emissions from managed soils**							
3.D.b.1	Atmospheric deposition	Volatilized N from agricultural inputs of N	NA	-	NA	-	NE	-
3.D.b.2	Nitrogen leaching and run-off	N from fertilizers and other agricultural inputs that is lost through leaching and run-off	NA	-	NA	-	NE	-

A '✓' indicates: emissions from this sub-category have been estimated.
Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential

LA – Level Assessment (in year); TA – Trend Assessment

5.5.2 Direct N_2O emissions from managed soils (IPCC category 3.D.a)

The following sources are included in IPCC category 3.D.a *Direct N_2O emissions from managed soils.*

3.D.1	**Direct N_2O emissions from managed soils**		
3.D.1.a	Inorganic N fertilizers	N input from application of inorganic fertilizers to cropland and grassland	✓
3.D.1.b	Organic N fertilizers	N input from organic N fertilizers to cropland and grassland	✓
3.D.1.b.i	Animal manure applied to soils	N input from manure applied to soils	✓
3.D.1.b.ii	Sewage sludge applied to soils	N input from sewage sludge applied to soils	NE
3.D.1.b.iii	Other organic fertilizers applied to soils	N input from application of other organic fertilizers	NO
3.D.1.c	Urine and dung deposited by grazing animals	N excretion on pasture, range and paddock	✓
3.D.1.d	Crop residues	N in crop residues returned to soils	✓
3.D.1.e	Mineralization/ immobilization associated with loss/gain of soil organic matter	N in mineral soils that is mineralized in association with loss of soil C	NO
3.D.1.f	Cultivation of organic soils (i.e, histosols)	Area of cultivated organic soils	NO
3.D.1.g	Other		NO

N_2O emissions from IPCC category 3.D.1. *Direct N_2O emissions from managed soils* amounted to 2.93kt N_2O in 1990 and 7.89 kt N_2O in 2020, which is an increase of 169.2% due to

- amount of manure from increased number of livestock,
- amount of inorganic fertilizer applied,
- area for crop production which implicates increased
  - crop production,
  - crop residues.

In 2020, N_2O emissions result with a share of

14.0% from IPCC category 3.D.1.a Inorganic N fertilizers;

77.5% from IPCC category 3.D.1.b.i Animal manure applied to soils;

2.6% from IPCC category 3.D.1.c Urine and dung deposited by grazing animals;

5.9% from IPCC category 3.D.1.d Crop residues.

Table 537 N_2O emissions from IPCC category 3.D.1 *Direct N_2O emissions from managed soils*

N_2O	**3.D.1**	**3.D.1.a**	**3.D.1.b**	**3.D.1.b.i**	**3.D.1.b.ii**	**3.D.1.b.iii**	**3.D.1.c**	**3.D.1.d**
	Direct N_2O emissions from managed soils	**Inorganic N fertilizers**	**Organic N fertilizers**	**Animal manure applied to soils**	**Sewage sludge applied to soils**	**Other organic fertilizers applied to soils**	**Urine and dung deposited by grazing animals**	**Crop residues**
	N input from application of inorganic fertilizers to cropland and grassland	N input from organic N fertilizers to cropland and grassland	N input from manure applied to soils	N input from sewage sludge applied to soils	N input from application of other organic fertilizers	N excretion on pasture, range and paddock	N in crop residues returned to soils	N input from application of inorganic fertilizers to cropland and grassland
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	
1990	2.93	0.99	1.66	1.66	NE	NO	0.12	0.15
1991	4.75	0.64	3.66	3.66	NE	NO	0.12	0.34
1992	4.99	0.73	3.84	3.84	NE	NO	0.12	0.29
1993	5.33	1.16	3.91	3.91	NE	NO	0.13	0.13
1994	4.94	0.91	3.81	3.81	NE	NO	0.12	0.10
1995	4.47	0.29	3.87	3.87	NE	NO	0.12	0.19
1996	4.53	0.22	3.78	3.78	NE	NO	0.12	0.41
1997	4.64	0.57	3.86	3.86	NE	NO	0.12	0.09
1998	5.21	0.69	4.14	4.14	NE	NO	0.13	0.25
1999	5.29	0.74	4.24	4.24	NE	NO	0.13	0.18
2000	4.92	0.70	4.00	4.00	NE	NO	0.13	0.10
2001	5.15	0.71	4.08	4.08	NE	NO	0.13	0.23
2002	4.94	0.44	4.19	4.19	NE	NO	0.13	0.18
2003	5.04	0.27	4.28	4.28	NE	NO	0.13	0.36
2004	6.48	1.65	4.35	4.35	NE	NO	0.14	0.35
2005	4.96	0.06	4.44	4.44	NE	NO	0.14	0.32
2006	5.84	0.69	4.65	4.65	NE	NO	0.15	0.35
2007	5.81	0.58	4.76	4.76	NE	NO	0.15	0.32
2008	5.39	0.36	4.71	4.71	NE	NO	0.15	0.17
2009	6.17	0.58	4.96	4.96	NE	NO	0.16	0.47
2010	6.70	0.94	5.19	5.19	NE	NO	0.17	0.39
2011	6.83	0.88	5.37	5.37	NE	NO	0.17	0.40
2012	7.37	1.14	5.58	5.58	NE	NO	0.18	0.47
2013	7.50	1.01	5.84	5.84	NE	NO	0.19	0.47
2014	7.88	1.20	6.11	6.11	NE	NO	0.20	0.37
2015	7.98	1.17	6.22	6.22	NE	NO	0.20	0.39
2016	7.83	1.10	6.16	6.16	NE	NO	0.20	0.37
2017	7.63	1.10	5.95	5.95	NE	NO	0.20	0.38
2018	7.86	1.10	5.97	5.97	NE	NO	0.20	0.58
2019	7.87	1.10	6.02	6.02	NE	NO	0.20	0.55
2020	7.89	1.10	6.11	6.11	NE	NO	0.20	0.47
Trend								
1990 - 2020	*169.2%*	*11.4%*	*267.7%*	*267.7%*	*NA*	*NA*	*64.9%*	*203.7%*
2005 - 2020	*59.0%*	*1618.1%*	*37.7%*	*37.7%*	*NA*	*NA*	*45.5%*	*46.9%*
2019 - 2020	*0.2%*	*0.0%*	*1.5%*	*1.5%*	*NA*	*NA*	*2.2%*	*-14.6%*

5.5.3 Methodological issues

5.5.3.1 Choice of methods

For estimating the direct N_2O emissions from managed soils the 2006 IPCC Guidelines Tier 1 approach[513] has been applied.

TIER 1 approach – direct N_2O emissions from managed soils

The Tier 1 method (Equation 11.1) entails adding up the

- annual direct N_2O–N emissions produced from managed soils (kg N_2O–N)
- annual direct N_2O–N emissions from N inputs to managed soils (kg N_2O–N)
- annual direct N_2O–N emissions from managed organic soils (kg N_2O–N)
- annual direct N_2O–N emissions from urine and dung inputs to grazed soils (kg N_2O–N)

and converting the N_2O–N emissions to N_2O emissions for reporting purposes.

Equation: Conversion N_2O emissions from of N_2O–N emissions (2006 IPCC GL, Vol. 4, Chap. 11)

$$\boldsymbol{N_2O\ emissions_{direct} = N_2O - N \times \frac{44}{28}}$$

Equation 11.1: Direct N_2O emissions from managed soils[514]

$$\boldsymbol{N_2O\ emissions_{direct} - N = N_2O - N_{N\ inputs} + N_2O - N_{OS} + N_2O - N_{PRP}}$$

Where:

N_2O emissions $_{direct}$ = direct N_2O emissions from managed soils (kg N_2O)
N_2O_{Direct} –N = annual direct N_2O–N emissions produced from managed soils (kg N_2O–N)
N_2O–$N_{N\ inputs}$ = annual direct N_2O–N emissions from N inputs to managed soils (kg N_2O–N)
N_2O–N_{OS} = annual direct N_2O–N emissions from managed organic soils (kg N_2O–N)
N_2O–N_{PRP} = annual direct N_2O–N emissions from urine and dung inputs to grazed soils (kg N_2O–N) with PRP = pasture, range and paddock

Furthermore, the annual direct N_2O–N emissions produced from soils is estimated applying the following equations.

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[513] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap 11.2.1.1 Choice of method. Page 11.6.

[514] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap 11.2.1.1 Choice of method. Equation 11.1 direct N_2O emissions from managed soils (TIER 1). Page 11.7.

Annual direct N_2O–N emissions from N inputs to managed soils ***(11.1.a)***

$$\boldsymbol{N_2O - N_{N\ inputs} = \left[\begin{array}{c}[(F_{SN} + F_{ON} + F_{CR} + F_{SOM}) \times EF_1] + \\ [(F_{SN} + F_{ON} + F_{CR} + F_{SOM})_{FR} \times EF_{1FR}]\end{array}\right]}$$

Annual direct N_2O–N emissions from managed organic soils ***(11.1.b)***

$$\boldsymbol{N_2O - N_{OS} = \left[\begin{array}{c}(F_{OS,CG,Temp} \times EF_{2CG,Temp}) + (F_{OS,CG,Trop} \times EF_{2CG,Trop}) + \\ (F_{OS,F,Temp,NR} \times EF_{2F,Temp,NR}) + (F_{OS,F,Temp,NP} \times EF_{2F,Temp,NP}) \\ +(F_{OS,F,Trop} \times EF_{2F,Trop})\end{array}\right]}$$

Annual direct N_2O–N emissions from urine and dung inputs to grazed soils ***(11.1.c)***

$$\boldsymbol{N_2O - N_{PRP} = [(F_{PRP,CPP} \times EF_{3PRP,CPP}) + (F_{PRP,SO} \times EF_{3PRP,SO})]}$$

Where:

$N_2O–N_{N\ inputs}$ = annual direct N_2O–N emissions from N inputs to managed soils (kg N_2O–N)

$N_2O–N_{OS}$ = annual direct N_2O–N emissions from managed organic soils (kg N_2O–N)

$N_2O–N_{PRP}$ = annual direct N_2O–N emissions from urine and dung inputs to grazed soils (kg N_2O–N) with PRP = pasture, range and paddock

F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg N)

F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils

F_{CR} = annual amount of N in crop residues (above-ground and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils, kg N yr^{-1}

F_{SOM} = annual amount of N in mineral soils that is mineralised, in association with loss of soil C from soil organic matter as a result of changes to land use or management, kg N yr^{-1}

F_{OS} = annual area of managed/drained organic soils, ha

(Note: the subscripts CG, F, Temp, Trop, NR and NP refer to Cropland and Grassland, Forest Land, Temperate, Tropical, Nutrient Rich, and Nutrient Poor, respectively)

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock, kg N yr^{-1} (Note: the subscripts CPP and SO refer to Cattle, Poultry and Pigs, and Sheep and Other animals, respectively)

EF_1 = emission factor for N_2O emissions from N inputs, kg N_2O–N (kg N input)$^{-1}$

EF_{1FR} = emission factor for N_2O emissions from N inputs to flooded rice, kg N_2O–N (kg N input)$^{-1}$

EF_2 = emission factor for N_2O emissions from drained/managed organic soils, kg N_2O–N ha-1 yr^{-1}

(Note: the subscripts CG, F, Temp, Trop, NR and NP refer to Cropland and Grassland, Forest Land, Temperate, Tropical, Nutrient Rich, and Nutrient Poor, respectively)

$EF_{3\ PRP}$ = emission factor for N_2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals, kg N_2O–N (kg N input)$^{-1}$;

(Note: the subscripts CPP and SO refer to Cattle, Poultry and Pigs, and Sheep and Other animals, respectively)

For better understanding, the processes in soil and crust the following figures provide simplified illustration of nitrogen (N) transactions

•	between the atmosphere and liquid manure with emphasis on critical processes involved in the emission of gases	Figure 209
•	the atmosphere and the soil with emphasis on agronomic aspects related to plant fertilization and the reactions involved in the formation and emission of nitrous oxide (direct and indirect).	Figure 210

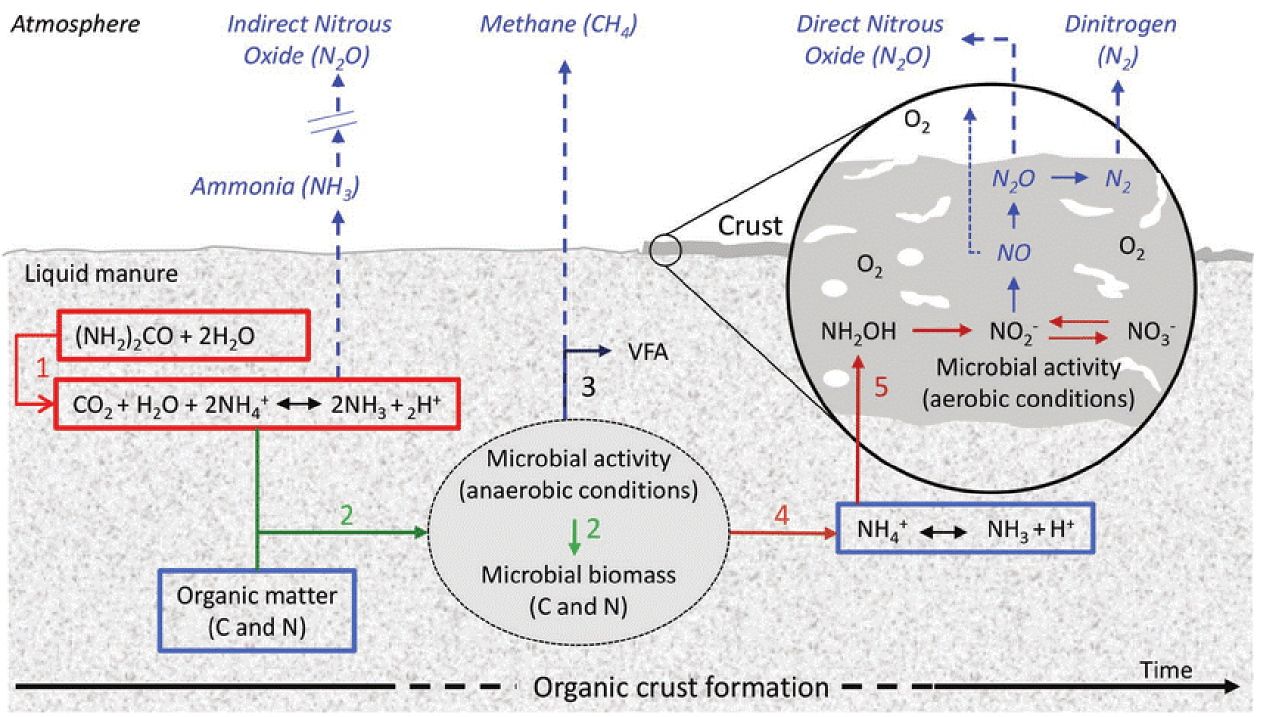

Figure 209 Simplified illustration of N transactions between the atmosphere and liquid manure with emphasis on critical processes involved in the emission of gases

Simplified illustration of N transactions between the atmosphere and liquid manure (data from Aguerre et al., 2012), with emphasis on critical processes involved in the emission of gases: (1) hydrolysis of urinary urea-N (giving rise to ammonia, which after emission and deposition on soils contributes to indirect nitrous oxide emission), microbial fermentation of OM under anaerobic conditions (giving rise to methane) associated with (2) microbial growth, (3) acidification of the medium through the formation of VFA, and (4) ammonia formation from the degradation of N-containing organic compounds. In addition, when an organic crust formed (5), the nitrification of ammonium under aerobic conditions was responsible for nitrous oxide and presumably dinitrogen emissions.

Nitrogen-containing structures are as follows:

$(NH_2)_2CO$ = urea; NH_4^+ = ammonium; NH_3 = ammonia; NH_2OH = hydroxylamine; NO_2^- = nitrite; NO_3^- = nitrate; NO = nitric oxide (emitted gas); N_2O = nitrous oxide; N_2 = dinitrogen.

Source: WATTIAUX, M. A.; PAS, UDDIN, M. E. ; LETELIER, P., JACKSON, R. D. & LARSON, R. A. (2019): Emission and mitigation of greenhouse gases from dairy farms: The cow, the manure, and the field. In: Applied Animal Science 35:238–254. Sustainability and Integrated Systems. https://doi.org/10.15232/aas.2018-01803

Available on 29.04.2019 at: https://www.researchgate.net/publication/331916870_Invited_Review_Emission_and_mitigation_of_greenhouse_gases_from_dairy_farms_The_cow_the_manure_and_the_field

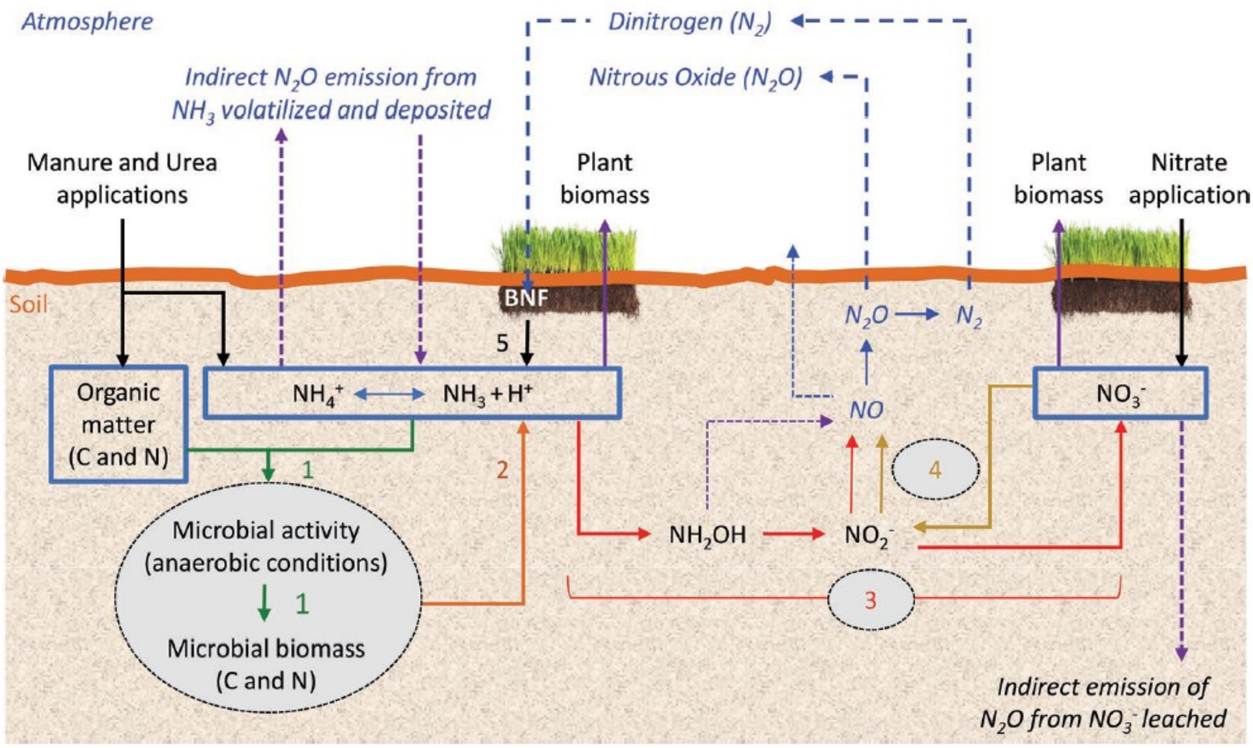

Figure 210 Simplified illustration of N transactions between the atmosphere and the soil with emphasis on agronomic aspects related to plant fertilization and the reactions involved in the formation and emission of nitrous oxide (direct and indirect)

Simplified illustration of N transactions between the atmosphere and the soil with emphasis on agronomic aspects related to plant fertilization and the reactions involved in the formation and emission of nitrous oxide (direct and indirect). Different types of arrows are used to identify the main transformations associated with (1) immobilization, (2) mineralization, (3) nitrification, (4) denitrification, and (5) biological nitrogen fixation (BNF) by legumes.

Nitrogen-containing structures are as follows:

N_2 = dinitrogen; NH_3 = ammonia; $NH4^+$ = ammonium; NH_2OH = hydroxylamine;
NO = nitric oxide (emitted gas); NO_2^- = nitrite; NO_3^- = nitrate; N_2O = nitrous oxide

Source: WATTIAUX, M. A.; PAS, UDDIN, M. E. ; LETELIER, P., JACKSON, R. D. & LARSON, R. A. (2019): Emission and mitigation of greenhouse gases from dairy farms: The cow, the manure, and the field. In: Applied Animal Science 35:238–254. Sustainability and Integrated Systems. https://doi.org/10.15232/aas.2018-01803

Available on 29.04.2019 at: https://www.researchgate.net/publication/331916870_Invited_Review_Emission_and_mitigation_of_greenhouse_gases_from_dairy_farms_The_cow_the_manure_and_the_field

5.5.3.2 Choice of activity data (AD) and emission factor (EF)

In the following subchapters/sections the activity data (AD) and emission factors (EF) as well as the emission calculations and results are presented separately for each N input from

1) Applied synthetic fertilizer (F_{SN})	$N_2O - N_{N\ inputs} = \begin{bmatrix} [(F_{SN}) \times EF_1] + \\ [(F_{SN})_{FR} \times EF_{1FR}] \end{bmatrix}$ *See above equation 11.1.a*
2) Applied organic N fertilizer (F_{ON})	$N_2O - N_{N\ inputs} = \begin{bmatrix} [(F_{ON}) \times EF_1] + \\ [(F_{ON})_{FR} \times EF_{1FR}] \end{bmatrix}$ *See above equation 11.1.a*
3) annual amount of N in crop residues, including N-fixing crops, and from forage/pasture renewal, returned to soils (F_{CR})	$N_2O - N_{N\ inputs} = \begin{bmatrix} [(F_{CR}) \times EF_1] + \\ [(F_{CR})_{FR} \times EF_{1FR}] \end{bmatrix}$ *See above equation 11.1.a*
4) Mineralised N resulting from loss of soil organic C stocks in mineral soils through land-use change or management practices (F_{SOM})	$N_2O - N_{N\ inputs} = \begin{bmatrix} [(F_{SOM}) \times EF_1] + \\ [(F_{SOM})_{FR} \times EF_{1FR}] \end{bmatrix}$ *See above equation 11.1.a*
5) Area of drained/managed organic soils (F_{OS})	*See above equation 11.1.b*
6) Urine and dung from grazing animals (F_{PRP})	*See above equation 11.1.c*

5.5.3.2.1 AD and calculation for N Input from *Applied synthetic fertilizer (F_{SN})*

Activity data, parameter and emission calculation for *N Input from Applied synthetic fertilizer (F_{SN})*

The data of annual amount of applied synthetic fertilizer (F_{SN}) consumption is taken from international source: FAO agricultural data base on synthetic fertilizer consumption[515].

The information on fertilizer consumption / distribution of the Algeria Statistical yearbook was used only for crosscheck.

Default emission factors (EF_1) and (EF_{1FR}) were taken from Table 11.1 of 2006 IPCC Guidelines, Vol. 4, Chap. 11[516] and are presented in the following table.

Table 538 Default emission factors to estimate direct N_2O emissions from managed soils

Emission factor		**N_2O (kg N_2O–N (kg N)$^{-1}$)**		**Source**
		EF	**type**	**2006 IPCC Guidelines Vol. 4, Chap. 11 (11.2.1.2)**
EF_1 for N additions from mineral fertilizers, organic amendments and crop residues, and N mineralized from mineral soil as a result of loss of soil carbon	EF_1	0.01	D	**Table 11.1** Default emission factors to estimate direct N_2O emissions from managed soils (page 11.11)

Note:							
D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

With the Equation 11.1.a (see also in section 5.5.3.1 Choice of methods) and the equation for conversion N_2O-N tot N_2O the N_2O emissions from N inputs to managed soils

Annual direct N_2O–N emissions from N inputs to managed soils (2006 IPCC GL, Vol. 4, Chap. 11) ***Erreur ! Signet non défini.***

$$N_2O-N_{N\ inputs} = [[(F_{SN}) \times EF_1] + [(F_{SN})_{FR} \times EF_{1FR}]] \qquad \textbf{(11.1.a)}$$

$$N_2O\ emissions_{direct} = N_2O-N \times \frac{44}{28}$$

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[515] http://www.fao.org/faostat/en/#data

[516] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap 11.2.1.2 Choice of emission factor. Table 11.1. Page 11.11.

Table 539 Annual amount of applied synthetic fertilizer (IPCC category 3.D.1.a. Inorganic N fertilizers)

	Nutrient nitrogen N (total)				
	Agricultural Use	**Production**	**Import Quantity**	**Export Quantity**	**Source**
	t	**t**	**t**	**t**	
1990	63,000	80,000	3,000	22,000	FAO database
1991	41,000	87,900	NE	25,000	
1992	46,700	64,500	NE	20,100	
1993	73,800	104,500	500	11,200	
1994	58,200	82,900	NE	6,200	
1995	18,400	12,000	NE	NE	
1996	14,000	8,300	22,800	3,800	
1997	36,000	28,400	26,300	17,000	
1998	44,000	40,700	33,800	44,400	
1999	47,000	54,400	31,800	45,300	
2000	44,300	90,700	65,200	112,800	
2001	45,300	118,200	60,900	134,400	
2002	28,036	72,600	35,775	149,439	
2003	17,076	99,660	43,121	185,007	
2004	104,717	153,790	45,618	149,703	
2005	4,086	83,100	33,775	198,615	
2006	43,847	27,440	36,121	88,570	
2007	36,626	137,780	24,060	73,378	
2008	23,102	11,040	26,482	68,094	
2009	37,100	13,400	43,046	68,510	
2010	60,100	20,800	58,610	96,368	
2011	56,300	19,500	51,519	91,528	
2012	72,600	24,500	66,010	111,144	
2013	64,000	68,000	53,005	53,485	
2014	76,500	438,300	55,421	437,934	
2015	74,400	777,600	60,966	765,726	
2016	70,200	1,043,200	36,635	1,097,907	
2017	70,200	1,043,200	34,874	706,437	
2018	70,200	1,043,200	72,756	1,442,947	
2019	70,200	1,043,200	50,571	1,257,722	
2020	70,200	1,043,200	50,571	1,257,722	As of 2019
Trend					
1990 - 2020	*169.2%*	*11.4%*	*267.7%*	*267.7%*	
2005 - 2020	*59.0%*	*1618.1%*	*37.7%*	*37.7%*	
2019 - 2020	*0.2%*	*0.0%*	*1.5%*	*1.5%*	

5.5.3.2.2 AD and calculation for N Input from Applied organic N fertilizer (F_{ON})

Activity data, parameter and emission calculation for N Input from *Applied organic N fertilizer (F_{ON})*

The data of annual amount of applied organic fertilizer (F_{ON}) is calculated according the following equation taken from 2006 IPCC Guidelines, Vol. 4, Chap. 11[517] .

Equation 11.3: N from organic N additions applied to soils (TIER 1) (2006 IPCC GL, Vol. 4, Chap. 11) [517]

$$F_{ON} = F_{AM} + F_{SEW} + F_{COMP} + F_{OOA}$$

Where:

F_{ON} = total annual amount of organic N fertiliser applied to soils other than by grazing animals (kg N yr^{-1})

F_{AM} = annual amount of animal manure N applied to soils (kg N yr^{-1})

F_{SEW} = annual amount of total sewage N (coordinate with Waste Sector to ensure that sewage N is not double-counted) that is applied to soils (kg N yr^{-1})

F_{COMP} = annual amount of total compost N applied to soils (ensure that manure N in compost is not double-counted), kg N yr^{-1}

F_{OOA} = annual amount of other organic amendments used as fertiliser (e.g., rendering waste, guano, brewery waste, etc.) (kg N yr^{-1})

F_{AM} - annual amount of animal manure N applied to soils

The term F_{AM} is determined by adjusting the amount of manure N available (N_{MMS_Avb}) for the amount of

- managed manure used for feed ($Frac_{FEED}$),
- burned for fuel ($Frac_{FUEL}$), or
- used for construction ($F_{rac\ CNST}$)

Equation 11.4: N from animal manure applied to soils (TIER 1)
(2006 IPCC GL, Vol. 4, Chap. 11)[518]

$$F_{AM} = N_{MMS\ Avb} \times [1 - (Frac_{Feed} + Frac_{Fuel} + Frac_{CNST})]$$

Where:

F_{AM} = annual amount of animal manure N applied to soils (kg N yr^{-1})

N_{MMS_Avb} = amount of managed manure N available for soil application, feed, fuel or construction, (kg N yr^{-1}) *(Equation 10.34 in Chapter 10 of Vol. 4 of 2006 IPCC GL[519])*

$Frac_{FEED}$ = fraction of managed manure used for feed

$Frac_{FUEL}$ = fraction of managed manure used for fuel

$Frac_{CNST}$ = fraction of managed manure used for construction

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[517] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap 11.2.1.3 Choice of activity data. Page 11.13.

[518] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application. Sub-chap. 11.2.1.3. Equation 11.4. Page 11.13.

[519] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10: Emissions from Livestock and Manure Management, sub-chap. 10.5.4 Coordination with reporting for N_2O emissions from managed soils. Page 10.64.

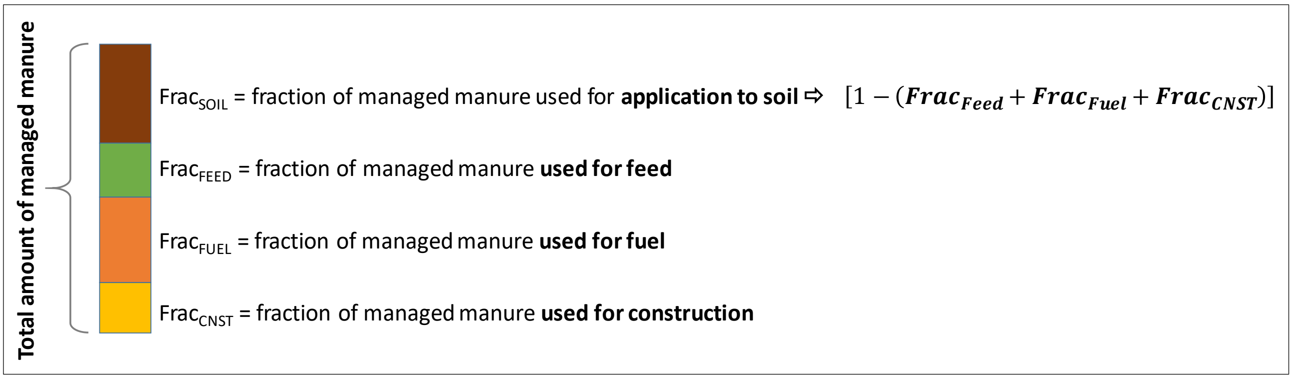

Figure 211 Fraction of of managed animal manure used for different purposes.

Data for $Frac_{FUEL}$, $Frac_{FEED}$, $Frac_{CNST}$ was not available therefore N_{MMS_Avb} was used as F_{AM} without adjusting for $Frac_{FUEL}$, $Frac_{FEED}$, $Frac_{CNST}$, which is also proposed by 2006 IPCC GL

Finally, the managed manure nitrogen available for

- (a) application to managed soils,
- (b) for use in feed, fuel, or construction purposes (assumed be 0)

is estimated according to Equation 10.34 of Vol. 4 of 2006 IPCC GL[519].

Equation 10.34: Managed manure N available for application to managed soils, feed, fuel or construction uses (2006 IPCC GL, Vol. 4, Chap. 10.5.4)

$$\boldsymbol{N_{NMS\_Avb}} = \sum_{\boldsymbol{S}} \left\{ \sum_{\boldsymbol{(T)}} \left[\left[\left(\boldsymbol{N_{(T)}} \times \boldsymbol{Nex_{(T)}} \times \boldsymbol{MS_{(T,S)}} \right) \times \left(\boldsymbol{1} - \frac{\boldsymbol{Frac_{LossMS}}}{\boldsymbol{100}} \right) \right] + \left[\boldsymbol{N_{(T)}} \times \boldsymbol{MS_{(T,S)}} \times \boldsymbol{N_{beddingMS}} \right] \right] \right\}$$

Where:

$NMMS_{\_Avb}$ = amount of managed manure nitrogen available for application to managed soils or for feed, fuel, or construction purposes (kg N yr^{-1})

$N_{(T)}$ = number of head of livestock species/category T

$Nex_{(T)}$ = annual average N excretion per animal of species/category T (kg N $animal^{-1}$ $^{yr-1}$)

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S, dimensionless

$Frac_{LossMS}$ = amount of managed manure nitrogen for livestock category T that is lost in the manure management system S (%)

$N_{beddingMS}$ = amount of nitrogen from bedding (to be applied for solid storage and deep bedding MMS if known organic bedding usage) (kg N animal-1 $^{yr-1}$)

S = manure management system

T = species/category of livestock

Data used for estimation the amount of managed manure nitrogen available for application to managed soils or for feed, fuel, or construction purposes were already used in other categories of IPCC Sector *Agriculture* and presented front sections.

$N_{(T)}$ - Number of head of livestock species/category T

The activity data are the same as used in category 3.A Enteric Fermentation and 3.B Manure Management and are presented.

$Nex_{(T)}$ - Annual average N excretion per animal of species/category T

The annual average N excretion per animal of species/category T ($Nex_{(T)}$) is calculated with Equation 10.30 of 2006 IPCC GL[520], presented in Table 533 and exemplarily calculated in (direct N_2O emissions) in Chapter 5.3.2.

$MS_{(T,S)}$ - fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S

The fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S is defined and is presented in Table 540.

$Frac_{LossMS}$ - amount of managed manure nitrogen for livestock category T that is lost in the manure management systems

Default values for total nitrogen loss from manure management was taken from Table 10.23 of 2006 IPCC GL[521] and are presented in the following table. These default values include losses that occur from the point of excretion, including animal housing losses, manure storage losses, and losses from leaching and runoff at the manure storage system where applicable.

Table 540 Default values for nitrogen loss due to volatilization of NH_3 and NO_x from manure management

Animal type	**Manure management system (MMS)**	**Total N loss from MMS ($Frac_{LossMS}$)**
Dairy Cow	Liquid/Slurry	40%
	Solid storage	30%
	Daily spread	7%
Poultry	Poultry without litter	55%
	Poultry with litter	40%
Other Cattle	Solid storage	45%
	Deep bedding	40%
Other (includes sheep, horses, and fur-bearing animals)	Deep bedding	25%
	Solid storage	7%

Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10: Emissions from Livestock and Manure Management, sub-chapter 10.5.5 Uncertainty assessment, Table 10.22: Default values for nitrogen loss due to volatilization of NH3 and NOx from manure management, p. 10.67.2019 refinement to 2006 IPCC Guidelines TABLE 10.22 (UPDATED) Volume 4: AFOLU, Chapter 10: Emissions from Livestock and Manure Management,

$N_{beddingMS}$ - amount of nitrogen from bedding

Bedding materials vary greatly and are depending on the characteristics of bedding material used in their livestock industries. Due to lack of data in this inventory cycle, it was assumed that this manure management did not exist in the country. See also planned improvements.

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[520] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10: Emissions from Livestock and Manure Management, sub-chapter 10.5.2 Choice of emission factors, p. 10.57.

[521] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 10: Emissions from Livestock and Manure Management, sub-chapter 10.5.5 Uncertainty assessment, Table 10.23 Default values for total nitrogen loss from manure management. P. 10.67.

F_{SEW} - Annual amount of total sewage N that is applied to soils

The annual amount of total sewage sludge applied to soils depends on the sewage practices, which is quite different between rural and urban regions. Information about amount sewage sludge and related N content was not available. Therefore, this source of nitrogen was not estimated. (See also chapter planned improvements below).

N_2O emissions from wastewater treatment is entirely estimated in Chapter.

Double counting is therefore excluded.

F_{COMP} - Annual amount of total compost N applied to soil

The annual amount of compost applied to soils depends on the composting activities within the country However, information about amount of compost applied to soil and related N content was not available. Therefore, this source of nitrogen was not estimated. (See chapter planned improvement)

N_2O Emissions from biological treatment is entirely estimated in Chapter 7 Waste (IPCC sector 5).

Double counting is therefore excluded.

F_{OOA} - annual amount of other organic amendments used as fertiliser

No information about amount of other organic amendments (e.g., rendering waste, guano, brewery waste, etc.) used as fertilizer was not available. Therefore, this source of nitrogen was not estimated. (See chapter planned improvement.

5.5.3.2.3 AD and calculation for *N Input from annual amount of N in crop residues (F_{CR})*

Activity data, parameter, and emission calculation for N Input from annual amount of *N in crop residues, including N-fixing crops, and from forage/pasture renewal, returned to soils (F_{CR})*

The term F_{CR} refers to the amount of N in crop residues (above-ground and below-ground), including N-fixing crops, returned to soils annually. It also includes the N from N-fixing and non-N-fixing forages mineralised during forage or pasture renewal. It is estimated from crop yield statistics and default factors for above-/ belowground residue: yield ratios and residue N contents.

Equation 11.6: N from crop residues and forage/pasture renewal (TIER 1)

2006 IPCC GL, Vol. 4, Chap. 11.2.1.3)

$$F_{CR} = \sum_{T} \{Crop_{(T)} \times Frac_{Renew(T)} \times \left[\left(Area_{(T)} - Area_{\,burnt\,(T)} \times C_F\right) \times R_{AG(T)} \times N_{AG(T)} \times \left(1 - Frac_{Remove(T)}\right) + Area_{(T)} - R_{BG(T)} \times N_{BG(T)} \right] \}$$

As no country specific data were available the recommended alternative approach was applied for estimating the amount of N in crop residues (above-ground and below-ground), including N-fixing crops, returned to soils annually.

Equation 11.7A: N from crop residues and forage/pasture renewal (TIER 1)

Alternative approach to estimate F_{CR} (using Table 11.2)

2006 IPCC GL, Vol. 4, Chap. 11.2.1.3

$$F_{CR} = \sum_{T} \{Frac_{Renew(T)} \times \left[\left(Area_{(T)} - Area_{\,burnt\,(T)} \times C_F\right) \times AG_{DM(T)} \times 1000 \times N_{AG(T)} \times \left(1 - Frac_{Remove(T)}\right) + Area_{(T)} \times \left(AG_{DM(T)} \times 1000 + Crop_{(T)}\right) \times R_{BG-BIO(T)} \times N_{BG(T)} \right] \}$$

Where:

F_{CR} = annual amount of N in crop residues (above and below ground), including N-fixing crops, and from forage/pasture renewal, returned to soils annually (kg N yr^{-1})

$Crop_{(T)}$ = harvested annual dry matter yield for crop T (kg d.m. ha-1)

$Area_{(T)}$ = total annual area harvested of crop T (ha $^{yr-1}$)

$Area\ burnt_{\ (T)}$ = annual area of crop T burnt (ha $^{yr-1}$)

C_f = combustion factor (dimensionless)

referred to 2006 IPCC GL, Vol. 4, Chapter 2, Table 2.6

$AG_{DM(T)}$ = above-ground residue dry matter (Mg/ha)

see equation below

$N_{AG(T)}$ = N content of above-ground residues for crop T (kg N (kg d.m.) $^{-1}$;

which is based on Table 11.2 of 2006 IPCC GL, Vol. 4, Chapter 11

$Frac_{Remove(T)}$ = fraction of above-ground residues of crop T removed annually for purposes such as feed, bedding and construction, kg N (kg crop-N)$^{-1}$.

No data for $Frac_{Remove}$ were available, thus no removal is assumed.

$R_{BG-BIO(T)}$ = Ratio of belowground residues to above-ground biomass (kg d.m. (kg d.m.)$^{-1}$) by the ratio of total above-ground biomass to crop yield.

see ## which is based on Table 11.2 of 2006 IPCC GL, Vol. 4, Chapter 11

$N_{BG(T)}$ = N content of below-ground residues for crop T (kg N (kg d.m.)$^{-1}$)

see *which is based on Table 11.2 of 2006 IPCC GL, Vol. 4, Chapter 11*

T = crop or forage type: wheat, potatoes, beans, etc.

The term $AG_{DM(T)}$ refers to the above-ground residue dry matter and is calculated according to the following equation.

Equation for calculation of the above-ground residue dry matter ($AG_{DM(T)}$)
2006 IPCC GL, Vol. 4, Chap. 11.2.1.3, Table 11.2)

$$AG_{DM(T)} = \frac{Crop_{(T)}}{1000} \times \ slope_{(T)} \times +intercept_{(T)}$$

The yield statistics for all crops are reported as fresh weight, a correction factor needs to be applied to estimate dry matter yields ($Crop_{(T)}$) following the Equation 11.7 of 2006 IPCC GL, Vol. 4, Chap. 11. The default values for dry matter content given in following tables and were taken from Table 11.2 of 2006 IPCC GL, Vol. 4, Chap. 11. may be used.

Equation 11.7: Dry-weight correction of reported crop yields
(2006 IPCC GL, Vol. 4, Chap. 11.2.1.3)

$$Crop_{(T)} = \ Yield\ Fresh_{(T)} \times DRY$$

Where:

$Crop_{(T)}$ = harvested dry matter yield for crop T (kg d.m. ha^{-1})
$Yield\_Fresh_{(T)}$ = harvested fresh yield for crop T (kg fresh weight ha^{-1})
DRY = dry matter fraction of harvested crop T (kg d.m. (kg fresh weight)-^{1})

In ## are presented relevant default factors for estimation of N added to soils from crop residues :

- Dry matter fraction of harvested product (DRY)
- Above-ground residue dry matter AG_{DM}(T)
- AGDM(T) = (Crop(T)/1000)*
- slope(T) +
- intercept(T)
- N content of above-ground residues (NAG)
- Ratio of below- ground residues to above-ground biomass (RBG-BIO)
- N content of below-ground residues (NBG)

With the Equation 11.1.a (see also above in 5.5.3.1 Choice of methods) and the Equation for conversion N_2O-N tot N_2O the N_2O emissions from N inputs to managed soils

Annual direct N_2O–N emissions from N inputs to managed soils (2006 IPCC GL, Vol. 4, Chap. 11)

$$\boldsymbol{N_2O - N_{N\ inputs} = \ [[(F_{CR}) \times \ EF_1] + \ [(F_{CR})_{FR} \times \ EF_{1FR}]\,]} \qquad \textbf{\textit{(11.1.a)}}$$

$$\boldsymbol{N_2O\ emissions_{direct} = N_2O - N\ \times \frac{44}{28}}$$

5.5.4 Uncertainty assessment and time-series consistency for IPCC category 3.D.a Direct N_2O emissions

The uncertainties for activity data and emission factors used for IPCC category 3.D Agricultural soils are presented in the following table.

Table 541Uncertainty for IPCC sub-category 3.D.a Direct N_2O emissions

Uncertainty	CH_4	N_2O	N_2O	Reference
				2006 IPCC GL, Vol. 4, Chap. 10
Activity data	NA	20%	NA	Chapter 11.2.1.4
Emission factor (direct emission)		250%		Chapter 10.4.4
Combined Uncertainty		254%		

5.6 Indirect N_2O emissions from managed soils (IPCC category 3.D.2)

3.D.2	Indirect N_2O Emissions from managed soils	
3.D.2.a	Atmospheric deposition	Volatilized N from agricultural inputs of N
3.D.2.b	Nitrogen leaching and run-off	N from fertilizers and other agricultural inputs that is lost through leaching and run-off

In addition to the direct emissions of N_2O from managed soils, emissions of N_2O also take place through two indirect pathways.

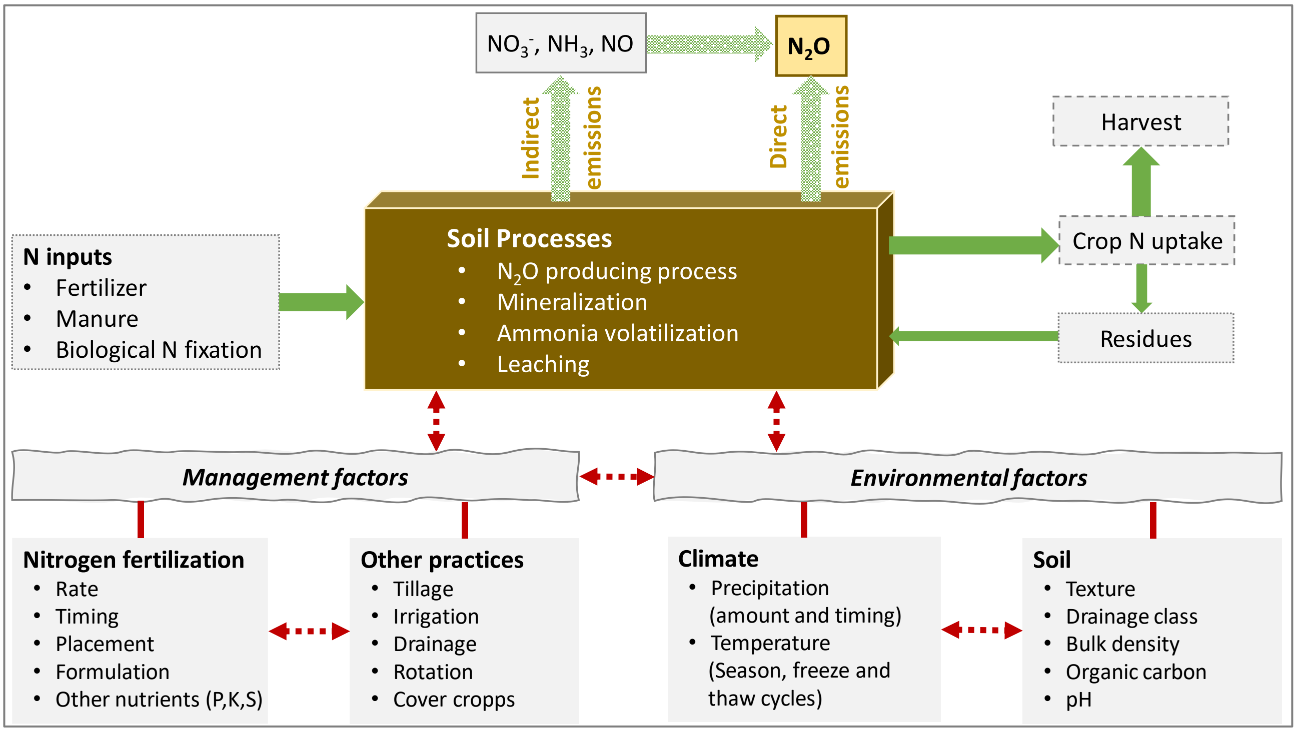

Figure 212 Factors influencing direct and indirect emissions of N_2O from agricultural soils

Source: WATTIAUX, M. A.; PAS, UDDIN, M. E. ; LETELIER, P., JACKSON, R. D. & LARSON, R. A. (2019): Emission and mitigation of greenhouse gases from dairy farms: The cow, the manure, and the field. In: Applied Animal Science 35:238–254. Sustainability and Integrated Systems. https://doi.org/10.15232/aas.2018-01803
Available on 29.04.2019 at: https://www.researchgate.net/publication/331916870_Invited_Review_Emission_and_mitigation_of_greenhouse_gases_from_dairy_farms_The_cow_the_manure_and_the_field

The first pathways is the volatilisation of N as NH_3 and oxides of N (NO_x), and the deposition of these gases and their products NH_4^+ and NO_3^- onto soils and the surface of lakes and other waters (see also Figure 212). As described in the 2006 IPCC GL, Vol. 4, Chapter 11.2.2 the sources of N as NH_3 and NO_x are not confined to agricultural fertilisers and manures, but also include fossil fuel combustion, biomass burning, and processes in the chemical industry. Thus, these processes cause N_2O emissions in an exactly analogous way to those resulting from deposition of agriculturally derived NH_3 and NO_x, following the application of synthetic and organic N fertilizers and /or urine and dung deposition from grazing animals (see also Figure 207).

The second pathway is the leaching and runoff from land of N from synthetic and organic fertilizer additions, crop residues, mineralization of N associated with loss of soil C in mineral and drained/managed organic soils through land-use change or management practices, and urine and dung deposition from grazing animals. As described in the 2006 IPCC GL, Vol. 4, Chapter 11.2.2 some of the inorganic N in or on the soil, mainly in the NO_3^- form, may bypass biological retention mechanisms in the soil/vegetation system by transport in overland water flow (runoff) and/or flow through soil macropores or pipe drains. Where NO_3^- is present in the soil in excess of biological demand, e.g., under cattle urine patches, the excess leaches through the soil profile. The nitrification and denitrification processes described at the beginning of this chapter transform some of the NH_4^+ and NO_3^- to N_2O. This may take place in the groundwater below the land to which the N was applied, or in riparian zones receiving drain or runoff water, or in the ditches, streams, rivers and estuaries (and their sediments) into which the land drainage water eventually flows.

Thus, agricultural nitrogen (N) sources of indirect N_2O emissions from managed soils arise from

- synthetic N fertilizers (F_{SN});
- organic N applied as fertilizer (e.g., applied animal manure, compost, sewage sludge, rendering waste and other organic amendments) (F_{ON});
- urine and dung N deposited on pasture, range and paddock by grazing animals (F_{PRP});
- N in crop residues (above- and below-ground), including N-fixing crops and forage/pasture renewal returned to soils (F_{CR}); and
- N mineralization associated with loss of soil organic matter resulting from change of land use or management on mineral soils (F_{SOM}).

Indirect N_2O emissions from managed soils (IPCC category 3.D.b) are not estimated due to lack of resources. However, the methodology is provided.

5.6.1 Methodological issues

5.6.1.1 Choice of methods

TIER 1 approach - $N_2O_{(ATD)}$ Volatilization

For estimating the N_2O emissions from atmospheric deposition of N volatilized from managed the 2006 IPCC Guidelines Tier 1 approach[522] has been applied.

Equation 11.9: N_2O from atmospheric deposition of N volatilized from managed soils (TIER 1)

(2006 IPCC GL, Vol. 4, Chap. 11)

$$\boldsymbol{N_2O_{(ATD)} - N = \left[(F_{SN} \times Frac_{GASF}) + \left((F_{ON} \times Frac_{PRP}) \times Frac_{GASF}\right)\right] \times EF_4}$$

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[522] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chap. 11, sub-chap. 11.2.2.1 Choice of method

Where:

$N_2O_{(ATD)}$–N = annual amount of N_2O–N produced from atmospheric deposition of N volatilized from managed soils (kg N_2O–N yr^{-1})

F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg N yr^{-1})

$Frac_{GASF}$ = fraction of synthetic fertiliser N that volatilises as NH3 and NOx (kg N volatilized (kg of N applied)$^{-1}$)

F_{ON} = annual amount of managed animal manure, compost, sewage sludge and other organic N additions applied to soils (kg N yr^{-1})

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N yr-1)

$Frac_{GASM}$ = fraction of applied organic N fertiliser materials (FON) and of urine and dung N deposited by grazing animals (FPRP) that volatilises as NH3 and NOx (kg N volatilized (kg of N applied or deposited)$^{-1}$) (Table 11.3)

EF_4 = emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces ([kg N–N_2O (kg NH3–N + NOx–N volatilized)$^{-1}$])

Conversion of $N_2O_{(ATD)}$-N emissions to N_2O emissions for reporting purposes is performed by using the following equation:

Equation 11.10: Indirect N_2O emissions due to volatilization of N from manure management

$$\boldsymbol{N_2O_{(ATD)} = N_2O_{(ATD)} - N \times \frac{44}{28}}$$

Where:

$N_2O_{(ATD)}$ = indirect N_2O emissions due to volatilization of N from Manure Management (kg N_2O)

$N_2O_{(ATD)}$–N = annual amount of N_2O–N produced from atmospheric deposition of N volatilized from managed soils (kg N_2O–N yr^{-1})

44/28 = conversion of kg N_2O-N into kg N_2O.

TIER 1 approach - $N_2O_{(L)}$ Leaching/Runoff

For estimating the N_2O emissions from leaching and runoff in regions where leaching and runoff occurs the 2006 IPCC Guidelines Tier 1 approach[523] has been applied.

Equation 11.10: N_2O from N leaching/runoff from managed soils in regions where leaching/runoff occurs (TIER 1)

(2006 IPCC GL, Vol. 4, Chap. 11)

$$\boldsymbol{N_2O_{(L)} - N = (F_{SN} + F_{ON} + F_{PRP} + F_{CR} + F_{SOM}) \times Frac_{LEACH-(H)} \times EF_5}$$

Where:

$N_2O_{(L)}$–N = annual amount of N_2O–N produced from leaching and runoff of N additions to managed soils in regions where leaching/runoff occurs (kg N_2O–N yr-1)

F_{SN} = annual amount of synthetic fertilizer N applied to soils in regions where leaching/runoff occurs (kg N yr-1)

F_{ON} = annual amount of managed animal manure, compost, sewage sludge and other organic N additions applied to soils in regions where leaching/runoff occurs (kg N yr-1)

F_{PRP} = annual amount of urine and dung N deposited by grazing animals in regions where leaching/runoff occurs (kg N yr-1)

from Equation 11.5, page 11.13, Chap. 11.2.1.3 Choice of activity data, Vol. 4 of 2006 IPCC GL

F_{CR} = amount of N in crop residues (above- and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils annually in regions where leaching/runoff occurs (kg N yr-1)

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[523] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chap. 11, sub-chap. 11.2.2.1 Choice of method

F_{SOM} = annual amount of N mineralized in mineral soils associated with loss of soil C from soil organic matter as a result of changes to land use or management in regions where leaching/runoff occurs (kg N yr-1)

from Equation 11.8, page 11.16, Chap. 11.2.1.3 Choice of activity data, Vol. 4 of 2006 IPCC GL

$Frac_{LEACH-(H)}$ = fraction of all N added to/mineralized in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (kg N (kg of N additions)-1)

from Table 11.3, page 11.23, Chap. 11.2.2.3 Choice of activity data, Vol. 4 of 2006 IPCC GL and presented in Table 542

EF_5 = emission factor for N_2O emissions from N leaching and runoff (kg N_2O–N (kg N leached & runoff)$^{-1}$)

from Table 11.3, page 11.23, Chap. 11.2.2.3 Choice of activity data, Vol. 4 of 2006 IPCC GL and presented in Table 542 in

Conversion of $N_2O_{(L)}$-N emissions to N_2O emissions for reporting purposes is performed by using the following equation:

Equation 11.10: Indirect N_2O emissions due to volatilization of N from manure management

$$\boldsymbol{N_2O_{(AL)} = N_2O_{(L)} - N \times \frac{44}{28}}$$

Where:

$N_2O_{(L)}$ = indirect N_2O emissions due to leaching and runoff of N additions to managed soils in regions where leaching/runoff occurs (kg N_2O)

$N_2O_{(L)}$–N = annual amount of N_2O–N produced from leaching and runoff of N additions to managed soils in regions where leaching/runoff occurs (kg N_2O–N yr^{-1})

44/28 = conversion of kg N_2O-N into kg N_2O.

5.6.1.2 Choice of volatilization and leaching factors

The method for estimating indirect N_2O emissions includes two emission factors:

- associated with volatilised and re-deposited N (EF_4),
- associated with N lost through leaching/runoff (EF_5).

The method also requires values for the fractions of N that are lost through volatilisation ($Frac_{GASF}$ and $Frac_{GASM}$) or leaching/runoff ($Frac_{LEACH-(H)}$).

As no country specific emission factors and values for the fractions of N that are lost were available, default emission factors and parameter were used.

Table 542 Default emission, volatilization and leaching factors for indirect soil N_2O emissions

Factor	Description	Unit	Default value
EF_4	N volatilisation and re-deposition	kg N_2O–N —————————————— (kg NH3–N + NOX–N volatilised)	0.010
EF_5	leaching/runoff	kg N_2O–N —————————— (kg N leaching/runoff)	0.0075
$Frac_{GASF}$	Volatilization from synthetic fertilizer	(kg NH3–N + NOx–N) —————————— (kg N applied)	0.10
$Frac_{GASM}$	Volatilization from all organic N fertilizers applied , and dung and urine deposited by grazing animals	(kg NH3–N + NOx–N) ———————————— (kg N applied or deposited)	0.20
$Frac_{LEACH-(H)}$	N losses by leaching/runoff for regions where ∑ (rain in rainy season) - ∑ (PE in same period) > soil water holding capacity, OR where irrigation (except drip irrigation) is employed	kg N —————————————— (kg N additions or deposition by grazing animals)	0.30
	N losses by leaching/runoff for dryland regions where precipitation is lower than evapotranspiration throughout most of the year and leaching is unlikely to occur		0

Source: 2006 IPCC GL, Vol. 4, Chap. 11, sub-chap. 11.2.2.3, Choice of activity data, Table 11.3, page 11.23

5.6.1.3 Choice of activity data

In order to estimate indirect N_2O emissions from the various N additions to managed soils, the parameters F_{SN}, F_{ON}, F_{PRP}, F_{CR}, F_{SOM} need to be estimated. These parameters are already described in Chapter 5.5.3.2 of this report described.

Applied synthetic fertiliser (F_{SN})

The term F_{SN} refers to the annual amount of synthetic fertiliser N applied to soils.
Relevant information is provided in Chapter 5.5.3.2.1 of this report.

Applied organic N fertilisers (F_{ON})

The term FON refers to the amount of organic N fertiliser materials intentionally applied to soils.
Relevant information is provided in Chapter 5.5.3.2.15.5.3.2.25.5.3.2.3 of this report.

Urine and dung from grazing animals (F_{PRP})

The term F_{PRP} refers to the amount of N deposited on soil by animals grazing on pasture, range and paddock.
Relevant information is provided in Chapter 6.5.2 of this report.

Crop residue N, including N from N-fixing crops and forage/pasture renewal, returned to soils (F_{CR})

The term FCR refers to the amount of N in crop residues (above- and below-ground), including N-fixing crops, returned to soils annually. It also includes the N from N-fixing and non-N-fixing forages mineralised during forage/pasture renewal.
Relevant information is provided in Chapter 5.5.3.2.1 of this report.

Mineralised N resulting from loss of soil organic C stocks in mineral soils (F_{SOM})

The term F_{SOM} refers to the amount of N mineralised from the loss of soil organic C in mineral soils through land-use change or management practices.
Relevant information is provided in Chapter 7 of this report.

5.6.2 Uncertainty assessment and time-series consistency for IPCC category 3.D Agricultural soils

The uncertainties for activity data and emission factors used for IPCC category 3.D Agricultural soils are presented in the following table.

Table 543 Uncertainty for IPCC sub-category 3.D Agricultural soils.

Uncertainty		**N_2O**	**Reference**
			2006 IPCC GL, Vol. 4, Chap. 11
Activity data			
$Frac_{loss}$	amount of managed manure nitrogen for livestock category that is lost in the manure management system	20%	Table 10.32 p 10.67
F_{sn}	activity data on synthetic fertilizer	20%	Expert judgment
F_{cr}	activity data crop residues	20%	Expert judgment
EF_1	N_2O emission factor for soils	250%	Table 11.1, page 11.11
EF_{PRP}	emission factor N deposited by grazing animals on pasture, range and paddock	200%	Table 11.1 page 11.11
EF_4	N volatilization and re-deposition	50%	Table 11.1 page 11.11
Combined Uncertainty		326%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

5.6.3 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of livestock data (statistical yearbook and FAOstat- Live Animals),
    - consistent use of data on area and yield of crops (statistical yearbook and FAOstat- crops),
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked of different sources: national statistic (ONS) and international statistics (FAO)
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- consistency and completeness checks are performed;
- time series consistency - plausibility checks of dips and jumps.

5.6.4 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 3.D Agricultural soils.

Table 544 Recalculations done since NC in IPCC sub-category 3.D Agricultural soils

GHG source & sink category	Revisions of data NC / BUR ⇒ submission 2020	Type of revision	Type of improvement
3.D	application of 2006 IPCC Guidelines	method	Comparability
3.D.a	use of N_2O default emission factor (direct emission) of 2006 IPCC Guidelines	EF	Comparability

5.6.5 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 545 Planned improvements for IPCC sub-category 3.D Agricultural soils

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.D	F_{SN} - Annual amount of applied synthetic fertilizer consumption applied to soils • amount and type (fertilizers by product and/or nutrient) of annual amount of applied synthetic fertilizer	AD	Accuracy Consistency Transparency	high
3.D	F_{ON} - annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils • amount of animal manure and N content, • amount of compost and N content, • amount of sewage sludge and N content (cross-check with Waste Sector to ensure there is no double counting), • annual amount of other organic amendments used as fertiliser (e.g., rendering waste, guano, brewery waste, etc.) and N content	AD	Accuracy Consistency Transparency	high
3.D	(1) $Area_{(T)}$ - Total annual area harvested of crops (types) (2) $Yield_{\_Fresh(T)}$ - Harvested fresh yield for crop T (3) Area burnt $_{(T)}$ - annual area of crop T burned (4) Dry matter (d.m.) fraction (DRY) • grains: e.g., wheat (split in winter and summer harvest), barley, oats, rice, rye, millet, maize (corn), sorghum, spelt, teff, (wild) rice, etc. • beans & pulses: e.g., beans, lentils, peas, etc. • tubers: e.g., (sweet) potato, yam, cassava, sweet lupins, etc. • root crops: beets-roots, sugar beet, pigweed, sunflower, mustard, carrots, etc. • N-fixing forages • Non-N-fixing forages • Perennial grasses • Grass-clover mixtures	AD	Accuracy Consistency Transparency	high
3.D	SOC_0 - soil organic carbon stock in the last year of an inventory time period (tonnes C) $SOC_{(0-T)}$ - soil organic carbon stock at the beginning of the inventory time period (tonnes C) *See Planned Improvements for LULUCF*	AD	Accuracy Transparency Consistency Comparability Completeness	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.D	(1) number of head of livestock species/category T fraction of total annual N excretion for each livestock (2) species/category T that is deposited on pasture, range and paddock (PRP) (3) annual average N excretion per head of species/category T *see Planned Improvements for 3.B. Enteric Fermentation and 3.A. Manure management*	AD	Accuracy Consistency	High

5.7 Prescribed burning of savannas (IPCC category 3.E)

GHG emission from IPCC category 3.E Prescribed burning of savannas were not estimated because these kinds of forest don’t exist in Algeria.

5.8 Field burning of agricultural residues (IPCC category 3.F)

Crop residues are sometimes burned, for convenience and as a means of disease control through residue removals. As described in the *2006 IPCC Guidelines Volume 4, Chapter 5.2.4,* CH_4 and N_2O emissions from *Cropland* are usually associated with burning of agriculture residues, which vary by crop and management system. Field burning of agricultural residues emits CH_4 and N_2O. CO_2 emissions from biomass burning do not have to be reported, since the carbon released during the combustion process is assumed to be reabsorbed by the vegetation during the next growing season.

This chapter includes information on and description of methodologies used for estimating GHG emissions as well as references to activity data and emission factors reported under IPCC category *Field burning of agricultural residues* for the period 1990 to 2020.

5.8.1 Category description

IPCC code	description	CO_2		CH_4		N_2O	
		Estimated	Key Category	estimated	Key category	estimated	Key category
3.F	**Field burning of agricultural residues**	✓*	-	✓	-	✓	-
A ‘✓’ indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential **CO_2***: from biomass burning are not accounted in this category .							
LA – Level Assessment (in year); TA – Trend Assessment							

GHG emissions from IPCC category 3.F Field burning of agricultural residues result from burning of residues of wheat, barley, maize, oat and sorghum.

- CH_4 emissions from IPCC category 3.F Field burning of agricultural residues amounted to 2.64 kt in 1990 and 3.12 kt in 2020.
- N_2O emissions from IPCC category 3.F Field burning of agricultural residues amounted to 0.069 kt in 1990 and 0.081 kt in 2020.

Emissions increased by 18.0%.

Table 546 CH_4 emissions from IPCC category 3.F Field burning of agricultural residues

CH_4	3.F	3.F.1.	3.F.1.a.	3.F.1.b.	3.F.1.c.	3.F.1.d	3.F.2.	3.F.3.	3.F.4.	3.F.5.
	Field burning of agricultural residues	Cereals	Wheat	Barley	Maize	Oat Sorghum	Pulses	Tubers and roots	Sugar cane	Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	2.64	2.64	1.28	1.18	0.09	0.09	NO	NO	NO	NO
1991	3.83	3.83	1.87	1.68	0.14	0.14	NO	NO	NO	NO
1992	3.95	3.95	2.00	1.68	0.13	0.13	NO	NO	NO	NO
1993	2.17	2.17	1.36	0.70	0.05	0.05	NO	NO	NO	NO
1994	1.42	1.42	0.96	0.39	0.04	0.04	NO	NO	NO	NO
1995	2.86	2.86	1.82	0.89	0.08	0.08	NO	NO	NO	NO
1996	4.07	4.07	2.46	1.39	0.11	0.11	NO	NO	NO	NO
1997	1.23	1.23	0.89	0.29	0.03	0.03	NO	NO	NO	NO
1998	3.92	3.92	2.78	1.01	0.06	0.06	NO	NO	NO	NO
1999	2.09	2.09	1.48	0.51	0.05	0.05	NO	NO	NO	NO
2000	1.14	1.14	0.89	0.23	0.05	0.02	NO	NO	NO	NO
2001	2.65	2.65	1.98	0.56	0.05	0.05	NO	NO	NO	NO
2002	2.04	2.04	1.51	0.43	0.05	0.05	NO	NO	NO	NO
2003	3.21	3.21	2.21	0.84	0.08	0.08	NO	NO	NO	NO
2004	3.32	3.32	2.17	0.99	0.08	0.08	NO	NO	NO	NO
2005	2.54	2.54	1.73	0.74	NO	0.07	NO	NO	NO	NO
2006	2.89	2.89	1.93	0.88	NO	0.08	NO	NO	NO	NO
2007	3.10	3.10	1.97	1.05	NO	0.09	NO	NO	NO	NO
2008	1.60	1.60	1.09	0.47	NO	0.05	NO	NO	NO	NO
2009	3.43	3.43	2.00	1.35	NO	0.08	NO	NO	NO	NO
2010	3.08	3.08	1.90	1.10	NO	0.09	NO	NO	NO	NO
2011	2.79	2.79	1.81	0.92	NO	0.06	NO	NO	NO	NO
2012	3.31	3.31	2.10	1.11	NO	0.09	NO	NO	NO	NO
2013	2.93	2.93	1.87	0.97	NO	0.09	NO	NO	NO	NO
2014	2.71	2.71	1.78	0.86	NO	0.07	NO	NO	NO	NO
2015	2.90	2.90	1.96	0.87	NO	0.07	NO	NO	NO	NO
2016	3.65	3.65	2.23	1.34	NO	0.08	NO	NO	NO	NO
2017	3.79	3.79	2.29	1.41	NO	0.10	NO	NO	NO	NO
2018	3.35	3.35	2.10	1.17	NO	0.08	NO	NO	NO	NO
2019	3.44	3.44	2.13	1.22	NO	0.08	NO	NO	NO	NO
2020	3.12	3.12	2.00	1.06	NO	0.07	NO	NO	NO	NO
Trend										
1990 - 2020	18.0%	18.0%	55.6%	-10.7%	-100.0%	-24.2%	NA	NA	NA	NA
2005 - 2020	22.9%	22.9%	15.2%	42.9%	NA	1.3%	NA	NA	NA	NA
2019 - 2020	-9.3%	-9.3%	-6.4%	-13.7%	NA	-19.7%	NA	NA	NA	NA

Table 547 N_2O emissions from IPCC category 3.F Field burning of agricultural residues

N_2O	**3.F**	**3.F.1.**	**3.F.1.a.**	**3.F.1.b.**	**3.F.1.c.**	**3.F.1.d**	**3.F.2.**	**3.F.3.**	**3.F.4.**	**3.F.5.**
	Field burning of agricultural residues	**Cereals**	**Wheat**	**Barley**	**Maize**	**Oat Sorghum**	**Pulses**	**Tubers and roots**	**Sugar cane**	**Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.069	0.069	0.033	0.031	0.002	0.002	NO	NO	NO	NO
1991	0.099	0.099	0.048	0.044	0.004	0.004	NO	NO	NO	NO
1992	0.102	0.102	0.052	0.044	0.003	0.003	NO	NO	NO	NO
1993	0.056	0.056	0.035	0.018	0.001	0.001	NO	NO	NO	NO
1994	0.037	0.037	0.025	0.010	0.001	0.001	NO	NO	NO	NO
1995	0.074	0.074	0.047	0.023	0.002	0.002	NO	NO	NO	NO
1996	0.105	0.105	0.064	0.036	0.003	0.003	NO	NO	NO	NO
1997	0.032	0.032	0.023	0.007	0.001	0.001	NO	NO	NO	NO
1998	0.102	0.102	0.072	0.026	0.002	0.002	NO	NO	NO	NO
1999	0.054	0.054	0.038	0.013	0.001	0.001	NO	NO	NO	NO
2000	0.030	0.030	0.023	0.006	0.001	0.000	NO	NO	NO	NO
2001	0.069	0.069	0.051	0.014	0.001	0.001	NO	NO	NO	NO
2002	0.053	0.053	0.039	0.011	0.001	0.001	NO	NO	NO	NO
2003	0.083	0.083	0.057	0.022	0.002	0.002	NO	NO	NO	NO
2004	0.086	0.086	0.056	0.026	0.002	0.002	NO	NO	NO	NO
2005	0.066	0.066	0.045	0.019	NO	0.002	NO	NO	NO	NO
2006	0.075	0.075	0.050	0.023	NO	0.002	NO	NO	NO	NO
2007	0.080	0.080	0.051	0.027	NO	0.002	NO	NO	NO	NO
2008	0.042	0.042	0.028	0.012	NO	0.001	NO	NO	NO	NO
2009	0.089	0.089	0.052	0.035	NO	0.002	NO	NO	NO	NO
2010	0.080	0.080	0.049	0.029	NO	0.002	NO	NO	NO	NO
2011	0.072	0.072	0.047	0.024	NO	0.002	NO	NO	NO	NO
2012	0.086	0.086	0.054	0.029	NO	0.002	NO	NO	NO	NO
2013	0.076	0.076	0.048	0.025	NO	0.002	NO	NO	NO	NO
2014	0.070	0.070	0.046	0.022	NO	0.002	NO	NO	NO	NO
2015	0.075	0.075	0.051	0.022	NO	0.002	NO	NO	NO	NO
2016	0.095	0.095	0.058	0.035	NO	0.002	NO	NO	NO	NO
2017	0.098	0.098	0.059	0.036	NO	0.002	NO	NO	NO	NO
2018	0.087	0.087	0.055	0.030	NO	0.002	NO	NO	NO	NO
2019	0.089	0.089	0.055	0.032	NO	0.002	NO	NO	NO	NO
2020	0.081	0.081	0.052	0.027	NO	0.002	NO	NO	NO	NO
Trend										
1990 - 2020	18.0%	18.0%	55.6%	-10.7%	-100.0%	-24.2%	NA	NA	NA	NA
2005 - 2020	22.9%	22.9%	15.2%	42.9%	NA	1.3%	NA	NA	NA	NA
2019 - 2020	-9.3%	-9.3%	-6.4%	-13.7%	NA	-19.7%	NA	NA	NA	NA

5.8.2 Methodological issues

5.8.2.1 Choice of methods

TIER 1 approach

For estimating the CH_4 and N_2O emissions from IPCC category 3.F *Field burning of agricultural residues* the 2006 IPCC Guidelines Tier 1 approach[524] has been applied.

Equation 2.27. estimation of greenhouse gas emissions from fire

(2006 IPCC Guidelines, Vol. 4, Chap 2)

$$L_{fire} = A \times L_B \times C_f . G_{ef} \times 10^{-3}$$

Where

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG e.g., CH_4, N_2O, etc.
A = area burnt, ha
M_B = mass of fuel available for combustion, tonnes ha-1.
C_f = combustion factor, dimensionless (default values in Table 2.6)
G_{ef} = emission factor, g kg-1 dry matter burnt (default values in Table 2.5 chap 2 vol 4;2006 IPCC).

5.8.2.2 Choice of activity data

The agricultural data used and presented in this inventory are taken from national and international sources:

- Statistiques agricoles [525]
- FAO agricultural data base[526]

In the following Figures and Tables are provided the data on cultivated and harvested crops presented.

It is assumed that no agricultural crop residues were burnt on-site took place, thus no double counting.

For estimating the biomass burnt on field the parameter (1) Residue/Crop Ratio, (2) Dry Matter Fraction and (3) Fraction of Crop Residue Burnt in Fields were used and presented in the following Table.

Table 548 Fraction of Crop Residue Burned in Fields, Dry Matter Fraction and Residue/Crop Ratio

	Dry Matter Fraction (DRY)	**Combustion Factor Cf**
	unit	**unit**
Wheat	0.89	0.90
Barley	0.89	0.85
Oats	0.89	0.85
Maize	0.87	0.80
Sorghum	0.89	
Source	Table 11.2, 2006 IPCC GL, Vol. 4, Chap. 11, page 11.16	Table 2.6, Chap 2, Vol 4., 2019 Refinements to the 2006 IPCC Guidelines

In the following table is provided an exemplary calculation of CH_4 and N_2O emissions from *Field burning of agricultural residues* (TIER 1) from wheat.

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[524] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 5 Cropland, sub-chap 5.2.4.1 Choice of method and chapter 2.4 Non-CO_2 emissions

[525] Available (03. May 2022) on n https://madr.gov.dz/Statistiques agricoles

[526] Available (03. May 2022) on http://www.fao.org/faostat/en/#data/QC

Table 549 Exemplary calculation of CH_4 and N_2O emissions from Field burning of agricultural residues (TIER 1) from wheat

	Parameters	**Crop**	**Units**	**Formula**	**Sources**	**2020**
1	T	Wheat				
2	Area (T)	Area harvested (annual)	ha		MADR/FAO	1,848,083
3	CropF	Yield (harvested fresh yield)	kg/ha		MADR/FAO	1,681
4	Prod	Crop Production	tonnes		MADR/FAO	3,106,754
5	Area $_{\text{burned-share}}$	Share area burned (annual)	%		Expert judgment	10%
6	Areaburned	Area burned (annual)	ha	Area(T) * Areaburned-share		184,808
7	DRY	dry matter fraction of harvested crop	kg d.m. / kg fresh weight			0.89
8	Crop(T)	harvested annual dry matter yield	kg d.m. ha-1	Yield Fresh (T) · DRY	Equation 11.7	1496.18
9	Mb*Cf	fuel (dead organic matter plus live biomass) biomass consumption values	tonnes dm/ha		Table 2.4	4.00
10	AGR(T)	Total amount of above-ground crop residue	Mg d.m. yr-1	Crop(T)+AGDM(T)	###[527]	3,755.93
11	FracBurnt (T)	fraction of annual harvested area of crop T burnt	-			0.10
12	Cf	Combustion factor	-		Table 2.6, Chap 2, Vol 4	0.9
13	EF CO_2	CO_2 emission factor	g / kg d.m burnt		Table 2.5	1515
14	CO_2	CO_2 emission from Agricultural residues	kt		Equation 2.27	1,119.94
15	EF CH_4	CH_4 emission factor	g / kg d.m burnt		Table 2.5	2.7
16	CH_4	CH_4 emission from Agricultural residues	kt		Equation 2.27	2.00
17	EF N_2O	N_2O emission factor	g / kg d.m burnt		Table 2.5	0.07
18	N_2O	N_2O emission from Agricultural residues	kt		Equation 2.27	0.05
19	EF CO	CO emission factor	g / kg d.m burnt		Table 2.5	92
20	CO	CO emission from Agricultural residues	kt		Equation 2.27	68.01
21	EF NOX	NOX emission factor	g / kg d.m burnt		Table 2.5	2.5
22	NOX	NOX emission from Agricultural residues	kt		Equation 2.27	1.85

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[527] *Doctoral dissertations University of Tennessee, Knoxville*

Table 550 Area harvested (annual) and share of burned area

	Wheat		Barley		Oats		Maize		Sorghum	
	Area harvested	Share area burned	Area harvested	Share area burned	Area harvested	Share area burned	Area harvested	Share area burned	Area harvested	Share area burned
	ha		ha		ha		ha		ha	
1990	1,187,820	10%	1,095,120	10%	897,747	430,015	467,731	1%	280	10%
1991	1,729,440	10%	1,555,670	10%	902,304	432,199	470,106	1%	130	10%
1992	1,848,010	10%	1,558,050	10%	1,007,837	482,748	525,089	1%	80	10%
1993	1,255,420	10%	652,630	10%	974,491	466,776	507,716	1%	20	10%
1994	892,600	10%	361,080	10%	923,822	442,505	481,317	1%	0	10%
1995	1,680,720	10%	824,170	10%	1,009,530	483,559	525,971	1%	30	10%
1996	2,278,500	10%	1,282,500	10%	1,051,287	503,560	547,726	1%	40	10%
1997	825,240	10%	264,840	10%	1,133,628	543,001	590,627	1%	30	10%
1998	2,577,150	10%	939,210	10%	1,182,684	566,499	616,185	1%	20	10%
1999	1,372,400	10%	468,960	10%	1,111,896	532,592	579,304	1%	20	10%
2000	827,000	10%	215,630	10%	1,113,433	544,702	568,731	1%	120	10%
2001	1,836,410	10%	515,690	10%	1,121,792	525,572	596,220	1%	200	10%
2002	1,398,460	10%	401,400	10%	1,179,890	551,400	628,490	1%	200	10%
2003	2,047,570	10%	782,380	10%	1,213,800	567,730	646,070	1%	230	10%
2004	2,010,600	10%	915,440	10%	1,264,810	594,200	670,610	1%	196	10%
2005	1,603,744	10%	684,648	10%	1,274,510	590,050	684,460	1%	370	10%
2006	1,783,825	10%	812,280	10%	1,321,280	599,070	722,210	1%	437	10%
2007	1,819,877	10%	971,246	10%	1,352,635	613,325	739,310	1%	202	10%
2008	1,006,571	10%	435,963	10%	1,353,536	616,571	736,965	1%	168	10%
2009	1,848,575	10%	1,250,762	10%	1,411,460	650,834	760,626	1%	43	10%
2010	1,755,728	10%	1,018,792	10%	1,534,055	696,615	837,440	1%	35	10%
2011	1,672,431	10%	852,379	10%	1,565,552	712,186	853,366	1%	94	10%
2012	1,945,776	10%	1,030,477	10%	1,654,927	753,390	901,537	1%	85	10%
2013	1,727,242	10%	897,719	10%	1,715,477	767,611	947,866	1%	2	10%
2014	1,651,311	10%	791,843	10%	1,851,939	827,303	1,024,636	1%	75	10%
2015	1,814,722	10%	802,336	10%	1,743,308	765,588	977,720	1%	219	10%
2016	2,062,179	10%	1,236,204	10%	1,705,378	767,835	937,543	1%	351	10%
2017	2,118,469	10%	1,303,149	10%	1,760,780	778,076	982,704	1%	312	10%
2018	1,948,402	10%	1,080,250	10%	1,769,824	803,098	966,726	1%	265	10%
2019	1,974,987	10%	1,133,005	10%	1,755,155	786,147	969,008	1%	132	10%
2020	1,848,083	10%	978,114	10%	1,747,713	782,814	964,899	1%	68	10%

5.8.2.3 Choice of emission factors

The default emissions factors used were taken from Table 2.5, Chap 2, Vol 4 2019 Refinement to 2006 IPCC Guidelines

Table 551 Fraction of Crop Residue Burned in Fields, Dry Matter Fraction and Residue/Crop Ratio

	CO_2	CH_4	N_2O	CO	NOx
	g / kg dry matter burnt				
Default Emission factor	1515	3	0.07	92	2.5
Source	Table 2.5, Chap 2, Vol 4., 2019 Refinements to the 2006 IPCC Guidelines				

5.8.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 3.F Field burning of agricultural residues are presented in the following table.

Table 552 Uncertainty for IPCC sub-category 3.F Field burning of agricultural residues.

Uncertainty	CO_2	CH_4	N_2O	**Reference**
				2006 IPCC GL, Vol. 4, Chap. 11
Activity data (AD)	-	20%	20%	Expert judgment on Chapter 11.2.1.4
Emission factor (EF)	-	180%	180%	Table 11.1 Chapter 1.2.1.2
Combined Uncertainty	-	181%	181%	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

5.8.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - consistent use of data on area under crop cultivation,
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources: national statistic (ONS) and international statistics (FAO)
- consistency and completeness checks are performed;
- time series consistency - plausibility checks of dips and jumps.

5.8.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 3.F Field burning of agricultural residues.

Table 553 Recalculations done in IPCC sub-category 3.F Field burning of agricultural residues

GHG source & sink category	Revisions	Type of revision	Type of improvement
3.F	Application of methodology of 2019 Refinements to the 2006 IPCC Guidelines 2006	Met	Comparability Transparency Accuracy
3.F	Revision of share of crop residues burnt in field Revision of Dry matter fraction Consideration of more crops	AD	Comparability Transparency Accuracy

5.8.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 554 Planned improvements for IPCC sub-category 3.F Field burning of agricultural residues

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.F	Correction of technical mistakes in calculation	AD	Accuracy	medium
3.F	Consideration of cultivated crops and crop residues which are burnt and if possible, by provinces • Crops where crop residues are burned • Use of crop residues: biofuel, domestic livestock feed, building materials, burning in the field etc. • Dry matter fraction • Estimation of above-ground (and below ground) biomass, dead organic matter (dead wood and litter)	AD	Transparency Accuracy	medium
3.F	Cross-check with FAO statistics[528] (Emissions – Agriculture) where emissions from crop residues were estimated	EMI	Consistency	medium

5.9 Liming (IPCC category 3.G)

The IPCC category 3.G Liming does not exist in Algeria.

5.10 Urea application (IPCC category 3.H)

This chapter includes information on and description of methodologies used for estimating GHG emissions as well as references to activity data and emission factors reported under IPCC category *Urea application*.

As described in the 2006 IPCC GL, Col. 4, Chap. 11, adding urea to soils during fertilisation leads to a loss of CO_2 that was fixed in the industrial production process. Urea ($CO(NH_2)_2$) is converted into ammonium (NH_4^+), hydroxyl ion (OH^-), and bicarbonate (HCO_3^-), in the presence of water and urease enzymes. Similar to the soil reaction following addition of lime, bicarbonate that is formed evolves into CO_2 and water.

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[528] Available (03. March 2019) on http://www.fao.org/faostat/en/#data/GA

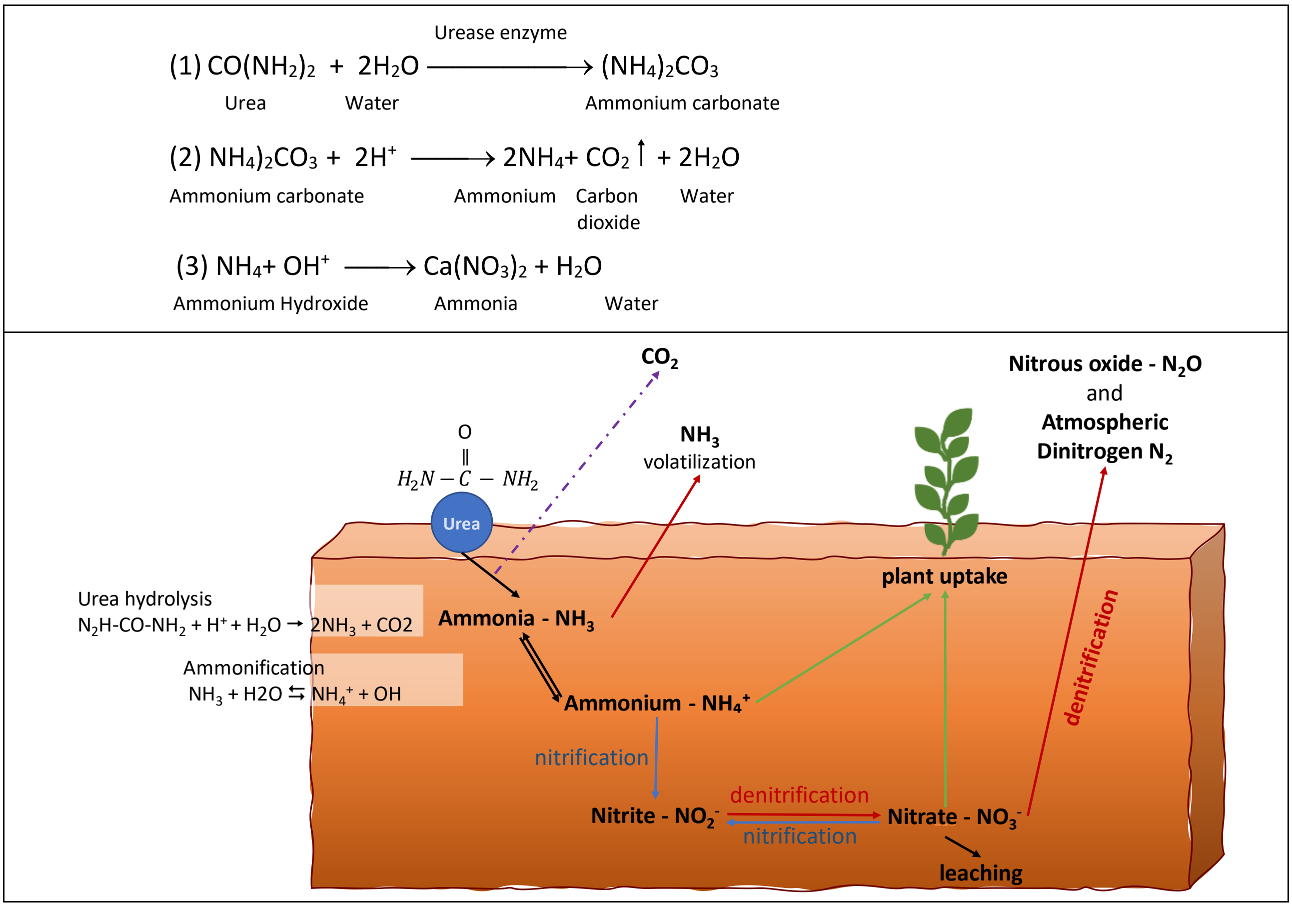

Figure 213 Urea hydrolysis reaction (equation)

This source category is included because the CO_2 removal from the atmosphere during urea manufacturing is estimated in the IPCC sector *Industrial Processes and Product Use Sector (IPPU).*

5.10.1 Category description

GHG emissions from this sector comprise emissions from the following categories:

IPCC code	description	CO_2		CH_4		N_2O	
		Estimated	Key Category	estimated	Key category	estimated	Key category
3.H	**Urea application**	✓	-	NA	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
LA – Level Assessment (in year); TA – Trend Assessment							

The IPCC category 3.H *Urea application* was responsible for 44.53 kt CO_2 emissions in 2009 and for 67.47 kt CO_2 emissions in 2016. Due to lack of data, it was not possible to estimate CCO_2 emissions for the whole time series.

An overview of the *Urea application* (IPCC category 3.H) related CO_2 emissions is provided in the following figure and table.

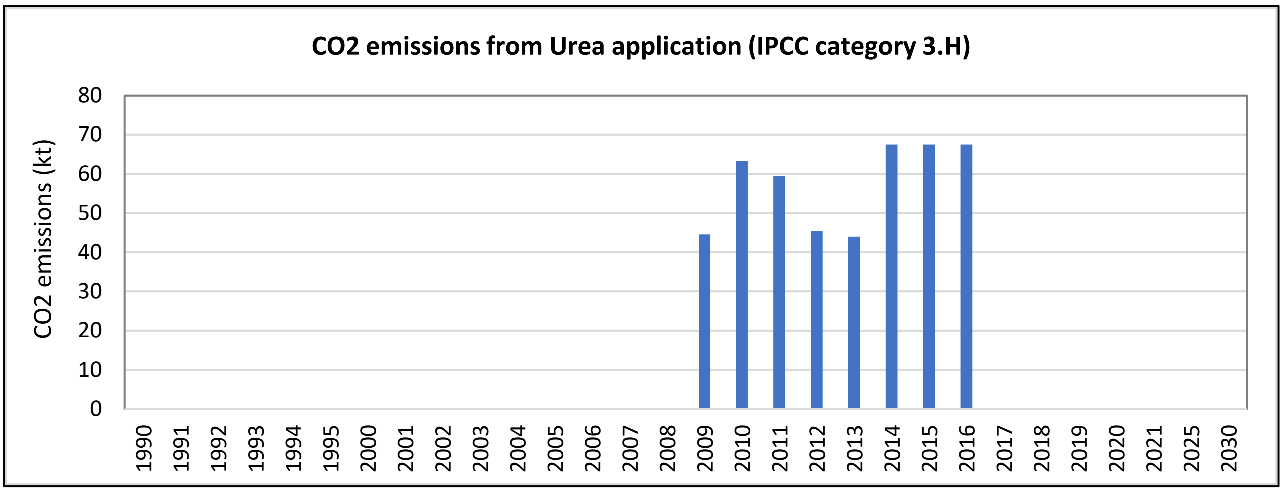

Figure 214 CO_2 Emissions from IPCC sub-category 3.H Urea application

Table 555 Annual amount of urea applied, emission factor and CO_2 emissions from IPCC category 3.H Urea application

	Urea application	**Emission factor N_2O-N**	**CO_2-C emissions**	**conversion factor CO_2–C emissions into CO_2**	**CO_2 emissions**	**Method**	**EF used**
	tonnes	**t of C/t of urea**	**kt**		**kt**		
1990	NE	0.2	NE	3.67	NE	T1	D
1991	NE	0.2	NE	3.67	NE	T1	D
1992	NE	0.2	NE	3.67	NE	T1	D
1993	NE	0.2	NE	3.67	NE	T1	D
1994	NE	0.2	NE	3.67	NE	T1	D
1995	NE	0.2	NE	3.67	NE	T1	D
1996	NE	0.2	NE	3.67	NE	T1	D
1997	NE	0.2	NE	3.67	NE	T1	D
1998	NE	0.2	NE	3.67	NE	T1	D
1999	NE	0.2	NE	3.67	NE	T1	D
2000	NE	0.2	NE	3.67	NE	T1	D
2001	NE	0.2	NE	3.67	NE	T1	D
2002	NE	0.2	NE	3.67	NE	T1	D
2003	NE	0.2	NE	3.67	NE	T1	D
2004	NE	0.2	NE	3.67	NE	T1	D
2005	NE	0.2	NE	3.67	NE	T1	D
2006	NE	0.2	NE	3.67	NE	T1	D
2007	NE	0.2	NE	3.67	NE	T1	D
2008	NE	0.2	NE	3.67	NE	T1	D
2009	60,729	0.2	12,146	3.67	44.53	T1	D
2010	86,279	0.2	17,256	3.67	63.27	T1	D
2011	81,131	0.2	16,226	3.67	59.50	T1	D
2012	62,000	0.2	12,400	3.67	45.47	T1	D
2013	60,000	0.2	12,000	3.67	44.00	T1	D
2014	92,000	0.2	18,400	3.67	67.47	T1	D

	Urea application	**Emission factor N_2O-N**	**CO_2-C emissions**	**conversion factor CO_2–C emissions into CO_2**	**CO_2 emissions**	**Method**	**EF used**
	tonnes	**t of C/t of urea**	**kt**		**kt**		
2015	92,000	0.2	18,400	3.67	67.47	T1	D
2016	92,000	0.2	18,400	3.67	67.47	T1	D
2017	NE	0.2	NE	3.67	NE	T1	D
2018	NE	0.2	NE	3.67	NE	T1	D
2019	NE	0.2	NE	3.67	NE	T1	D
2020	NE	0.2	NE	3.67	NE	T1	D
Trend							
1990 – 2020	*NA*		*NA*		*NA*		
Source	FaoSTAT-Fertilizers by Product[529]	2006 IPCC GL, Vol. 4, Chap. 11, sub-chap. 11.4.2	Equation 11.13, 2006 IPCC GL, Vol. 4, Chap. 11, sub-chap. 11.4.1		Multiplication by 44/12 to convert CO_2–C emissions into CO_2	Tier 1 (T1)	Default (D)

5.10.2 Methodological issues

5.10.2.1 Choice of methods

TIER 1 approach

For estimating the CO_2 emissions from urea application, the 2006 IPCC Guidelines Tier 1 approach[530] has been applied.

Equation 11.13: CO_2 emissions from urea application

(2006 IPCC GL, Vol. 4, Chap. 11)

$$\boldsymbol{CO_2 - C\ emission = AD \times EF}$$

$$\boldsymbol{CO_2\ emissions = \frac{CO_2O - C \times \frac{44}{12}}{1000}}$$

Where:

CO_2 emission = annual CO_2 emissions from urea application (Gg)

CO_2–C emission = annual C emissions from urea application (tonnes C)

AD = annual amount of urea fertilisation (tonnes urea)

EF = emission factor (tonne of C / tonne of urea)

44/12 = conversion factor from C to CO_2

1000 = conversion factor from tonnes to Gg

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[529] FAO (2022): Available on 18.04.2022 at: http://www.fao.org/faostat/en/#data/RFB

[530] Source: 2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11 - N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap. 11.4.1, page 11.32.

5.10.2.2 Choice of activity data

The agricultural data used and presented in this inventory were taken from FAO agricultural data base[531] The annual amount of urea in used IPCC sector Agriculture is determined by national production, import and export, as well as ‘other uses of urea’.

Agricultural use of Urea **=** production **+** import **–** export – Other Uses of Urea

5.10.2.3 Choice of emission factors

The default emission factor was taken from IPCC 2006 Guidelines and presented in presented in the following table.

Table 556 CO_2 Emission factor TIER 1 for IPCC category 3.H Urea application

	EF CO_2-C (t of carbon/t of urea)			**Source**
	Method	**EF**	**type**	
Urea application	T1	0.20	D	2006 IPCC Guidelines, Volume 4: AFOLU, Chapter 11 - N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application, sub-chap. 11.4.2, page 11.34.

Note:

D Default CS Country specific PS Plant specific IEF Implied emission factor

5.10.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 3.D Urea *Application are* presented in the following table.

Table 557 Uncertainty for IPCC sub-category 3.H Urea *Application*.

Uncertainty	**CO_2**	**CH_4**	**N_2O**	**Reference**
Activity data (AD)	50%	-	-	Base on Chapter 11.4.4, 2006 IPCC GL, Vol. 4, Chap. 11
Emission factor (EF)	2%	-	-	
Combined Uncertainty	50 %	-	-	$U_{Total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

5.10.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.

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[531] FAO (2022): Available on 18.04.2022 at: http://www.fao.org/faostat/en/#data/RFB

- cross-checked from different sources: national statistic (ONS) and international statistics (FAO)
- time series consistency - plausibility checks of dips and jumps.

5.10.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last two submission to the UNFCCC and relevant to IPCC category 3.H Urea *application*.

Table 558 Recalculations done since submission 2010 IPCC category 3.H Urea application

GHG source & sink category	Revisions	Type of revision	Type of improvement
3.H	No recalculation as this source was estimated the first time.	-	-

5.10.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 559 Planned improvements for IPCC sub-category 3.C Urea application

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.H	Collection of activity data for the time series 1990 – 2020	AD	Accuracy Completeness	medium

5.11 Other carbon-containing fertilizers (IPCC category 3.I)

The IPCC category 3.I Other carbon-containing fertilizers does not exist in Algeria.

5.12 Other (IPCC category 3.J)

The IPCC category 3.J Other does not exist in Algeria.

6 Land Use, Land Use Change and Forestry (LULUCF) (IPCC sector 4)

6.1 Overview of the sector and background information

This chapter includes information and description of methodologies used for estimating GHG emissions and removals as well as references to aand emission factors reported under IPCC Sector 4 LULUCF for the period 1990 to 2020.

Total GHG emissions and removals from IPCC sector 4 LULUCF amounted to -5,554.50 kt CO2 eq in 1990, then decreased slightly to -5,675.52 kt CO2 eq in 2005, and increased to -8,933.41 kt CO2 eq in 2020. Except for the year 1994, where the IPCC sector 4 LULUCF was even a source, the IPCC sector 4 LULUCF was a net sink in Algeria: the range was -12,194.33 kt CO2 eq in 2015 to -1,090.23 kt CO2 eq in 2012.

The fluctuation in GHG emissions and removals from IPCC sector 4 LULUCF are mainly due to losses of carbon due to forest fires. In 1994, but also in 2004 and 2012, exceptionally strong forest fires took place:

- In 1994, the carbon loss from these fires resulted in LULUCF being a significant source of GHG emissions: 23,317.51 kt CO_2 eq.
- In 2012, the carbon sink was greatly reduced by the fires: GHG removals of -1,090.23 kt CO_2 eq.

Total CO_2 emissions and removals from IPCC sector 4 LULUCF amounted to -5,554.50 kt in 1990, then increased to -5,675.52 kt in 2005, and increased to -8,933.41 kt in 2020.

- In 1994, the carbon loss from these fires resulted in LULUCF is being a significant source of CO_2 emissions: 23,317.51kt.

Total CH_4 emissions and removals from IPCC sector 4 LULUCF amounted to 1.88 kt in 1990, then increased to 2.12 kt in 2005, and increased to 2.71 kt in 2020.

- In 1994, about 22.65 kt CH_4 emissions and in 2012, about 7.26 kt CH_4 emissions resulted from forest fires due to biomass burning.

Total N_2O emissions and removals from IPCC sector 4 LULUCF amounted to 0.10 kt in 1990, then increased to 0.12 kt in 2005, and increased to 0.15 kt in 2020.

- In 1994, about 1.25 kt N_2O emissions and in 2012, about 0.4 kt N_2O emissions resulted from forest fires due to biomass burning.

The IPCC sector 4 LULUCF is dominated by fluxes of CO_2. Emissions of CH_4 and N_2O contribute only marginally to the overall GHG balance of the sector LULUCF.

It must be noted that only GHG emissions from IPCC category 4.A.1 Forest land remaining forest land were estimated.

LULUCF is a significant sector in National total GHG inventory. In the following figure and table GHG emissions from this sector comprise emissions from the categories are described in the following table:

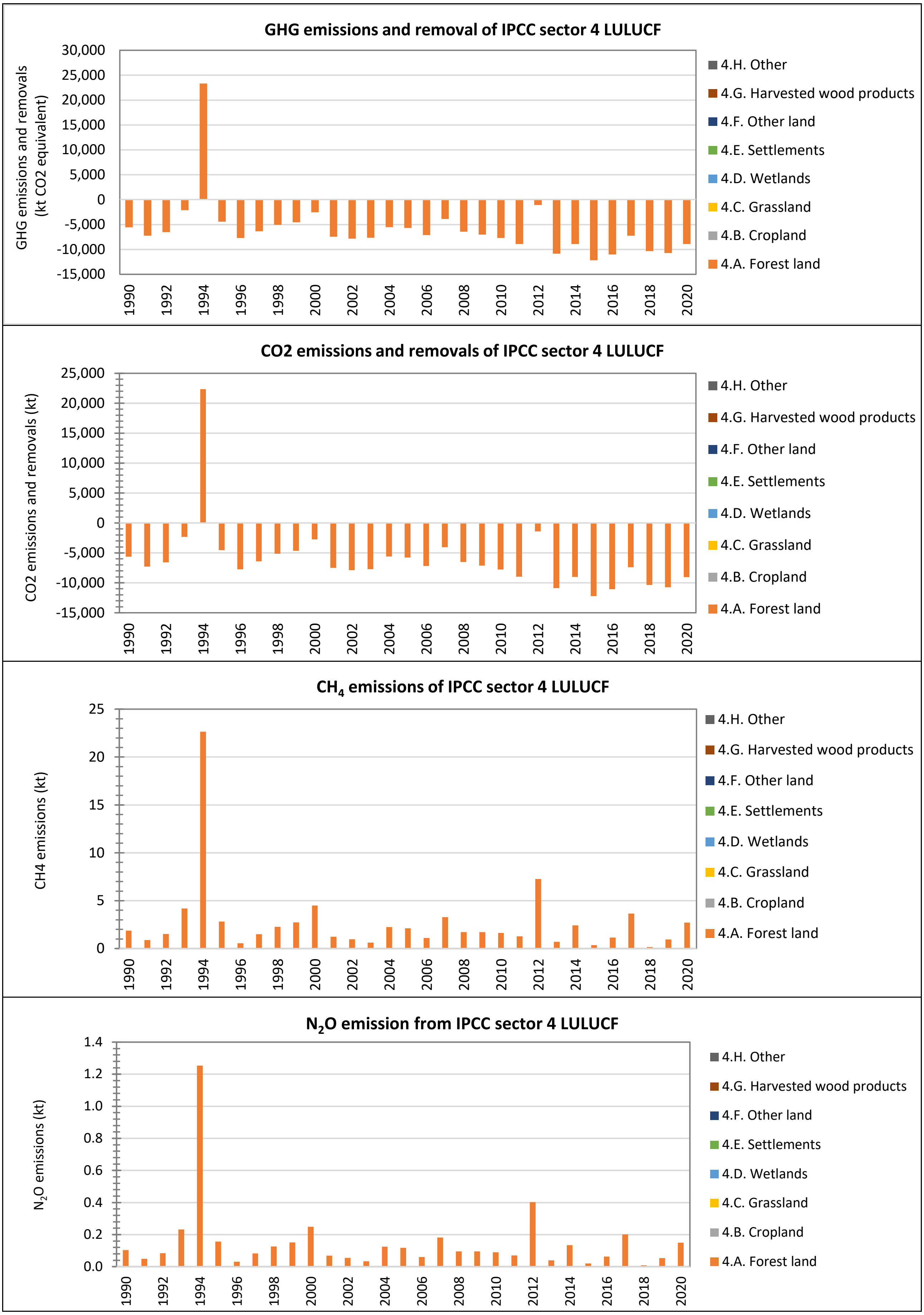

Figure 215 **Total GHG emissions and removals by category of IPCC sector 4 LULUCF (1990-2020)**

Table 560 GHG Emissions and removals from IPCC sector 4 LULUCF: 1990-2020

GHG emissions	**TOTAL GHG**	**CO_2**	**CH4**	**N_2O**	**CH4**	**N_2O**
	kt CO_2 equivalent	**kt**	**kt CO_2 equivalent**	**kt CO_2 equivalent**	**kt**	**kt**
1990	-5,554.50	-5632.29	46.88	30.91	1.88	0.10
1991	-7,242.99	-7279.77	22.16	14.61	0.89	0.05
1992	-6,524.49	-6587.94	38.24	25.21	1.53	0.08
1993	-2,144.59	-2318.53	104.82	69.12	4.19	0.23
1994	23,317.51	22378	566.19	373.35	22.65	1.25
1995	-4,437.96	-4555.29	70.71	46.62	2.83	0.16
1996	-7,706.58	-7729.99	14.10	9.30	0.56	0.03
1997	-6,344.83	-6406.63	37.24	24.56	1.49	0.08
1998	-5,052.01	-5146.5	56.94	37.55	2.28	0.13
1999	-4,540.33	-4653.72	68.34	45.06	2.73	0.15
2000	-2,556.43	-2743.13	112.51	74.19	4.50	0.25
2001	-7,446.68	-7497.77	30.79	20.30	1.23	0.07
2002	-7,836.97	-7877.72	24.56	16.19	0.98	0.05
2003	-7,682.83	-7708.41	15.42	10.17	0.62	0.03
2004	-5,515.52	-5608.88	56.26	37.10	2.25	0.12
2005	-5,675.52	-5763.64	53.11	35.02	2.12	0.12
2006	-7,126.29	-7171.78	27.42	18.08	1.10	0.06
2007	-3,897.41	-4033.31	81.90	54.00	3.28	0.18
2008	-6,447.48	-6518.88	43.03	28.37	1.72	0.10
2009	-7,052.46	-7123.8	42.99	28.35	1.72	0.10
2010	-7,725.87	-7793.62	40.83	26.92	1.63	0.09
2011	-8,924.84	-8977.83	31.93	21.06	1.28	0.07
2012	-1,090.23	-1391.52	181.57	119.73	7.26	0.40
2013	-10,838.35	-10867.7	17.71	11.68	0.71	0.04
2014	-8,904.60	-9005.03	60.52	39.91	2.42	0.13
2015	-12,194.33	-12209	8.82	5.82	0.35	0.02
2016	-11,020.69	-11068.1	28.59	18.85	1.14	0.06
2017	-7,234.71	-7386.17	91.27	60.18	3.65	0.20
2018	-10,359.57	-10365.8	3.78	2.49	0.15	0.01
2019	-10,707.34	-10747.1	23.95	15.79	0.96	0.05
2020	-8,933.41	-9045.91	67.79	44.70	2.71	0.15
Trend						
1990 - 2020	60.8%	60.6%	44.6%	44.6%	44.6%	44.6%
2005 - 2020	57.4%	56.9%	27.7%	27.7%	27.7%	27.7%
2019 - 2020	-16.6%	-15.8%	183.1%	183.1%	183.1%	183.1%

Table 561 GHG Emissions and removals from IPCC sector 4 LULUCF per category: 1990-2020

GHG emissions	**4**	**4.A**	**4.B**	**4.C**	**4.D**	**4.E**	**4.F**	**4.G**
	TOTLAL LULUCF	**Total Forest land**	**Total Cropland**	**Total Grassland**	**Total Wetlands**	**Total Settlements**	**Total Other land**	**Harvested Wood Products (HWP)**
	kt CO2 equivalent							
1990	-5,554.50	-5,554.50	NE	NE	NE	NE	NE	NE
1991	-7,242.99	-7,242.99	NE	NE	NE	NE	NE	NE
1992	-6,524.49	-6,524.49	NE	NE	NE	NE	NE	NE
1993	-2,144.59	-2,144.59	NE	NE	NE	NE	NE	NE
1994	23,317.51	23,317.51	NE	NE	NE	NE	NE	NE
1995	-4,437.96	-4,437.96	NE	NE	NE	NE	NE	NE
1996	-7,706.58	-7,706.58	NE	NE	NE	NE	NE	NE
1997	-6,344.83	-6,344.83	NE	NE	NE	NE	NE	NE
1998	-5,052.01	-5,052.01	NE	NE	NE	NE	NE	NE
1999	-4,540.33	-4,540.33	NE	NE	NE	NE	NE	NE
2000	-2,556.43	-2,556.43	NE	NE	NE	NE	NE	NE
2001	-7,446.68	-7,446.68	NE	NE	NE	NE	NE	NE
2002	-7,836.97	-7,836.97	NE	NE	NE	NE	NE	NE
2003	-7,682.83	-7,682.83	NE	NE	NE	NE	NE	NE
2004	-5,515.52	-5,515.52	NE	NE	NE	NE	NE	NE
2005	-5,675.52	-5,675.52	NE	NE	NE	NE	NE	NE
2006	-7,126.29	-7,126.29	NE	NE	NE	NE	NE	NE
2007	-3,897.41	-3,897.41	NE	NE	NE	NE	NE	NE
2008	-6,447.48	-6,447.48	NE	NE	NE	NE	NE	NE
2009	-7,052.46	-7,052.46	NE	NE	NE	NE	NE	NE
2010	-7,725.87	-7,725.87	NE	NE	NE	NE	NE	NE
2011	-8,924.84	-8,924.84	NE	NE	NE	NE	NE	NE
2012	-1,090.23	-1,090.23	NE	NE	NE	NE	NE	NE
2013	-10,838.35	-10,838.35	NE	NE	NE	NE	NE	NE
2014	-8,904.60	-8,904.60	NE	NE	NE	NE	NE	NE
2015	-12,194.33	-12,194.33	NE	NE	NE	NE	NE	NE
2016	-11,020.69	-11,020.69	NE	NE	NE	NE	NE	NE
2017	-7,234.71	-7,234.71	NE	NE	NE	NE	NE	NE
2018	-10,359.57	-10,359.57	NE	NE	NE	NE	NE	NE
2019	-10,707.34	-10,707.34	NE	NE	NE	NE	NE	NE
2020	-8,933.41	-8,933.41	NE	NE	NE	NE	NE	NE
Trend								
1990 - 2020	60.8%	60.8%	NA	NA	NA	NA	NA	NA
2005 - 2020	57.4%	57.4%	NA	NA	NA	NA	NA	NA
2019 - 2020	-16.6%	-16.6%	NA	NA	NA	NA	NA	NA

6.2 Land-use definitions and the land representation approach used and their correspondence to the land use, land-use change and forestry categories.

The definitions of the land-use categories for greenhouse gas inventory reporting are presented in the following table:

- Land-use definitions as described in the 2019 Refinement to the 2006 IPCC Guidelines;
- Forest or land cover class according to FAO;
- National Land-use Definition according to national law[532].

Currently there is no consistent use of the land-use definitions.

- National classification on land-use used in Statitisque agricole Superficie et production. Serie "B", which is in line with the current law. [533]
- The FAO Global Forest Resources Assessment (FRA) 2015[534] and 2020[535] for Algeria was prepared using the FAO land-use definition. The General Directorate of Forestry[536] (DGF) has specified out in the FRA Forest Report Assessment that the national definitions of the forest estate have been adopted in relation to the FAO definitions, but only for the FRA 2015 and 2020.

Table 562 Definition of Land-use categories and Land-use categories for greenhouse gas inventory reporting

IPCC code	Description	Forest or land cover class	Definition according to 2006 IPCC Guidelines	National Definition
4.A Forest Land	The IPCC category 4.A *Forest Land* includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but *in situ* could potentially reach the threshold values used by a country to define the Forest Land category.	Forest [537]	Land spanning more than 0.5 hectare with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Forest is determined both by the presence of trees and the absence of other predominant land uses. The trees should be able to reach a minimum height of 5 meters in situ. Areas under reforestation that have not yet reached but are expected to reach a canopy cover of 10 percent and tree height of 5 meters are included, as are temporarily unstocked areas, resulting from human intervention or natural causes, which are expected to regenerate.	The general forestry law (Legislation and regulations supporting sustainable forest management) was promulgated in 1984 [538] and amended in 1991 [539]. The land definitions were not changed. However, the FAO definitions were used for the preparation of the FRA 2015 [540]. Currently this law is under consideration. **Forest is any land covered with forest species in a natural state.** Article 08 [541]

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[532] Loi n°84-12 du 23 juin 1984 portant régime général des forêts https://www.joradp.dz/FTP/JO-FRANCAIS/1984/F1984026.pdf?znjo=26

[533] Sources: MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022):

Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2019.pdf

[534] https://www.fao.org/3/az147f/az147f.pdf

[535] https://www.fao.org/3/cb0128fr/cb0128fr.pdf

[536] Direction Générale des Forêts ; http://dgf.org.dz/fr

[537] 2006 IPCC Guidelines, Volume 4, Chapter 4, TABLE 4.2 FOREST AND LAND COVER CLASSES

[538] Loi n°84-12 du 23 juin 1984 portant régime général des forêts https://www.joradp.dz/FTP/JO-FRANCAIS/1984/F1984026.pdf?znjo=26

[539] Loi n°91-20 du 02 décembre 1991modifiant et complétant la loi n°84-12 du 23 juin 1984 portant régime général des forêts https://www.joradp.dz/FTP/JO-FRANCAIS/1991/F1991062.pdf?znjo=62

[540] https://www.fao.org/3/cb0128fr/cb0128fr.pdf

[541] Loi n°84-12 du 23 juin 1984 portant régime général des forêts

Article n°08 : on entend par foret , toute terre couverte d'essence forestière sous forme de peuplement à l'état normal

Article n°09 : on entend par peuplement à l'état normal, tout peuplement comportant au minimum : - cent arbre (100) à l'hectare en état de maturité en zone aride et semi-aride, - trois cent (300) arbres à l'hectare en état de maturité en zone humide et subhumide.

Article n°10 : on entend par terre à vocation forestière : - Toutes terres couvertes de bois et maquis ou d'essence forestière résultant de la dégradation des forêts, et ne remplissent pas les conditions fixées aux articles 8 et 9 de la loi n°84-12. – toute terre qui, pour des raisons écologiques et économiques trouvent leur meilleure utilisation dans l'établissement d'une forêt.

IPCC code	**Description**	**Forest or land cover class**	**Definition according to 2006 IPCC Guidelines**	**National Definition**
			Includes: areas with bamboo and palms provided that height and canopy cover criteria are met; forest roads, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks, shelterbelts and corridors of trees with an area of more than 0.5 hectare and width of more than 20 meters; plantations primarily used for forestry or protective purposes, such as rubber-wood plantations and cork oak stands. Excludes: tree stands in agricultural production systems, for example in fruit plantations and agroforestry systems. The term also excludes trees in urban parks and gardens.	The permanent forest estate is composed of all wooded land, regardless of its legal nature (state-owned or private forests). It is governed by Law 84-12 of 23, Algeria June 19, 1984, amended and supplemented, which allows the allocation of forest land to a regime other than forestry, only for public utility. Private forests are also subject to the general forestry regime, which prohibits any change of use except in the case of a particular provision related to public utility. Land with forestry purpose (Terre à vocation forestière) is any land covered with woodland and scrub or forest species resulting from forest degradation Article 10 Erreur ! Signet non défini..
		Other wooded land	Land not classified as "Forest", spanning more than 0.5 hectare; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.	
		Other land with tree cover	Land classified as Other Land, spanning more than 0.5 hectare with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity. Includes: groups of trees and scattered trees in agricultural landscapes, parks, gardens, and around buildings (provided that the area, height and canopy cover criteria are met); tree plantations established mainly for other purposes than wood, such as fruit orchards and palm plantations.	Other wooded land (OWL): This category includes all scrub land formations. Land with forestry vocation is understood to be: - Any land covered with wood and scrub or forest species resulting from the degradation of forests, and do not meet the conditions set out in Articles 8 and 9 of Law No. 84-12. - Any land which, for ecological and economic reasons, finds its best use in the establishment of a forest.10 [542].

Article n°11 : on entend par formations forestières , toute végétation arborée constitué en bosquets, bandes , brise-vent, hales quel que soit son état.

[542] Loi n°84-12 du 23 juin 1984 portant régime général des forêts : **Article n°10** : on entend par terre à vocation forestière : - Toutes terres couvertes de bois et maquis ou d'essence forestière résultant de la dégradation des forêts, et ne remplissent pas les conditions fixées aux articles 8 et 9 de la loi n°84-12. – toute terre qui, pour des raisons écologiques et économiques trouvent leur meilleure utilisation dans l'établissement d'une forêt.

IPCC code	Description	Forest or land cover class	Definition according to 2006 IPCC Guidelines	National Definition
4.B Cropland	The IPCC category 4.B *Cropland* includes cropped land, including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category.	Cropland [543]	Cropland includes arable and tillable land, rice fields, and agroforestry systems where the vegetation structure falls below the thresholds used for the Forest Land category and is not expected to exceed those thresholds at a later time. Cropland includes all annual and perennial crops as well as temporary fallow land (i.e., land set at rest for one or several years before being cultivated again). Annual crops include cereals, oils seeds, vegetables, root crops and forages. Perennial crops include trees and shrubs, in combination with herbaceous crops (e.g., agroforestry) or as orchards, vineyards and plantations such as cocoa, coffee, tea, oil palm, coconut, rubber trees, and bananas, except where these lands meet the criteria for categorization as Forest Land. Arable land which is normally used for cultivation of annual crops but which is temporarily used for forage crops or grazing as part of an annual crop-pasture rotation (mixed system) is included under cropland.	Agricultural land or land with an agricultural vocation, all of which, through the intervention of man, allows for annual and multi-annual production for human, animal, or industrial consumption, directly or after processing. Art n°04 [544]
4.C Grassland	The IPCC category 4.B *Grassland* includes rangelands and pastureland that are not considered Cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and bushes that fall below the threshold values used in the Forest Land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastural systems, consistent with national definitions.	Grass land [545]	Grasslands are generally distinguished from "forest" as ecosystems having a tree canopy cover of less than a certain threshold, which varies from region to region. Below-ground carbon dominates in grassland and is mainly contained in roots and soil organic matter. The transition along rainfall or soil gradients from grassland to forest is often gradual. Many shrublands with high proportions of perennial woody biomass may be a type of grassland and countries may elect to account for some or all of these shrublands in the Grassland category.	Pastoral land is any rangeland covered with dense or sparse natural vegetation including plants with annual or multi-annual growing cycles as well as shrubs or fodder trees and which is used on a multi-annual basis for grazing animals. Art n°11

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[543] 2006 IPCC Guidelines, Volume 4, Chapter 5, 5.1 INTRODUCTION.

[544] Loi n°90-25 du 18 novembre 1990 portant orientation foncière https://www.joradp.dz/FTP/JO-FRANCAIS/1990/F1990049.pdf?znjo=49.

Article n°04 : une terre agricole à vocation agricole, toute terre qui, par l'intervention de l'homme permet une production annuelle et pluriannuelle à l'usage de la consommation humaine, animale ou industrielle, directement ou après transformation.

Article n°11 : constitue, au sens de présente loi, une terre pastorale, toute terre de parcours couverte d'une végétation naturelle dense et clairsemée comprenant des plantes à cycles végétatifs annuels et pluriannuels ainsi que des arbustes ou des arbres fourragers et qui est exploité d'une façon pluriannuelle pour le pacage des animaux.

Article n°20 : constitue au sens de la présente loi, une terre urbanisé tout terrain même non doté de toutes les viabilités, occupé par des constructions agglomérées, par leurs espaces de prospects et par les emprises des équipements et activités même non construites, espaces verts , parcs et constructions agglomérées.

Article n°21 : constituent une terre urbanisable, au sens de la présente loi, tous terrains destinés à être urbanisés à des échéances déterminés par les instruments d'aménagements et d'urbanisme.

Article n°18 : constitue au sens de la présente de la loi, une terre saharienne, toute terre située au-dessous de l'isohyète 100 mm.

[545] 2006 IPCC Guidelines, Volume 4, Chapter 6, 6.1 INTRODUCTION

IPCC code	Description	Forest or land cover class	Definition according to 2006 IPCC Guidelines	National Definition
4.D Wetlands	The IPCC category 4.B *Wetlands* includes areas of peat extraction and land that is covered or saturated by water for all or part of the year (peatlands and other wetland types) and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.		Wetlands are ecosystems where the biological and geochemical processes, and resulting greenhouse gas emissions and removals, are controlled by the degree of water saturation as well as climate and nutrient availability. Most ecological classifications of wetlands, including those of the Ramsar Convention on Wetlands, consider many of these lands as Wetlands, even those disturbed by human activities or artificially built. The Wetlands classification adopted by the Ramsar Convention (Ramsar, 1996) is widely used to address management issues. Table 7.3 relates wetland classes in this report to selected definitions in the Ramsar Convention.[546]	Wetland: any area characterized by the presence of fresh, brackish or salt water the presence of fresh, brackish or salt water, permanent or temporary, on the surface or at a shallow depth in the ground, stagnant or running, natural or artificial, in an interface and/or of interface and/or transition, between terrestrial and aquatic environments between terrestrial and aquatic environments, these areas shelter continuously or momentary, of plant and/or animal species. Art n°03 [547]
4.E Settlements	The IPCC category 4.B *Settlements* includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. This should be consistent with national definitions.		The land-use category Settlements includes soils, herbaceous perennial vegetation such as turf grass and garden plants, trees in rural settlements, homestead gardens and urban areas. Examples of settlements include land along streets, in residential (rural and urban) and commercial lawns, in public and private gardens, in golf courses and athletic fields, and in parks, provided such land is functionally or administratively associated with particular cities, villages or other settlement types and is not accounted for in another land-use category.[548]	An urbanized land is any land, even if not equipped with all the viabilities, occupied by the built-up constructions, by the space of prospects and by the rights of way of the equipment's and activities, even if not built up, green spaces, parks and built-up constructions. Art n°20 et Art n°21
4.F Other Land	The IPCC category 4.B *Other Land* includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories. It allows the total of identified land areas to match the national area, where data are available.		Other Land is often unmanaged, and in that case changes in carbon stocks and non-CO2 emissions and removals are not estimated.	Other lands includes forest land , alfatiere land and Unproductive land not used for agriculture but they already included in forest land according to IPCC definition and expert judgment of DGF. Regarding national law , it left only saharian land wich they are lands below the isohyet 100 mm[Erreur ! Signet non défini.] Art n°18[Erreur ! Signet non défini.].

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[546] 2006 IPCC Guidelines, Volume 4, Chapter7, 7.1 INTRODUCTION

[547] La loi 11-02 du 17 février 2011 relative aux Aires protégées dans le cadre de développement durable. https://www.joradp.dz/FTP/jo-francais/2011/F2011013.pdf

Article n°03 : Zone humide : toute zone se caractérisant par la présence d'eau douce, saumâtre ou salée, permanente ou temporaire, en surface ou à faible profondeur dans le sol, stagnante ou courante, naturelle ou artificielle, en position d'interface et/ou de transition, entre milieux terrestres et milieux aquatiques, ces zones abritent de façon continue ou momentanée des espèces végétales et/ou animales.

[548] 2006 IPCC Guidelines, Volume 4, Chapter8, 8.1 INTRODUCTION

6.3 Country-specific approaches

6.3.1 Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

The following figure above presents the national definition on land use and the related land-use categories for greenhouse gas inventory reporting.

National classification					**GHG inventory reporting**
Superficie Agricole Totale (S.A.T)	**Superficie Agricole Utile (S.A.U)**	**Terres Labourables**	Cultures herbacées	Annual crops	4.B. Cropland
			Terres au repos	Fallow land	4.B. Cropland
		Cultures Permanentes	Plantations fruitières	Fruit plantations	4.B. Cropland
			Vignobles	Vineyards	4.B. Cropland
			Prairies naturelles	Natural meadows	4.C. Grassland
			Total Superficie Agricole Utile (S.A.U)	**Total Agricultural Area**	
			Pacages et parcours	Pastures and rangelands	4.C. Grassland
			Terres improductives des exploitations agricoles	Unproductive land on farms	4.E. Settlements
			Total des terres utilisées par l'agriculture (S.A.T)	**Total land used for agriculture**	
Autres Terres			**Terres alfatières**	**Alfa grass**	4.C. Grassland
			Terres forestières (bois, forêts, maquis...)	**Forest land (woods, forests, scrubland...)**	
			Total forêts	**Total Forest**	
			forêts	forest	4.A. Forest land
			reboisement	afforestation	4.A. Forest land
			Total maquis	**Total scrubland**	
			maquis arbore	woody scrubland	4.A. Forest land
			maquis	Scrubland	4.A. Forest land
			Zone humide	Wetland	4.D. Wetland
			Règlements	Settlemtes	4.E. Settlements
			Terres improductives non affectées à l'agriculture moins Zone humide moins Règlements	Non-productive land, not used for agriculture - minus Wetland - minus Settlemtes	4.F. Other land
Total Superficie Territoriale				**Country area**	

Figure 216 National classification on land-use and GHG inventory reporting

Sources: modified after MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT (MARD)(2022): Statitisque agricole. Superficie et production. Serie "B" 2019. Alger.[549]

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[549] Available (03. May 2022) on https://madr.gov.dz/wp-content/uploads/2022/04/SERIE-B-2019.pdf

Algeria considers all its land as managed except some wetland subcategories, as can be seen in the following Table. For unmanaged wetland subcategories and the Sahara (desert) no emissions/removals are estimated.

The following figures and table show a significant evolution for all land categories, except the category 4.F Other land which has decreased by 3% and the category 4.D Wetland which is constant

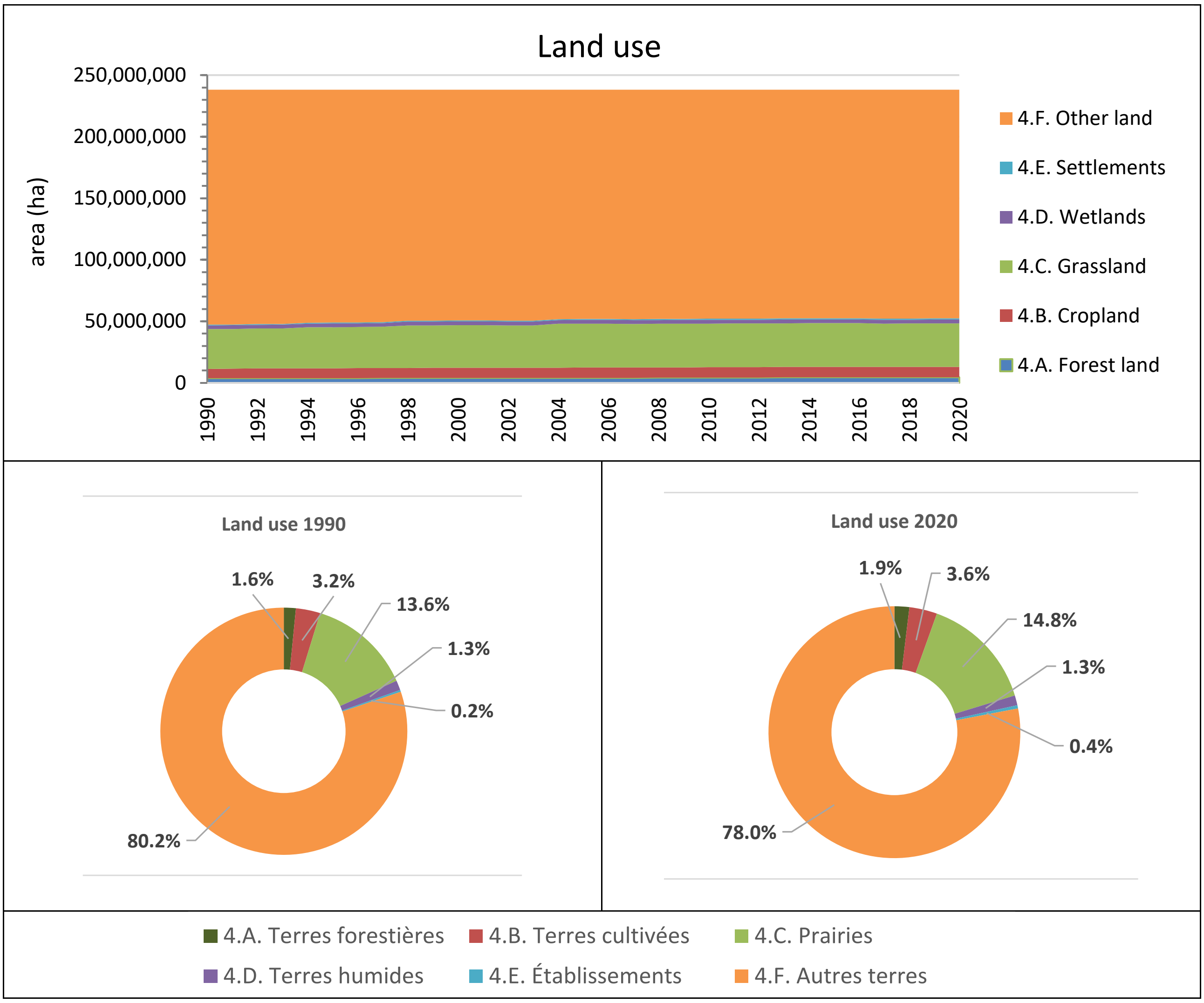

Figure 217 **Land-use categories in ha (1990-2020)**

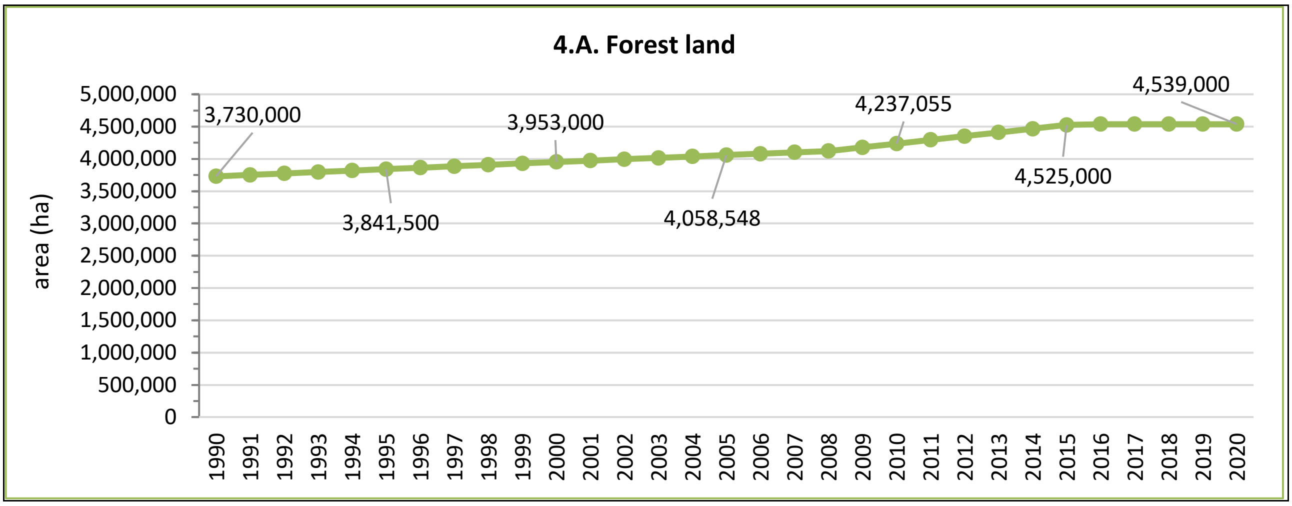

Figure 218 Forest land in ha (1990-2020)

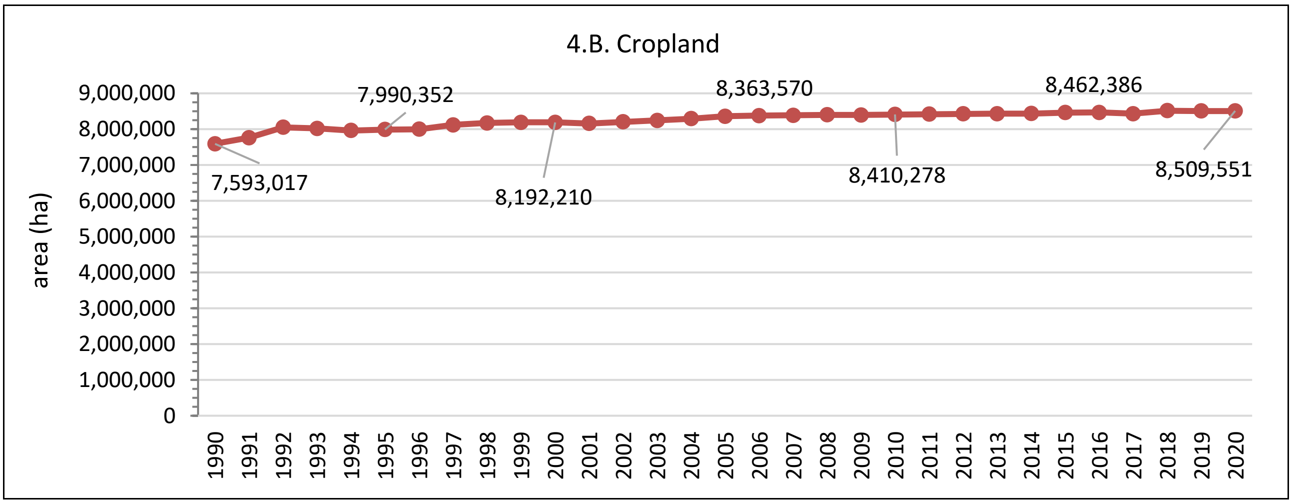

Figure 219 Cropland in ha (1990-2020)

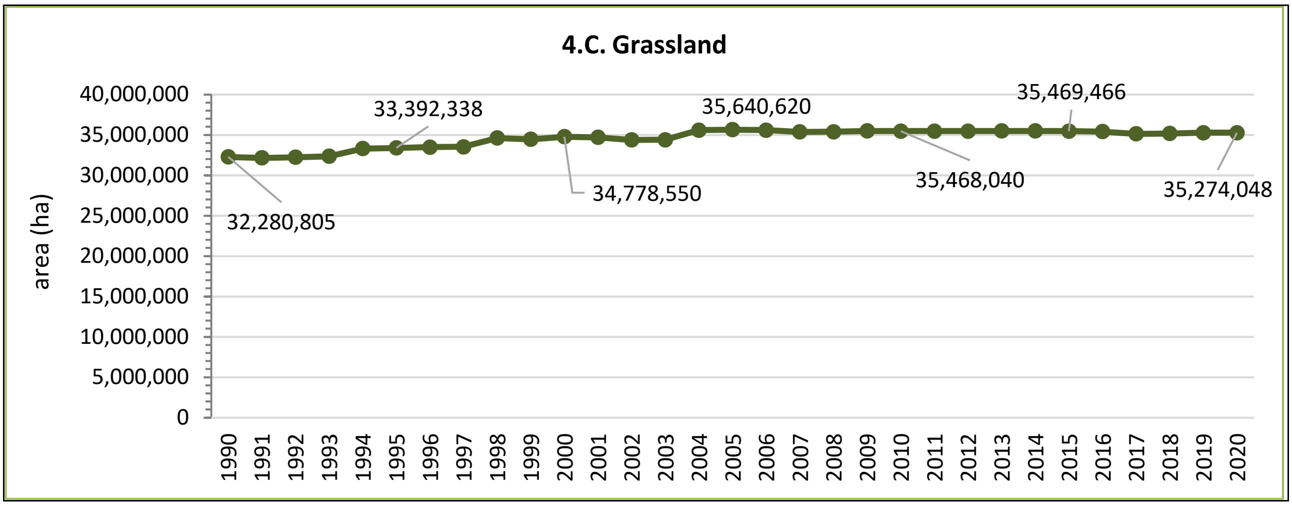

Figure 220 Grassland in ha (1990-2020)

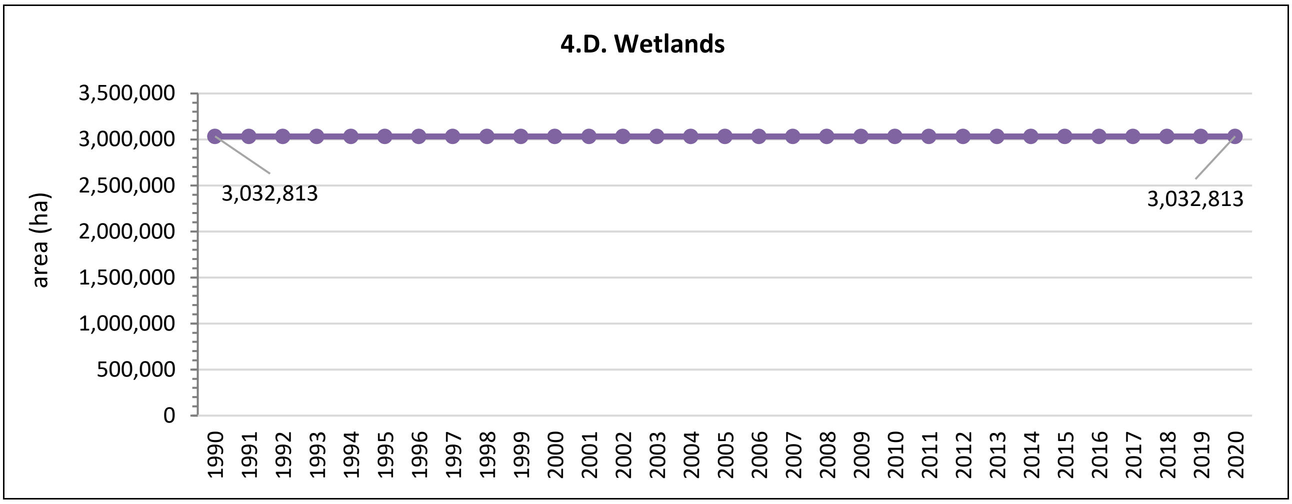

Figure 221 Wetland in ha (1990-2020)

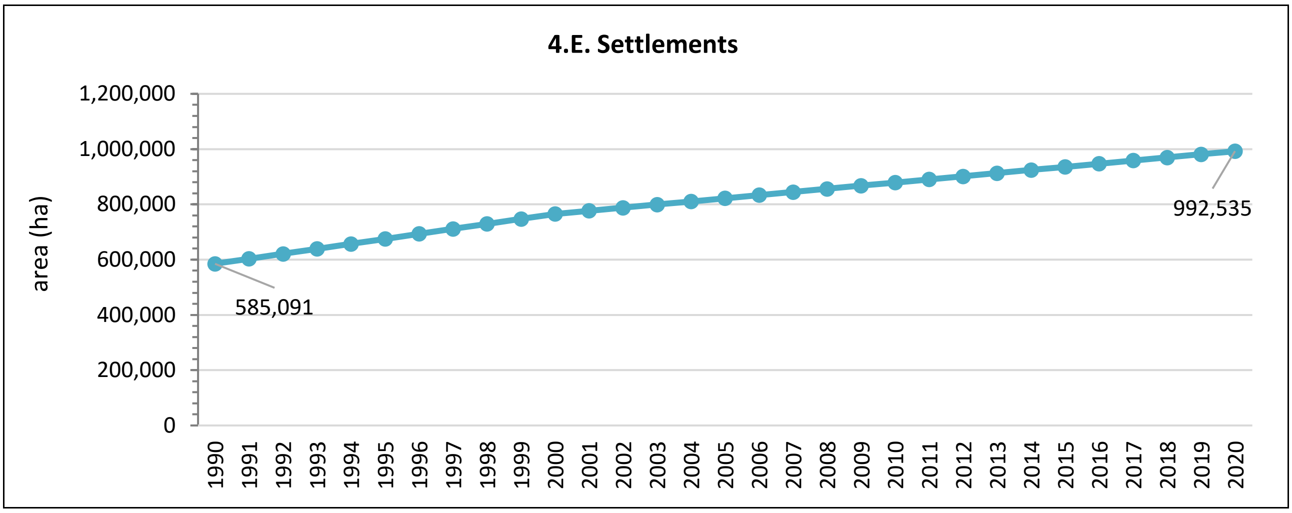

Figure 222 Settlement in ha (1990-2020)

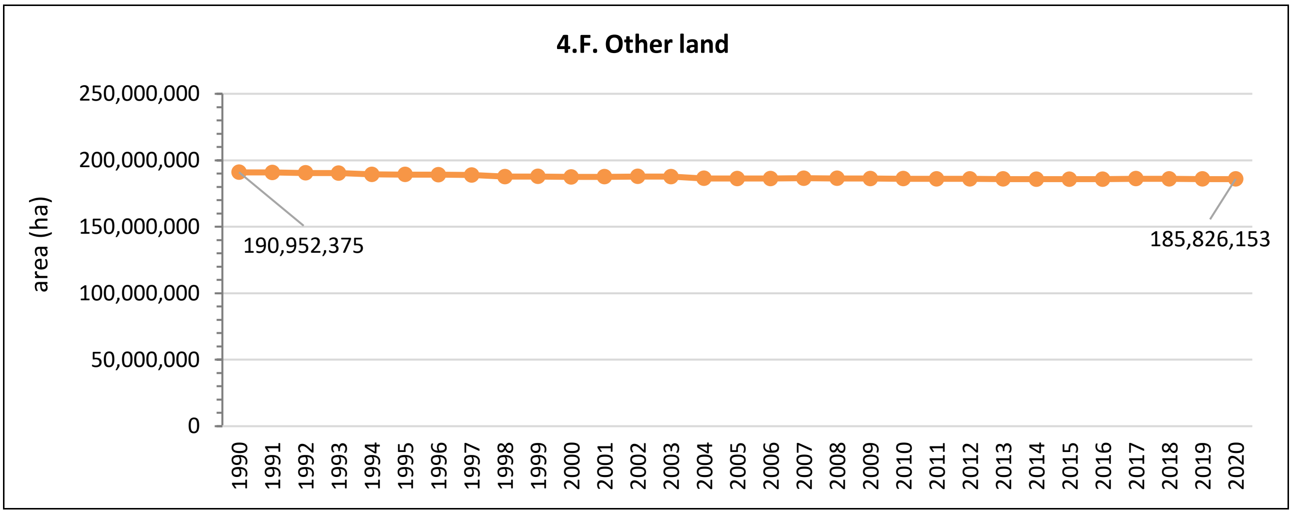

Figure 223 Other Land in ha (1990-2020)

Table 563 Land use in IPCC sector 4 LULUCF

TOTAL area	**4**	**4.A**	**4.B**	**4.C**	**4.D**	**4.E**	**4.F**
	TOTAL Land	**Total Forest land**	**Total Cropland**	**Total Grassland**	**Total Wetlands**	**Total Settlements**	**Total Other land**
1990	238,174,100	3,730,000	7,593,017	32,280,805	3,032,813	585,091	190,952,375
1991	238,174,100	3,752,300	7,764,624	32,162,372	3,032,813	603,105	190,858,887
1992	238,174,100	3,774,600	8,053,684	32,223,485	3,032,813	621,120	190,468,399
1993	238,174,100	3,796,900	8,023,760	32,357,582	3,032,813	639,134	190,323,911
1994	238,174,100	3,819,200	7,965,912	33,300,604	3,032,813	657,149	189,398,423
1995	238,174,100	3,841,500	7,990,352	33,392,338	3,032,813	675,163	189,241,935
1996	238,174,100	3,863,800	8,000,670	33,476,193	3,032,813	693,178	189,107,447
1997	238,174,100	3,886,100	8,120,427	33,517,609	3,032,813	711,192	188,905,959
1998	238,174,100	3,908,400	8,173,670	34,614,060	3,032,813	729,207	187,715,951
1999	238,174,100	3,930,700	8,191,690	34,455,030	3,032,813	747,221	187,816,646
2000	238,174,100	3,953,000	8,192,210	34,778,550	3,032,813	765,236	187,452,292
2001	238,174,100	3,974,110	8,162,840	34,690,660	3,032,813	776,601	187,537,077
2002	238,174,100	3,995,219	8,205,050	34,373,410	3,032,813	787,966	187,779,642
2003	238,174,100	4,016,329	8,244,980	34,396,190	3,032,813	799,330	187,684,458
2004	238,174,100	4,037,439	8,296,246	35,584,844	3,032,813	810,695	186,412,063
2005	238,174,100	4,058,548	8,363,570	35,640,620	3,032,813	822,060	186,256,489
2006	238,174,100	4,079,658	8,378,022	35,595,218	3,032,813	833,425	186,254,964
2007	238,174,100	4,100,767	8,389,208	35,367,677	3,032,813	844,790	186,438,844
2008	238,174,100	4,121,877	8,400,463	35,387,172	3,032,813	856,155	186,375,620
2009	238,174,100	4,179,466	8,398,790	35,485,420	3,032,813	867,520	186,210,091
2010	238,174,100	4,237,055	8,410,278	35,468,040	3,032,813	878,885	186,147,028
2011	238,174,100	4,294,644	8,420,670	35,471,896	3,032,813	890,250	186,063,827
2012	238,174,100	4,352,233	8,430,295	35,466,110	3,032,813	901,615	185,991,034
2013	238,174,100	4,409,822	8,435,254	35,494,146	3,032,813	912,980	185,889,085
2014	238,174,100	4,467,411	8,439,263	35,489,893	3,032,813	924,345	185,820,375
2015	238,174,100	4,525,000	8,462,386	35,469,466	3,032,813	935,710	185,748,725
2016	238,174,100	4,539,000	8,470,686	35,409,966	3,032,813	947,075	185,774,560
2017	238,174,100	4,539,000	8,433,780	35,120,288	3,032,813	958,440	186,089,779
2018	238,174,100	4,539,000	8,518,608	35,161,161	3,032,813	969,805	185,952,713
2019	238,174,100	4,539,000	8,509,551	35,274,048	3,032,813	981,170	185,837,518
2020	238,174,100	4,539,000	8,509,551	35,274,048	3,032,813	992,535	185,826,153
Trend							
1990 - 2020		*22%*	*12%*	*9%*	*0%*	*70%*	*-3%*
2005 - 2020		*12%*	*2%*	*-1%*	*0%*	*21%*	*0%*
2019 - 2020		*0%*	*0%*	*0%*	*0%*	*1%*	*0%*

6.3.1.1 Forest land

National forest inventory:

Among the tools necessary for monitoring the dynamics of forest resources and planning their use, the inventory provides a better understanding of the geographical distribution, potential, status and biological diversity of national forest resources and the evolution of stands in terms of quality and quantity.

The national forest inventory is an important instrument for defining policies and strategic orientations for the development of national forest resources.

Algeria's forest resources have undergone significant changes and degradation in recent decades, but their current state remains poorly known. From 1978 to 1984, Algeria carried out the first national forest inventory in its history, which gave rise to a national forestry development plan (PNDF). In 2000, the forestry administration initiated a national project for the updating of the national forestry inventory, the execution of which was entrusted to a national consultancy firm and was completed in 2008. The NFI 2000-2008 is articulated around four phases (NFI terms of reference 2008):

1. Computerization of the 1984 NFI data;
2. Development of a 2008 database.
3. Elaboration of thematic maps;
4. Realization of a ground inventory;
5. Elaboration of a national forestry development plan (PNDF).

Further information related to the forest inventory 1984 and 2003/2008 can be found in

- Direction Générale des Forêts (DGF) (1984): Inventaire national forestier. Algérie.
- FAO (1990) : Forest resources assessment 1990. Non-tropical developing countries - Mediterranean region[550]
- BNEDER (Bureau National d'Etudes pour le Développement Rural)(2009): Plan national de developpement forestier (PNDF) rapport de synthese nationale. Alger.
- FAO (2010): Evaluation des ressources forestières mondiales 2010. Rapport Algérie. Rome.[551]

The area of Forest Land Remaining Forest Land was taken from the FAO Global Forest Resource Assessment (FRA) 2020[552] which was prepared by DGF - Direction Générale des Forêts Algérie[553].

It must be mentioned again that the national definition of forest land does not correspond to that of the FRA; see chapter 6.3.1 *Information on approaches used for representing land areas and on land-use databases used for the inventory preparation*.

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[550] Available (02. January 2023) on https://www.fao.org/3/t3910e/t3910e00.htm and https://www.fao.org/3/al439f/al439f.pdf

[551] Available (02. January 2023) on https://www.fao.org/3/al439f/al439f.pdf

[552] https://www.fao.org/3/cb0128fr/cb0128fr.pdf

[553] http://www.dgf.org.dz/fr

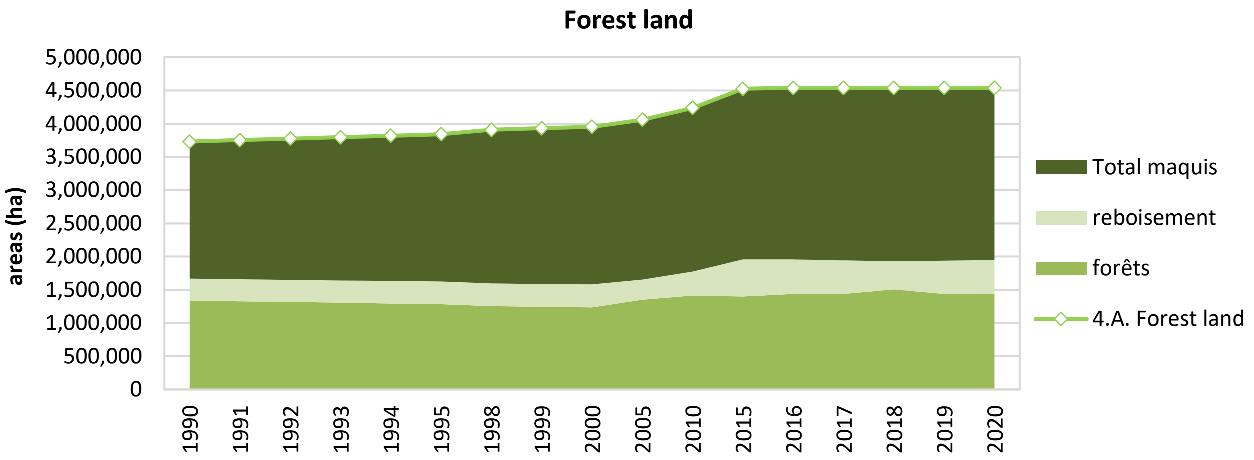

Figure 224 **Area in 4.A.1 Forest remaining forest**

Table 564 Activity data for IPCC category 4.A.1 Forest remaining forest

	Forest land	**Total forêts**	forêts	reboisement	**Total maquis**	**Source**
	ha	**ha**	ha	ha	**ha**	
1990	3,730.000	1,667.000	1,334.000	333,000	2,063.000	FRA 2020
1991	3,752.300	1,658.200	1,324.000	334,200	2,094.100	interpolation
1992	3,774.600	1,649.400	1,314.000	335,400	2,125.200	
1993	3,796.900	1,640.600	1,304.000	336,600	2,156.300	
1994	3,819.200	1,631.800	1,294.000	337,800	2,187.400	
1995	3,841.500	1,623.000	1,284.000	339,000	2,218.500	
1996	3,863.800	1,614.200	1,274.000	340,200	2,249.600	
1997	3,886.100	1,605.400	1,264.000	341,400	2,280.700	
1998	3,908.400	1,596.600	1,254.000	342,600	2,311.800	
1999	3,930.700	1,587.800	1,244.000	343,800	2,342.900	
2000	3,953.000	1,579.000	1,234.000	345,000	2,374.000	FRA 2020
2001	3,974.110	1,594.100	1,257.225	336,875	2,380.010	interpolation
2002	3,995.219	1,609.200	1,280.451	328,749	2,386.020	
2003	4,016.329	1,624.299	1,303.676	320,624	2,392.030	
2004	4,037.439	1,639.399	1,326.901	312,498	2,398.00.040	
2005	4,058.548	1,654.499	1,350.126	304,373	2,404.049	
2006	4,079.658	1,669.599	1,373.352	296,247	2,410.059	
2007	4,100.767	1,684.698	1,396.577	288,122	2,416.069	
2008	4,121.877	1,699.798	1,419.802	279,996	2,422.079	Forest inventory

	Forest land	**Total forêts**	forêts	reboisement	**Total maquis**	**Source**
	ha	**ha**	ha	ha	**ha**	
2009	4,179.466	1,736.398	1,416.973	319,425	2,443.068	interpolation
2010	4,237.055	1,772.999	1,414.144	358,854	2,464.056	
2011	4,294.644	1,809.599	1,411.315	398,283	2,485.045	
2012	4,352.233	1,846.199	1,408.487	437,713	2,506.034	
2013	4,409.822	1,882.799	1,405.658	477,142	2,527.023	
2014	4,467.411	1,919.400	1,402.829	516,571	2,548.011	
2015	4,525.000	1,956.000	1,400.000	556,000	2,569.000	FRA 2020
2016	4,539.000	1,956.000	1,435.000	521,000	2,583.000	
2017	4,539.000	1,943.000	1,437.000	506,000	2,596.000	
2018	4,539.000	1,930.000	1,502.000	428,000	2,609.000	
2019	4,539.000	1,939.000	1,438.000	501,000	2,600.000	
2020	4,539.000	1,949.000	1,439.000	510,000	2,590.000	
Trend						
1990 - 2020	*22%*	*17%*	*8%*	*53%*	*26%*	
2005 - 2020	*12%*	*18%*	*7%*	*68%*	*8%*	
2019 - 2020	*0%*	*1%*	*0%*	*2%*	*0%*	

6.3.2 Information on approaches used for natural disturbances.

As outlined in the 2019 refinements of the 2006 IPCC Guidelines[554], natural disturbances are defined in the context of the AFOLU sector as non-anthropogenic events or non-anthropogenic circumstances that cause significant emissions and are beyond the control of, and not materially influenced by a country. These include

- wildfires,
- insect and disease infestations,
- extreme weather events, and/or
- geological disturbances,

beyond the control of, and not materially influenced by a country.

Natural disturbances exclude human activities such as harvesting, prescribed burning and fires associated with activities such as slash and burn.

Non-anthropogenic events refer to non-human induced events, such as e.g.

- fire initiated by lightening,
- damage by wind storms.

Non-anthropogenic circumstances refer to non-human induced conditions that exacerbate these disturbances such as e.g.

- fire occurring during particularly harsh conditions like strong winds, high temperature, drought, etc.

In this inventory cycle only fires in forest and maquis are ataken into account.

The assessment of the fires is done in consultation with the forest conservation for each wilaya. This assessment includes two essential informations which are: the surface of the burned lands (forest land and

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[554] 2019 Refiment2006 IPCC Guidelines, Volume 4, Chapter 6: Grassland, page 6.6

other vegetation) as well as the damages of the fires by wilaya.

This assessment is then be deepened by surveys of fire damage assessment in collaboration with ASAL to plan reforestation programs according to the natural regeneration.

Data from DGF were used for estimating carbon loss due to disturbances.

Not estimated were natural disturbances such as insect and disease infestations, extreme weather events, and geological disturbances due to lack of resources.

6.4 Status of reporting of LULUCF

GHG emissions from this sector comprise emissions from the following categories are described in the following table, which also provides guidance in reporting:

Table 565 IPCC categories according to the IPCC 2006 Guidelines, status of the estimates made and being key category

IPCC [555] categories	Description	CO_2	Key category	CH_4	Key category	N_2O	Key category
4.A	**Forest land**						
4.A.1	Forest land remaining forest land	✓	LA 1990 2020	✓		✓	
4.A.2	Land converted to forest land	NE		NA		NA	
4.B	**Cropland**						
4.B.1	Cropland remaining cropland	NE		NE		NE	
4.B.2	Land converted to cropland[556]	NE		NE		NE	
4.C	**Grassland**						
4.C.1	Grassland remaining grassland A Tier 1 approach assumes no **change in biomass** in *Grassland Remaining Grassland*. [557] The Tier 1 method assumes that the **dead wood and litter stocks** are at equilibrium, so there is no need to estimate the carbon stock changes for these pools. [558] Mineral soils - Tier 1: For mineral soils, the estimation method is based on changes in **soil organic C stocks** over a finite period following changes in management that impact soil organic C storage. After a finite transition period, one can assume a steady state for this stock. Organic soils - Tier 1: Equation 2.26 of Chapter 2 is used to estimate **C stock change** in managed grassland on organic soils (e.g., peatderived, Histosols). [559]	NE		NE		NE	
4.C.2	Land converted to grassland[560]	NE		NE		NE	
4.D	**Wetlands**						
4.D.1	Wetlands remaining wetlands[561]	NE		NE		NE	
4.D.2	Lands converted to wetlands[562]	NE		NE		NE	
4.E	**Settlements**						

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[555] IPCC categories – applied according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[556] 4.B.2.a Forest land converted to cropland, 4.B.2.b Grassland converted to cropland, 4.B.2.c Wetland converted to cropland, 4.B.2.d Settlements converted to cropland, 4.B.2.e Other land converted to cropland

[557] In grassland where there is no change in either type or intensity of management, biomass will be in an approximate steady-state (i.e., carbon accumulation through plant growth is roughly balanced by losses through grazing, decomposition and fire). In grassland where management changes are occurring over time (e.g., through introduction of silvopastoral systems, tree/brush removal for grazing management, improved pasture management or other practices), the carbon stock changes can be significant. 2006 IPCC Guidelines, Volume 4, Chapter 6: Grassland, page 6.6

[558] Countries experiencing significant changes in grassland types or disturbance or management regimes in their grasslands are encouraged to develop domestic data to quantify this impact and report it under Tier 2 or 3 methodologies. 2006 IPCC Guidelines, Volume 4, Chapter 6: Grassland, page 6.11

[559] The methodology is to stratify managed organic soils by climate region and assign a climate-specific annual emission rate. Land areas are multiplied by the emission factor and then summed to derive annual C emissions. Natural grasslands that may be used for seasonal grazing but have not been artificially drained should not be included in this category. 2006 IPCC Guidelines, Volume 4, Chapter 6: Grassland, page 6.15

[560] 4.C.2.a Forest land converted to grassland, 4.C.2.b Cropland converted to grassland, 4.C.2.c Wetland converted to grassland, 4.C.2.d Settlements converted to grassland, 4.C.2.e Other land converted to grassland.

[561] 4.D.1.a Peat extraction remaining peat extraction, 4.D.1.b, Flooded land remaining flooded land, 4.D.1.c Other wetlands remaining other wetlands

[562] 4.D.2.a Forest land converted to wetlands, 4.D.2.b Cropland converted to wetlands, 4.D.2.c Grassland converted to wetlands, 4.D.2.d Settlements converted to wetlands, 4.D.2.e Other land converted to wetlands

IPCC [555] categories	Description	CO_2	Key category	CH_4	Key category	N_2O	Key category
4.E.1	Settlements remaining settlements [563] Tier 1 assumes no change in **C stocks in live biomass** in *Settlements Remaining Settlements*, in other words, that the growth and loss terms balance. [564] Tier 1 assumes that the **dead wood and litter stocks** are at equilibrium, and so there is no need to estimate the carbon stock changes for these pools. [565] Mineral soils: It is assumed in the Tier 1 method that inputs equal outputs so that settlement **soil C stocks** do not change in *Settlements Remaining Settlements*. Organic soils: Settlements are unlikely to be built on deep organic soils.	NE		NE		NE	
4.E.2	Lands converted to settlements[566]	NE		NE		NE	
4.F	**Other Land**						
4.F.1	Other land remaining other land	NA		NA		NA	
4.F.2	Land converted to other land[567]	NE		NA		NA	
4.G	**Harvested wood products**						
4.G.1	Solid wood[568]	NE		NA		NA	
4.G.2	Paper and paper board	NE		NA		NA	
4.G.3	Other	NE		NA		NA	
4.H	**Other**						
4.H	Other	NE		NE		NE	
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential							
LA – Level Assessment (in year); TA – Trend Assessment							

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[563] 2006 IPCC Guidelines, Volume 4, Chapter 8: Settlements, page 8.15

[564] If the category *Settlements Remaining Settlements* is determined to be a key category, then a country should collect appropriate activity data and/or develop emission factors appropriate to the region and adopt Tier 2 or 3.

[565] Countries experiencing significant changes in tree cover in settlements are encouraged to develop national data to quantify this change and report it under Tier 2 or 3 methodologies.

[566] 4.E.2.a Forest land converted to settlements, 4.E.2.b Cropland converted to settlements, 4.E.2.c Grassland converted to settlements, 4.E.2.d Wetlands converted to settlements, 4.E.2.e Other land converted to settlements

[567] 4.F.2.a Forest land converted to other land, 4.F.2.b Cropland converted to other land, 4.F.2.c Grassland converted to other land

4.F.2.d Wetlands converted to other land, 4.F.2.e Settlements converted to other land

[568] 4.G.1.a Sawn wood, 4.G.1.b Wood panels, 4.G.1.c Other solid wood products

GHG emissions from this sector comprise emissions from the following categories are described in the following table, which also provides guidance in reporting:

Table 566 IPCC categories according to the IPCC 2006 Guidelines, Sectoral background data for LULUCF of CRT tables, and status of the estimates made

IPCC categories[569]	Description	Status for		
		CO_2 [570]	CH4	N2O
4.A [571]	**Forest land**			
4.A.1	Forest land remaining forest land	✓	✓	✓
4.A.2	Land converted to forest land[572]			
4.A.2.a	Cropland converted to forest land	NE	NA	NA
4.A.2.b	Grassland converted to forest land	NE	NA	NE
4.A.2.c	Wetlands converted to forest land	NE	NA	NA
4.A.2.d	Settlements converted to forest land	NE	NA	NA
4.A.2.e	Other land converted to forest land	NE	NA	NA
4.B [573]	**Cropland**			
4.B.1	Cropland remaining cropland	NE	NA	NA
4.B.2	Land converted to cropland[574]			
4.B.2.a	Forest land converted to cropland	NE	NA	NE
4.B.2.b	Grassland converted to cropland	NE	NA	NE
4.B.2.c	Wetland converted to cropland	NE	NA	NA
4.B.2.d	Settlements converted to cropland	NE	NA	NA
4.B.2.e	Other land converted to cropland	NE	NA	NA
4.C [575]	**Grassland**			
4.C.1	Grassland remaining grassland	NE	NE	NA
4.C.2	Land converted to grassland[576]			
4.C.2.a	Forest land converted to grassland	NE	NA	NE
4.C.2.b	Cropland converted to grassland	NE	NA	NE
4.C.2.c	Wetland converted to grassland	NE	NA	NA
4.C.2.d	Settlements converted to grassland	NE	NA	NA
4.C.2.e	Other land converted to grassland	NE	NA	NA
4.D [577]	**Wetlands**			
4.D.1	Wetlands remaining wetlands			
4.D.1.a	Peat extraction remaining peat extraction	NE	NA	NA

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[569] IPCC categories – applied according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

[570] The signs are positive (+) for emissions are and negative (–) for removals.

[571] CRT Table4.A

[572] Parties may report aggregated estimates for all conversions of land to forest land if data are not available to report them separately. They should specify in the documentation box which types of land conversion are included.

[573] CRT Table4.B

[574] Parties may report aggregated estimates for all conversions of land to cropland, if data are not available to report them separately. They should specify in the documentation box which types of land conversion are included.

[575] CRT Table4.C

[576] Parties may report aggregated estimates for all conversions of land to grassland, if data are not available to report them separately. They should specify in the documentation box which types of land conversion are included.

[577] CRT Table4.D

IPCC categories[569]	Description	Status for		
		CO_2 [570]	CH4	N2O
4.D.1.b	Flooded land remaining flooded land	NE	NA	NA
4.D.1.c	Other wetlands remaining other wetlands	NE	NA	NA
4.D.2	Lands converted to wetlands[578]			
4.D.2.a	Forest land converted to wetlands	NE	NA	NE
4.D.2.b	Cropland converted to wetlands	NE	NA	NE
4.D.2.c	Grassland converted to wetlands	NE	NA	NE
4.D.2.d	Settlements converted to wetlands	NE	NA	NE
4.D.2.e	Other land converted to wetlands	NE	NA	NE
4.E [579]	**Settlements**			
4.E.1	Settlements remaining settlements	NE	NA	NE
4.E.2	Lands converted to settlements			
4.E.2.a	Forest land converted to settlements	NE	NA	NE
4.E.2.b	Cropland converted to settlements	NE	NA	NE
4.E.2.c	Grassland converted to settlements	NE	NA	NE
4.E.2.d	Wetlands converted to settlements	NE	NA	NE
4.E.2.e	Other land converted to settlements	NE	NA	NE
4.F [580]	**Other Land**			
4.F.1	Other land remaining other land	NE	NA	NA
4.F.2	Lands converted to settlements[581]			
4.F.2.a	Forest land converted to other land	NE	NA	NA
4.F.2.b	Cropland converted to other land	NE	NA	NA
4.F.2.c	Grassland converted to other land	NE	NA	NA
4.F.2.d	Wetlands converted to other land	NE	NA	NA
4.F.2.e	Settlements converted to other land	NE	NA	NA
4.G [582]	**TOTAL HWP consumed domestically (ΔC HWPdom IU DC)**			
4.G.1	Solid wood[583]			
4.G.1.a	Sawn wood	NE	NA	NA
4.G.1.b	Wood panels	NE	NA	NA
4.G.1.c	Other solid wood products	NE	NA	NA
4.G.2	Paper and paper board	NE	NA	NA
4.G.3	Other	NE	NA	NA

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[578] Parties may report aggregated estimates for all land conversions to wetlands, if data are not available to report them separately. They should specify in the documentation box which types of land conversion are included.

[579] CRT Table4.E

[580] CRT Table4.F

[581] Parties may report aggregated estimates for all conversions of land to other land, if data are not available to report them separately. They should specify in the documentation box which types of land conversion are included.

[582] CRT Table4.Gs1

[583] If data are available, Parties are encouraged to report at the disaggregated data using the pre-defined drop-down menu. Furthermore, Parties are encouraged, to the extent possible, to use the pre-defined category definitions rather than create similar categories, in order to ensure the highest possible degree of comparability of the reporting. If detailed data are not available, Parties should include all emissions from solid wood under other solid wood products.

IPCC categories[569]	Description	Status for		
		CO_2 [570]	CH4	N2O
4(I) [584]	**Direct and indirect N2O emissions from N inputs to managed soils other than cropland and grassland**			
4(I).A	**Forest land** [585]			
4(I).A.1	Forest land remaining forest land			
4(I).A.1.a	Inorganic N fertilizers[586]	NA	NA	NE
4(I).A.1.b	Organic N fertilizers[587]	NA	NA	NE
4(I).A.2	Land converted to forest land			
4(I).A.2.a	Inorganic N fertilizer [586]	NA	NA	NE
4(I).A.2.b	Organic N fertilizer [587]	NA	NA	NE
4(I).D	Wetlands			
4(I).D.1	Wetlands remaining wetlands			
4(I).D.1.a	Inorganic N fertilizers [586]	NA	NA	NE
4(I).D.1.b	Organic N fertilizers [587]	NA	NA	NE
4(I).D.2.	Land converted to wetlands			
4(I).D.2.a	Inorganic N fertilizers [586]	NA	NA	NE
4(I).D.2.b	Organic N fertilizers [587]	NA	NA	NE
4(I).E	Settlements			
4(I).E.1	Settlements remaining settlements			
4(I).E.1.a	Inorganic N fertilizers [586]	NA	NA	NE
4(I).E.1.b	Organic N fertilizers [587]	NA	NA	NE
4(I).E.2	Land converted to Settlements			
4(I).E.2.a	Inorganic N fertilizers [586]	NA	NA	NE
4(I).E.2.b	Organic N fertilizers [587]	NA	NA	NE
4(I).H	Other (please specify)			
4(I).H.1	Inorganic N fertilizers [586]	NA	NA	NE
4(I).H.2	Organic N fertilizers [587]	NA	NA	NE
4(II) [588]	**Emissions and removals from drainage and rewetting and other management of organic and mineral soils**			
4(II).A	**Forest land**			
4(II).A.1	Forest land remaining forest land			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*

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[584] CRT Table4(I)

[585] If a Party is not able to separate the N inputs applied to land-use categories, other than cropland and grasslands, it may report all N_2O emissions from N inputs to managed soils under the agriculture sector. This should be explicitly indicated in the documentation box.

[586] N input from application of inorganic fertilizers to land-use categories other than cropland and grasslands.

[587] N input from organic N fertilizers to land-use categories other than cropland and grassland.

[588] CRT Table4(II)

IPCC categories[569]	**Description**	**Status for**		
		CO_2 [570]	**CH4**	**N2O**
4(II).A.2	Land [589] converted to forest land [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).B.	**Cropland**			
4(II).B.1	Cropland remaining cropland [591]			
	Total organic soils	NE	*NA*	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NA*	*NE*
	Total mineral soils	NE	*NA*	NE
	Rewetted mineral soils / Other	*NE*	*NA*	*NE*
4(II).B.2	Land [592] converted to cropland [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).C	**Grassland**			
4(II).C.1	Grassland remaining grassland [591]			
	Total organic soils	NE	*NA*	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NA*	*NE*
	Total mineral soils	NE	*NA*	NE
	Rewetted mineral soils / Other	*NE*	*NA*	*NE*
4(II).C.2	Land [593] converted to grassland [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*

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[589] 4(II).A.2.a. Cropland converted to forest land, 4(II).A.2.b. Grassland converted to forest land, 4(II).A.2.c. Wetlands converted to forest land, 4(II).A.2.d. Settlements converted to forest land, 4(II).A.2.e. Other land converted to forest land

[590] If data are available, Parties are encouraged to report disaggregated data using the predefined drop-down menu. Furthermore, Parties are encouraged, to the extent possible to use the predefined category definitions rather than create similar categories, in order to ensure the highest possible degree of comparability of the reporting. If detailed data are not available, Parties should include all emissions from land conversion here.

[591] N_2O emissions from drained cropland and grassland soils are covered in the agriculture tables of the CRT under cultivation of organic soils.

[592] 4(II).B.2.a. Forest land converted to cropland, 4(II).B.2.b. Grassland converted to cropland, 4(II).B.2.c. Wetlands converted to cropland, 4(II).B.2.d. Settlements converted to cropland, 4(II).B.2.d. Settlements converted to cropland, 4(II).B.2.e. Other land converted to cropland

[593] 4(II).C.2.a. Forest land converted to grassland, 4(II).C.2.b. Cropland converted to grassland, 4(II).C.2.c. Wetlands converted to grassland, 4(II).C.2.d. Settlements converted to grassland, 4(II).C.2.e. Other land converted to grassland

IPCC categories[569]	**Description**	**Status for**		
		CO_2 [570]	**CH4**	**N2O**
4(II).D	**Wetlands**			
4(II).D.1	Wetlands remaining wetlands			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).D.2	Land [594] converted to wetland [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).E.	**Settlements**			
4(II).E.1	Settlements remaining settlements			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).E.2	Land [595] converted to settlements [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).F	**Other land**			
4(II).F.2	Land [596] converted to other land [590]			
	Total organic soils	NE	NE	NE
	Drained organic soils / Rewetted organic soils / Other	*NE*	*NE*	*NE*
	Total mineral soils	NE	NE	NE
	Rewetted mineral soils / Other	*NE*	*NE*	*NE*
4(II).H	**Other**	NO	NO	NO
4(III) [597]	**Direct and indirect nitrous oxide (N2O) emissions from nitrogen (N) mineralization/immobilization associated with loss/gain of soil organic matter**			
4(III)	**Total for all land-use categories**			
4(III).A	**Forest land**			
4(III).A.1.	Forest land remaining forest land	NA	NA	NE
4(III).A.2.	Lands converted to forest land [598]	NA	NA	NE

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[594] 4(II).D.2.a. Lands converted to peat extraction, 4(II).D.2.b. Lands converted to flooded land, 4(II).D.2.c. Lands converted to other wetlands

[595] 4(II).E.2.a. Forest land converted to settlements, 4(II).E.2.b. Cropland converted to settlements, 4(II).E.2.c. Wetlands converted to settlements, 4(II).E.2.d. Settlements converted to settlements, 4(II).E.2.e. Other land converted to settlements

[596] 4(II).F.2.a. Forest land converted to other land, 4(II).F.2.b. Cropland converted to other land, 4(II).F.2.c. Wetlands converted to other land, 4(II).F.2.d. Settlements converted to other land, 4(II).F.2.e. Other land converted to other land

[597] CRT Table4(III)

[598] 4(III).A.2.a. Cropland converted to forest land, 4(III).A.2.b. Grassland converted to forest land, 4(III).A.2.c. Wetlands converted to forest land, 4(III).A.2.d. Settlements converted to forest land, 4(III).A.2.e. Other land converted to forest land

IPCC categories[569]	Description	Status for		
		CO_2 [570]	CH4	N2O
4(III).B.	**Cropland** [599]			
4(III).B.2.	Lands converted to cropland [600]	NA	NA	NE
4(III).C.	**Grasslands**			
4(III).C.1.	Grasslands remaining grasslands	NA	NA	NE
4(III).C.2.	Lands converted to grasslands [601]	NA	NA	NE
4(III).D.	**Wetlands**			
4(III).D.1.	Wetlands remaining wetlands	NA	NA	NE
4(III).D.2.	Lands converted to wetlands [602]	NA	NA	NE
4(III).E.	**Settlements**(7)			
4(III).E.1.	Settlements remaining settlements	NA	NA	NE
4(III).E.2.	Lands converted to settlements [603]	NA	NA	NE
4(III).F.	**Other land**			
4(III).F.2.	Lands converted to other land [604]	NA	NA	NE
4(IV) [605]	**Biomass Burning - Total for all land-use categories**			
4(IV).A.	**Forest land**			
4(IV).A.1. b	Forest land remaining forest land [606]			
4(IV).A.1.a.	Controlled burning	IE	IE	IE
4(IV).A.1.b.	Wildfires	✓	✓	✓
4(IV).A.2.	Land converted to forest land			
4(IV).A.2.a.	Controlled burning	NE	NE	NE
4(IV).A.2.b.	Wildfires	NE	NE	NE
4(IV).B.	**Cropland**			
4(IV).B.1.	Cropland remaining cropland [607]			
4(IV).B.1.a.	Controlled burning	NE	NE	NE
4(IV).B.1.b.	Wildfires	NE	NE	NE
4(IV).B.2.a.	Land converted to Cropland			
4(IV).B.2.a.	Controlled burning	NE	NE	NE
4(IV).B.2.b.	Wildfires	NE	NE	NE
4(IV).C	**Grassland** (7)			
4(IV).C.1	Grassland remaining grassland (6)			
4(IV).C.1.a	Controlled burning	NE	NE	NE

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[599] N_2O emissions from cropland remaining cropland and grassland remaining grassland for agriculture purpose are included in the agriculture sector

[600] 4(III).B.2.a. Forest land converted to cropland, 4(III).B.2.b. Grassland converted to cropland, 4(III).B.2.c. Wetlands converted to cropland, 4(III).B.2.d Settlements converted to cropland, 4(III).B.2.e. Other land converted to cropland

[601] 4(III).C.2.a. Forest land converted to grasslands, 4(III).C.2.b. Cropland converted to grasslands, 4(III).C.2.c. Wetlands converted to grasslands, 4(III).C.2.d. Settlements converted to grasslands, 4(III).C.2.e. Other land converted to grasslands

[602] 4(III).D.2.a. Forest land converted to wetlands, 4(III).D.2.b. Cropland converted to wetlands, 4(III).D.2.c. Grassland converted to wetlands, 4(III).D.2.d. Settlements converted to wetlands, 4(III).D.2.e. Other land converted to wetlands

[603] 4(III).E.2.a. Forest land converted to settlements, 4(III).E.2.b. Cropland converted to settlements, 4(III).E.2.c. Grassland converted to settlements, 4(III).E.2.d. Wetlands converted to settlements, 4(III).E.2.e. Other land converted to settlements

[604] 4(III).F.2.a. Forest land converted to other land, 4(III).F.2.b. Cropland converted to other land, 4(III).F.2.c. Grassland converted to other land, 4(III).F.2.d. Wetlands converted to other land, 4(III).F.2.e. Settlements converted to other land

[605] CRT Table4(IV)

[606] CH_4 and N_2O emissions associated with the burning of forest land and grassland defined as savannah should be reported under the agriculture sector. CO_2 emissions/removals associated with burning of savannahs should be included here, taking into account footnote 5

[607] In situ above-ground woody biomass burning is reported here. Agricultural residue burning is reported in the agriculture sector.

IPCC categories[569]	Description	Status for		
		CO_2 [570]	CH4	N2O
4(IV).C.1.b	Wildfires	NE	NE	NE
4(IV).C.2	Land converted to Grassland			
4(IV).C.2.a	Controlled burning	NE	NE	NE
4(IV).C.2.b	Wildfires	NE	NE	NE
4(IV).D.	**Wetlands** (7)			
4(IV).D.1	Wetlands remaining wetlands			
4(IV).D.1.a	Controlled burning	NE	NE	NE
4(IV).D.1.b	Wildfires	NE	NE	NE
4(IV).D.2	Land converted to wetlands			
4(IV).D.2.a	Controlled burning	NE	NE	NE
4(IV).D.2.b	Wildfires	NE	NE	NE
4(IV).E	**Settlements**			
4(IV).E.1	Settlementss remaining settlementss			
4(IV).E.1.a	Controlled burning	NE	NE	NE
4(IV).E.1.b	Wildfires	NE	NE	NE
4(IV).E.2	Land converted to Settlementss			
4(IV).E.2.a	Controlled burning	NE	NE	NE
4(IV).E.2.b	Wildfires	NE	NE	NE
4(IV).F	**Other land**			
4(IV).F.2	Land converted to Other land			
4(IV).F.2.a	Controlled burning	NE	NE	NE
4(IV).F.2.b	Wildfires	NE	NE	NE
4(G)	C stock changes in Harvested Wood Products			
4.H	Other	NO	NO	NO

6.5 Forest land (IPCC category 4.A)

6.5.1 Forest land remaining forest land (IPCC category 4.A.a)

This section describes the estimation of emissions and removals from Forest Land remaining forest land.

Using the National Forest inventory data, the approach for estimating CO2 emissions and removals is based on the following steps:

(1) Stratification into climate zones according to the IPCC guideline 2006 and the distribution of wilayas by zone according to the National Forest Inventory 2008.

(2) Geographical distribution in surface of the main species in Algeria by type of stand **in stand > 20** and **stand < 20**

(3) The estimation of the surface area of species using the percentages by climatic zone from the NFI 2008.

(4) Identification of emission factors from table 4.7 and 4.8 The approach is based on the Geographic distribution of the main species

(1) Stratification into climate zones according to the IPCC guideline 2006 and the distribution of wilayas by zone according to the National Forest Inventory 2008.

Table 567 Stratification of wilayas in Climate Zone

Wilayas	**Climate region**	**Wilayas**	**Climate region**	**Wilayas**	**Climate region**	**Wilayas**	**Climate region**
	Sutropical humid Forest		**Subtropical dry Forest**		**Subtropical steppe**		**Tropical mountain systems**
6	Bejaia	1	Adrar	3	Laghouat	25	Constantine
9	Blida	2	Chlef	12	Tebessa	34	Bordj bou arreridj
16	Alger	4	Oum el bouaghi	17	Djelfa		
18	Jijel	5	Batna	20	Saida		
19	Setif	7	Biskra	28	M'sila		
21	Skikda	8	Bechar	32	El bayadh		
23	Annaba	10	Bouira	45	Naama		
26	Medea	11	Tamanrasset				
35	Boumerdes	13	Tlemcen				
36	El taref	14	Tiaret				
41	Souk ahras	15	Tizi ouzou				
42	Tipaza	22	Sidi bel abbes				
43	Mila	24	Guelma				
44	Ain defla	27	Mostaghanem				
		29	Mascara				
		30	Ouargla				
		31	Oran				
		33	Illizi				
		37	Tindouf				
		38	Tissemssilt				
		39	El oued				

Wilayas	Climate region	Wilayas	Climate region	Wilayas	Climate region	Wilayas	Climate region
	Sutropical humid Forest		Subtropical dry Forest		Subtropical steppe		Tropical mountain systems
		46	Ain temouchenet				
		40	Khenchela				
		47	Ghardaia				
		48	Relizane				
		49	TIMIMOUNE				
		50	BENI ABBES				
		51	AIN SALAH				
		52	AIN GUEZZEM				
		53	TOUGGOURT				
		54	DJANET				
		55	EL MEGHAIER				
		56	EL MENEA				

(2) Geographical distribution in surface of the main species in Algeria by type of stand in stand > 20 and stand < 20

Table 568 Geographic Distribution in Area by stand age

	<20 ans	>20 ans	>20 ans	>20 ans	>20 ans	TOTAL
IFN 2008	Stand young	Stand middle age	Stand âge	Irregular stand	Taillis	
Species	(ha)	(ha)	(ha)	(ha)	(ha)	
Pine of Aleppo	213,345	588,442	290,422	52,043	1,212	1,145,464
cork oak	3,264	98,782	242,098	790	351	345,285
zeem oak	2,628	6,648	34,646			43,922
cedar	804	5,797	25,718	1,203		33,522
Maritime Pine	12,730	4,610	2,136			19,476
Eucalyptus	2,121	14,627	10,971		2,599	30,318
Various	7,095	16,519	11,666		3,963	39,243
Total	241,987	735,425	617,657	54,036	8,125	**1,657,230**

(3) The estimation of the surface area of species using the percentages by climatic zone from the NFI 2008.

Table 569 Pourcentages of species by stand age

	<20 ans	>20 ans	>20 ans	>20 ans	>20 ans
IFN 2008	Stand young	Stand middle age	Stand âge	Irregular stand	Taillis
Species	Percentage of total species				
Pine of Aleppo	18,6%	51,4%	25,4%	4,5%	0,1%
cork oak	0,9%	28,6%	70,1%	0,2%	0,1%
zeem oak	6,0%	15,1%	78,9%	0,0%	0,0%
cedar	2,4%	17,3%	76,7%	3,6%	0,0%
Maritime Pine	65,4%	23,7%	11,0%	0,0%	0,0%
Eucalyptus	7,0%	48,2%	36,2%	0,0%	8,6%
Various	18,1%	42,1%	29,7%	0,0%	10,1%
Total	14,6%	44,4%	37,3%	3,3%	0,5%

(4) Identification of emission factors from table 4.7 and 4.8 The approach is based on the Geographic distribution of the main species

6.5.1.1 Category description

This section describes the estimation of CO_2 emissions resulting from forest land as described in the 2006 IPCC Guidelines (Volume 4, chapter 4). emissions and removals of CO_2 within the AFOLU Sector are generally estimated based on changes in ecosystem carbon stocks.

Carbon pool: A reservoir, A system which has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and the atmosphere. The units are in mass.[608]

Net losses in total ecosystem carbon stocks are used to estimate CO2 emissions to the atmosphere, and net gains in total ecosystem carbon stocks are used to estimate removal of CO2 from the atmosphere.

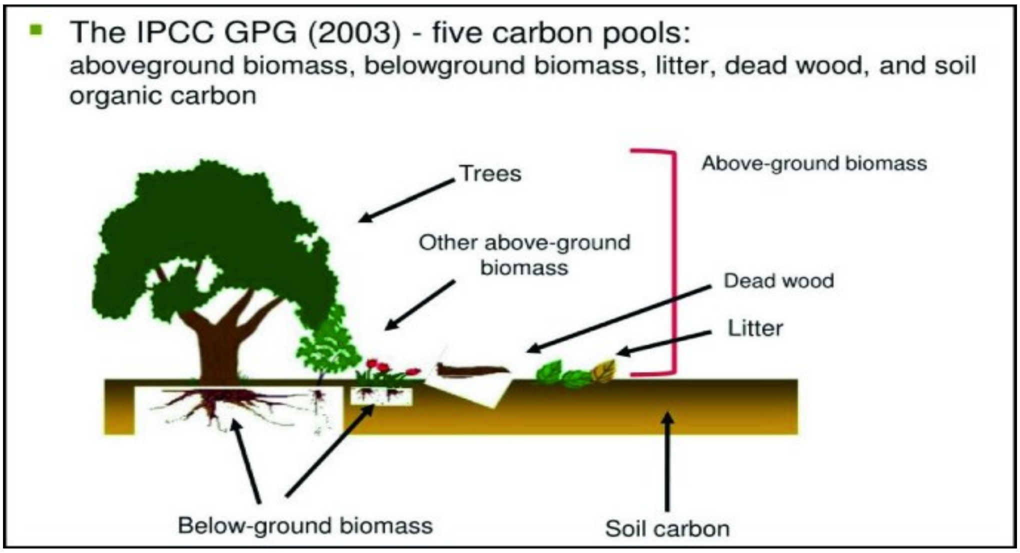

Figure 225 The IPCC GPG (2003) – five carbon pools

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[608] 2006 IPCC Guidelines, Volume 4, Chapter 4 FOREST LAND Glossary.

Table 8 gives an overview of the IPCC categories included in this chapter and the corresponding subdivisions for which the calculations are made. It also provides information on the status of emission estimates of all subcategories. The symbol „✓" indicates that emissions/removals from this subcategory have been estimated.

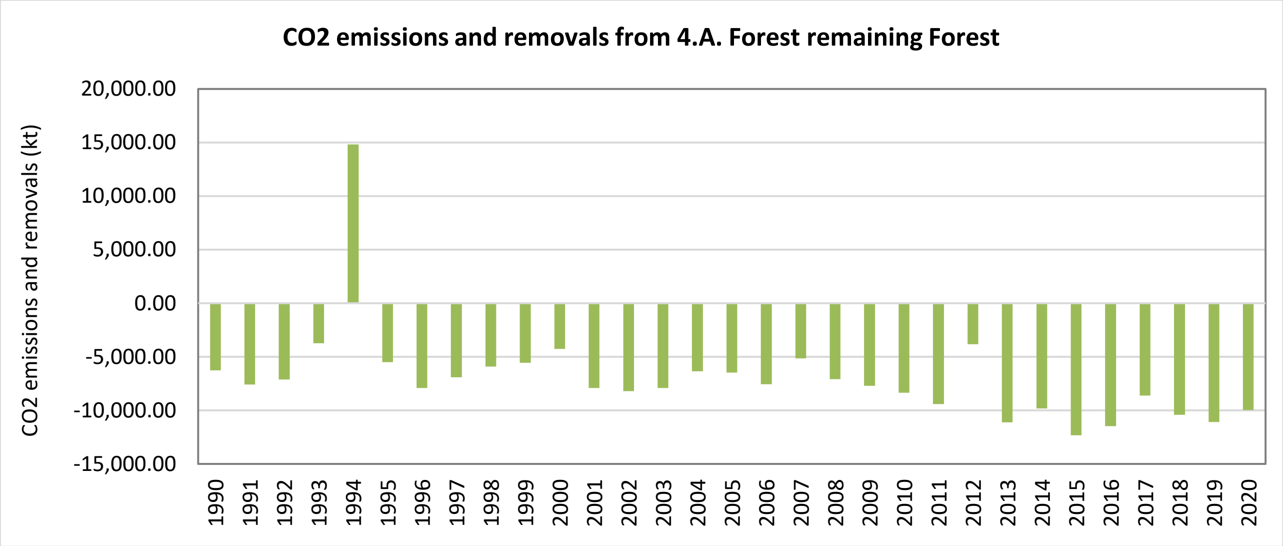

Figure 226 GHG emissions and removals in Forest land remaining Forest land

In the period 1990- 2020 the CO_2 removals increased by 41% and in the period 2005-2020 the CO_2 emissions increased by 94%. Instead of the period of 2019-2020 were removals decreased by -1%. this may be due to fires which in increase for the five last years.

A significant CO2 emission in 1994 due to an expressional fire in this year which affect important areas and

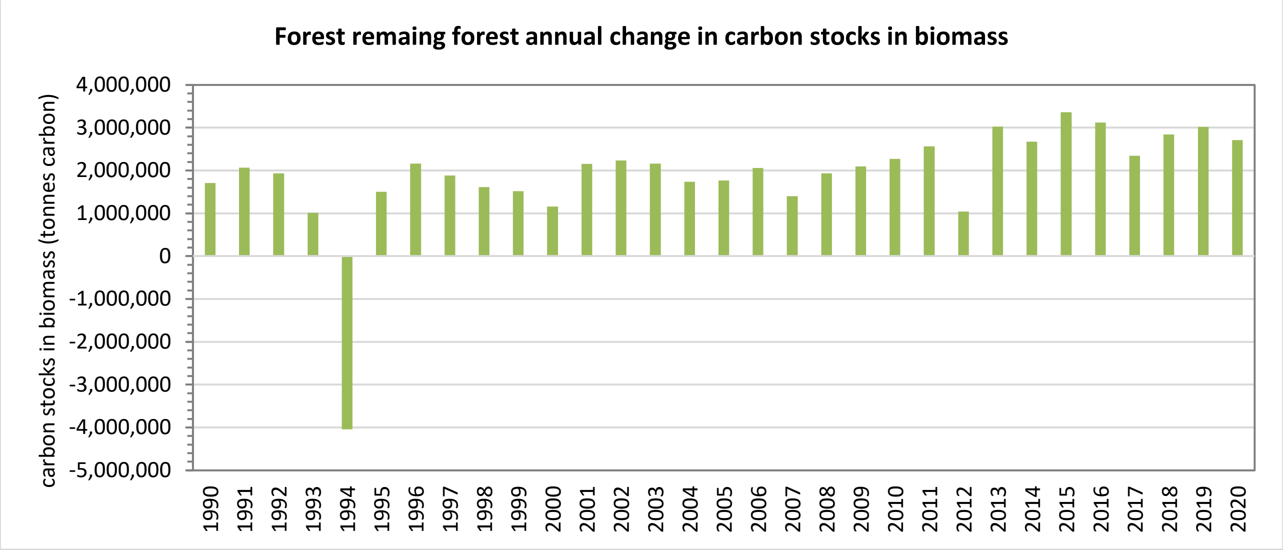

Figure 227 Forest remaining forest annual change in carbon stocks in biomass

Table 570 CO2 Emissions from IPCC category 4.A Total Forest land (excluding emissions from biomass burning)

	4.A	**4.A.1**	**Forest Land Remaining Forest Land**						**4.A.2**
	Total Forest land	**Forest Land Remaining Forest Land**	**Annual increase in carbon stocks in biomass (includes above-ground and below-ground biomass)**			**Loss of carbon from wood removals**	**Loss of carbon from fuelwood removals**	**Loss of carbon from disturbance**	**Land converted to forest land**
			Foret	**Afforestation**	**Maquis**				
	kt CO_2	**kt CO_2**	**tonnes C**	**tonnes C**	**tonnes C**	**tonnes C**	**tonnes C**	**tonnes C**	**tonnes C**
1990	-6,258.26	-6,258.26	681,519	1,248,661	808,937	80,751	86,234	349,175	NE
1991	-7,575.70	-7,575.70	676,410	1,253,161	821,132	103,062	119,658	119,582	NE
1992	-7,098.52	-7,098.52	671,301	1,257,661	833,327	97,379	96,472	219,313	NE
1993	-3,718.18	-3,718.18	666,192	1,262,160	845,522	138,559	166,376	574,978	NE
1994	14,817.52	14,817.52	661,084	1,266,660	857,717	85,870	115,438	3,211,994	NE
1995	-5,499.45	-5,499.45	655,975	1,271,160	869,912	96,840	134,851	416,906	NE
1996	-7,918.33	-7,918.33	650,866	1,275,659	882,106	115,620	132,104	76,819	NE
1997	-6,903.94	-6,903.94	645,757	1,280,159	894,301	113,638	141,026	213,998	NE
1998	-5,906.88	-5,906.88	640,648	1,284,659	906,496	144,138	154,190	312,090	NE
1999	-5,566.24	-5,566.24	635,539	1,289,158	918,691	124,588	140,155	397,919	NE
2000	-4,245.48	-4,245.48	630,431	1,293,658	930,886	131,178	105,266	612,114	NE
2001	-7,908.88	-7,908.88	642,296	1,263,190	933,242	103,586	59,081	178,212	NE
2002	-8,205.68	-8,205.68	654,161	1,232,721	935,599	86,701	66,677	138,907	NE
2003	-7,914.27	-7,914.27	666,027	1,202,253	937,955	49,084	192,684	82,131	NE
2004	-6,360.15	-6,360.15	677,892	1,171,784	940,312	98,605	134,689	294,407	NE
2005	-6,472.77	-6,472.77	689,758	1,141,316	942,669	64,282	144,532	295,406	NE
2006	-7,537.90	-7,537.90	701,623	1,110,847	945,025	65,092	131,217	154,543	NE
2007	-5,126.91	-5,126.91	713,488	1,080,379	947,382	63,448	158,935	449,117	NE
2008	-7,093.48	-7,093.48	725,354	1,049,910	949,738	79,927	87,056	228,226	NE
2009	-7,697.86	-7,697.86	723,909	1,197,759	957,968	67,487	114,142	208,481	NE
2010	-8,338.83	-8,338.83	722,463	1,345,608	966,198	78,597	91,705	209,720	NE
2011	-9,404.21	-9,404.21	721,018	1,493,457	974,428	75,706	66,725	169,628	NE
2012	-3,816.03	-3,816.03	719,573	1,641,305	982,658	60,026	63,177	1,028,197	NE
2013	-11,104.21	-11,104.21	718,128	1,789,154	990,888	80,096	59,912	94,867	NE
2014	-9,813.21	-9,813.21	716,683	1,937,003	999,119	78,376	67,398	342,464	NE
2015	-12,326.74	-12,326.74	715,237	2,084,852	1,007,349	57,642	43,042	122,117	NE
2016	-11,449.94	-11,449.94	733,118	1,953,611	1,012,838	84,274	45,838	158,316	NE
2017	-8,604.91	-8,604.91	734,140	1,897,365	1,017,936	34,925	112,756	503,642	NE
2018	-10,416.33	-10,416.33	767,347	1,604,886	1,023,033	85,515	170,017	21,692	NE
2019	-11,066.86	-11,066.86	734,651	1,878,616	1,019,504	71,438	105,172	130,659	NE
2020	-9,951.16	-9,951.16	735,162	1,912,364	1,015,583	36,780	72,540	365,258	NE
Trend									
1990 - 2020	59.0%	59.0%	7.9%	53.2%	25.5%	-54.5%	-15.9%	4.6%	NE
2005 - 2020	53.7%	53.7%	6.6%	67.6%	7.7%	-42.8%	-49.8%	23.6%	NE
2019 - 2020	-10.1%	-10.1%	0.1%	1.8%	-0.4%	-48.5%	-31.0%	179.6%	NE

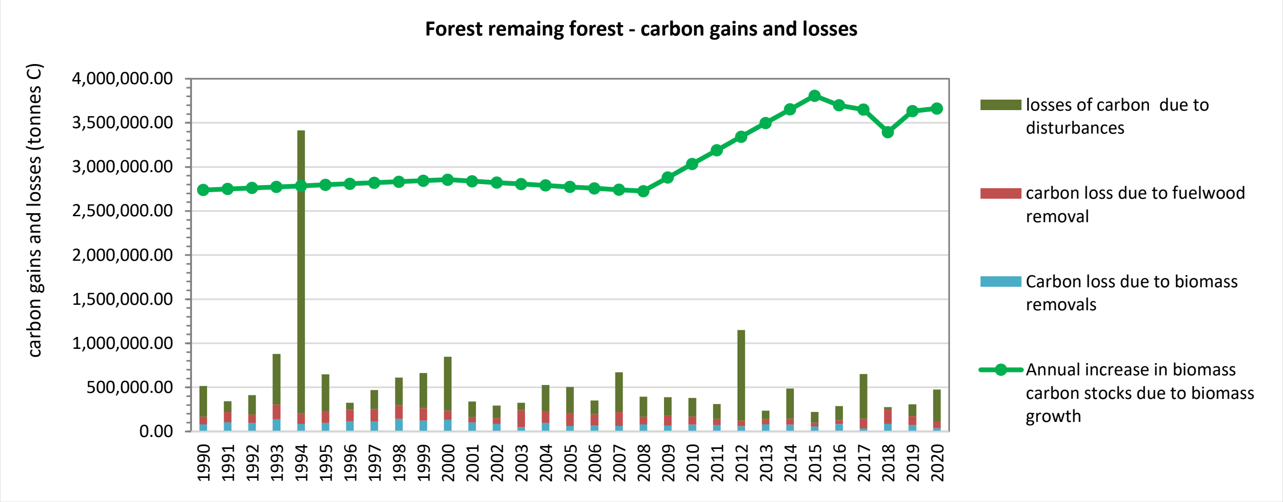

Figure 228 Forest remaining forest - carbon gains and losses

6.5.1.2 Methodological issues

The **biomass gain-loss method** is applied. According to the 2006 IPCC Guidelines, the biomass gain-loss method is applicable for all tiers estimating **Gains** include total (above-ground and below-ground) biomass growth. Losses are roundwood removal/harvest, fuelwood removal/harvest/gathering, and losses from disturbances by fire, insects, diseases, and other disturbances.

Tier 1 is feasible even when country-specific estimates of activity data and emission/removal factors are not available and works when changes of the carbon pool in biomass on *Forest Land Remaining Forest Land* are relatively small. Emission and removal factors are default from the 2006 IPCC Guidelines.

For estimation of **annual biomass gain** (ΔC_G) in *Forest Land Remaining Forest Land* using estimates of area and biomass growth, for each forest type and climatic zone in the country available using Equations 2.9 and 2.10 in Chapter 2 of Volume 4 of the 2006 IPCC GL[609].

Equation 2.2: Annual carbon stock changes for a land-use category as a sum of changes in each stratum within the category (2006 IPCC Guidelines, Volume 4, Chapter 2)

$$\Delta C_{LU} = \sum_{i,j} \Delta C_{LUi}$$

Where:

ΔC_G = carbon stock changes for a land-use (LU) category

i = denotes a specific stratum or subdivision within the land-use category (by any combination of species, climatic zone, ecotype, management regime etc

Calculation steps for TIER 1

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[609] 2006 IPCC Guidelines, Volume 4, Chapter 2, 2.3 Generic methods for CO_2 emissions and removals

Step 1: **categorize the area (A)** of *Forest Land Remaining Forest Land* into forest types of different climatic or ecological zones, as adopted by the country.

The method requires the biomass carbon loss to be subtracted from the biomass carbon gain (Equation 2.7). The annual change in carbon stocks in biomass can be estimated using the gain-loss method, where the annual increase in carbon stocks due to biomass growth and annual decrease in carbon stocks due to biomass losses are estimated:

- The annual increase in biomass carbon stock is estimated using Equation 2.9, where area under each forest sub-category is multiplied by mean annual increment in tonnes of dry matter per hectare per year.

Step 2: **Estimate the annual biomass gain** in *Forest Land Remaining Forest Land* (ΔC_G)

- Since the biomass growth is usually in terms of merchantable volume or above-ground biomass, the belowground biomass is estimated with a below-ground biomass to above-ground biomass ratio (Equation 2.10).
- Biomass Expansion Factors (BEFI) expand merchantable volume to total aboveground biomass volume to account for non-merchantable components of the tree, stand and forest. BEFI is
- dimensionless.
- The average above-ground biomass of forest areas affected by disturbances are given in Tables 4.7 and 4.8 of 2019 Refinements to 2006 IPCC GL;
- net average annual above-ground biomass growth values are provided in Tables 4.9, 4.10, and 4.12; net volume annual increment values are provided in Tables 4.11A and 4.11B; wood density is given in Tables
- 4.13 and 4.14; and below-ground biomass to above-ground biomass ratios (R) are given in Table 4.4. Refer to Box 4.2 for detailed explanation on how to convert and expand volumes of growing stock, increment and wood removals to biomass.
- In some ecosystems, basic wood density (D) can influence spatial patterns of forest biomass (Baker et al., 2004b). Tier 1 users who do not have measurements of wood density at the desired sub-strata level can
- estimate wood density by estimating the proportion of total forest biomass contributed by the 2-3 dominant species and using species-specific wood density values (Tables 4.13 and 4.14) to calculate a weighted average wood density value.
- Annual biomass loss or decrease in biomass carbon stocks is estimated using Equation 2.11, which requires estimates of annual carbon loss due to wood removals (Equation 2.12), fuelwood removal (Equation 2.13) and disturbances (Equation 2.14). Transfer of biomass to dead organic matter is estimated using Equation 2.20, based on estimates of annual biomass carbon lost due to mortality (Equation 2.21), annual carbon transfer to slash (Equation 2.22).
- Biomass estimates are converted to carbon values using carbon fraction of dry matter (Table 4.3).

Step 3: Estimate the **annual carbon loss due to wood removals** ($L_{\text{wood-removals}}$) using Equation 2.12 in Chapter 2 of Vol.4 of the 2006 IPCC GL.

Step 4: Estimate **annual carbon loss due to fuelwood removal** (L_{fuelwood}) using Equation 2.13 in Chapter 2 of Vol.4 of the 2006 IPCC GL.

Step 5: Estimate **annual carbon loss due to disturbance** ($L_{\textit{disturbance}}$) using Equation 2.14 in Chapter 2 of Vol.4 of the 2006 IPCC GL, avoid double counting of losses already covered in wood removals and fuelwood removals;

Step 6: From the estimated losses in Steps 3 to 5, estimate the **annual decrease in carbon stocks due to biomass losses** (ΔC_L) using Equation 2.11 in Chapter 2 Chapter 2 of Vol.4 of the 2006 IPCC GL.

Step 7: Estimate the **annual change in carbon stocks in biomass** (ΔC_B) using Equation 2.7 in Chapter 2 Chapter 2 of Vol.4 of the 2006 IPCC GL.

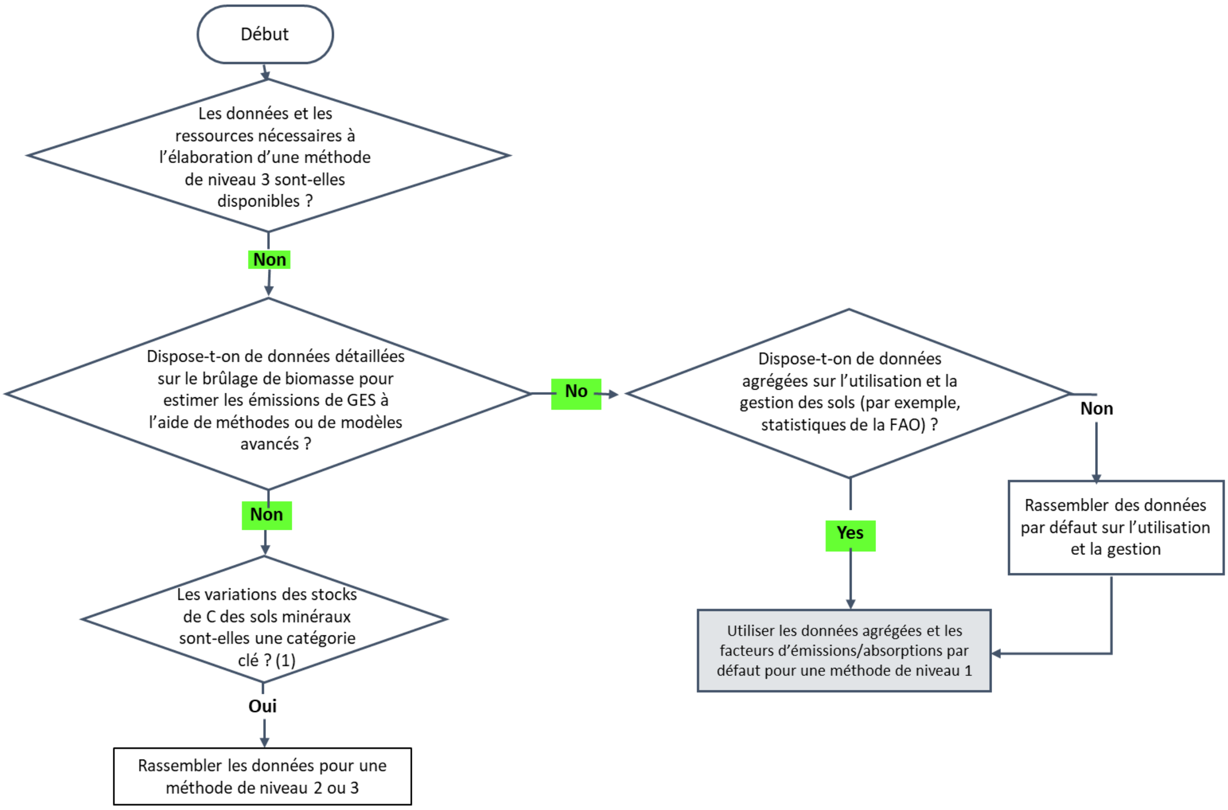

Figure 229 **Decision Tree for GHG emissions and removals from fire in forest land remaining forest land**

6.5.1.2.1 Annual biomass gain in Forest Land Remaining Forest Land

6.5.1.2.1.1 Choice of method

For estimation of **annual biomass gain** (ΔC_G) in *Forest Land Remaining Forest Land* using estimates of area and biomass growth, for each forest type and climatic zone in the country available using Equations 2.9 and 2.10 in Chapter 2 of Volume 4 of the 2006 IPCC GL[610].

Equation 2.9: Annual increase in biomass carbon stock due to
biomass increment in land remaining in forest land remaining land forest
(2006 IPCC Guidelines, Volume 4, Chapter 2)

$$\Delta C_G = \sum_{i,j} (A_{i,j} * \ G_{TOTAL\,i,j} \ * CF_{i,j})$$

Where:

ΔC_G = annual increase in biomass carbon stocks due to biomass growth in land remaining in the same land-use category by vegetation type and climatic zone , tonnes C yr^{-1}

A = area of land remaining in the same land-use category, ha

G_{TOTAL} = mean annual biomass growth, tonnes d. m .ha^{-1}, yr^{-1}

i = ecological zone (i=1 to n)

j = *Climate domain (j= 1 to m)*

CF= carbon fraction of dry matter , tonne C (tonne d.m)$^{-1}$

G_{TOTAL} is the total biomass growth expanded from the above-ground biomass growth (Gw) to include belowground biomass growth. Following a Tier 1 method, this may be achieved directly by using default values of G_W for naturally regenerated trees or broad categories of plantations together with R, the ratio of below-ground biomass to above-ground biomass differentiated by woody vegetation type.

Equation 2.10: Annual increment in biomass
in land remaining in forest land remaining land forest ***Erreur ! Signet non défini.***
(2006 IPCC Guidelines, Volume 4, Chapter 2)

$$G_{TOTAL} = \sum\{G_w * \ (1 + R)\}$$

Biomass increment data (dry matter) are used directly

Where:

G_{TOTAL} = average annual growth above and below-ground , tonnes d. m. ha^{-1} yr^{-1}

G_W = average annual above-ground biomass growth for a specific woody vegetation type, tonnes d. m. ha^{-1} yr^{-1}

R = ratio of below-ground biomass to above-ground for a specific vegetation type, in tonne d.m below-ground biomass (tonne d.m. above-ground biomass)$^{-1}$.

R must be set to zero if assuming no changes of below allocation patterns (**Tier 1**)!

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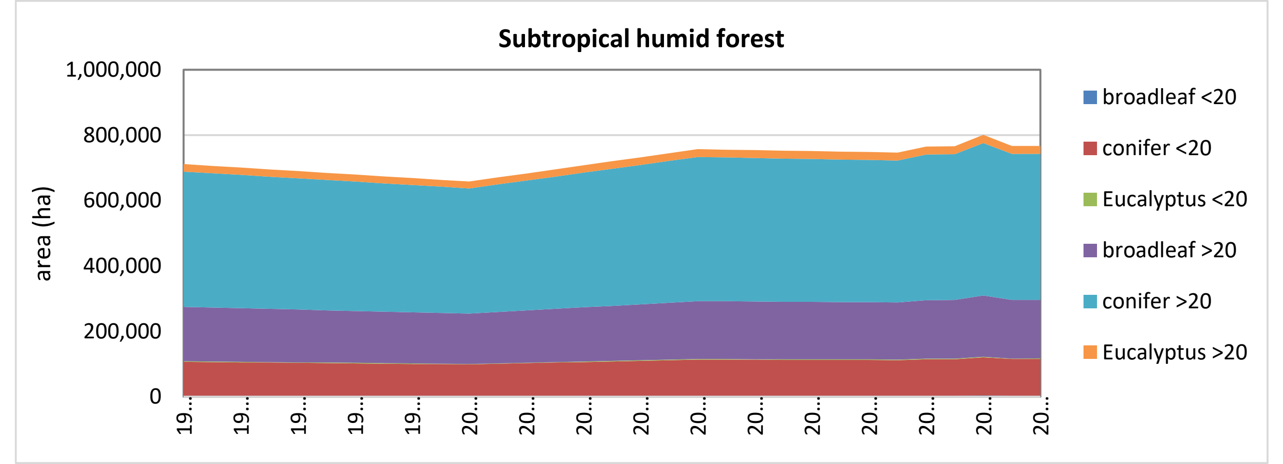
[610] 2006 IPCC Guidelines, Volume 4, Chapter 2, 2.3 Generic methods for CO_2 emissions and removals

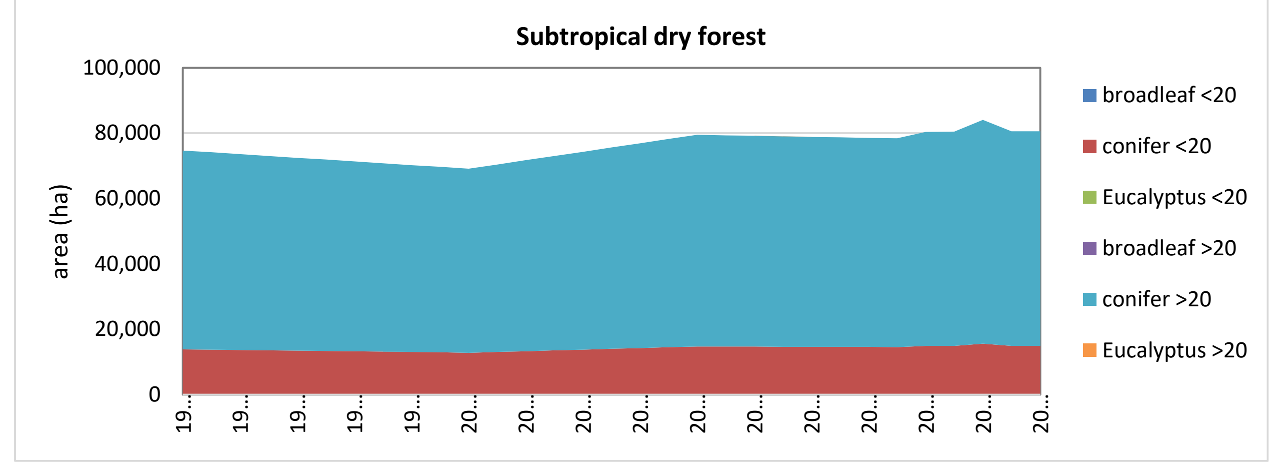
6.5.1.2.1.2 Choice of activity data

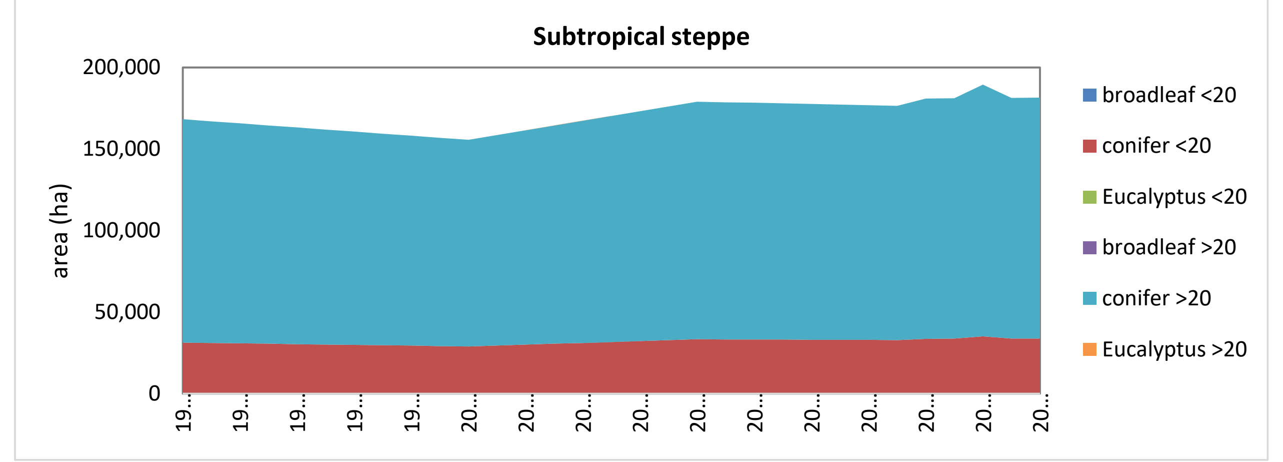
The area of Forest Land Remaining Forest Land was taken from the FAO Global Forest Resource Assessment (FRA) 2020[611] which was prepared by DGF - Direction Générale des Forêts Algérie[612].

It must be mentioned again that the national definition of forest land does not correspond to that of the FRA; see chapter 6.3.1 *Information on approaches used for representing land areas and on land-use databases used for the inventory preparation*.

FOREST







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[611] https://www.fao.org/3/cb0128fr/cb0128fr.pdf

[612] http://www.dgf.org.dz/fr

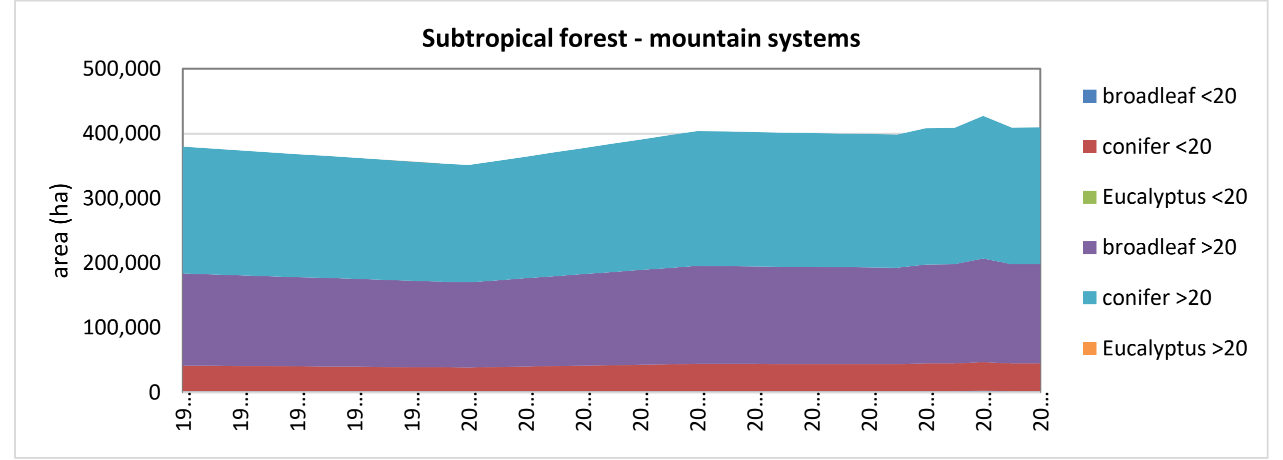

Figure 230 Area in 4.A.1 Forest remaining forest – Type forest

Table 571 Activity data for IPCC category 4.A.1: Forest area - Subtropical humid forest

Climate zone	**Subtropical humid forest**						
Type	**TOTAL**	**Broadleaf**	**Conifer**	**Eucalyptus**	**Broadleaf**	**Conifer**	**Eucalyptus**
		Chene Liege, Chene Zeem	**Pin d'alep, Cedre, Pin Maritime, Divers**		**Chene Liege, Chene Zeem**	**Pin d'alep, Cedre, Pin Maritime, Divers**	
Age		**< 20 years**			**> 20 years**		
	ha						
1990	711,570	2,787	103,764	1,707	166,371	414,243	22,697
1991	706,236	2,766	102,986	1,695	165,124	411,138	22,527
1992	700,901	2,745	102,208	1,682	163,877	408,033	22,357
1993	695,567	2,724	101,430	1,669	162,630	404,927	22,187
1994	690,233	2,703	100,653	1,656	161,383	401,822	22,017
1995	684,899	2,682	99,875	1,643	160,135	398,717	21,847
1996	679,565	2,661	99,097	1,631	158,888	395,612	21,677
1997	674,231	2,640	98,319	1,618	157,641	392,506	21,506
1998	668,897	2,619	97,541	1,605	156,394	389,401	21,336
1999	663,563	2,599	96,763	1,592	155,147	386,296	21,166
2000	658,229	2,578	95,986	1,579	153,900	383,191	20,996
2001	670,617	2,626	97,792	1,609	156,796	390,403	21,391
2002	683,006	2,675	99,599	1,639	159,693	397,615	21,786
2003	695,394	2,723	101,405	1,669	162,589	404,827	22,181
2004	707,783	2,772	103,212	1,698	165,486	412,039	22,577
2005	720,172	2,820	105,018	1,728	168,382	419,251	22,972
2006	732,560	2,869	106,825	1,758	171,279	426,463	23,367
2007	744,949	2,917	108,631	1,787	174,176	433,675	23,762
2008	757,337	2,966	110,438	1,817	177,072	440,887	24,157
2009	755,828	2,960	110,218	1,814	176,719	440,009	24,109
2010	754,319	2,954	109,998	1,810	176,366	439,130	24,061
2011	752,811	2,948	109,778	1,806	176,014	438,252	24,013
2012	751,302	2,942	109,558	1,803	175,661	437,373	23,965
2013	749,793	2,936	109,338	1,799	175,308	436,495	23,917
2014	748,284	2,930	109,118	1,795	174,955	435,616	23,868
2015	746,775	2,924	108,898	1,792	174,602	434,738	23,820
2016	765,444	2,998	111,620	1,837	178,968	445,606	24,416
2017	766,511	3,002	111,776	1,839	179,217	446,228	24,450
2018	801,183	3,137	116,832	1,922	187,324	466,412	25,556
2019	767,044	3,004	111,854	1,840	179,342	446,538	24,467
2020	767,578	3,006	111,931	1,842	179,466	446,849	24,484

Table 572 Activity data for IPCC category 4.A.1: Forest area - Subtropical dry forest

Climate zone	**Subtropical dry forest**						
Type	**TOTAL**	**Broadleaf**	**Conifer**	**Eucalyptus**	**Broadleaf**	**Conifer**	**Eucalyptus**
		Chene Liege, Chene Zeem	**Pin d'alep, Cedre, Pin Maritime, Divers**		**Chene Liege, Chene Zeem**	**Pin d'alep, Cedre, Pin Maritime, Divers**	
Age		**< 20 years**			**> 20 years**		
	ha						
1990	74,712	NO	13,872	NO	NO	60,840	NO
1991	74,152	NO	13,768	NO	NO	60,384	NO
1992	73,592	NO	13,664	NO	NO	59,928	NO
1993	73,032	NO	13,560	NO	NO	59,472	NO
1994	72,472	NO	13,456	NO	NO	59,016	NO
1995	71,912	NO	13,352	NO	NO	58,560	NO
1996	71,352	NO	13,248	NO	NO	58,104	NO
1997	70,792	NO	13,144	NO	NO	57,648	NO
1998	70,232	NO	13,040	NO	NO	57,192	NO
1999	69,672	NO	12,936	NO	NO	56,736	NO
2000	69,112	NO	12,832	NO	NO	56,279	NO
2001	70,413	NO	13,074	NO	NO	57,339	NO
2002	71,713	NO	13,315	NO	NO	58,398	NO
2003	73,014	NO	13,557	NO	NO	59,457	NO
2004	74,315	NO	13,798	NO	NO	60,516	NO
2005	75,616	NO	14,040	NO	NO	61,576	NO
2006	76,916	NO	14,281	NO	NO	62,635	NO
2007	78,217	NO	14,523	NO	NO	63,694	NO
2008	79,518	NO	14,765	NO	NO	64,753	NO
2009	79,359	NO	14,735	NO	NO	64,624	NO
2010	79,201	NO	14,706	NO	NO	64,495	NO
2011	79,043	NO	14,676	NO	NO	64,366	NO
2012	78,884	NO	14,647	NO	NO	64,237	NO
2013	78,726	NO	14,617	NO	NO	64,108	NO
2014	78,567	NO	14,588	NO	NO	63,979	NO
2015	78,409	NO	14,559	NO	NO	63,850	NO
2016	80,369	NO	14,923	NO	NO	65,447	NO
2017	80,481	NO	14,943	NO	NO	65,538	NO
2018	84,122	NO	15,619	NO	NO	68,502	NO
2019	80,537	NO	14,954	NO	NO	65,583	NO
2020	80,593	NO	14,964	NO	NO	65,629	NO

Table 573 Activity data for IPCC category 4.A.1: Forest area - Subtropical steppe

Climate zone	**Subtropical steppe**						
Type	**TOTAL**	**Broadleaf**	**Conifer**	**Eucalyptus**	**Broadleaf**	**Conifer**	**Eucalyptus**
		Chene Liege, Chene Zeem	**Pin d'alep, Cedre, Pin Maritime, Divers**		**Chene Liege, Chene Zeem**	**Pin d'alep, Cedre, Pin Maritime, Divers**	
Age		**< 20 years**			**> 20 years**		
	ha						
1990	168,254	NO	31,295	NO	NO	136,959	NO
1991	166,992	NO	31,060	NO	NO	135,933	NO
1992	165,731	NO	30,825	NO	NO	134,906	NO
1993	164,470	NO	30,591	NO	NO	133,879	NO
1994	163,209	NO	30,356	NO	NO	132,853	NO
1995	161,947	NO	30,122	NO	NO	131,826	NO
1996	160,686	NO	29,887	NO	NO	130,799	NO
1997	159,425	NO	29,652	NO	NO	129,772	NO
1998	158,164	NO	29,418	NO	NO	128,746	NO
1999	156,902	NO	29,183	NO	NO	127,719	NO
2000	155,641	NO	28,949	NO	NO	126,692	NO
2001	158,570	NO	29,493	NO	NO	129,077	NO
2002	161,500	NO	30,038	NO	NO	131,461	NO
2003	164,429	NO	30,583	NO	NO	133,846	NO
2004	167,358	NO	31,128	NO	NO	136,230	NO
2005	170,288	NO	31,673	NO	NO	138,615	NO
2006	173,217	NO	32,218	NO	NO	140,999	NO
2007	176,146	NO	32,763	NO	NO	143,384	NO
2008	179,076	NO	33,307	NO	NO	145,768	NO
2009	178,719	NO	33,241	NO	NO	145,478	NO
2010	178,362	NO	33,175	NO	NO	145,188	NO
2011	178,005	NO	33,108	NO	NO	144,897	NO
2012	177,649	NO	33,042	NO	NO	144,607	NO
2013	177,292	NO	32,976	NO	NO	144,316	NO
2014	176,935	NO	32,909	NO	NO	144,026	NO
2015	176,578	NO	32,843	NO	NO	143,735	NO
2016	180,993	NO	33,664	NO	NO	147,329	NO
2017	181,245	NO	33,711	NO	NO	147,534	NO
2018	189,443	NO	35,236	NO	NO	154,207	NO
2019	181,371	NO	33,734	NO	NO	147,637	NO
2020	181,497	NO	33,758	NO	NO	147,739	NO

Table 574 Activity data for IPCC category 4.A.1: Forest area - Subtropical mountain systems

Climate zone	**Subtropical mountain systems**						
Type	**TOTAL**	**Broadleaf**	**Conifer**	**Eucalyptus**	**Broadleaf**	**Conifer**	**Eucalyptus**
		Chene Liege, Chene Zeem	**Pin d'alep, Cedre, Pin Maritime, Divers**		**Chene Liege, Chene Zeem**	**Pin d'alep, Cedre, Pin Maritime, Divers**	
Age		**< 20 years**			**> 20 years**		
	ha						
1990	379,464	1,956	39,408	NO	142,181	195,918	NO
1991	376,620	1,942	39,113	NO	141,115	194,450	NO
1992	373,775	1,927	38,818	NO	140,049	192,981	NO
1993	370,930	1,912	38,522	NO	138,984	191,512	NO
1994	368,086	1,898	38,227	NO	137,918	190,044	NO
1995	365,241	1,883	37,931	NO	136,852	188,575	NO
1996	362,397	1,868	37,636	NO	135,786	187,106	NO
1997	359,552	1,854	37,340	NO	134,720	185,638	NO
1998	356,708	1,839	37,045	NO	133,655	184,169	NO
1999	353,863	1,824	36,750	NO	132,589	182,700	NO
2000	351,019	1,810	36,454	NO	131,523	181,232	NO
2001	357,625	1,844	37,140	NO	133,998	184,643	NO
2002	364,232	1,878	37,826	NO	136,474	188,054	NO
2003	370,838	1,912	38,513	NO	138,949	191,465	NO
2004	377,445	1,946	39,199	NO	141,425	194,876	NO
2005	384,051	1,980	39,885	NO	143,900	198,287	NO
2006	390,658	2,014	40,571	NO	146,375	201,698	NO
2007	397,264	2,048	41,257	NO	148,851	205,109	NO
2008	403,871	2,082	41,943	NO	151,326	208,520	NO
2009	403,066	2,078	41,860	NO	151,025	208,104	NO
2010	402,262	2,074	41,776	NO	150,723	207,689	NO
2011	401,457	2,070	41,692	NO	150,422	207,273	NO
2012	400,652	2,066	41,609	NO	150,120	206,858	NO
2013	399,848	2,061	41,525	NO	149,819	206,442	NO
2014	399,043	2,057	41,442	NO	149,517	206,027	NO
2015	398,238	2,053	41,358	NO	149,216	205,611	NO
2016	408,194	2,104	42,392	NO	152,946	210,752	NO
2017	408,763	2,107	42,451	NO	153,159	211,045	NO
2018	427,253	2,203	44,371	NO	160,087	220,592	NO
2019	409,048	2,109	42,481	NO	153,266	211,192	NO
2020	409,332	2,110	42,510	NO	153,372	211,339	NO

6.5.1.2.1.3 Choice of Removal factor

Default values for the above-ground biomass growth (GW) were taken from Tables 4.9 and 4.10 of the 2006 IPCC Guidelines and are presented in the next tables.

Table 575 Above-ground net biomass growth in natural forests

Domain	Ecological zone	Continent	Above-ground biomass growth		Status in Algeria
			tonnes d.m. ha^{-1} yr^{-1}		
Subtropica	Subtropical dry forest	Africa (≤20 y)	2.4	2.3-2.5	Zones de Montagne (ZdM)
		Africa (>20 y)	1.8	0.6-3.0	
	Subtropical steppe	Africa (≤20 y)	1.2	0.8-1.5	Sud
		Africa (>20 y)	0.9	0.2-1.6	
	Subtropical mountain systems	Africa (≤20 y)	3.50	2.0-5.0	HAUTS PLATEAUX (HPl)
		Africa (>20 y)	1.25	1.0-1.5	
Sources: Table 4.9 Above-ground net biomass growth in natural forests; 2006 IPCC Guidelines, Volume 4, Chapter 4					

Table 576 Above-ground net biomass growth in tropical and sub-tropical forest plantation

Domain	Ecological zone	Continent	Above-ground biomass growth		Status in Algeria
			tonnes d.m. ha^{-1} yr^{-1}		
	Subtropical dry forest	Africa Eucalyptus sp. ≤20 y	13	-	Zones de Montagne (ZdM)
		Africa Pinus sp. > 20 y	10	-	
		Africa Pinus sp. ≤ 20 y	8	-	
		Africa other ≤ 20 y	10	4-20	
	Subtropical steppe	Africa Eucalyptus sp. >20 y	8	5-14	Sud
		Africa Eucalyptus sp. ≤20 y	5	3-7	
		Africa Pinus sp. > 20 y	2.5	2.5	
		Africa Pinus sp. ≤ 20 y	3	0.5-6	
		Africa other > 20 y	10	10	
		Africa other ≤ 20 y	15	15	
	Subtropical mountain systems	Africa	10	10	HAUTS PLATEAUX (HPl)
Sources: Table 4.10 Above-ground net biomass growth in tropical and sub-tropical forest plantations; 2006 IPCC Guidelines, Volume 4, Chapter 4					

The ratios of below-ground biomass to above-ground biomass for a specific vegetation type (R) was taken from Tables 4.4 of the 2006 IPCC Guidelines and are presented in the next table.

However, as Tier 1 is applied which is based on the assumption that there are no changes of below allocation patterns , R must be set to zero .

Table 577 Exemplary calculation of Annual increase in carbon stocks in biomass in 4.A.1 Forest Land Remaining Forest Land.

4.A.1 Forest Land Remaining Forest Land: Annual increase in carbon stocks in biomass (includes above-ground and below-ground biomass)						
#	**Parameter**	**Unit**	**Formula**	**Source**	**Comment**	**2020**
A	Area of Forest Land Remaining Forest Land	ha		**DGF -**	**forest area**	4,539,000
G_W	Average annual above-ground biomass growth	tonnes dm ha-1 yr-1	-	table 4.9 Tier 1 estimated biomass values	Default for Subtropical steppe - Africa	1.2
R	Ratio of below-ground biomass to above-ground biomass	tonnes bg dm (tonne ag dm)$^{-1}$	-	zero (0) or Table 4.4	Tier 1	0
G_{TOTAL}	Average annual biomass growth above- and below-ground	tonnes dm ha^{-1} yr-1	GW * (1+R)	Equation 2.10, Chap 2, Vol. 4, 2006 IPCC GL		1.20
CF	Carbon fraction of dry matter	[tonnes C (tonne dm)$^{-1}$]	-	Table 4.3, Chap 4, Vol. 4, 2006 IPCC GL	Default value	0.47
ΔC_G	**Annual increase in biomass carbon stocks due to biomass growth**	**tonnes C yr^{-1}**	A * G_{TOTAL} * CF	**Equation 2.9, Chap 2, Vol. 4, 2006 IPCC GL**		**2,559,996**
CO_2	CO_2 emission	tonnes CO2 yr^{-1}	$L_{fuelwood}$ * 44/12	Chapter 2.2.3, 2006 IPCC GL	Conversion of C stock changes to CO2 emissions	-9,386,652
CO_2	**CO_2 emission**	**kt CO2 yr^{-1}**	CO_2 emission (t)/1000			**-9,386.65**

6.5.1.2.2 Annual decrease in carbon stocks due to biomass losses

6.5.1.2.2.1 Choice of method

Loss estimates are needed for calculating biomass carbon stock change using the Gain-Loss Method. For this the annual biomass loss ΔC_L is the sum of losses from

- wood removal (harvest),
- fuelwood removal (not counting fuelwood gathered from woody debris), and
- disturbances, such as fire, storms, and insect and diseases,

For estimating ΔCL we used equation 2.11 in Chapter 2 of Volume 4 of the 2006 IPCC GL [610].

Equation 2.11 Annual decrease in carbon stocks due to biomass losses

in land remaining in the same land-use category

(2006 IPCC Guidelines, Volume 4, Chapter 2)[610]

$$\Delta C_L = L_{wood-removals} + L_{fuelwood} + L_{distrubances}$$

Where:

ΔC_L = annual decrease in carbon stocks due to biomass loss in land remaining in the same land-use category, tonnes C yr-1

L wood-removals = annual carbon loss due to wood removals, tonnes C yr-1 (Calculated using equation2.12)

L fuelwood = annual biomass carbon loss due to fuelwood removals, tonnes C yr-1 (Calculated using equation 2.13)

L disturbance = annual biomass carbon losses due to disturbances, tonnes C yr^{-1} (Calculated using equation 2.14)

The carbon loss due to biomass removals, fuelwood removal and disturbances are provided in the following table. The underlying methodology, activity data and parameter are described in the following chapters.

Table 578 Carbon loss due to biomass removals, fuelwood removal and disturbances

	Carbon loss due to biomass removals	carbon loss due to fuelwood removal	losses of carbon due to disturbances
	tonnes C	tonnes C	tonnes C
1990	80,751.25	86,234.05	349,175.02
1991	103,062.24	119,658.00	119,581.95
1992	97,378.54	96,472.38	219,313.47
1993	138,558.86	166,375.58	574,978.30
1994	85,869.66	115,437.75	3,211,993.89
1995	96,840.38	134,851.02	416,906.19
1996	115,619.99	132,104.03	76,818.97
1997	113,637.81	141,025.93	213,998.06
1998	144,137.77	154,190.42	312,089.65
1999	124,587.74	140,155.40	397,918.55
2000	131,178.26	105,265.70	612,113.76
2001	103,586.03	59,081.33	178,212.35
2002	86,700.92	66,676.77	138,907.16
2003	49,084.02	192,683.76	82,131.22
2004	98,604.80	134,689.42	294,407.45
2005	64,282.15	144,532.31	295,406.32
2006	65,092.08	131,217.19	154,543.24
2007	63,448.04	158,934.56	449,117.14
2008	79,926.90	87,055.51	228,226.44
2009	67,487.00	114,141.75	208,481.12
2010	78,596.58	91,705.08	209,720.43
2011	75,705.92	66,725.06	169,628.48
2012	60,026.00	63,177.41	1,028,197.35
2013	80,096.12	59,911.94	94,867.10
2014	78,375.61	67,397.93	342,463.82
2015	57,641.52	43,041.84	122,116.50
2016	84,274.14	45,838.50	158,315.95
2017	34,925.06	112,755.74	503,642.08
2018	85,514.92	170,016.92	21,692.30
2019	71,437.68	105,171.81	130,658.91
2020	36,780.39	72,539.93	365,257.63
Trend			
1990 - 2020	-54%	-16%	5%
2005 - 2020	-43%	-50%	24%
2019 - 2020	-49%	-31%	180%

6.5.1.2.3 Annual carbon loss due to wood removals in Forest Land Remaining Forest Land

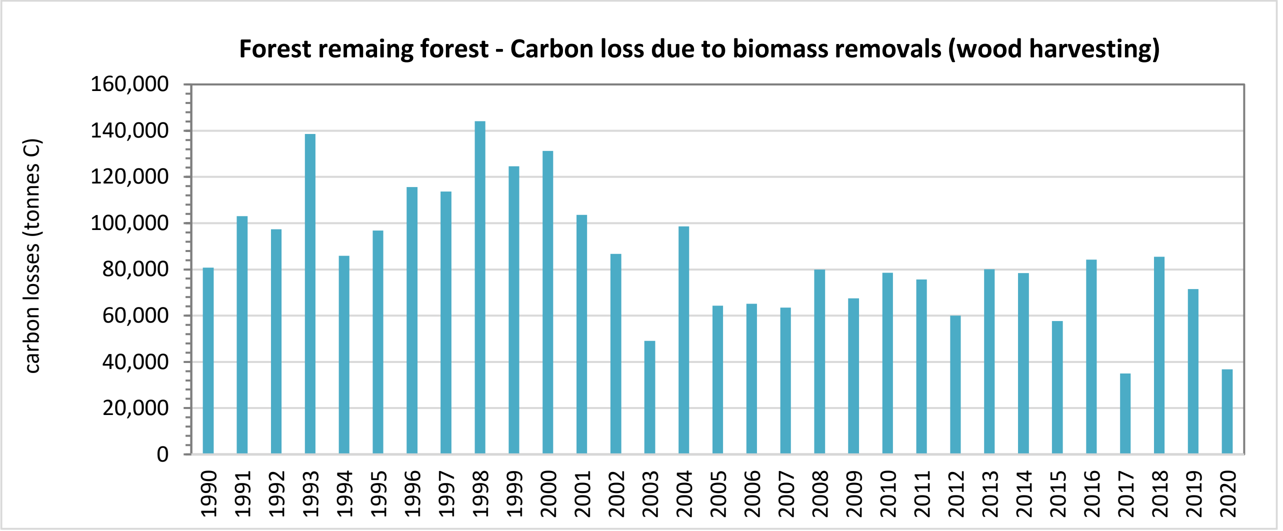

Figure 231 **Carbon loss due to biomass removals in IPCC category 4.A.1 LULUCF (1990-2020)**

The carbon losses due to biomass removals was in the first period (1990 – 2004) more significant. In the last decade commercial wood was mainly imported. However, wood harvesting took place

- Sawlogs and veneer logs, coniferous / non-coniferous
- Pulpwood, round and split, coniferous / non-coniferous
- Other industrial roundwood, coniferous / non-coniferous
- Sawnwood, coniferous / non-coniferous

The production and export of cork is an important economic of the Forestry industry in Algeria.

Table 579 Carbon loss due to biomass removals

	CO_2 emission	Carbon loss due to biomass removals			
		Total Commercial wood + CORK	Commercial wood, coniferous	Commercial wood, non-coniferous	Cork, non-coniferous
	kt	tonnes C			
1990	296.09	80,751	38,179	18,231	24,342
1991	377.89	103,062	52,711	25,567	24,784
1992	357.05	97,379	42,537	20,573	34,268
1993	508.05	138,559	73,688	35,146	29,725
1994	314.86	85,870	51,044	24,470	10,355
1995	355.08	96,840	59,422	28,795	8,623
1996	423.94	115,620	58,306	28,113	29,201
1997	416.67	113,638	62,279	29,976	21,383
1998	528.51	144,138	68,357	32,504	43,276
1999	456.82	124,588	62,180	29,500	32,908
2000	480.99	131,178	50,304	47,829	33,045
2001	379.82	103,586	40,818	35,951	26,818
2002	317.90	86,701	34,675	30,540	21,485

	CO_2 emission	Carbon loss due to biomass removals			
		Total Commercial wood + CORK	Commercial wood, coniferous	Commercial wood, non-coniferous	Cork, non-coniferous
	kt	tonnes C			
2003	179.97	49,084	14,387	16,035	18,663
2004	361.55	98,605	38,604	41,915	18,086
2005	235.70	64,282	17,187	20,649	26,447
2006	238.67	65,092	25,530	20,104	19,458
2007	232.64	63,448	17,503	23,814	22,131
2008	293.07	79,927	22,693	30,876	26,358
2009	247.45	67,487	22,818	31,046	13,623
2010	288.19	78,597	48,687	14,178	15,732
2011	277.59	75,706	51,941	10,967	12,798
2012	220.10	60,026	42,077	8,885	9,064
2013	293.69	80,096	50,443	10,651	19,002
2014	287.38	78,376	51,903	10,959	15,513
2015	211.35	57,642	44,820	9,464	3,358
2016	309.01	84,274	57,195	12,077	15,002
2017	128.06	34,925	15,001	3,167	16,757
2018	313.55	85,515	50,938	10,756	23,821
2019	261.94	71,438	45,856	9,683	15,899
2020	134.86	36,780	17,928	3,785	15,067

6.5.1.2.3.1 Choice of method

The method for estimating the annual biomass carbon loss due to wood-removals is provided in Equation 2.12 in Chapter 2 of Volume 4 of the 2006 IPCC GL[613].

Equation 2.12: Annual carbon loss in wood removals
in land remaining in forest land remaining land forest
(2006 IPCC Guidelines, Volume 4, Chapter 2)

$$\mathrm{L}_{wood-removals} = \{H * BCEF_R * (1+R) * CF\}$$

Where:

L wood-removals = annual carbon loss due to biomass removals, tonnes C yr-1

H = annual wood removals , roundwood , m3 yr-1

BCEF R = biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark), tonnes biomass removal (m3 of removals)-1, (Table 4.5 for Forest Land).

R = ratio of below to above-ground biomass, in tonnes d.m below-ground biomass (tonne d.m. above-ground biomass)-1. **R must be set to zero if assuming no changes of below-ground biomass allocation patterns (TIER 1)**.

CF = carbon fraction of dry matter, tonne C (tonne d.m)-1

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[613] 2006 IPCC Guidelines, Volume 4, Chapter 2, 2.3 Generic methods for CO_2 emissions and removals

6.5.1.2.3.2 Choice of activity data

The annual wood removal was estimated using the total wood harvested given by DGF and expert judgment for the age of the tree/stand.

Table 580 Commercial wood (coniferous and non-coniferous) and cork

		Share	Share	Source
Age of tree/stand	**CORK**			
	<20		8%	DGF (expert judgment)
	21-40		25%	
	41-100		45%	
	100 -200		20%	
	>200		2%	
	TOTAL Commercial wood			
	<20		10%	Calculated
	21-40		35%	
	41-100		35%	
	100 -200		10%	
	>200		10%	
	Commercial wood, coniferous	83% (2020)		FAO
	<20		0%	DGF (expert judgment)
	21-40		15%	
	41-100		60%	
	100 -200		20%	
	>200		5%	
	Commercial wood, non-coniferous	17% (2020)		FAO
	<20		0%	DGF (expert judgment)
	21-40		0%	
	41-100		40%	
	100 -200		60%	

Table 581 Activity data for IPCC category 4.A.1 Forest remaining forest commercial wood

	Total wood (commercial wood, fuelwood)	Total commercial	Commercial wood, conifers	Commercial wood, non conifers	Cork
	m^3	m^3	m^3	m^3	m^3
1990	123,990	66,474	45,255	21,219	38,025
1991	172,048	92,239	62,480	29,758	38,716
1992	138,711	74,366	50,420	23,946	53,533
1993	239,220	128,251	87,344	40,907	46,436
1994	165,980	88,985	60,504	28,482	16,177
1995	193,893	103,950	70,434	33,516	13,470
1996	189,943	101,833	69,111	32,722	45,617
1997	202,771	108,710	73,821	34,889	33,404
1998	221,700	118,858	81,025	37,833	67,605
1999	201,520	108,039	73,703	34,336	51,408
2000	185,506	115,296	59,627	55,669	51,622
2001	129,632	90,226	48,382	41,844	41,894
2002	121,120	76,648	41,101	35,547	33,564
2003	164,232	35,716	17,053	18,663	29,154
2004	184,379	94,544	45,758	48,786	28,253
2005	140,805	44,405	20,372	24,033	41,315
2006	141,180	53,661	30,261	23,400	30,397
2007	154,471	48,465	20,747	27,718	34,572
2008	120,900	62,836	26,898	35,937	41,176
2009	139,312	63,182	27,047	36,135	21,281
2010	135,377	74,212	57,710	16,502	24,576
2011	118,836	74,332	61,567	12,765	19,992
2012	102,354	60,216	49,875	10,341	14,160
2013	112,149	72,189	59,792	12,397	29,684
2014	119,231	74,278	61,522	12,756	24,234
2015	92,849	64,141	53,126	11,015	5,246
2016	112,425	81,852	67,795	14,056	23,435
2017	96,673	21,467	17,781	3,687	26,177
2018	186,295	72,897	60,379	12,519	37,212
2019	135,772	65,625	54,355	11,270	24,836
2020	74,039	25,656	21,250	4,406	23,537
Trend					
1990 - 2020	-40%	-61%	-53%	-79%	-38%
2005 - 2020	-47%	-42%	4%	-82%	-43%
2019 - 2020	-45%	-61%	-61%	-61%	-5%
Source	DGF	DGF	Share of 83% is based on FAo data	Share of 17% is based on FAo data	DGF

6.5.1.2.3.3 Choice of factors

The default value for above-ground net biomass growth (CF) were taken from Table 4.3 of the 2006 IPCC Guidelines.

Table 582 Above-ground net biomass growth in tropical and sub-tropical natural forest

Domain	**Part of tree**	**Carbon fraction, (CF)** **[tonne C (tonne d.m.)$^{-1}$]**	
Default value	All	0.47	
	All	0.47	(0.44 - 0.49)
	wood	0.49	
	wood, tree d < 10 cm	0.46	
	wood, tree d ≥ 10 cm	0.49	
	foliage	0.47	
	foliage, tree d < 10 cm	0.43	
Tropical and Subtropical	foliage, tree d ≥ 10 cm	0.46	
	All	0.47	(0.47 - 0.49)
	broad-leaved	0.48	(0.46 - 0.50)
Temperate and Boreal	Conifers	0.51	(0.47 - 0.55)
Sources: Carbon fraction of aboveground forest biomass, 2006 IPCC Guidelines, Volume 4, Chapter 4			

The default values for biomass conversion and expansion factor for conversion of removals in merchantable volume to biomass removals including bark ($BCEF_R$) were taken from Tables 4.5 of the 2006 IPCC Guidelines.

Table 583 Default biomass conversion and expansion factors (BCEF), tonnes biomass (m3 of wood volume)-1

Default biomass conversion and expansion factors (BCEF) (tonnes biomass (m3 of wood volume)$^{-1}$)										
Climatic zone	**Forest type**	**BCEF**	**Growing stock level (m^3)**							
			<20		**21-40**		**41-80**		**>80**	
Mediterranean, dry tropical, subtropical	hardwoods	$BCEF_S$	**5**	2.0-8.0	**1,9**	1.0-2.6	**0,8**	0.6-1.4	**0,66**	0.4-0.9
		$BCEF_I$	1,5		0,5		0,55		0,66	
		$BCEF_R$	5,55		2,11		0,89		0,73	
	conifers	$BCEF_S$	**6**	3.0-8.0	**1,2**	0.5-2.0	**0,6**	0.4-0.9	0,55	0.4-0.7
		$BCEF_I$	1,5		0,4		0,45		0,54	
		$BCEF_R$	6,67		1,33		0,67		0,61	
Sources: Table 4.5 Default biomass conversion and expansion factors; 2006 IPCC Guidelines, Volume 4, Chapter 4										

The ratio of below to above-ground biomass is assumed to be zero if assuming no changes of below-ground biomass allocation patterns (TIER 1).

Table 584 Exemplary calculation of Annual increase in carbon stocks in biomass.

4.A.1 Forest Land Remaining Forest Land: Carbon loss due to biomass removals						
#	**Parameter**	**Unit**	**Formula**	**Source**	**Comment**	**2020**
H	Annual wood removal	m3 yr-1		**DGF**	**Commercial wood, coniferous; <20**	4.420
$BCEF_R$	Biomass conversion and expansion factor for conversion of removals in merchantable volume to biomass removals (including bark)	tonnes of biomass removals (m3 of removals) – 1	-	Table 4.5, Chap 5, Vol. 4, 2006 IPCC GL	Subtropical steppe - Africa	6,67
R	Ratio of below-ground biomass to above-ground biomass	tonnes bg dm (tonne ag dm)-1	-	Table 4.4, Chap 4, Vol. 4, 2006 IPCC GL	Subtropical steppe	0
CF	Carbon fraction of dry matter	tonnes C (tonne dm)-1		Table 4.3, Chap 4, Vol. 4, 2006 IPCC GL	Default value	0,47
$L_{wood-removals}$	Carbon loss due to biomass removals	**tonnes C yr^{-1}**	H * $BCEF_R$ * (1+R) * CF	**Equation 2.12, Chap 2, Vol. 4, 2006 IPCC GL**		**13.857**
$L_{wood-removals}$	CO_2 emission (t)	tonnes CO2 yr^{-1}	$L_{fuelwood}$ * 44/12		Conversion of C stock changes to CO2 emissions	50.808
$L_{wood-removals}$	**CO_2 emission**	**kt CO2 yr^{-1}**	CO_2 emission (t)/1000			**50,81**

6.5.1.2.4 Annual carbon loss due to fuelwood removal in Forest Land Remaining Forest Land

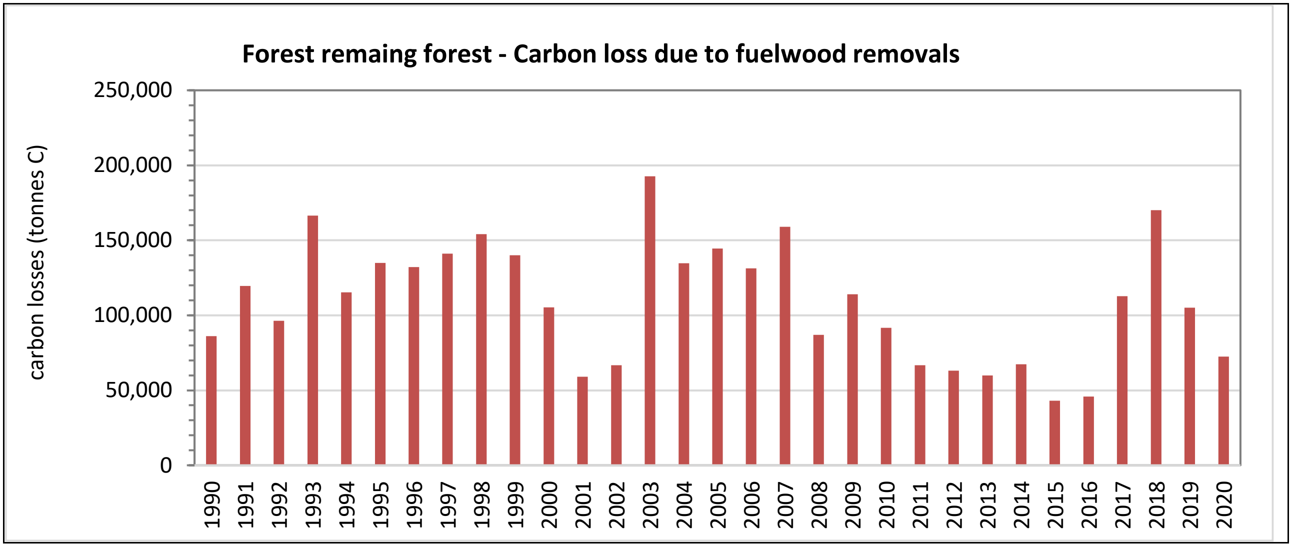

Figure 232 **Carbon loss due to fuelwood removals in IPCC category 4.A.1 LULUCF (1990-2020)**

Table 585 Carbon loss due to biomass removals

	CO_2 emission	Carbon loss due to fuelwood removals
	kt	tonnes C
1990	950.96	259,352
1991	295.23	80,517
1992	663.79	181,034
1993	1,525.76	416,115
1994	9,649.72	2,631,741
1995	1,399.91	381,795
1996	213.59	58,253
1997	662.01	180,548
1998	773.87	211,054
1999	1,203.43	328,208
2000	1,713.00	467,183
2001	479.66	130,816
2002	359.33	97,999
2003	180.67	49,274
2004	363.33	99,091
2005	726.86	198,235
2006	434.29	118,442
2007	1,156.69	315,461
2008	506.60	138,164
2009	484.64	132,174
2010	496.16	135,317
2011	426.93	116,436
2012	2,692.43	734,299
2013	185.84	50,682

	CO_2 emission	Carbon loss due to fuelwood removals
	kt	tonnes C
2014	823.80	224,673
2015	301.50	82,228
2016	348.20	94,963
2017	1,413.40	385,473
2018	54.92	14,979
2019	301.88	82,332
2020	774.08	211,113

6.5.1.2.4.1 Choice of method

For estimating the CO_2 emissions and removals from fuelwood in forest land remaining forest land the Tier 1 of 2006 the IPCC Guidelines have been applied:

Equation 2.13: Annual carbon loss in biomass of fuelwood removal
in land remaining in forest land remaining land forest
(2006 IPCC Guidelines, Volume 4, Chapter 2)

$$L_{fuelwood} = \left[\{FG_{trees} * BCEF_R * (1 + R)\} + FG_{part} * D\right] * CF$$

Where:

$L_{fuelwood}$ = annual carbon loss due to fuelwood removals, tonnes C yr-1

FG_{trees} = annual volume of fuelwood removal of whole trees, m3 yr-1

FG_{part} = annual volume of fuelwood removal as tree parts, m3 yr-1

R = ratio of below-ground biomass to above-ground biomass, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)-1; R must be set to zero if assuming no changes of below-ground biomass allocation patterns. (Tier 1)

CF = carbon fraction of dry matter, tonne C (tonne d.m.)-1

D = basic wood density, tonnes d.m. m-3

BCEF R = biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark), tonnes biomass removal (m^3 of removals)-1, (see Table 4.5 for Forest Land). However, if BCEFR values are not available and if the biomass expansion factor for wood removals (BEFR) and basic wood density (D) values are separately estimated, then the following conversion can be used: BCEF R = BEFR * D.

6.5.1.2.4.2 Choice of activity data

The total fuel wood was taken from DGF data and fuel wood conifers and conifers were calculated using shares of DGF expert judgement according to the next table.

Table 586 Wood fuel (coniferous and non-coniferous)

Age of tree/stand	Wood fuel, coniferous	Percentage	Source
	<20	40%	DGF (expert judgment)
	21-40	20%	
	41-100	10%	
	100 -200	10%	

	>200	20%	
	Wood fuel, non-coniferous		
	<20	40%	DGF (expert judgment)
	21-40	40%	
	41-100	5%	
	100 -200	5%	
	>200	10%	

Table 587 Fuel wood

	Total wood (commercial wood, fuelwood)	**Total fuel wood**	**Fuel wood conifers**	**Fuel wood Non-conifers**	**Source**
	m³	**m³**	**m³**	**m³**	
1990	123,990	57,516	47,374	10,142	**DGF**
1991	172,048	79,809	65,736	14,073	
1992	138,711	64,345	52,999	11,346	
1993	239,220	110,969	91,401	19,568	
1994	165,980	76,995	63,418	13,577	
1995	193,893	89,943	74,083	15,860	
1996	189,943	88,111	72,574	15,537	
1997	202,771	94,061	77,475	16,586	
1998	221,700	102,842	84,707	18,134	
1999	201,520	93,481	76,997	16,484	
2000	185,506	70,210	57,830	12,380	
2001	129,632	39,406	32,457	6,949	
2002	121,120	44,472	36,630	7,842	
2003	164,232	128,516	105,854	22,662	
2004	184,379	89,835	73,994	15,841	
2005	140,805	96,400	79,401	16,999	
2006	141,180	87,519	72,087	15,433	
2007	154,471	106,006	87,314	18,692	
2008	120,900	58,064	47,826	10,239	
2009	139,312	76,130	62,706	13,424	
2010	135,377	61,165	50,380	10,786	
2011	118,836	44,504	36,657	7,848	
2012	102,354	42,138	34,708	7,430	
2013	112,149	39,960	32,914	7,046	
2014	119,231	44,953	37,026	7,927	
2015	92,849	28,708	23,646	5,062	
2016	112,425	30,573	25,182	5,391	
2017	96,673	75,206	61,944	13,261	

	Total wood (commercial wood, fuelwood)	Total fuel wood	Fuel wood conifers	Fuel wood Non-conifers	Source
	m^3	m^3	m^3	m^3	
2018	186,295	113,398	93,402	19,996	
2019	135,772	70,147	57,778	12,369	
2020	74,039	48,383	39,851	8,531	
Trend					
1990 - 2020	-40%	-16%	-16%	-16%	
2005 - 2020	-47%	-50%	-50%	-50%	
2019 - 2020	-45%	-31%	-31%	-31%	

6.5.1.2.4.3 Choice of removal factors

The default value for above-ground net biomass growth (CF) were taken from Table 4.3 of the 2006 IPCC Guidelines.

Table 588 Above-ground net biomass growth in tropical and sub-tropical natural forest

Domain	Part of tree	Carbon fraction, (CF)	
		[tonne C (tonne d.m.)$^{-1}$]	
Default value	All	0.47	
	All	0.47	(0.44 - 0.49)
	wood	0.49	
	wood, tree d < 10 cm	0.46	
	wood, tree d ≥ 10 cm	0.49	
	foliage	0.47	
	foliage, tree d < 10 cm	0.43	
Tropical and Subtropical	foliage, tree d ≥ 10 cm	0.46	
	All	0.47	(0.47 - 0.49)
	broad-leaved	0.48	(0.46 - 0.50)
Temperate and Boreal	Conifers	0.51	(0.47 - 0.55)
Sources: Carbon fraction of aboveground forest biomass, 2006 IPCC Guidelines, Volume 4, Chapter 4			

The default values for biomass conversion and expansion factor for conversion of removals in merchantable volume to biomass removals including bark ($BCEF_R$) were taken from Tables 4.5 of the 2006 IPCC Guidelines.

Table 589 Default biomass conversion and expansion factors (BCEF), tons biomass (m3 of wood volume)-1

Default biomass conversion and expansion factors (BCEF) (tons biomass (m3 of wood volume)$^{-1}$)										
Climatic zone	**Forest type**	**BCEF**	**Growing stock level (m^3)**							
			<20		**21-40**		**41-80**		**>80**	
Mediterranean, dry tropical, subtropical	hardwoods	$BCEF_S$	**5**	2.0-8.0	**1,9**	1.0-2.6	**0,8**	0.6-1.4	**0,66**	0.4-0.9
		$BCEF_I$	1,5		0,5		0,55		0,66	
		$BCEF_R$	5,55		2,11		0,89		0,73	
	conifers	$BCEF_S$	**6**	3.0-8.0	**1,2**	0.5-2.0	**0,6**	0.4-0.9	0,55	0.4-0.7
		$BCEF_I$	1,5		0,4		0,45		0,54	
		$BCEF_R$	6,67		1,33		0,67		0,61	
Sources: Table 4.5 Default biomass conversion and expansion factors; 2006 IPCC Guidelines, Volume 4, Chapter 4										

The ratio of below to above-ground biomass is assumed to be zero if assuming no changes of below-ground biomass allocation patterns (TIER 1).

Table 590 Exemplary calculation of Annual carbon loss due to fuelwood removal.

4.A.1 Forest Land Remaining Forest Land: Loss of carbon from fuelwood removals						
	Parameter	**Unit**	**Formula**	**Source**	**Comment**	**2020**
FG_{trees}	Annual volume of fuelwood removal of whole trees	m3 yr^{-1}		**DGF -**	**Wood fuel, coniferous; <20**	15,940
$BCEF_R$	Biomass conversion and expansion factor for conversion of removals in merchantable volume to biomass removals (including bark)	tons of biomass removals (m3 of removals) $^{-1}$	-	Table 4.4, Chap 5, Vol. 4, 2006 IPCC GL	Subtropical steppe - Africa	6.67
R	Ratio of below-ground biomass to above-ground biomass	tonnes bg dm (tonne ag dm)$^{-1}$	-	Table 4.4, Chap 4, Vol. 4, 2006 IPCC GL	Subtropical steppe	0
FG_{part}	Annual volume of fuelwood removal as tree parts	m3 yr^{-1}	-		Expert judgement: included in volume of fuelwood removal of whole trees	IE
D	Basic wood density	tonnes m^{-3}	-		Expert judgement	0.50
CF	Carbon fraction of dry matter	tonnes C (tonne dm)$^{-1}$		Table 4.3, Chap 4, Vol. 4, 2006 IPCC GL	Default value	0.47
$L_{fuelwood}$	**carbon loss due to fuelwood removal**	**tonnes C yr^{-1}**	[FG_{trees} * BCEFR * (1+R) + FGpart * D] * CF	**Equation 2.14, Chap 2, Vol. 4, 2006 IPCC GL**		**49,972**

6.5.1.2.5 Annual carbon loss due to disturbance in Forest Land Remaining Forest Land

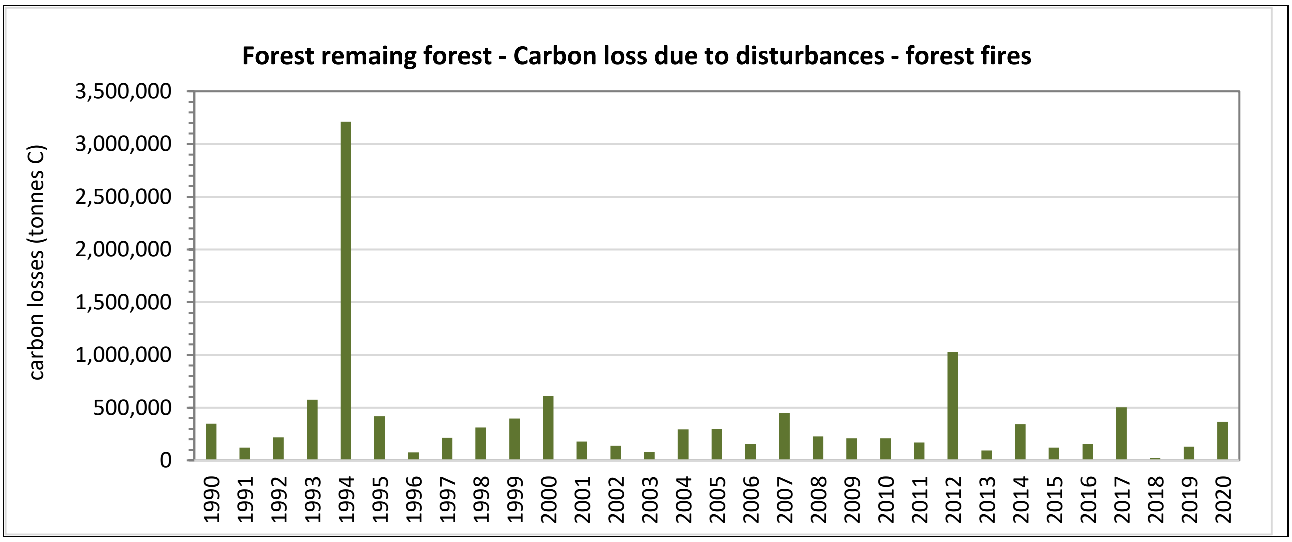

Figure 233 **Carbon loss due to disturbance (forest fires) in IPCC category 4.A.1 LULUCF (1990-2020)**

Table 591 Carbon loss due to biomass removals

	CO_2 emission	Carbon loss due to disturbance (forest fires)		
		Total = forest and maquis	forest	maquis
	kt	tonnes C		
1990	1,280.31	349,175.02	2,631,741	89,823
1991	438.47	119,581.95	381,795	39,065
1992	804.15	219,313.47	58,253	38,279
1993	2,108.25	574,978.30	180,548	158,863
1994	11,777.31	3,211,993.89	211,054	580,253
1995	1,528.66	416,906.19	328,208	35,112
1996	281.67	76,818.97	467,183	18,566
1997	784.66	213,998.06	130,816	33,450
1998	1,144.33	312,089.65	97,999	101,035
1999	1,459.03	397,918.55	49,274	69,711
2000	2,244.42	612,113.76	99,091	144,931
2001	653.45	178,212.35	198,235	47,397
2002	509.33	138,907.16	118,442	40,908
2003	301.15	82,131.22	315,461	32,857
2004	1,079.49	294,407.45	138,164	195,317
2005	1,083.16	295,406.32	132,174	97,171
2006	566.66	154,543.24	135,317	36,101
2007	1,646.76	449,117.14	116,436	133,656
2008	836.83	228,226.44	734,299	90,062
2009	764.43	208,481.12	50,682	76,307
2010	768.97	209,720.43	224,673	74,403
2011	621.97	169,628.48	82,228	53,192

	CO_2 emission	Carbon loss due to disturbance (forest fires)		
		Total = forest and maquis	forest	maquis
	kt	tonnes C		
2012	3,770.06	1,028,197.35	94,963	293,898
2013	347.85	94,867.10	385,473	44,185
2014	1,255.70	342,463.82	14,979	117,790
2015	447.76	122,116.50	82,332	39,889
2016	580.49	158,315.95	211,113	63,353
2017	1,846.69	503,642.08	2,631,741	118,169
2018	79.54	21,692.30	381,795	6,713
2019	479.08	130,658.91	58,253	48,327
2020	1,339.28	365,257.63	180,548	154,145

6.5.1.2.5.1 Choice of method

A generic approach for estimating the amount of carbon lost from disturbances is provided in Equation 2.14 n Chapter 2 of Volume 4 of the 2006 IPCC GL. In the specific case of losses from fire on managed land, including wildfires and controlled fires, this method should be used to provide input to the methodology to estimate CO2 and non-CO2 emissions from fires. The Tier 1 assumption is that all of fuelwood is emitted in the year of disturbance:

Equation 2.14: Annual carbon losses in biomass due to disturbances

(2006 IPCC Guidelines, Volume 4, Chapter 2)

$$\mathrm{L}_{distrubance} = \{A_{distrubance} * B_w * (1 + R) * CF * fd$$

Where:

$L_{\text{disturbance}}$ = annual other losses of carbon, tonnes C yr-1

(Note that this is the amount of biomass that is lost from the total biomass. The partitioning of biomass that is transferred to dead organic matter and biomass that is oxidized and released to the atmosphere is explained in Equations 2.15 and 2.16).

$A_{\text{disturbance}}$ = area affected by disturbances, ha yr^{-1} ,

B_W = average above-ground biomass of land areas affected by disturbances, tonnes d.m. ha^{-1},

R = ratio of below-ground biomass to above-ground biomass, in tonne d.m. below-ground biomass (tonne d.m. above-ground biomass)-1. R must be set to zero if no changes of below-ground biomass are assumed (Tier 1)

C_F = carbon fraction of dry matter, tonne C (tonnes d.m.)-1

fd = fraction of biomass lost in disturbance (see note below)

Equation 2.14 does not specify the fate of the carbon removed from the biomass carbon stock. The Tier 1 assumption is that all of $L_{\text{disturbances}}$ is emitted in the year of disturbance.

6.5.1.2.5.2 Choice of activity data

The area affected by disturbances was taken from DGF data for the time series 1990-2020.

Forest fires were mainly caused by unattended campfires, the burning of rubbish, the use and malfunction of equipment, negligently discarded cigarettes and deliberate arson. The risk for forest fires increased due to climate change that causes drought and heat waves. The most marked period is that corresponding to the year 1994 when the burnt areas reached a record figure of 270,000 ha, this period corresponds to the political instability that Algeria experienced (period of terrorism).

Table 592 Area affected by disturbances

	Total area affected by disturbances	**Forest Area affected by disturbances**	**Maquis Area affected by disturbances**	**Source**
	ha	**ha**	**ha**	
1990	20,149.34	20,149.34	0.00	DGF
1991	9,525.79	6,091.24	3,434.55	
1992	16,435.36	13,069.86	3,365.50	
1993	45,053.82	31,086.61	13,967.21	
1994	243,365.65	192,349.89	51,015.76	
1995	30,391.81	27,304.81	3,087.00	
1996	6,062.67	4,430.34	1,632.33	
1997	16,008.28	13,067.35	2,940.93	
1998	24,476.12	15,593.11	8,883.01	
1999	29,373.24	23,244.26	6,128.98	
2000	48,359.80	35,617.51	12,742.29	
2001	13,233.51	9,066.40	4,167.11	
2002	10,556.57	6,959.94	3,596.63	
2003	6,626.49	3,737.69	2,888.79	
2004	24,182.78	7,010.58	17,172.20	
2005	22,826.28	14,283.01	8,543.27	
2006	11,785.00	8,611.00	3,174.00	
2007	35,202.35	23,451.31	11,751.04	
2008	18,495.79	10,577.53	7,918.26	
2009	18,478.72	11,769.85	6,708.87	
2010	17,549.84	11,008.31	6,541.53	
2011	13,725.00	9,048.33	4,676.66	
2012	78,043.28	52,203.81	25,839.47	
2013	7,611.69	3,726.97	3,884.72	
2014	26,014.59	15,658.48	10,356.11	
2015	3,791.00	5,716.00	3,503.00	
2016	12,290.00	6,720.00	5,570.00	
2017	39,230.64	28,841.25	10,389.39	

	Total area affected by disturbances	Forest Area affected by disturbances	Maquis Area affected by disturbances	Source
	ha	ha	ha	
2018	1,625.17	1,034.98	590.19	
2019	10,293.50	6,044.58	4,248.92	
2020	29,139.41	15,587.04	13,552.37	
Trend				
1990 - 2020	45%	-23%	NE	
2005 - 2020	28%	9%	59%	
2019 - 2020	183%	158%	219%	

6.5.1.2.5.3 Choice of disturbances factors

The default values for above-ground biomass of areas affected were taken from table 4.7 of the 2019 Refinements to the 2006 IPCC GL

Table 593 Above-ground biomass in forests

Domain	**Ecological zone**	**Continent**	**Status/condition**	**Above-ground biomass**	**Status in Algeria**
				(tonnes d.m. ha^{-1})	
Subtropical	Subtropical humid forest	Africa	Primary	54.1	Not occurring (NO)
			Secondary >20 years		
			Secondary ≤20 years		
	Subtropical dry forest	Africa	Primary	65.2	Zones de Montagne (ZdM)
			Secondary >20 years		
			Secondary ≤20 years		
	Subtropical steppe	Africa	Primary	50.5	Sud
			Secondary >20 years		
			Secondary ≤20 years		
	Subtropical mountain systems	Africa	Primary	35.1	HAUTS PLATEAUX (HPI)
			Secondary >20 years		
			Secondary ≤20 years		
Sources: able 4.7 Above-ground biomass in forests; 2006 IPCC Guidelines, Volume 4, Chapter 4					

The ratio of below to above-ground biomass is assumed to be zero if assuming no changes of below-ground biomass allocation patterns (TIER 1).

Table 594 Exemplary calculation of Loss of carbon from disturbance

4.A.1Forest Land Remaining Forest Land: Loss of carbon from disturbance in forest						
#	**Parameter**	**Unit**	**Formula**	**Source**	**Comment**	**2020**
$A_{disturbance}$	Area affected by disturbances	ha yr^{-1}		**DFG - Total (Forêt+ Maquis)**	Subtropical humid forest	9,386
B_W	Average above-ground biomass of areas affected	tonnes dm ha^{-1}	-	Table 4.7, Chap 4, 2019 Refine to 2006 IPCC GL	Subtropical humid forest	54.1
R	Ratio of below-ground biomass to above-ground biomass	tonnes bg dm (tonne ag $dm)^{-1}$	-	Table 4.4, Chap 4, Vol. 4, 2006 IPCC GL	Subtropical steppe	0
CF	Carbon fraction of dry matter	tonnes C (tonne $dm)^{-1}$	-	Table 4.3, Chap 4, Vol. 4, 2006 IPCC GL	Default value	0.47
f_d	fraction of biomass lost in disturbance	-	-	page A1.12, 3B1a - Sheet 4 of 4, Annex 1: Worksheets, Vol. 4, 2006 IPCC GL	a stand-replacing disturbance will kill all (fd = 1) biomass while an insect disturbance may only remove a portion (e.g. fd = 0.3) of the average biomass C density.	0.5
$L_{disturbances}$	**losses of carbon due to disturbances**	**tonnes C yr^{-1}**	**$A*B_W*(1+R)*CF*fd$**	**Equation 2.14, Chap 2, Vol. 4, 2006 IPCC GL**	**area affected by forest fires**	**119,335**
$L_{disturbances}$	CO_2 emission (t)	tonnes CO2 yr^{-1}	$L_{disturbance}$ * 44/12		Conversion of C stock changes to CO2 emissions	437,561
$L_{disturbances}$	**CO_2 emission**	**kt CO2 yr^{-1}**	CO_2 emission (t)/1000			**437.56**

6.5.1.3 Uncertainty assessment and time-series consistency

No uncertainties provided for LULUCF due to lack of detailed information of background data of activity data.

6.5.1.4 Source-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
  - documented sources,
  - use of units,
  - strictly defined interfaces between spreadsheets/calculation modules,
  - unique structure of sheets which do the same,
  - record keeping, use of write protection,
  - unique use of formulas, special cases are documented/highlighted,
  - quick-control checks for data consistency through all steps of calculation.
- time series consistency (plausibility checks of dips and jumps).

6.5.1.5 Category-specific recalculations including explanatory information and justifications

The IPCC category 4.B Cropland was not estimated due to lack of resources and data.

6.5.1.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 595 Planned improvements for IPCC category 4.A Forestland

GHG source & sink category	Planned improvement	Type of improvement		Priority
4.A.1	Collection of activity data	AD	Accuracy Transparency Comparability Completeness Consistency	High
4.A.2	Collection of country specific parameter	EF		High
4.A.2	Estimation of emissions and removal			

6.1 Cropland (IPCC category 4.B) - Other land (IPCC category 4.F)

The IPCC category 4.B Cropland was not estimated due to lack of resources and data.

6.1.1 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 596 Planned improvements for IPCC category 4.B Cropland - IPCC category 4.F Other land.

GHG source & sink category	Planned improvement	Type of improvement		Priority
4.B – 4.F	Application of methodology of 2006 IPCC Guidelines and guidance of 2019 refinements to the 2006 IPCC Guidelines	AD	Accuracy Transparency Comparability Completeness Consistency	High
4.B – 4.F	Collection of activity data and parameter	EF		Medium

7 Waste (IPCC sector 5)

7.1 Overview of sector

This chapter includes information on and description of methodologies used for estimating GHG emissions, as well as references to activity data and emission factors reported under IPCC Sector *5 – Waste* for the period 1990 to 2020. In the Waste sector emissions of CO_2, CH_4 and N_2O originate from the IPCC categories:

- 5.A Solid waste disposal,
- 5.B Biological treatment of solid waste,
- 5.C Incineration and open burning of waste,
- 5.D Wastewater treatment and discharge.

7.2 Emission trends

Overall GHG emissions from management and treatment of solid waste and wastewater amounted to 3,454.82kt CO_2 eq in 1990 and amounted to 9,132.21kt CO_2 eq in 2020. In 2020, GHG emissions from the waste sector were 164.3% above the level of 1990. The GHG emissions from waste sector are about 4.3% of total greenhouse gas emissions in Algeria in 2020 and 3.9% in 1990. In the period, 2005 to 2020 GHG emissions from the Waste sector increased by 57.5% and in the period 2019 to 2020 GHG emissions from the Waste sector increased by 3.0%. The reasons for the significant increase in emissions are, on the one hand, the strong population growth and, on the other hand, the growing waste generation rate.

The major GHG emitted from this sector is CH_4, which represents 86.8% of all emissions from this sector in 2020, followed by N_2O with 8.8% and CO_2 with 4.5%.

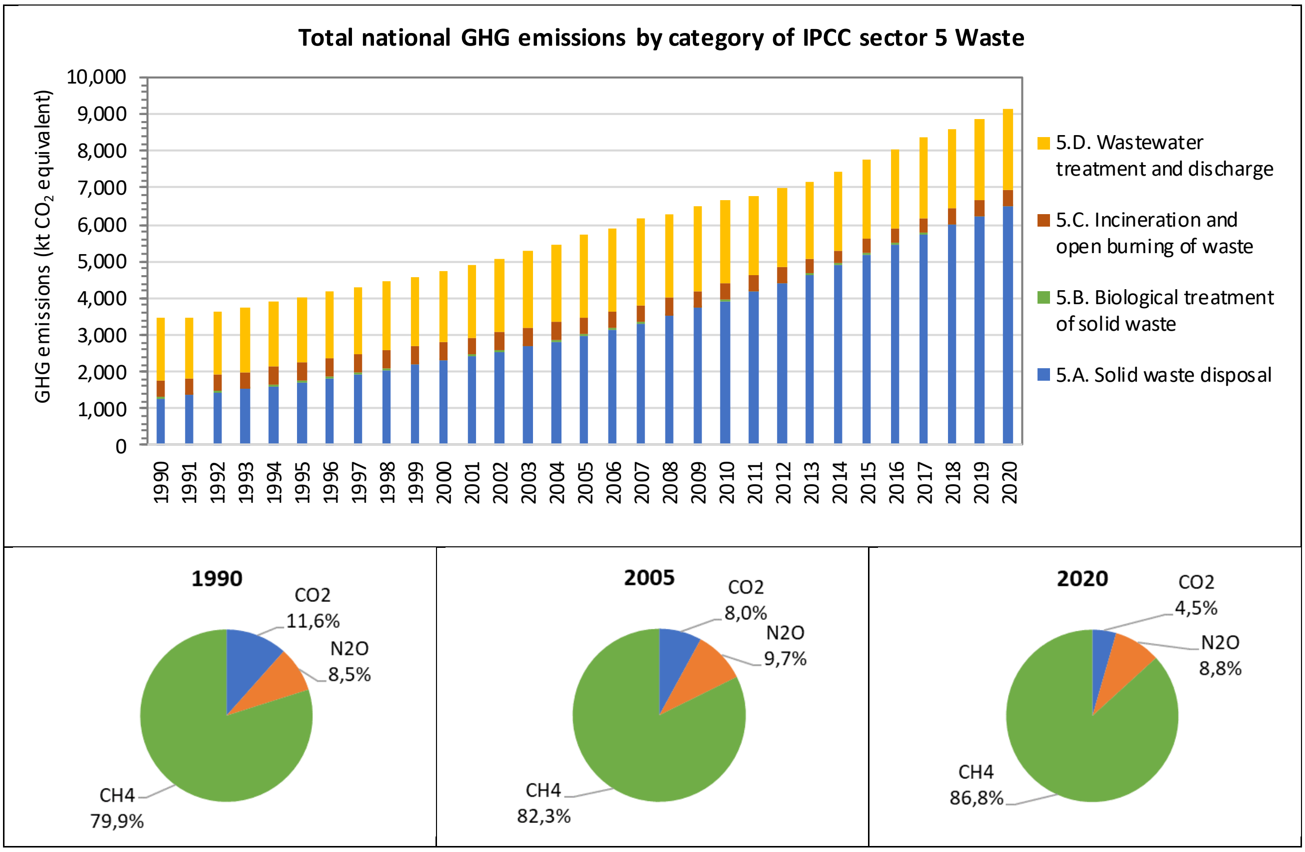

Figure 234 Trend of GHG emissions from IPCC sector Waste and Share of GHG

CH_4 emissions

CH_4 emissions from Waste sector amounted to 316.9 kt in 2020 which is 187% above the level of 1990 (110.4kt). CH_4 emissions originate from all sub-categories within this sector, but the largest source is 5.A Solid Waste Disposal, contributing 82% to total CH_4 emissions from this sector.

The increase of CH_4 emissions is a result of strong population growth and growing waste generation rate at the same time. The amount of landfilled waste increased significantly with still a high organic fraction within this waste. Furthermore, the high number of unmanaged landfill sites, where limited soil cover, poor waste compaction, high leachate levels, and other conditions, does not allow to control the landfill gas generation or methane recovery. Flaring takes place on some landfills but currently not data are available therefore the notation key NO was used. Furthermore, the increasing number of inhabitants connected to septic tanks or cesspools contributed to the CH_4 emissions.

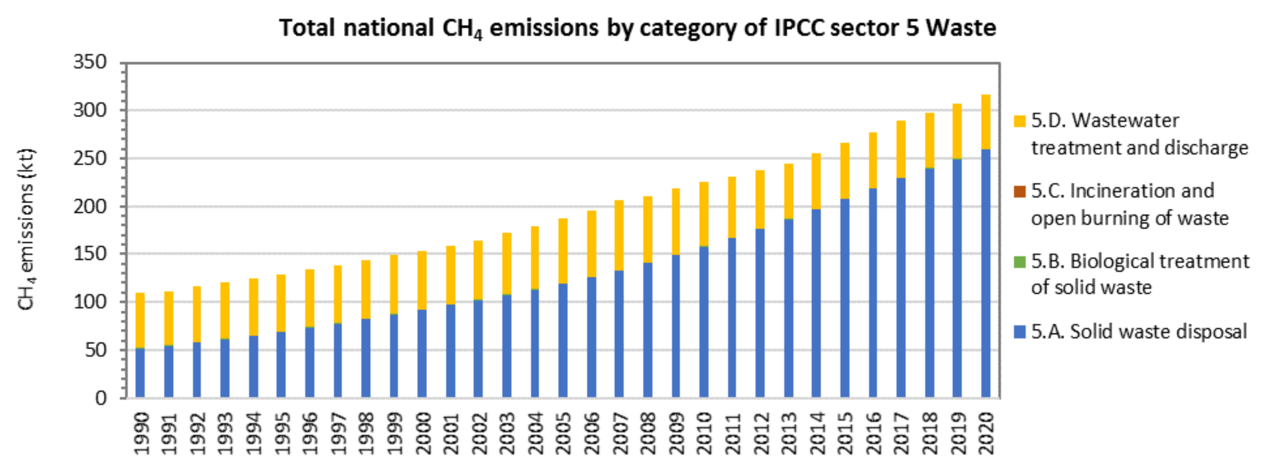

Figure 235 Trend of CH4 emissions from IPCC sector 5 Waste by category

CO_2 emissions

In the period 1990 to 2020 CO_2 emissions from the Waste Sector increased by 2.2% from 399.9 kt CO_2 in 1990 to 408.9 kt CO_2 in 2020. In the period 2005 to 2020 GHG emissions from the Waste sector decreased by 9.9%. In the period 2019 to 2020. CO_2 emissions from the Waste sector increased by 2.2%. CO_2 emissions originate from waste incineration (mainly open burning). The reasons for the significant increase in emissions are, on the one hand, the strong population growth and, on the other hand, the growing waste generation rate.

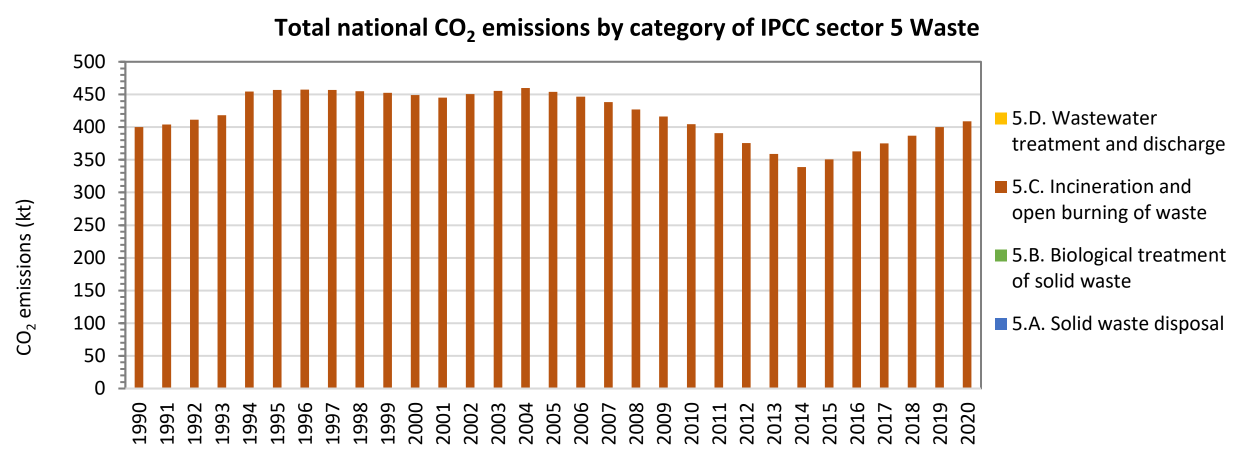

Figure 236 Trend of CO_2 emissions from IPCC sector 5 Waste by category

N_2O emissions

In the period 1990 to 2020 N_2O emissions from the Waste Sector increased by 171.9% from 0.9 kt N_2O in 1990 to 2.7 kt N_2O in 2020. In the period 2005 to 2020 GHG emissions from the Waste sector increased by 44.1%. In the period 2019 to 2020 N_2O emissions from the Waste sector decreased by 0.9%. N_2O emissions originate with 87.5% from 5.D. Wastewater Treatment and Discharge, but also to a small extent from 5.B Biological Treatment of Solid Waste. In both categories, emissions are increasing due to increasing population and wastewater treatment management. N_2O from waste incineration of municipal solid waste is a minor source of N_2O emissions.

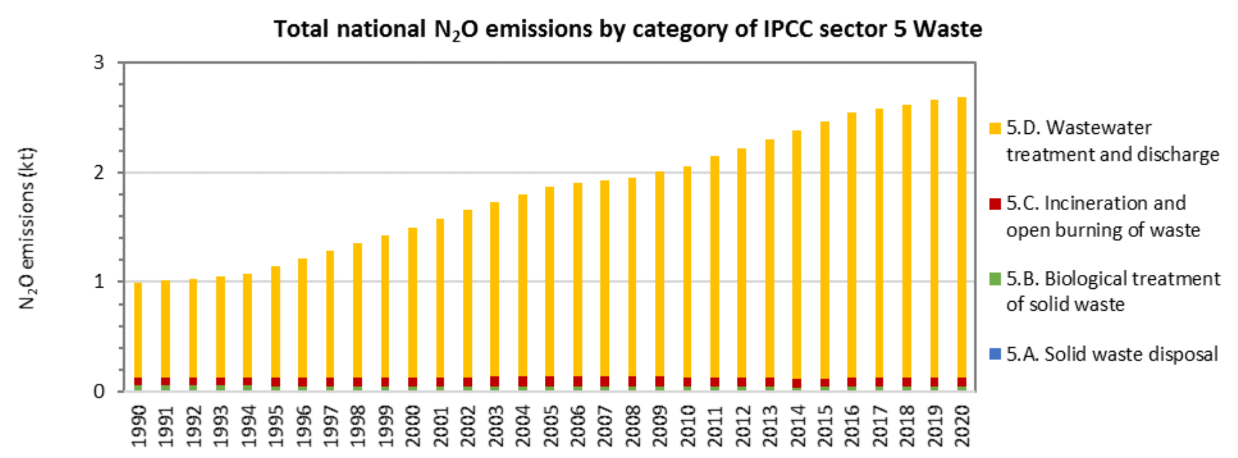

Figure 237 Trend of N_2O emissions from IPCC sector 5 Waste by category

Table 597 GHG Emissions from IPCC sector 5 Waste

	TOTAL GHG	**CO_2**	**CH_4**	**N_2O**	**CH_4**	**N_2O**
	kt CO_2 **equivalent**	**kt**	**kt** CO_2 **equivalent**	**kt** CO_2 **equivalent**	**kt**	**kt**
1990	3,454.82	399.95	2,760.26	294.61	110.41	0.99
1991	3,495.04	403.84	2,789.91	301.30	111.60	1.01
1992	3,617.75	411.51	2,898.20	308.04	115.93	1.03
1993	3,735.21	418.49	3,002.02	314.70	120.08	1.06
1994	3,884.40	454.66	3,108.36	321.38	124.33	1.08
1995	4,033.24	456.88	3,234.43	341.93	129.38	1.15
1996	4,174.98	457.41	3,355.24	362.32	134.21	1.22
1997	4,312.50	456.77	3,472.86	382.86	138.91	1.28
1998	4,451.45	455.11	3,592.69	403.65	143.71	1.35
1999	4,595.33	452.62	3,717.84	424.88	148.71	1.43
2000	4,738.64	449.25	3,842.93	446.46	153.72	1.50
2001	4,890.65	445.25	3,976.72	468.68	159.07	1.57
2002	5,058.06	450.71	4,114.01	493.34	164.56	1.66
2003	5,281.39	455.62	4,309.33	516.43	172.37	1.73
2004	5,463.65	460.11	4,465.64	537.90	178.63	1.81
2005	5,707.73	454.06	4,697.70	555.97	187.91	1.87
2006	5,905.90	446.82	4,892.51	566.57	195.70	1.90
2007	6,169.31	438.43	5,155.07	575.81	206.20	1.93
2008	6,282.86	426.95	5,275.00	580.90	211.00	1.95
2009	6,492.79	416.47	5,478.76	597.56	219.15	2.01
2010	6,644.27	404.62	5,626.83	612.83	225.07	2.06
2011	6,796.20	390.83	5,765.72	639.65	230.63	2.15
2012	6,971.82	375.63	5,935.06	661.13	237.40	2.22
2013	7,155.99	359.17	6,109.90	686.92	244.40	2.31
2014	7,432.16	338.90	6,383.56	709.71	255.34	2.38
2015	7,746.10	350.90	6,660.04	735.16	266.40	2.47
2016	8,052.22	363.06	6,930.03	759.13	277.20	2.55
2017	8,377.25	375.28	7,231.69	770.28	289.27	2.58
2018	8,605.51	387.18	7,440.09	778.24	297.60	2.61
2019	8,860.28	400.02	7,666.81	793.46	306.67	2.66
2020	9,132.21	408.90	7,922.38	800.93	316.90	2.69
Trend						
1990 - 2020	164.33%	2.24%	187.02%	171.9%	187.0%	171.86%
2005 - 2020	60.00%	-9.95%	68.64%	44.1%	68.6%	44.06%
2019 - 2020	3.07%	2.22%	-3.23%	0.9%	3.3%	0.94%

Table 598 GHG Emissions from IPCC sector 5 Waste in CO_2 equivalents

GHG Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
1990	3,454.82	1,278.19	NO	1,278.19	NO	39.46	39.46	NO	420.46	NO	401.79	1,716.70	1,716.70	NO	NO
1991	3,495.04	1,362.70	NO	1,362.70	NO	38.96	38.96	NO	424.85	NO	405.72	1,668.53	1,668.53	NO	NO
1992	3,617.75	1,441.15	NO	1,441.15	NO	38.45	38.45	NO	433.01	NO	413.44	1,705.13	1,705.13	NO	NO
1993	3,735.21	1,523.37	NO	1,523.37	NO	37.90	37.90	NO	440.47	NO	420.46	1,733.47	1,733.47	NO	NO
1994	3,884.40	1,609.41	NO	1,609.41	NO	37.98	37.98	NO	477.09	NO	456.67	1,759.93	1,759.93	NO	NO
1995	4,033.24	1,718.18	NO	1,718.18	NO	37.27	37.27	NO	479.70	NO	458.92	1,798.09	1,798.09	NO	NO
1996	4,174.98	1,828.70	NO	1,828.70	NO	36.48	36.48	NO	480.57	NO	459.49	1,829.23	1,829.23	NO	NO
1997	4,312.50	1,940.62	NO	1,940.62	NO	35.65	35.65	NO	480.23	NO	458.87	1,856.01	1,856.01	NO	NO
1998	4,451.45	2,053.81	NO	2,053.81	NO	34.79	34.79	NO	478.84	NO	457.24	1,884.01	1,884.01	NO	NO
1999	4,595.33	2,175.40	NO	2,175.40	NO	33.94	33.94	NO	476.61	NO	454.77	1,909.38	1,909.38	NO	NO
2000	4,738.64	2,298.03	NO	2,298.03	NO	33.08	33.08	NO	473.49	NO	451.42	1,934.04	1,934.04	NO	NO
2001	4,890.65	2,421.74	NO	2,421.74	NO	32.25	32.25	NO	469.72	NO	447.44	1,966.94	1,966.94	NO	NO
2002	5,058.06	2,547.57	NO	2,547.57	NO	32.62	32.62	NO	476.66	NO	453.04	2,001.20	2,001.20	NO	NO
2003	5,281.39	2,677.30	NO	2,677.30	NO	32.91	32.91	NO	483.08	NO	458.09	2,088.10	2,088.10	NO	NO
2004	5,463.65	2,811.15	303.91	2,507.24	NO	33.13	33.13	NO	489.09	NO	462.71	2,130.29	2,130.29	NO	NO
2005	5,707.73	2,970.97	428.92	2,542.05	NO	33.17	33.17	NO	482.89	NO	456.65	2,220.70	2,220.70	NO	NO
2006	5,905.90	3,140.55	566.25	2,574.30	NO	33.12	33.12	NO	475.40	NO	449.38	2,256.82	2,256.82	NO	NO
2007	6,169.31	3,320.45	716.70	2,603.75	NO	33.00	33.00	NO	466.67	NO	440.96	2,349.20	2,349.20	NO	NO
2008	6,282.86	3,511.31	881.15	2,630.16	NO	32.64	32.64	NO	454.63	NO	429.44	2,284.28	2,284.28	NO	NO

GHG Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
2009	6,492.79	3,718.15	1,061.81	2,656.33	NO	32.41	32.41	NO	443.70	NO	418.91	2,298.53	2,298.53	NO	NO
2010	6,644.27	3,935.52	1,258.32	2,677.20	NO	32.09	32.09	NE	431.30	NO	407.01	2,245.36	2,245.36	NO	NO
2011	6,796.20	4,165.79	1,472.34	2,693.45	NO	31.67	31.67	NE	416.86	NO	393.16	2,181.88	2,181.88	NO	NO
2012	6,971.82	4,402.00	1,701.88	2,700.13	NO	30.78	30.78	NE	400.91	NO	377.90	2,138.13	2,138.13	NO	NO
2013	7,155.99	4,650.69	1,950.26	2,700.43	NO	29.83	29.83	NE	383.62	NO	361.36	2,091.85	2,091.85	NO	NO
2014	7,432.16	4,916.36	2,220.70	2,695.65	NO	28.79	28.79	NE	362.39	NO	341.00	2,124.62	2,124.62	NO	NO
2015	7,746.10	5,192.56	2,555.41	2,637.15	NO	29.50	29.50	NE	375.15	NO	353.07	2,148.89	2,148.89	NO	NO
2016	8,052.22	5,463.70	2,351.31	3,112.39	NO	30.19	30.19	NE	388.05	NO	365.30	2,170.28	2,170.28	NO	NO
2017	8,377.25	5,726.83	2,499.77	3,227.06	NO	30.87	30.87	NE	401.00	NO	377.59	2,218.55	2,218.55	NO	NO
2018	8,605.51	5,980.95	2,364.07	3,616.88	NO	31.49	31.49	NE	413.58	NO	389.55	2,179.49	2,179.49	NO	NO
2019	8,860.28	6,216.25	3,126.45	3,089.79	NO	31.23	31.23	NE	427.06	NO	402.44	2,185.75	2,185.75	NO	NO
2020	9,132.21	6,475.52	3,306.82	3,168.69	NO	30.60	30.60	NE	436.29	NO	411.36	2,189.80	2,189.80	NO	NO
Trend															
1990 - 2020	164.33%	406.62%	NA	147.90%	NA	-22.45%	-22.45%	NA	3.76%	NA	3,76%	27.56%	27.56%	NA	NA
2005 - 2020	60.00%	117.96%	670.97%	24.65%	NA	-7.74%	-7.74%	NA	-9.65%	NA	-9,65%	-1.39%	-1.39%	NA	NA
2019 - 2020	3.07%	4.17%	5.77%	2.55%	NA	-2.02%	-2.02%	NA	2.16%	NA	2,16%	0.19%	0.19%	NA	NA

Table 599 CO$_2$ Emissions from IPCC sector 5 Waste in kt

CO$_2$ Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	399.95	NA	NA	NA	NA	NA	NA	NA	399.95	NE	399.95	NA	NA	NA	NO
1991	403.84	NA	NA	NA	NA	NA	NA	NA	403.84	NE	403.84	NA	NA	NA	NO
1992	411.51	NA	NA	NA	NA	NA	NA	NA	411.51	NE	411.51	NA	NA	NA	NO
1993	418.49	NA	NA	NA	NA	NA	NA	NA	418.49	NE	418.49	NA	NA	NA	NO
1994	454.66	NA	NA	NA	NA	NA	NA	NA	454.66	NE	454.66	NA	NA	NA	NO
1995	456.88	NA	NA	NA	NA	NA	NA	NA	456.88	NE	456.88	NA	NA	NA	NO
1996	457.41	NA	NA	NA	NA	NA	NA	NA	457.41	NE	457.41	NA	NA	NA	NO
1997	456.77	NA	NA	NA	NA	NA	NA	NA	456.77	NE	456.77	NA	NA	NA	NO
1998	455.11	NA	NA	NA	NA	NA	NA	NA	455.11	NE	455.11	NA	NA	NA	NO
1999	452.62	NA	NA	NA	NA	NA	NA	NA	452.62	NE	452.62	NA	NA	NA	NO
2000	449.25	NA	NA	NA	NA	NA	NA	NA	449.25	NE	449.25	NA	NA	NA	NO
2001	445.25	NA	NA	NA	NA	NA	NA	NA	445.25	NE	445.25	NA	NA	NA	NO
2002	450.71	NA	NA	NA	NA	NA	NA	NA	450.71	NE	450.71	NA	NA	NA	NO
2003	455.62	NA	NA	NA	NA	NA	NA	NA	455.62	NE	455.62	NA	NA	NA	NO
2004	460.11	NA	NA	NA	NA	NA	NA	NA	460.11	NE	460.11	NA	NA	NA	NO
2005	454.06	NA	NA	NA	NA	NA	NA	NA	454.06	NE	454.06	NA	NA	NA	NO
2006	446.82	NA	NA	NA	NA	NA	NA	NA	446.82	NE	446.82	NA	NA	NA	NO
2007	438.43	NA	NA	NA	NA	NA	NA	NA	438.43	NE	438.43	NA	NA	NA	NO
2008	426.95	NA	NA	NA	NA	NA	NA	NA	426.95	NE	426.95	NA	NA	NA	NO
2009	416.47	NA	NA	NA	NA	NA	NA	NA	416.47	NE	416.47	NA	NA	NA	NO
2010	404.62	NA	NA	NA	NA	NA	NA	NE	404.62	NE	404.62	NA	NA	NA	NO

CO_2 Emissions

	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2011	390.83	NA	NA	NA	NA	NA	NA	NE	390.83	NE	390.83	NA	NA	NA	NO
2012	375.63	NA	NA	NA	NA	NA	NA	NE	375.63	NE	375.63	NA	NA	NA	NO
2013	359.17	NA	NA	NA	NA	NA	NA	NE	359.17	NE	359.17	NA	NA	NA	NO
2014	338.90	NA	NA	NA	NA	NA	NA	NE	338.90	NE	338.90	NA	NA	NA	NO
2015	350.90	NA	NA	NA	NA	NA	NA	NE	350.90	NE	350.90	NA	NA	NA	NO
2016	363.06	NA	NA	NA	NA	NA	NA	NE	363.06	NE	363.06	NA	NA	NA	NO
2017	375.28	NA	NA	NA	NA	NA	NA	NE	375.28	NE	375.28	NA	NA	NA	NO
2018	387.18	NA	NA	NA	NA	NA	NA	NE	387.18	NE	387.18	NA	NA	NA	NO
2019	400.02	NA	NA	NA	NA	NA	NA	NE	400.02	NE	400.02	NA	NA	NA	NO
2020	408.90	NA	NA	NA	NA	NA	NA	NE	408.90	NE	408.90	NA	NA	NA	NO
Trend															
1990 - 2020	2.24%	NA	NA	NA	NA	NA	NA	NA	2.24%	NA	2.24%	NA	NA	NA	NA
2005 - 2020	-9.95%	NA	NA	NA	NA	NA	NA	NA	-9.95%	NA	-9.95%	NA	NA	NA	NA
2019 - 2020	2.22%	NA	NA	NA	NA	NA	NA	NA	2.22%	NA	2.22%	NA	NA	NA	NA

Table 600 CH_4 Emissions from IPCC sector 5 Waste in kt

CH_4 Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	110.41	51.13	NO	51.13	NO	0.92	0,92	NO	0.01	NE	0.01	58.36	58.36	IE	NO
1991	111.60	54.51	NO	54.51	NO	0.91	0,91	NO	0.01	NE	0.01	56.17	56.17	IE	NO
1992	115.93	57.65	NO	57.65	NO	0.90	0,90	NO	0.01	NE	0.01	57.38	57.38	IE	NO
1993	120.08	60.93	NO	60.93	NO	0.88	0,88	NO	0.01	NE	0.01	58.26	58.26	IE	NO
1994	124.33	64.38	NO	64.38	NO	0.89	0,89	NO	0.01	NE	0.01	59.07	59.07	IE	NO
1995	129.38	68.73	NO	68.73	NO	0.87	0,87	NO	0.01	NE	0.01	59.77	59.77	IE	NO
1996	134.21	73.15	NO	73.15	NO	0.85	0,85	NO	0.01	NE	0.01	60.20	60.20	IE	NO
1997	138.91	77.62	NO	77.62	NO	0.83	0,83	NO	0.01	NE	0.01	60.45	60.45	IE	NO
1998	143.71	82.15	NO	82.15	NO	0.81	0,81	NO	0.01	NE	0.01	60.74	60.74	IE	NO
1999	148.71	87.02	NO	87.02	NO	0.79	0,79	NO	0.01	NE	0.01	60.90	60.90	IE	NO
2000	153.72	91.92	NO	91.92	NO	0.77	0,77	NO	0.01	NE	0.01	61.02	61.02	IE	NO
2001	159.07	96.87	NO	96.87	NO	0.75	0,75	NO	0.01	NE	0.01	61.44	61.44	IE	NO
2002	164.56	101.90	NO	101.90	NO	0.76	0,76	NO	0.01	NE	0.01	61.89	61.89	IE	NO
2003	172.37	107.09	NO	107.09	NO	0.77	0,77	NO	0.01	NE	0.01	64.51	64.51	IE	NO
2004	178.63	112.45	12.16	100.29	NO	0.77	0,77	NO	0.01	NE	0.01	65.40	65.40	IE	NO
2005	187.91	118.84	17.16	101.68	NO	0.77	0,77	NO	0.01	NE	0.01	68.29	68.29	IE	NO
2006	195.70	125.62	22.65	102.97	NO	0.77	0,77	NO	0.01	NE	0.01	69.30	69.30	IE	NO
2007	206.20	132.82	28.67	104.15	NO	0.77	0,77	NO	0.01	NE	0.01	72.61	72.61	IE	NO
2008	211.00	140.45	35.25	105.21	NO	0.76	0,76	NO	0.01	NE	0.01	69.78	69.78	IE	NO
2009	219.15	148.73	42.47	106.25	NO	0.76	0,76	NO	0.01	NE	0.01	69.66	69.66	IE	NO
2010	225.07	157.42	50.33	107.09	NO	0.75	0,75	NE	0.01	NE	0.01	66.90	66.90	IE	NO

CH_4 Emissions

	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2011	230.63	166.63	58.89	107.74	NO	0.74	0,74	NE	0.01	NE	0.01	63.25	63.25	IE	NO
2012	237.40	176.08	68.08	108.01	NO	0.72	0,72	NE	0.01	NE	0.01	60.60	60.60	IE	NO
2013	244.40	186.03	78.01	108.02	NO	0.70	0,70	NE	0.01	NE	0.01	57.67	57.67	IE	NO
2014	255.34	196.65	88.83	107.83	NO	0.67	0,67	NE	0.01	NE	0.01	58.01	58.01	IE	NO
2015	266.40	207.70	102.22	105.49	NO	0.69	0,69	NE	0.01	NE	0.01	58.00	58.00	IE	NO
2016	277.20	218.55	94.05	124.50	NO	0.70	0,70	NE	0.01	NE	0.01	57.94	57.94	IE	NO
2017	289.27	229.07	99.99	129.08	NO	0.72	0,72	NE	0.01	NE	0.01	59.47	59.47	IE	NO
2018	297.60	239.24	94.56	144.68	NO	0.73	0,73	NE	0.01	NE	0.01	57.62	57.62	IE	NO
2019	306.67	248.65	125.06	123.59	NO	0.73	0,73	NE	0.01	NE	0.01	57.29	57.29	IE	NO
2020	316.90	259.02	132.27	126.75	NO	0.71	0,71	NE	0.01	NE	0.01	57.15	57.15	IE	NO
Trend															
1990 - 2020	187.02%	406.62%	NA	147.90%	NA	-22.45%	-22,45%	NA	33.50%	NA	33.50%	-2.06%	-2.06%	NA	NA
2005 - 2020	68.64%	117.96%	670.97%	24.65%	NA	-7.74%	-7,74%	NA	-4.98%	NA	-4.98%	-16.31%	-16.31%	NA	NA
2019 - 2020	3.33%	4.17%	5.77%	2.55%	NA	-2.02%	-2,02%	NA	1.29%	NA	1.29%	-0.23%	-0.23%	NA	NA

Table 601 CH_4 Emissions from IPCC sector 5 Waste in CO_2 equivalents

	CH_4 Emissions														
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
1990	2,760.26	1,278.19	NO	1,278.19	NO	23.01	23.01	NO	0.14	NE	0.14	1,458.92	1,458.92	IE	NO
1991	2,789.91	1,362.70	NO	1,362.70	NO	22.72	22.72	NO	0.15	NE	0.15	1,404.35	1,404.35	IE	NO
1992	2,898.20	1,441.15	NO	1,441.15	NO	22.42	22.42	NO	0.15	NE	0.15	1,434.48	1,434.48	IE	NO
1993	3,002.02	1,523.37	NO	1,523.37	NO	22.09	22.09	NO	0.15	NE	0.15	1,456.40	1,456.40	IE	NO
1994	3,108.36	1,609.41	NO	1,609.41	NO	22.14	22.14	NO	0.16	NE	0.16	1,476.65	1,476.65	IE	NO
1995	3,234.43	1,718.18	NO	1,718.18	NO	21.73	21.73	NO	0.16	NE	0.16	1,494.37	1,494.37	IE	NO
1996	3,355.24	1,828.70	NO	1,828.70	NO	21.27	21.27	NO	0.16	NE	0.16	1,505.12	1,505.12	IE	NO
1997	3,472.86	1,940.62	NO	1,940.62	NO	20.78	20.78	NO	0.16	NE	0.16	1,511.30	1,511.30	IE	NO
1998	3,592.69	2,053.81	NO	2,053.81	NO	20.28	20.28	NO	0.16	NE	0.16	1,518.43	1,518.43	IE	NO
1999	3,717.84	2,175.40	NO	2,175.40	NO	19.79	19.79	NO	0.17	NE	0.17	1,522.49	1,522.49	IE	NO
2000	3,842.93	2,298.03	NO	2,298.03	NO	19.29	19.29	NO	0.17	NE	0.17	1,525.45	1,525.45	IE	NO
2001	3,976.72	2,421.74	NO	2,421.74	NO	18.80	18.80	NO	0.17	NE	0.17	1,536.01	1,536.01	IE	NO
2002	4,114.01	2,547.57	NO	2,547.57	NO	19.02	19.02	NO	0.18	NE	0.18	1,547.24	1,547.24	IE	NO
2003	4,309.33	2,677.30	NO	2,677.30	NO	19.19	19.19	NO	0.19	NE	0.19	1,612.65	1,612.65	IE	NO
2004	4,465.64	2,811.15	303.91	2,507.24	NO	19.31	19.31	NO	0.20	NE	0.20	1,634.98	1,634.98	IE	NO
2005	4,697.70	2,970.97	428.92	2,542.05	NO	19.34	19.34	NO	0.20	NE	0.20	1,707.19	1,707.19	IE	NO
2006	4,892.51	3,140.55	566.25	2,574.30	NO	19.31	19.31	NO	0.20	NE	0.20	1,732.45	1,732.45	IE	NO
2007	5,155.07	3,320.45	716.70	2,603.75	NO	19.24	19.24	NO	0.20	NE	0.20	1,815.19	1,815.19	IE	NO
2008	5,275.00	3,511.31	881.15	2,630.16	NO	19.03	19.03	NO	0.19	NE	0.19	1,744.47	1,744.47	IE	NO
2009	5,478.76	3,718.15	1,061.81	2,656.33	NO	18.90	18.90	NO	0.19	NE	0.19	1,741.53	1,741.53	IE	NO

CH$_4$ Emissions

	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent	kt CO$_2$ equivalent
2010	5,626.83	3,935.52	1,258.32	2,677.20	NO	18.71	18.71	NE	0.19	NE	0.19	1,672.41	1,672.41	IE	NO
2011	5,765.72	4,165.79	1,472.34	2,693.45	NO	18.46	18.46	NE	0.18	NE	0.18	1,581.29	1,581.29	IE	NO
2012	5,935.06	4,402.00	1,701.88	2,700.13	NO	17.94	17.94	NE	0.18	NE	0.18	1,514.94	1,514.94	IE	NO
2013	6,109.90	4,650.69	1,950.26	2,700.43	NO	17.39	17.39	NE	0.17	NE	0.17	1,441.64	1,441.64	IE	NO
2014	6,383.56	4,916.36	2,220.70	2,695.65	NO	16.79	16.79	NE	0.16	NE	0.16	1,450.25	1,450.25	IE	NO
2015	6,660.04	5,192.56	2,555.41	2,637.15	NO	17.20	17.20	NE	0.17	NE	0.17	1,450.11	1,450.11	IE	NO
2016	6,930.03	5,463.70	2,351.31	3,112.39	NO	17.60	17.60	NE	0.17	NE	0.17	1,448.56	1,448.56	IE	NO
2017	7,231.69	5,726.83	2,499.77	3,227.06	NO	18.00	18.00	NE	0.18	NE	0.18	1,486.69	1,486.69	IE	NO
2018	7,440.09	5,980.95	2,364.07	3,616.88	NO	18.36	18.36	NE	0.18	NE	0.18	1,440.60	1,440.60	IE	NO
2019	7,666.81	6,216.25	3,126.45	3,089.79	NO	18.21	18.21	NE	0.19	NE	0.19	1,432.17	1,432.17	IE	NO
2020	7,922.38	6,475.52	3,306.82	3,168.69	NO	17.84	17.84	NE	0.19	NE	0.19	1,428.83	1,428.83	IE	NO
Trend															
1990 - 2020	187.02%	406.62%	NA	147.90%	NA	-22.45%	-22.45%	NA	33.50%	NA	33.50%	-2.06%	-2.06%	NA	NA
2005 - 2020	68.64%	117.96%	670.97%	24.65%	NA	-7.74%	-7.74%	NA	-4.98%	NA	-4.98%	-16.31%	-16.31%	NA	NA
2019 - 2020	3.33%	4.17%	5.77%	2.55%	NA	2.02%	2.02%	NA	1.29%	NA	1.29%	-0.23%	-0.23%	NA	NA

Table 602 N_2O Emissions from IPCC sector 5 Waste in kt

N_2O Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	0.99	NA	NA	NA	NA	0.06	0.06	NO	0.07	NE	0.07	0.87	0.87	NE	NO
1991	1.01	NA	NA	NA	NA	0.05	0.05	NO	0.07	NE	0.07	0.89	0.89	NE	NO
1992	1.03	NA	NA	NA	NA	0.05	0.05	NO	0.07	NE	0.07	0.91	0.91	NE	NO
1993	1.06	NA	NA	NA	NA	0.05	0.05	NO	0.07	NE	0.07	0.93	0.93	NE	NO
1994	1.08	NA	NA	NA	NA	0.05	0.05	NO	0.07	NE	0.07	0.95	0.95	NE	NO
1995	1.15	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.02	1.02	NE	NO
1996	1.22	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.09	1.09	NE	NO
1997	1.28	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.16	1.16	NE	NO
1998	1.35	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.23	1.23	NE	NO
1999	1.43	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.30	1.30	NE	NO
2000	1.50	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.37	1.37	NE	NO
2001	1.57	NA	NA	NA	NA	0.05	0.05	NO	0.08	NE	0.08	1.45	1.45	NE	NO
2002	1.66	NA	NA	NA	NA	0.05	0.05	NO	0.09	NE	0.09	1.52	1.52	NE	NO
2003	1.73	NA	NA	NA	NA	0.05	0.05	NO	0.09	NE	0.09	1.60	1.60	NE	NO
2004	1.81	NA	NA	NA	NA	0.05	0.05	NO	0.10	NE	0.10	1.66	1.66	NE	NO
2005	1.87	NA	NA	NA	NA	0.05	0.05	NO	0.10	NE	0.10	1.72	1.72	NE	NO
2006	1.90	NA	NA	NA	NA	0.05	0.05	NO	0.10	NE	0.10	1.76	1.76	NE	NO
2007	1.93	NA	NA	NA	NA	0.05	0.05	NO	0.09	NE	0.09	1.79	1.79	NE	NO
2008	1.95	NA	NA	NA	NA	0.05	0.05	NO	0.09	NE	0.09	1.81	1.81	NE	NO
2009	2.01	NA	NA	NA	NA	0.05	0.05	NO	0.09	NE	0.09	1.87	1.87	NE	NO
2010	2.06	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	1.92	1.92	NE	NO

N_2O Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt	kt
2011	2.15	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	2.02	2.02	NE	NO
2012	2.22	NA	NA	NA	NA	0.04	0.04	NE	0.08	NE	0.08	2.09	2.09	NE	NO
2013	2.31	NA	NA	NA	NA	0.04	0.04	NE	0.08	NE	0.08	2.18	2.18	NE	NO
2014	2.38	NA	NA	NA	NA	0.04	0.04	NE	0.08	NE	0.08	2.26	2.26	NE	NO
2015	2.47	NA	NA	NA	NA	0.04	0.04	NE	0.08	NE	0.08	2.34	2.34	NE	NO
2016	2.55	NA	NA	NA	NA	0.04	0.04	NE	0.08	NE	0.08	2.42	2.42	NE	NO
2017	2.58	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	2.46	2.46	NE	NO
2018	2.61	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	2.48	2.48	NE	NO
2019	2.66	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	2.53	2.53	NE	NO
2020	2.69	NA	NA	NA	NA	0.04	0.04	NE	0.09	NE	0.09	2.55	2.55	NE	NO
Trend															
1990 - 2020	171.86%	NA	NA	NA	NA	-22.45%	-22.45%	NA	33.50%	NA	33.50%	195.20%	195.20%	NA	NA
2005 - 2020	44.06%	NA	NA	NA	NA	-7.47%	-7.47%	NA	-4.98%	NA	-4.98%	48.19%	48.19%	NA	NA
2019 - 2020	0.94%	NA	NA	NA	NA	-2.02%	-2.02%	NA	1.29%	NA	1.29%	0.98%	0.98%	NA	NA

Table 603 N_2O Emissions from IPCC sector 5 Waste in CO_2 equivalents

N_2O Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
1990	294.61	NA	NA	NA	NA	16.46	16.46	NO	20.38	NE	20.38	257.78	257.78	NE	NO
1991	301.30	NA	NA	NA	NA	16.25	16.25	NO	20.87	NE	20.87	264.18	264.18	NE	NO
1992	308.04	NA	NA	NA	NA	16.03	16.03	NO	21.36	NE	21.36	270.65	270.65	NE	NO
1993	314.70	NA	NA	NA	NA	15.80	15.80	NO	21.83	NE	21.83	277.07	277.07	NE	NO
1994	321.38	NA	NA	NA	NA	15.84	15.84	NO	22.27	NE	22.27	283.27	283.27	NE	NO
1995	341.93	NA	NA	NA	NA	15.54	15.54	NO	22.67	NE	22.67	303.73	303.73	NE	NO
1996	362.32	NA	NA	NA	NA	15.21	15.21	NO	23.00	NE	23.00	324.11	324.11	NE	NO
1997	382.86	NA	NA	NA	NA	14.86	14.86	NO	23.30	NE	23.30	344.70	344.70	NE	NO
1998	403.65	NA	NA	NA	NA	14.51	14.51	NO	23.56	NE	23.56	365.59	365.59	NE	NO
1999	424.88	NA	NA	NA	NA	14.15	14.15	NO	23.83	NE	23.83	386.90	386.90	NE	NO
2000	446.46	NA	NA	NA	NA	13.80	13.80	NO	24.07	NE	24.07	408.59	408.59	NE	NO
2001	468.68	NA	NA	NA	NA	13.45	13.45	NO	24.30	NE	24.30	430.93	430.93	NE	NO
2002	493.34	NA	NA	NA	NA	13.60	13.60	NO	25.78	NE	25.78	453.96	453.96	NE	NO
2003	516.43	NA	NA	NA	NA	13.72	13.72	NO	27.26	NE	27.26	475.44	475.44	NE	NO
2004	537.90	NA	NA	NA	NA	13.81	13.81	NO	28.77	NE	28.77	495.32	495.32	NE	NO
2005	555.97	NA	NA	NA	NA	13.83	13.83	NO	28.63	NE	28.63	513.51	513.51	NE	NO
2006	566.57	NA	NA	NA	NA	13.81	13.81	NO	28.38	NE	28.38	524.37	524.37	NE	NO
2007	575.81	NA	NA	NA	NA	13.76	13.76	NO	28.05	NE	28.05	534.00	534.00	NE	NO
2008	580.90	NA	NA	NA	NA	13.61	13.61	NO	27.49	NE	27.49	539.81	539.81	NE	NO
2009	597.56	NA	NA	NA	NA	13.51	13.51	NO	27.04	NE	27.04	557.00	557.00	NE	NO

N_2O Emissions															
	5. Total waste	5.A. Solid waste disposal	5.A.1. Managed waste disposal sites	5.A.2. Unmanaged waste disposal sites	5.A.3. Uncategorized waste disposal sites	5.B. Biological treatment of solid waste	5.B.1. Composting	5.B.2. Anaerobic digestion at biogas facilities	5.C. Incineration and open burning of waste	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.D. Wastewater treatment and discharge	5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.E. Other
	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent	kt CO_2 equivalent
2010	612.83	NA	NA	NA	NA	13.38	13.38	NE	26.50	NE	26.50	572.95	572.95	NE	NO
2011	639.65	NA	NA	NA	NA	13.20	13.20	NE	25.85	NE	25.85	600.60	600.60	NE	NO
2012	661.13	NA	NA	NA	NA	12.83	12.83	NE	25.10	NE	25.10	623.19	623.19	NE	NO
2013	686.92	NA	NA	NA	NA	12.44	12.44	NE	24.28	NE	24.28	650.20	650.20	NE	NO
2014	709.71	NA	NA	NA	NA	12.01	12.01	NE	23.34	NE	23.34	674.37	674.37	NE	NO
2015	735.16	NA	NA	NA	NA	12.30	12.30	NE	24.08	NE	24.08	698.78	698.78	NE	NO
2016	759.13	NA	NA	NA	NA	12.59	12.59	NE	24.82	NE	24.82	721.72	721.72	NE	NO
2017	770.28	NA	NA	NA	NA	12.87	12.87	NE	25.54	NE	25.54	731.87	731.87	NE	NO
2018	778.24	NA	NA	NA	NA	13.13	13.13	NE	26.21	NE	26.21	738.90	738.90	NE	NO
2019	793.46	NA	NA	NA	NA	13.02	13.02	NE	26.85	NE	26.85	753.58	753.58	NE	NO
2020	800.93	NA	NA	NA	NA	12.76	12.76	NE	27.20	NE	27.20	760.97	760.97	NE	NO
Trend															
1990 - 2020	171.86%	NA	NA	NA	NA	-22.45%	-22.45%	NA	33.50%	NA	33.50%	195.20%	195.20%	NA	NA
2005 - 2020	44.06%	NA	NA	NA	NA	-7.47%	-7.47%	NA	-4.98%	NA	-4.98%	48.19%	48.19%	NA	NA
2019 - 2020	0.94%	NA	NA	NA	NA	-2.02%	-2.02%	NA	1.29%	NA	1.29%	0.98%	0.98%	NA	NA

7.2.1 Country-specific issues

Waste management has become a complex area legally, technically and commercially. Solid waste generation rates and composition vary from country to country depending on the economic situation, industrial structure, waste management regulations and lifestyle. Algeria still have a number of issues that need to be resolved related to solid waste management. Municipal administrations and mayors receive their mandate to manage municipal affairs through the current Municipal Law created in 2000. According to the current municipal law, municipalities are public legal and juristic entities given the task to provide for the general needs of urban populations.[614]

According to 2006 IPCC Guidelines it is *good practice* to account for all types of solid waste when estimating waste-related emissions in the greenhouse gas inventory. The availability and quality of data on solid waste generation as well as subsequent treatment vary significantly from country to country. In Algeria statistics on waste generation and treatment have been improved substantially during the last 10 years, but there is still gap in comprehensive waste data covering all waste types and treatment techniques. Therefore, an overall analysis was made of the collection process, disposal routes and various treatments techniques.

The following steps were done

Step 1 Definition of solid waste;

Step 2 Waste collection and waste disposal routes: Identification of waste treatments and allocation the waste to the waste treatments;

Step 3 - Compilation of activity data on waste generation per year starting from 1950;

Step 4 Estimation of GHG emission from the different waste treatments techniques.

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[614] The current law lists 44 functions of municipalities. For the full list see: Popal, A. B. (2014) Municipalities in Algeria. IDLG/GDMA, pgs. 18-20. Available (16. January 2019) on http://dmm.gov.af/Content/files/Municipalities%20in%20 Algeria _final.pdf

7.2.2 Definition of solid waste

Solid waste is generated from households, offices, shops, markets, restaurants, public institutions, industrial installations, water works and sewage facilities, construction and demolition sites, and agricultural activities.

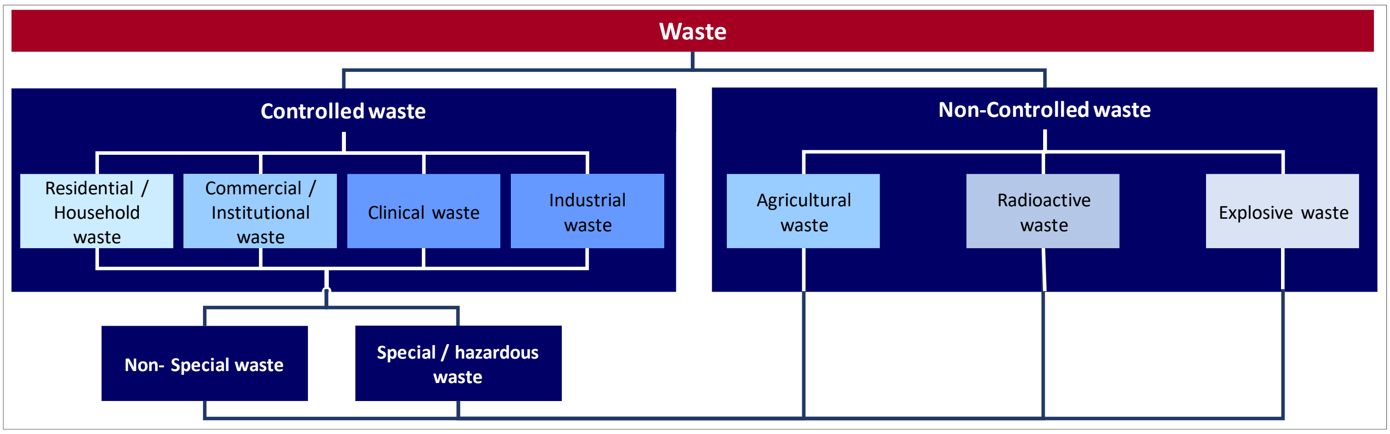

Figure 238 Definition of Waste

Solid waste fractions can be divided in the following fractions:

- Municipal Solid Waste (MSW) is generally defined as waste collected by municipalities or other local authorities. In Algeria, MSW includes
  - ⇒ household waste;
  - ⇒ garden (yard) and park waste; and
  - ⇒ commercial/institutional waste
  - ⇒ construction and demolition waste
- Sludge which comes from domestic and industrial wastewater treatment plants.
  - ⇒ In Algeria, Sludge is managed,
  - ⇒ On-sit storage
  - ⇒ dumped, ….
- Industrial waste from different industrial sectors.
  - ⇒ In Algeria, industrial waste is managed and storage
- Clinical waste includes materials like plastic syringes, animal tissues, bandages, cloths, etc.
  - ⇒ In Algeria, clinical waste is incinerated.
- Hazardous waste which mainly consists out of waste oil, waste solvents, ash, cinder and other wastes with hazardous nature, such as flammability, explosiveness, causticity, and toxicity.
  - ⇒ In Algeria, hazardous wastes is managed storage
- Agricultural waste, which is manure management and burning of agricultural residues, is considered in the agriculture sector.

7.2.2.1 Waste collection and waste disposal routes: waste treatments and related allocation

Waste collection and waste disposal routes: Identification of waste treatments and allocation of the waste to the related waste treatments

The collection process and the different disposal routes and treatments techniques are illustrative presented in the following figure. Solid waste management practices include collection, recycling, solid waste disposal on land, biological and other treatments as well as incineration without and with energy recovery and open burning of waste. Composting and the use of waste in agriculture needs also to be considered.

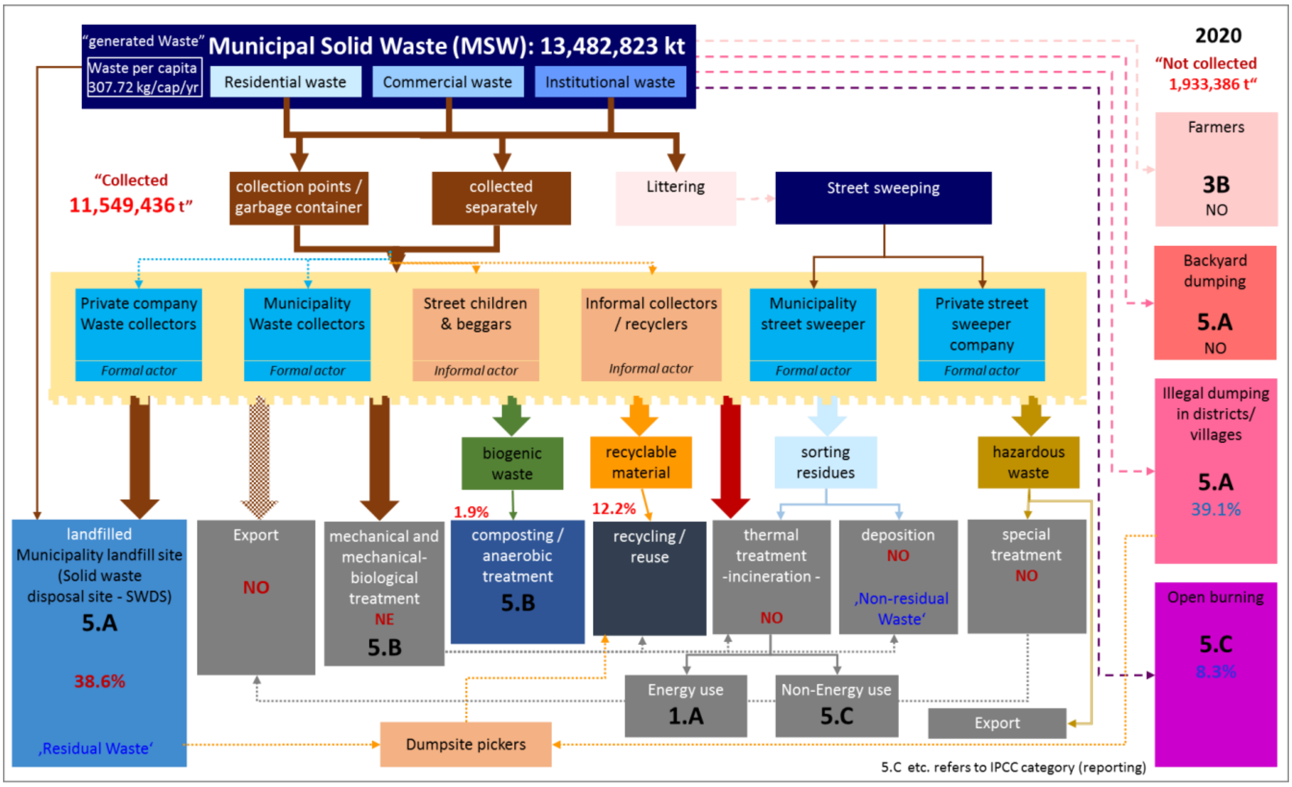

Figure 239 Waste collection and waste disposal route

7.2.2.2 Compilation of activity data on Municipal Solid Waste (MSW) generation (1950 - 2020)

Waste generation is the product of the per capita waste generation rate - *tonnes / capita/year* or *kg / capita / day* - for each component and population. Historical data on waste generation are necessary to estimate GHG emissions from the different waste treatments techniques (see chapter 7.2.2.2.3) which also reflects changes in waste management practices (e.g., site covering, compacting, CH_4 recovery etc.). For estimating CH_4 emission from **solid waste disposal** requires data on

- waste generation of MSW for the last 50 years, starting in 1950;
- waste generation of sludge for the last 50 years, starting in 1950;
- waste generation of industrial waste for the last 50 years, starting in 1950;
- recycling rate, starting in 1950.

For all other waste treatment techniques, data required, 1990 is the starting year:

IPCC category 5.C	Open burning and/or incineration – reporting under
IPCC category 5.B	Composting and anerobic treatment, mechanical and/or mechanical-biological treatment

7.2.2.2.1 Population of Algeria for the period 1950 - 2020

The main source of activity data – population by settlement - is National Statistical Office (NSO) of Algeria and UN statistics. Historical data on total population could be obtained from:

Data	Years	Source
Total population	1950 – 1969	United Nations, Department of Economic and Social Affairs (DESA), Population: World Population Prospects 2019[615];
	1970 - 2020	from Office National des Statistiques (ONS) of Algeria[616]
Rural / Urban population	1950 – 2020	from United Nations, Statistics Division: World Urbanization Prospects 2018[617].

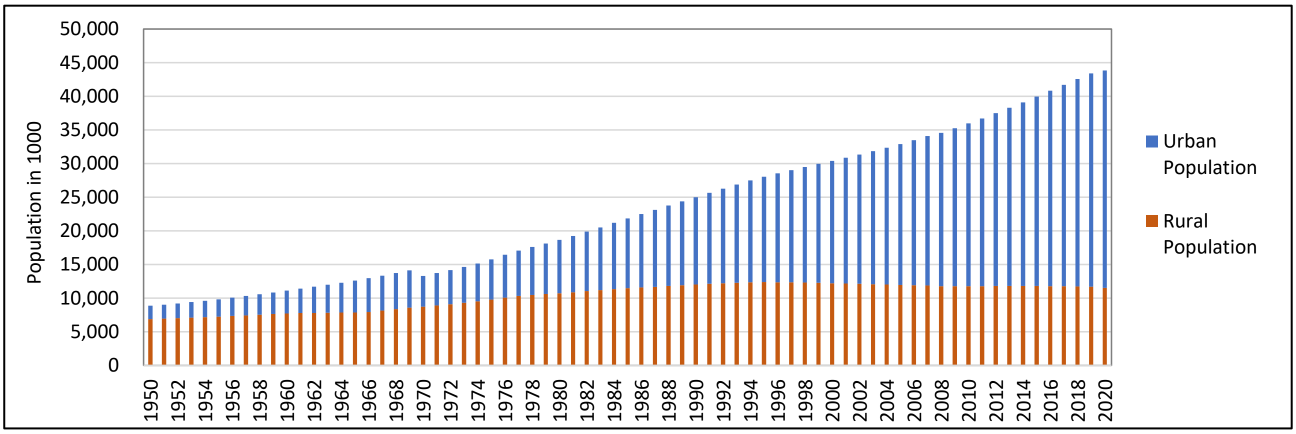

Figure 240 Population of Algeria 1950 - 2020

7.2.2.2.2 Waste generation rate per capita

In order to estimate the annual waste generation for Algeria, information on municipal solid waste generation rates for the urban and the rural population were collected. In the following table the data used in the inventory are presented. The data are based on studies and expert judgement.

Table 604 Waste generation rate for Algeria

	Municipal Solid Waste (MSW) generation rate kg/cap/year (value in brackets: kg/cap/day)			
	Total population	**Urban population**	**Rural population**	**Source**
1950		146.0 (0.4)	73.0 (0.2)	expert judgement for rural population: 50% of urban
1970		182.50 (0.50)	127.75 (0.35)	Used for calibration: Waste generation by income level: Low income; Source: Daniel and Perinaz (2012): What a Waste: A Global Review of Solid Waste Management. Washington, DC: World Bank.[618]

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[615] 2019 Revision of World Population Prospects: United Nations population estimates and projections. Total Population - Both Sexes. De facto population in a country, area or region as of 1 July of the year indicated. Figures are presented in thousands.
Available (25 May 2022) on https://population.un.org/wpp/Download/Standard/Population/

[616] DEMOGRAPHIE ALGERIENNE 2019 N°890/Bis. https://www.ons.dz/spip.phprubrique182

[617] World Urbanization Prospects 2018; File 1: Population of Urban and Rural Areas at Mid-Year (thousands) and Percentage Urban, 2018
Available (25 May 2022) on https://population.un.org/wup/Download/

[618] Hoornweg, Daniel; Bhada-Tata, Perinaz. 2012. What a Waste : A Global Review of Solid Waste Management. Urban development series; knowledge

	Municipal Solid Waste (MSW) generation rate kg/cap/year (value in brackets: kg/cap/day)			
	Total population	**Urban population**	**Rural population**	**Source**
1971-1976		constant	interpolation	ONS (2013): Collections Statistiques N° 177/2013 Série C : Statistiques Régionales et Cartographie[619]
1977		182.50 (0.50)		
1994		(0.76)		1st National Communication (NC) of Algeria[620] Brahim Djemaci (2014): Impact des facteurs d'attractivité des territoires sur la production future des déchets urbains en Algérie.[621]
2001		(0.45)	(0.35)	MATE [622] Youb Okkacha Youb Abderrahmane Bouabdessalam Hassiba (2014): Municipal Waste Management in the Algerian High Plateaus[623]
2004		(0.83)	interpolation	Used for calibration: Brahim Djemaci (2012) : La gestion des déchets municipaux en Algérie : Analyse prospective et éléments d'efficacité[624] Abdelli Islam Safia (2015): Optimisation d'une collecte d'ordures ménagères dans la wilaya de Mostaganem[625]
2008		(0.8)		ONS (2013): Collections Statistiques N° 177/2013 Série C : Statistiques Régionales et Cartographie[626]
2010	246.5			AND (2021): Annual data on waste generation, collection and treatment for 2010 - 2020 Used for calibration: AND (2015): Caractérisation des déchets ménagers et assimilés dans les zones nord, semi-aride et aride d'Algérie - DMA 2014[627] AND (2021): Rapport sur l'état de la gestion des déchets en Algérie MATE [628] Salim Kouloughli, Salah Kanfoud (2017) : Municipal Solid Waste Management in Constantine, Algeria World bank (2016): What a Waste 2.0 - A Global Snapshot of Solid Waste Management to 2050[629]
2011	254.3			
2012	261.4		(0.55)	
2013	268.2			
2014	274.5	(0.83)		
2015	280.3	(0.93)		
2016	285.8			
2017	290.9			
2018	296.0			
2019	301.0			
2020	308.7	(0.90)	(0.70)	
For all years in-between: Interpolation				

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papers no. 15. World Bank, Washington, DC. © World Bank.
Available (25 May 2022) on https://openknowledge.worldbank.org/handle/10986/17388

[619] Available (8 June 2022) on https://www.ons.dz/IMG/pdf/C_S_Num_172_Environfinal_okok.pdf

[620] 1st National Communication (NC) of Algeria: Available (25 May 2022) on https://unfccc.int/documents/67381 (Available on 25 May 2022)
GHG Inventory to NC 1 Algeria: https://unfccc.int/documents/66299 (Available on 25 May 2022)

[621] https://www.cairn.info/revue-mondes-en-developpement-2014-2-page-113.htm

[622] MATE, SWEPNET & AND

[623] https://www.sciencedirect.com/science/article/pii/S1876610214008170

[624] https://tel.archives-ouvertes.fr/tel-00804063/document

[625] http://e-biblio.univ-mosta.dz/handle/123456789/991

[626] Available (8 June 2022) on https://www.ons.dz/IMG/pdf/C_S_Num_172_Environfinal_okok.pdf

[627] Available (8 June 2022) on https://and.dz/site/wp-content/uploads/2016/04/etude-caracterisation-2014-1.pdf

[628] MATE, SWEPNET & AND

[629] Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050. Urban Development;. Washington, DC: World Bank. © World Bank.
Available (25 May 2022) on https://openknowledge.worldbank.org/handle/10986/30317

Table 605 Population, Waste generation rate, and generated Municipal solid waste (MSW) for 1950 - 2020

	Population						**Waste per capita**			**Generated Municipal solid waste (MSW) (calculated based on Per capita)**		
	Total	**Source**	**Rural**		**Urban**	Source	**Rural**	**Urban**	Source	**Total**	**Rural**	**Urban**
	millions		**millions**		**millions**		**kg/cap/yr**	**kg/cap/yr**		**kt**	**kt**	**kt**
1950	8.872	UN, World Population Prospects 2019[615]	6.901	World Urbanization Prospects 2018[617]	1,971	World Urbanization Prospects 2018[617]	73.00	146.00	Based on table Table 604	791,543	503,805	287,738
1951	9.040		6.964		2,076		75.74	147.83		834,317	527,426	306,890
1952	9.216		7.029		2,188		78.48	149.65		878,960	551,584	327,376
1953	9.405		7.099		2,306		81.21	151.48		925,896	576,528	349,368
1954	9.610		7.176		2,434		83.95	153.30		975,503	602,399	373,104
1955	9.830		7.259		2,570		86.69	155.13		1,028,025	629,293	398,732
1956	10.066		7.349		2,717		89.43	156.95		1,083,582	657,194	426,387
1957	10.316		7.444		2,872		92.16	158.78		1,142,118	686,040	456,078
1958	10.578		7.541		3,038		94.90	160.60		1,203,475	715,612	487,864
1959	10.849		7.637		3,212		97.64	162.43		1,267,353	745,672	521,681
1960	11.125		7.731		3,394		100.38	164.25		1,333,468	775,964	557,504
1961	11.405		7.778		3,626		103.11	166.08		1,404,314	802,050	602,264
1962	11.690		7.807		3,883		105.85	167.90		1,478,331	826,408	651,923
1963	11.985		7.831		4,154		108.59	169.73		1,555,421	850,329	705,091
1964	12.296		7.852		4,444		111.33	171.55		1,636,483	874,131	762,352
1965	12.627		7.874		4,753		114.06	173.38		1,722,181	898,109	824,073
1966	12.980		7.939		5,041		116.80	175.20		1,810,518	927,249	883,269
1967	13.354		8.145		5,209		119.54	177.03		1,895,763	973,692	922,071
1968	13.744		8.361		5,384		122.28	178.85		1,985,171	1,022,317	962,855
1969	14.144		8.581		5,564		125.01	180.68		2,077,916	1,072,711	1,005,205
1970	13.309	Office National des Statistiques (ONS)[619]	8.738	Calculated based on share provided by UN World Urbanization Prospects	4,571	Calculated based on share provided by UN World Urbanization Prospects	127.75	182.50		1,950,496	1,116,259	834,236
1971	13.739		8.920		4,819		127.75	182.50		2,018,998	1,139,528	879,470
1972	14.171		9.097		5,074		127.75	182.50		2,088,138	1,162,159	925,979
1973	14.649		9.297		5,352		127.75	182.50		2,164,420	1,187,716	976,704
1974	15.164		9.513		5,651		127.75	182.50		2,246,565	1,215,347	1,031,218
1975	15.768		9.777		5,991		127.75	182.50		2,342,342	1,249,069	1,093,272

	Population						Waste per capita			Generated Municipal solid waste (MSW) (calculated based on Per capita)		
	Total	**Source**	**Rural**		**Urban**	Source	**Rural**	**Urban**	Source	**Total**	**Rural**	**Urban**
	millions		**millions**		**millions**		**kg/cap/yr**	**kg/cap/yr**		**kt**	**kt**	**kt**
1976	16.450		10.080	2018[619]	6,370	2018[619]	127.75	182.50		2,450,219	1,287,772	1,162,446
1977	17.058	Office National des Statistiques (ONS)[619]	10.329	Calculated based on share provided by UN statistics	6.729	Calculated based on share provided by UN statistics	127.75	184.85	Based on table Table 604	2,571,359	1,319,481	1,243,955
1978	17.600		10.479		7.121		127.75	187.21		2,688,564	1,338,720	1,333,076
1979	18.120		10.606		7.514		127.75	189.56		2,805,842	1,354,916	1,424,384
1980	18.666		10.737		7.929		127.75	191.92		2,930,703	1,371,683	1,521,678
1981	19.262		10.886		8.376		127.75	194.27		3,067,253	1,390,652	1,627,290
1982	19.883		11.036		8.847		127.75	196.63		3,211,917	1,409,857	1,739,561
1983	20.522		11.184		9.338		127.75	198.98		3,363,853	1,428,714	1,858,173
1984	21.185		11.331		9.854		127.75	201.34		3,524,323	1,447,563	1,983,943
1985	21.863		11.473		10.390		127.75	203.69		3,692,125	1,465,710	2,116,318
1986	22.512		11.587		10.925		127.75	206.05		3,859,973	1,480,201	2,251,136
1987	23.139		11.676		11.463		127.75	208.40		4,029,001	1,491,601	2,388,934
1988	23.783		11.812		11.971		127.75	210.76		4,201,087	1,509,002	2,522,949
1989	24.409		11.929		12.480		127.75	213.11		4,374,564	1,523,974	2,659,571
1990	25.022		12.030		12.992		127.75	215.47		4,550,307	1,536,877	2,799,277
1991	25.643		12.125		13.518		127.75	217.82		4,732,192	1,549,021	2,944,432
1992	26.271		12.214		14.057		127.75	220.18		4,920,199	1,560,321	3,095,060
1993	26.894		12.290		14.604		127.75	222.53		5,112,212	1,570,056	3,249,842
1994	27.496		12.347		15.149		127.75	276.85		5,771,358	1,577,323	4,194,034
1995	28.060		12.378		15.682		127.75	279.21		5,941,219	1,581,228	4,378,646
1996	28.566		12.374		16.192		127.75	281.56		6,101,291	1,580,780	4,559,034
1997	29.045		12.351		16.694		127.75	283.92		6,257,958	1,577,839	4,739,696
1998	29.507		12.313		17.194		127.75	286.27		6,413,270	1,573,020	4,922,063
1999	29.965		12.275		17.690		127.75	288.63		6,568,769	1,568,075	5,105,914
2000	30.416		12.226		18.190		127.75	290.98		6,724,974	1,561,873	5,292,931
2001	30.879		12.175		18.704		127.75	293.34		6,886,108	1,555,392	5,486,463
2002	31.357		12.123		19.234		134.22	295.69		7,131,381	1,627,187	5,687,234

	Population						**Waste per capita**			**Generated Municipal solid waste (MSW) (calculated based on Per capita)**		
	Total	**Source**	**Rural**		**Urban**	Source	**Rural**	**Urban**	Source	**Total**	**Rural**	**Urban**
	millions		**millions**		**millions**		**kg/cap/yr**	**kg/cap/yr**		**kt**	**kt**	**kt**
2003	31.848		12.069		19.779		140.69	298.05		7,381,304	1,697,970	5,895,094
2004	32.364		12.016		20.348		147.16	300.40		7,638,759	1,768,307	6,112,507
2005	32.906	Office National des Statistiques (ONS)	11.965	Calculated based on share provided by UN statistics	20.941	Calculated based on share provided by UN statistics	153.63	302.75	Based on table Table 604	7,904,179	1,838,197	6,340,004
2006	33.481		11.917		21.564		160.10	305.11		8,179,469	1,907,975	6,579,316
2007	34.096		11.875		22.221		166.57	255.50		8,466,632	1,977,987	5,677,564
2008	34.591		11.782		22.809		173.04	262.02		8,728,793	2,038,742	5,976,445
2009	35.268		11.784		23.484		179.51	268.54		9,033,918	2,115,427	6,306,235
2010	35.978		11.789		24.189		185.98	275.05		9,350,374	2,192,528	6,653,328
2011	36.717		11.794		24.923		192.45	281.57		9,677,333	2,269,713	7,017,745
2012	37.495		11.801		25.694		198.93	288.09		10,017,639	2,347,499	7,402,187
2013	38.297		11.806		26.491		205.77	294.61		10,371,905	2,429,242	7,804,530
2014	39.114		11.805		27.309		212.61	301.13		10,733,348	2,509,807	8,223,542
2015	39.963		11.802		28.161		219.46	305.38		11,189,888	2,590,112	8,599,776
2016	40.836		11.796		29.040		226.30	309.64		11,661,416	2,669,471	8,991,945
2017	41.721		11.782		29.939		233.14	313.90		12,144,751	2,746,902	9,397,849
2018	42.578		11.749		30.829		239.99	318.16		12,628,141	2,819,539	9,808,602
2019	43.424		11.701		31.723		246.83	322.42		13,116,172	2,888,252	10,227,921
2020	43.850		11.533		32.317		253.68	326.68		13,482,823	2,925,520	10,557,303
Trend												
1950 - 2020	394.2%		67.1%		1539.8%					1603.4%	480.7%	3569.1%
1990 - 2020	73.5%		-2.7%		144.2%					210.9%	90.4%	277.1%
2005 – 2020	33.3%		-3.6%		54.3%					64.9%	59.2%	66.5%
2019 – 2020	1.0%		-1.4%		1.9%					2.8%	1.3%	3.2%

7.2.2.2.3 Allocation of the Municipal Solid Waste (MSW) to various waste treatments

The allocation of the Municipal Solid Waste (MSW) to the various waste treatment techniques is done for the pillar years 1950, 1990, 2004, 2014, 2020 and is based on expert judgement using default values from 2006 IPCC guidelines, literature and national expertise. For the years between the pillar years interpolation was be used. In the following figures and tables, an overview of the allocation of the waste from total, urban and rural population to various waste treatments is presented.

The Step 4 - Estimation of GHG emission from the different waste treatments techniques are presented in the following chapters.

7.2.2.2.4 Industrial waste 1950 - 2020

According to 2006 IPCC Guidelines, only those industrial wastes which are expected to contain DOC and fossil carbon should be considered for the purpose of emission estimation from waste.[630]

In Algeria, industrial waste is mainly included in the municipal solid waste stream, therefore, it was difficult to obtain data of the industrial waste separately.

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[630] 2006 IPCC Guidelines, Volume 5: Waste, Chapter 3: Solid Waste Disposal - 3.2.2 Choice of activity data

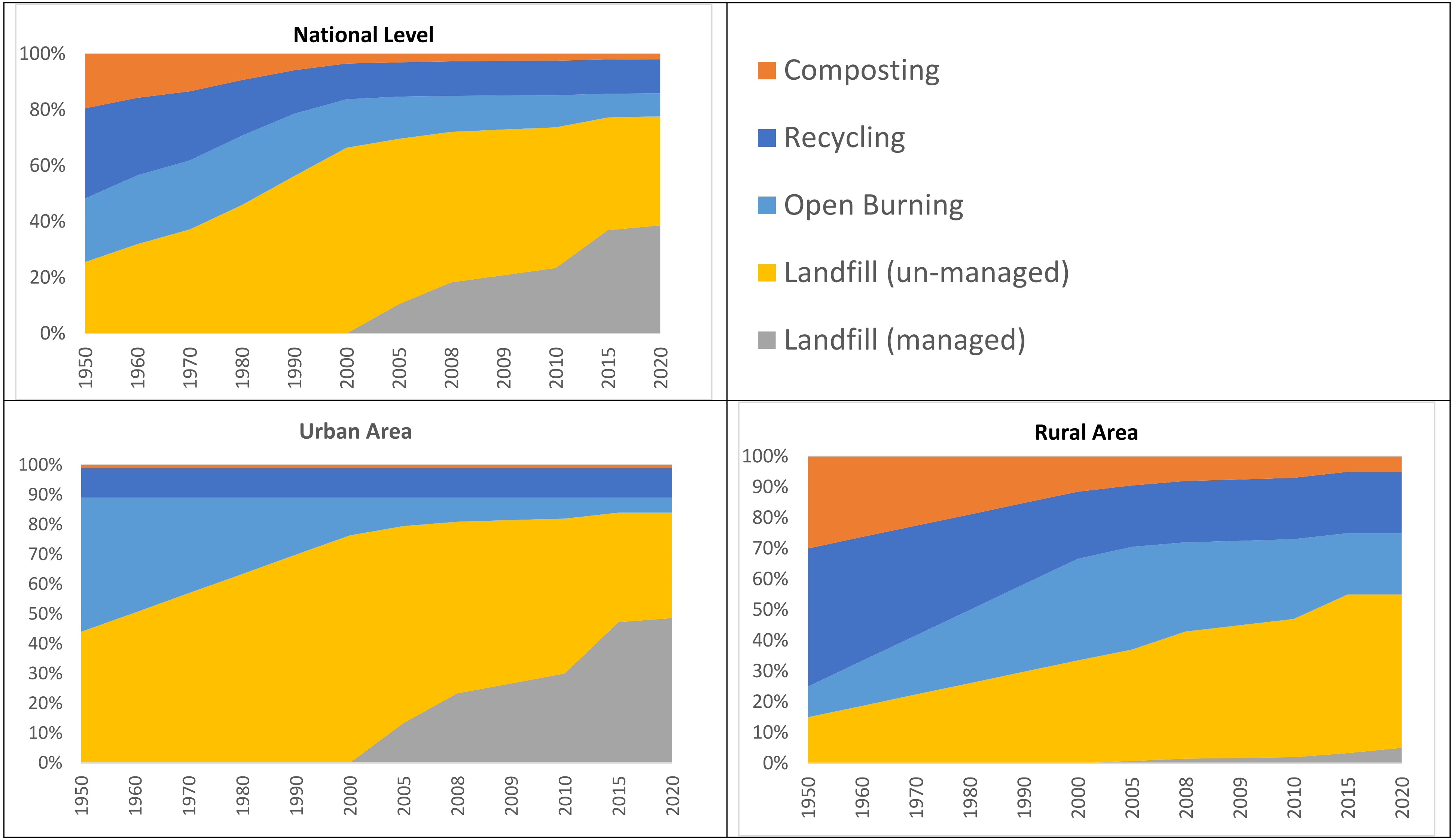

Figure 241 Share of waste treatment practices of Solid Waste from total, urban and rural population for the period 1950 - 2020

Table 606 Allocation of waste from total population to various waste treatments

		1950	1960	1970	1980	1990	2000	2005	2008	2009	2010	2015	2020
Population													
Total	1000	8,872	11,125	13,309	18,666	25,022	30,416	32,906	34,591	35,268	35,978	39,963	43,850
Urban	1000	1,971	3,394	4,571	7,929	12,992	18,190	20,941	22,809	23,484	24,189	28,161	32,317
Rural	1000	6,901	7,731	8,738	10,737	12,030	12,226	11,965	11,782	11,784	11,789	11,802	11,533
Share of Population													
Urban	%	22.9%	28.2%	34.3%	42.5%	51.9%	59.8%	63.6%	65.9%	66.6%	67.2%	70.5%	73.7%
Rural	%	77.1%	71.8%	65.7%	57.5%	48.1%	40.2%	36.4%	34.1%	33.4%	32.8%	29.5%	26.3%
Waste generation – per year													
Total	kg/cap	89.22	119.86	146.55	155.01	173.29	225.37	248.53	231.71	238.79	245.87	280.01	307.48
urban	kg/cap	146.00	164.25	182.50	191.92	215.47	290.98	302.75	262.02	268.54	275.05	305.38	326.68
rural	kg/cap	73.00	100.38	127.75	127.75	127.75	127.75	153.63	173.04	179.51	185.98	219.46	253.68
Waste generation data													
Total	tonne	791,543	1,333,468	1,950,496	2,893,361	4,336,154	6,854,805	8,178,201	8,015,187	8,421,662	8,845,856	11,189,888	13,482,823
urban	tonne	287,738	557,504	834,236	1,521,678	2,799,277	5,292,931	6,340,004	5,976,445	6,306,235	6,653,328	8,599,776	10,557,303
rural	tonne	503,805	775,964	1,116,259	1,371,683	1,536,877	1,561,873	1,838,197	2,038,742	2,115,427	2,192,528	2,590,112	2,925,520
Waste use Total (share)													
Recycling	%	32.3%	27.7%	24.7%	19.9%	15.6%	12.8%	12.3%	12.3%	12.3%	12.3%	12.3%	12.2%
Composting	%	19.5%	15.7%	13.4%	9.4%	5.8%	3.4%	3.0%	2.6%	2.5%	2.4%	1.9%	1.9%
Landfill (managed)	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.4%	18.2%	20.8%	23.4%	37.1%	39.2%
Dumping (Landfill un-managed)	%	25.5%	32.0%	37.2%	46.0%	56.4%	66.4%	59.2%	53.9%	52.1%	50.4%	40.2%	38.5%
Open Burning	%	22.7%	24.6%	24.7%	24.8%	22.3%	17.4%	15.1%	12.9%	12.2%	11.5%	8.5%	8.3%
Waste use Urban (share)													
Recycling	%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
Composting	%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Landfill (managed)	%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.3%	23.3%	26.7%	30.0%	47.2%	48.6%
Dump site (Landfill un-managed)	%	44.0%	50.5%	57.0%	63.4%	69.9%	76.4%	66.2%	57.7%	54.8%	52.0%	36.8%	35.4%
Open Burning	%	45.0%	38.5%	32.0%	25.6%	19.1%	12.6%	9.5%	8.0%	7.5%	7.0%	5.0%	5.0%

		1950	1960	1970	1980	1990	2000	2005	2008	2009	2010	2015	2020
Waste use Rural (share)													
Recycling		45.0%	40.4%	35.7%	31.1%	26.5%	21.9%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Composting		30.0%	26.3%	22.6%	18.9%	15.2%	11.5%	9.5%	8.0%	7.5%	7.0%	5.0%	5.0%
Landfill (managed)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	1.5%	1.8%	2.0%	3.3%	5.0%
Dumping (Landfill un-managed)		15.0%	18.7%	22.4%	26.1%	29.8%	33.5%	36.3%	41.5%	43.3%	45.0%	51.7%	50.0%
Open Burning		10.0%	14.6%	19.3%	23.9%	28.5%	33.1%	33.5%	29.0%	27.5%	26.0%	20.0%	20.0%
Waste – Landfill (managed)													
Total	tonne							822,503	1,591,236	1,881,490	2,190,632	4,146,200	5,280,904
Urban	tonne	0	0	0	0	0	0	845,249	1,394,185	1,681,242	1,995,466	4,059,863	5,134,628
Rural	tonne	0	0	0	0	0	0	13,786	30,581	37,020	43,851	86,337	146,276
Waste – Dumpsite / Landfill not managed													
Total	tonne	202,176	426,570	725,330	1,347,273	2,565,386	4,468,508	4,680,085	4,704,364	4,709,023	4,709,290	4,502,173	5,196,267
Urban	tonne	126,605	281,436	475,206	965,420	1,957,421	4,044,192	4,195,054	3,446,736	3,458,339	3,460,263	3,163,949	3,733,507
Rural	tonne	75,571	145,134	250,125	358,162	458,217	523,517	666,346	846,078	914,922	986,637	1,338,224	1,462,760
Recycling													
Total	tonne	255,486	369,010	482,383	578,914	686,916	870,591	1,001,640	1,005,393	1,053,709	1,103,838	1,378,000	1,640,834
Urban	tonne	28,774	55,750	83,424	152,168	279,928	529,293	634,000	597,645	630,624	665,333	859,978	1,055,730
Rural	tonne	226,712	313,260	398,959	426,746	406,988	341,298	367,639	407,748	423,085	438,506	518,022	585,104
Composting													
Total	tonne	154,019	209,625	260,534	274,312	261,370	232,256	238,029	222,864	221,719	220,010	215,503	251,849
urban	tonne	2,877	5,575	8,342	15,217	27,993	52,929	63,400	59,764	63,062	66,533	85,998	105,573
rural	tonne	151,141	204,050	252,192	259,096	233,378	179,326	174,629	163,099	158,657	153,477	129,506	146,276
Open Burning													
Total	tonne	179,863	328,263	482,248	716,553	972,231	1,184,249	1,218,096	1,069,351	1,054,710	1,035,790	948,011	1,112,969
Urban	tonne	129,482	214,742	267,265	388,873	533,936	666,517	602,300	478,116	472,968	465,733	429,989	527,865
Rural	tonne	50,380	113,521	214,983	327,680	438,295	517,732	615,796	591,235	581,742	570,057	518,022	585,104

7.3 Solid Waste Disposal (IPCC category 5.A)

The following section describes GHG emissions resulting from solid waste disposal on land. According to the 2019 Refinements of the 2006 IPCC Guidelines, the solid waste disposal sites (SWDS) can be divided into five groups.

Table 607 Solid Waste Disposal Site (SWDS) Classification

IPCC Code	Description	In Algeria used
5.A.1 Managed Waste Disposal Sites	5.A.1.a. ***Anaerobic managed solid waste disposal sites*** must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste.	**x**
	5.A.1.b. ***Semi-aerobic managed solid waste disposal sites*** must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system.	
	5.A.1.c. **Active-aeration of managed landfills** includes the technology of in-situ low pressure aeration, air sparging, bioventing, passive ventilation with extraction (suction). These must have controlled placement of waste and will include leachate drainage system to avoid the blockage of air penetration, and (i) cover material; (ii) air injection or gas extraction system without drying of waste.	
5.A.2 Unmanaged Waste Disposal Sites	5.A.2.a ***Unmanaged solid waste disposal sites – deep and/or with high water table*** are all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high-water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste.	**x**
	5.A.2.b ***Unmanaged shallow solid waste disposal sites*** are all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.	**x**
5.A.3 Uncategorized Waste Disposal Sites	***Uncategorised solid waste disposal sites*** are those SWDS where countries cannot categorize their landfills into above four categories of managed and unmanaged SWDS.	

Source: Table 3.1 (updated) SWDS classification and methane correction factors (MCF), 2019 Refinement to the 2006 IPCC Guidelines, Volume 5: Waste, Chapter 3: Solid Waste Disposal - 3.2.3 Choice of emission factors and parameters. Page 3.13

The methodology used to estimate emissions from waste management activities requires country- specific knowledge on waste generation, composition and management practice. The main parameters that influence the estimation of the emissions from landfills, apart from the amount of the disposed waste, is the waste composition.

These parameters are strictly dependent on the waste management policies throughout the waste streams which start from waste generation through collection and transportation, separation for resource recovery, recycling and energy recovery and terminate at landfill sites. The improvements of quality and quantity of data is needed. However, with the available information and expert judgement it was possible to evaluate and compile data coming from different sources and to adjust them to the recommended IPCC methodology which is used for GHGs emissions estimation. Currently country specific data was used where they are available. Default values were used when country specific data were not available.

7.3.1 Category description

GHG emissions/ removals	**CO_2**		**CH_4**		**N_2O**	
	Estimated	**KCA**	**Estimated**	**KCA**	**Estimated**	**KCA**
5.A. Solid waste disposal	NA	-	✓	LA 1990 & 2020	NA	-
5.A.1. Managed waste disposal sites	NA	-	✓	-	NA	-
5.A.1.a. Anaerobic	NA	-	✓	-	NA	-
5.A.1.b. Semi-aerobic	NA	-	NO	-	NA	-
5.A.1.c. Active-aeration	NA	-	NO	-	NA	-
5.A.2 Unmanaged Waste Disposal Sites	NA	-	✓	-	NA	-
5.A.3 Uncategorized Waste Disposal Sites	NA	-	NO	-	NA	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential						
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF						

This chapter includes the CH_4 emissions estimations from *Managed and Unmanaged Waste Disposal Sites* for Solid Waste Disposal. The IPCC category 5.A Treatment and Discharge is for CH_4 a Key Category

An overview of the GHG emissions from IPCC sub-category 5.A *Solid Waste Disposal* is provided in the following figure and table. The share in total GHG emissions from sector 5.A *Solid Waste Disposal* is 34.4% for the year 1990, 50.1% for the year 2005, and 69.4% for the year 2020. The share in total CH_4 emissions from sector 5.A *Solid Waste Disposal* is 46.3% for the year 1990, 63.2% for the year 2005, and 81.7% for the year 2020.

Rural population

In the period 1990 – 2020 the CH_4 emissions increased by 191.9%. In the period 2005 – 2020 the CH_4 emissions increased by 103.8% mainly due to increasing landfilling activities, which is a result of increasing population and growing waste generation rates. Also, the reduction of open burning results in increasing landfilling.

Urban population

In the period 1990 – 2020 the CH_4 emissions increased by 474.5%. In the period 2005 – 2020 the CH_4 emissions increased by 120.4% mainly due to increasing landfilling activities, which is a result of increasing population and growing waste generation rates. Also, the reduction of open burning results in increasing landfilling. Since 2004 managed landfilling takes places and the share of Municipal solid waste, which goes to managed landfills was in 2020 by 58%, which also results in higher CH_4 emissions.

Total population

In the period 1990 – 2020 the CH_4 emissions increased by 187%. In the period 2005 – 2020 the CH_4 emissions increased by 68.6% mainly due to increasing landfilling activities which is a result of increasing population and growing waste generation rates. Also, the reduction of open burning results in increasing landfilling.

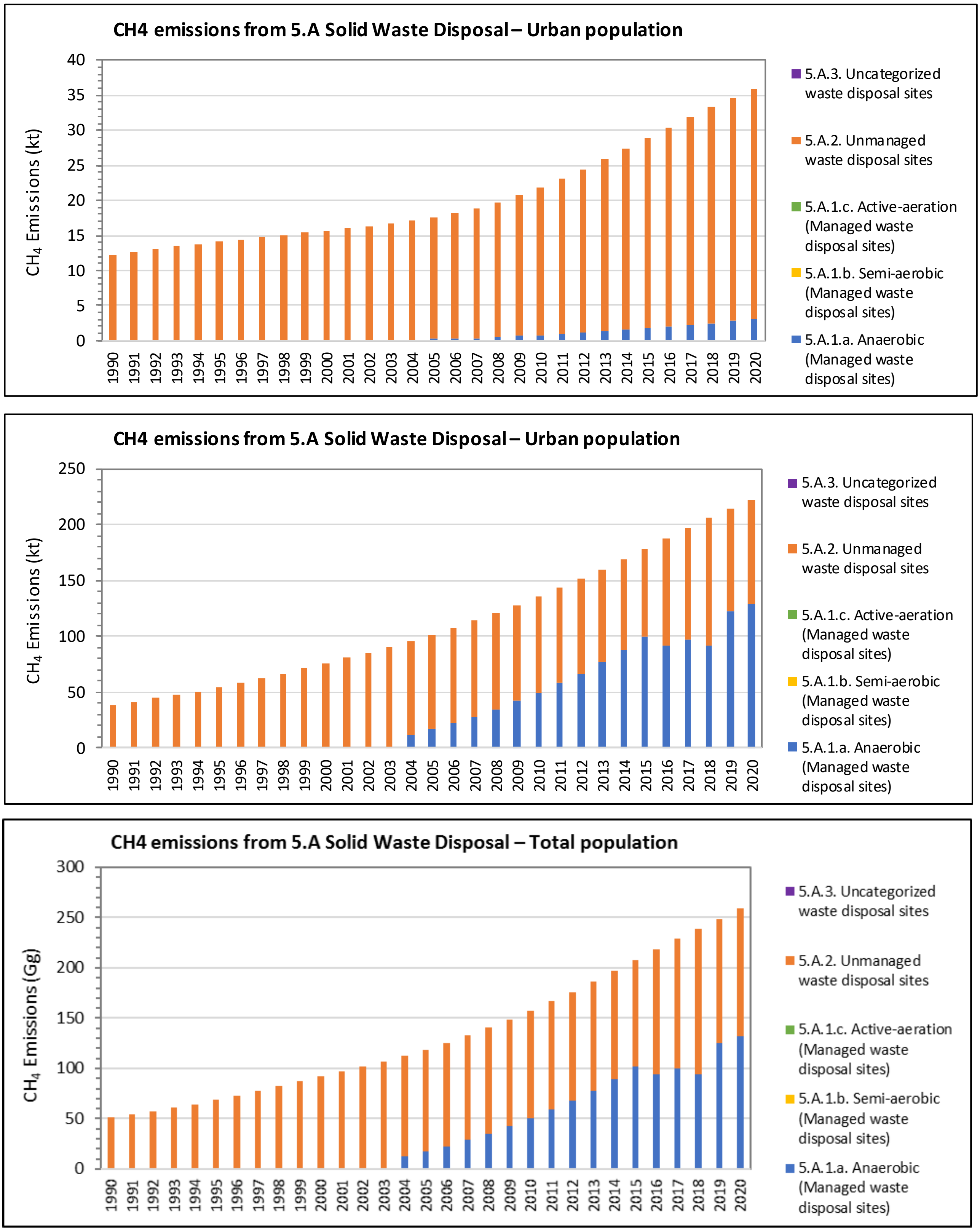

Figure 242 CH_4 emissions from IPCC sub-category 5.A Solid Waste Disposal – Total, urban and rural population 1990 – 2020

Table 608 GHG emissions from IPCC sub-category 5.A Solid Waste Disposal – Rural population – 1990 - 2020

Emission from Rural population	**GHG emissions**	**CH_4 Emissions**	**CH_4 Recovery**		**CH_4 Generated**				
			Flaring	**Energy recovery**	**5.A.1. Managed waste disposal sites**			**5.A.2. Unmanaged waste disposal sites**	**5.A.3. Uncategorized waste disposal sites**
					5.A.1.a. Anaerobic	**5.A.1.b. Semi-aerobic**	**5.A.1.c. Active-aeration**		
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	306.90	12.28	NO	NO	0.00	NO	NO	12.28	NO
1991	317.63	12.71	NO	NO	0.00	NO	NO	12.71	NO
1992	326.55	13.06	NO	NO	0.00	NO	NO	13.06	NO
1993	335.38	13.42	NO	NO	0.00	NO	NO	13.42	NO
1994	344.09	13.76	NO	NO	0.00	NO	NO	13.76	NO
1995	352.65	14.11	NO	NO	0.00	NO	NO	14.11	NO
1996	361.02	14.44	NO	NO	0.00	NO	NO	14.44	NO
1997	369.11	14.76	NO	NO	0.00	NO	NO	14.76	NO
1998	376.90	15.08	NO	NO	0.00	NO	NO	15.08	NO
1999	385.26	15.41	NO	NO	0.00	NO	NO	15.41	NO
2000	393.25	15.73	NO	NO	0.00	NO	NO	15.73	NO
2001	400.89	16.04	NO	NO	0.00	NO	NO	16.04	NO
2002	408.32	16.33	NO	NO	0.00	NO	NO	16.33	NO
2003	417.08	16.68	NO	NO	0.00	NO	NO	16.68	NO
2004	427.12	17.08	NO	NO	0.09	NO	NO	17.00	NO
2005	439.50	17.58	NO	NO	0.18	NO	NO	17.40	NO
2006	454.88	18.20	NO	NO	0.27	NO	NO	17.92	NO
2007	473.27	18.93	NO	NO	0.38	NO	NO	18.55	NO
2008	494.71	19.79	NO	NO	0.49	NO	NO	19.29	NO
2009	519.85	20.79	NO	NO	0.62	NO	NO	20.17	NO
2010	547.61	21.90	NO	NO	0.77	NO	NO	21.14	NO
2011	577.96	23.12	NO	NO	0.92	NO	NO	22.19	NO
2012	610.68	24.43	NO	NO	1.10	NO	NO	23.33	NO
2013	645.72	25.83	NO	NO	1.29	NO	NO	24.54	NO
2014	683.14	27.33	NO	NO	1.50	NO	NO	25.82	NO
2015	722.82	28.91	NO	NO	1.73	NO	NO	27.18	NO
2016	760.27	30.41	NO	NO	1.98	NO	NO	28.43	NO
2017	797.47	31.90	NO	NO	2.23	NO	NO	29.67	NO
2018	832.04	33.28	NO	NO	2.50	NO	NO	30.79	NO
2019	863.76	34.55	NO	NO	2.76	NO	NO	31.79	NO
2020	895.72	35.83	NO	NO	3.05	NO	NO	32.78	NO
Trend									
1990 - 2020	191.86%	191.86%	*NA*	*NA*	*NA*	*NA*	*NA*	167.05%	*NA*
2005 - 2020	103.80%	103.80%	*NA*	*NA*	1632.33%	*NA*	*NA*	88.36%	*NA*
2019 - 2020	3.70%	3.70%	*NA*	*NA*	10.18%	*NA*	*NA*	3.14%	*NA*

Table 609 GHG emissions from IPCC sub-category 5.A Solid Waste Disposal – Urban population – 1990 - 2020

Emission from Urban population	**GHG emissions**	**CH_4 Emissions**	**CH_4 Recovery**		**CH_4 Generated**				
			Flaring	**Energy recovery**	**5.A.1. Managed waste disposal sites**			**5.A.2. Unmanaged waste disposal sites**	**5.A.3. Uncategorized waste disposal sites**
					5.A.1.a. Anaerobic	**5.A.1.b. Semi-aerobic**	**5.A.1.c. Active-aeration**		
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	971.29	38.85	NO	NO	0.00	NO	NO	38.85	NO
1991	1,045.07	41.80	NO	NO	0.00	NO	NO	41.80	NO
1992	1,114.60	44.58	NO	NO	0.00	NO	NO	44.58	NO
1993	1,188.00	47.52	NO	NO	0.00	NO	NO	47.52	NO
1994	1,265.32	50.61	NO	NO	0.00	NO	NO	50.61	NO
1995	1,365.52	54.62	NO	NO	0.00	NO	NO	54.62	NO
1996	1,467.68	58.71	NO	NO	0.00	NO	NO	58.71	NO
1997	1,571.51	62.86	NO	NO	0.00	NO	NO	62.86	NO
1998	1,676.91	67.08	NO	NO	0.00	NO	NO	67.08	NO
1999	1,790.14	71.61	NO	NO	0.00	NO	NO	71.61	NO
2000	1,904.77	76.19	NO	NO	0.00	NO	NO	76.19	NO
2001	2,020.86	80.83	NO	NO	0.00	NO	NO	80.83	NO
2002	2,139.25	85.57	NO	NO	0.00	NO	NO	85.57	NO
2003	2,260.22	90.41	NO	NO	0.00	NO	NO	90.41	NO
2004	2,384.03	95.36	NO	NO	12.07	NO	NO	83.29	NO
2005	2,531.47	101.26	NO	NO	16.98	NO	NO	84.28	NO
2006	2,685.67	107.43	NO	NO	22.38	NO	NO	85.05	NO
2007	2,847.17	113.89	NO	NO	28.29	NO	NO	85.60	NO
2008	3,016.60	120.66	NO	NO	34.75	NO	NO	85.91	NO
2009	3,198.30	127.93	NO	NO	41.85	NO	NO	86.08	NO
2010	3,387.91	135.52	NO	NO	49.57	NO	NO	85.95	NO
2011	3,587.84	143.51	NO	NO	57.97	NO	NO	85.54	NO
2012	3,791.33	151.65	NO	NO	66.98	NO	NO	84.68	NO
2013	4,004.97	160.20	NO	NO	76.72	NO	NO	83.48	NO
2014	4,233.22	169.33	NO	NO	87.33	NO	NO	82.00	NO
2015	4,469.74	178.79	NO	NO	100.48	NO	NO	78.31	NO
2016	4,703.43	188.14	NO	NO	92.08	NO	NO	96.06	NO
2017	4,929.36	197.17	NO	NO	97.76	NO	NO	99.42	NO
2018	5,148.91	205.96	NO	NO	92.07	NO	NO	113.89	NO
2019	5,352.49	214.10	NO	NO	122.29	NO	NO	91.81	NO
2020	5,579.79	223.19	NO	NO	129.23	NO	NO	93.96	NO
Trend									
1990 - 2020	474.47%	474.47%	*NA*	*NA*	*NA*	*NA*	*NA*	141.85%	*NA*
2005 - 2020	120.42%	120.42%	*NA*	*NA*	661.02%	*NA*	*NA*	11.49%	*NA*
2019 - 2020	4.25%	4.25%	*NA*	*NA*	5.67%	*NA*	*NA*	2.35%	*NA*

Table 610 GHG emissions from IPCC sub-category 5.A Solid Waste Disposal – Total population – 1990 - 2020

Emission from Total population	**GHG emissions**	**CH_4 Emissions**	**CH_4 Recovery**		**CH_4 Generated**				
			Flaring	**Energy recovery**	**5.A.1. Managed waste disposal sites**			**5.A.2. Unmanaged waste disposal sites**	**5.A.3. Uncategorized waste disposal sites**
					5.A.1.a. Anaerobic	**5.A.1.b. Semi-aerobic**	**5.A.1.c. Active-aeration**		
	kt CO_2 equivalent	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	1,278.19	51.13	NO	NO	0.00	NO	NO	80.41	NO
1991	1,362.70	54.51	NO	NO	0.00	NO	NO	84.22	NO
1992	1,441.15	57.65	NO	NO	0.00	NO	NO	87.64	NO
1993	1,523.37	60.93	NO	NO	0.00	NO	NO	91.19	NO
1994	1,609.41	64.38	NO	NO	0.00	NO	NO	94.86	NO
1995	1,718.18	68.73	NO	NO	0.00	NO	NO	99.89	NO
1996	1,828.70	73.15	NO	NO	0.00	NO	NO	105.02	NO
1997	1,940.62	77.62	NO	NO	0.00	NO	NO	110.23	NO
1998	2,053.81	82.15	NO	NO	0.00	NO	NO	115.53	NO
1999	2,175.40	87.02	NO	NO	0.00	NO	NO	121.26	NO
2000	2,298.03	91.92	NO	NO	NO	NO	NO	1,278.19	NO
2001	2,421.74	96.87	NO	NO	NO	NO	NO	1,362.70	NO
2002	2,547.57	101.90	NO	NO	NO	NO	NO	1,441.15	NO
2003	2,677.30	107.09	NO	NO	NO	NO	NO	1,523.37	NO
2004	2,811.15	112.45	NO	NO	NO	NO	NO	1,609.41	NO
2005	2,970.97	118.84	NO	NO	NO	NO	NO	1,718.18	NO
2006	3,140.55	125.62	NO	NO	NO	NO	NO	1,828.70	NO
2007	3,320.45	132.82	NO	NO	NO	NO	NO	1,940.62	NO
2008	3,511.31	140.45	NO	NO	NO	NO	NO	2,053.81	NO
2009	3,718.15	148.73	NO	NO	NO	NO	NO	2,175.40	NO
2010	3,935.52	157.42	NO	NO	NO	NO	NO	2,298.03	NO
2011	4,165.79	166.63	NO	NO	NO	NO	NO	2,421.74	NO
2012	4,402.00	176.08	NO	NO	NO	NO	NO	2,547.57	NO
2013	4,650.69	186.03	NO	NO	NO	NO	NO	2,677.30	NO
2014	4,916.36	196.65	NO	NO	303.91	NO	NO	2,507.24	NO
2015	5,192.56	207.70	NO	NO	428.92	NO	NO	2,542.05	NO
2016	5,463.70	218.55	NO	NO	566.25	NO	NO	2,574.30	NO
2017	5,726.83	229.07	NO	NO	716.70	NO	NO	2,603.75	NO
2018	5,980.95	239.24	NO	NO	881.15	NO	NO	2,630.16	NO
2019	6,216.25	248.65	NO	NO	1,061.81	NO	NO	2,656.33	NO
2020	6,475.52	259.02	NO	NO	1,258.32	NO	NO	2,677.20	NO
Trend									
1990 - 2020	406.62%	406.62%	*NA*	*NA*	NA	*NA*	*NA*	147.90%	*NA*
2005 - 2020	117.96%	117.96%	*NA*	*NA*	670.97%	*NA*	*NA*	24.65%	*NA*
2019 - 2020	4.17%	4.17%	*NA*	*NA*	5.77%	*NA*	*NA*	2.55%	*NA*

7.3.2 Methodological issues - Choice of methods

CH_4 Emissions from solid waste disposal on land have been calculated using the First Order Decay (FOD) method, the IPCC Tier 1 method given in the 2006 IPCC Guidelines. The choice of a *good practice* method depends on national circumstances.

Tier 1 The estimations of the Tier 1 methods are based on the IPCC FOD method using mainly default activity data and default parameters.

Tier 2 Tier 2 methods use the IPCC FOD method and some default parameters but require good quality country-specific activity data on current and historical waste disposal at SWDS. Historical waste disposal data for 10 years or more should be based on country-specific statistics, surveys or other similar sources. Data are needed on amounts disposed at the SWDS.

Influencing factors of CH_4 Emissions generation and relevant data required:

- Waste amounts deposited / waste generated (starting year 1950)
- Waste treatment (collection, deposition/landfilling, composting, incineration/burning, recycling)
- Management practices at landfill sites – Methane correction factor (MCF)
- Conditions at landfill sites + Composition of waste deposited
- Organic carbon in landfill sites – degradable organic carbon (DOC)
- Methane generation rate constant (k)
- Landfill gas recovery, Oxidation
- National waste management policy

For estimating the CH_4 emissions the 2019 Refinement to the 2006 IPCC Guidelines Tier 1 approach[631] has been applied:

EQUATION 3.1 CH_4 emission from SWDS
(2019 Refinements to 2006 IPCC GL, Vol. 5, Chap.3)

$$\boldsymbol{CH_4 emissions = \left[\sum_x CH_4\ generated_{x,T} - R_T\right] \times (1 - OX_T)}$$

Where:

CH_4 Emissions = CH_4 emitted in year T (Gg)
T = inventory year
x = waste category (*municipal solid waste, sludge, industrial waste*) or type /material (*Food, paper, wood, textiles, etc etc.*)
R_T = recovered CH_4 in year T (Gg)
OX_T = oxidation factor in year T (fraction)

Methane generation: The **CH_4 generation potential** of the waste that is disposed in a certain year will decrease gradually throughout the following decades. In this process, the release of CH_4 from this specific amount of waste **decreases gradually**. The FOD model is built on an exponential factor that describes the fraction of degradable material which each year is degraded into CH_4.

The quantity of CH_4 emitted during decomposition process is directly proportional to the fraction of degradable organic carbon (DOC), which is defined as the carbon content of different types of organic biodegradable wastes such as paper and textiles, garden and park waste, food waste, wood and straw waste.

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[631] Source: 2019 Refinement to the 2006 IPCC Guidelines, Volume 5: Waste, Chapter 3: Solid Waste Disposal - 3.2.1.1 FIRST ORDER DECAY (FOD)

The equations for estimating the CH_4 generation are given below. As the mathematics are the same for estimating the CH_4 emissions from all waste categories/waste types/materials, no indexing referring to the different categories/waste materials/types is used in the equations below.

Equation 3.2: Decomposable DOC from waste disposal data

(2019 Refinements to 2006 IPCC GL, Vol. 5, Chap.3)

$$DDOCm = W \times DOC \times DOC_f \times MCF$$

Where

DDOCm = mass of decomposable DOC deposited (Gg)
W = mass of waste deposited (Gg)
DOC = degradable organic carbon in the year of deposition, fraction (Gg C/Gg waste)
DOC_f = fraction of DOC that can decompose (fraction)
MCF = CH_4 correction factor for aerobic decomposition in the year of deposition (fraction)

Although CH_4 generation potential (Lo)[2] is not used explicitly in the 2006 IPCC Guidelines, it equals the product of DDOCm, the CH_4 concentration in the gas (F) and the molecular weight ratio of CH_4 and C.

Equation 3.2: Transformation from DDOCm to L_O the year

(2019 Refinements to 2006 IPCC GL, Vol. 5, Chap.3)

$$L_o = DDOCm \times F \times \frac{16}{12}$$

Where:

Lo = CH_4 generation potential (Gg CH_4)
DDOCm = mass of decomposable DOC (Gg)
F = fraction of CH_4 in generated landfill gas (volume fraction)
16/12 = molecular weight ratio CH_4/C (ratio)

FIRST ORDER DECAY BASICS

With a first order reaction, the amount of product is always proportional to the amount of reactive material. This means that the year in which the waste material was deposited in the SWDS is irrelevant to the amount of CH_4 generated each year. It is only the total mass of decomposing material currently in the site that matters.

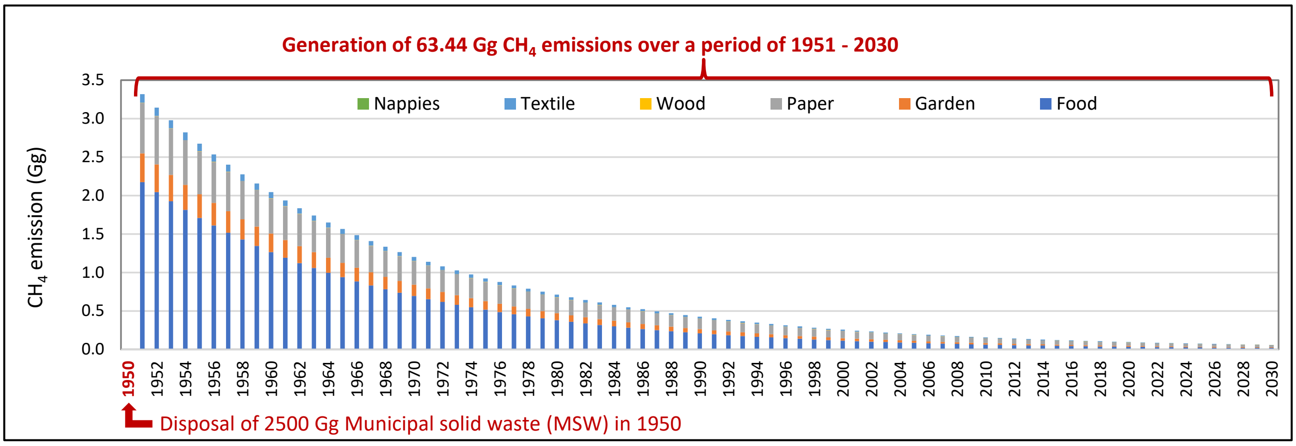

Figure 243 CH_4 emissions from IPCC sub-category 5.A Solid Waste Disposal of the disposal of waste in the year 1950

This also means that when the amount of decomposing material in the SWDS at the start of the year is known, every year can be regarded as year number 1 in the estimation method, and the **basic first order calculations** can be done by these two simple equations, with the decay reaction beginning on the 1st of January the year after deposition.

Equation 3.4: DDOCm accumulated in the SWDS at the end of year T
(2019 Refinements to 2006 IPCC GL, Vol. 5, Chap.3)

$$\boldsymbol{DDOCma_T = DDOCmd_T + \left(DDOCmd_T \times e^{-k}\right)}$$

Equation 3.5: DDOCm decomposed in the SWDS at the end of year T
(2019 Refinements to 2006 IPCC GL, Vol. 5, Chap.3)

$$\boldsymbol{DDOCm\ decomp_T = DDOCma_{T-1} \times \left(1 - e^{-k}\right)}$$

Where:

T = inventory year
DDOCmaT = DDOCm accumulated in the SWDS at the end of year T (Gg)
DDOCmaT-1 = DDOCm accumulated in the SWDS at the end of year (T-1) (Gg)
DDOCmdT = DDOCm deposited into the SWDS in year T (Gg)
DDOCm decompT = DDOCm decomposed in the SWDS in year T (Gg)
k = reaction constant,
k = ln(2)/$t_{1/2}$ (y-1)
$t_{1/2}$ = half-life time (y)²

7.3.2.1 Waste composition

Waste composition is one of the main factors influencing emissions from solid waste treatment, as different waste types contain different amount of degradable organic carbon (DOC) and fossil carbon.

Waste types such as food waste, garden waste, paper and cardboard, wood, textiles, and nappies (disposable diapers) contain most of the DOC in MSW. Ash, dust, rubber and leather contain also certain amounts of non-fossil carbon, but this is hardly degradable. Some textiles, plastics (including plastics in disposable nappies), rubber and electronic waste contain the bulk part of fossil carbon in MSW. Paper (with coatings) and leather (synthetic) can also include small amounts of fossil carbon.

Table 611 Decomposition duration of different trash in the Municipal Solid Waste (MSW)

Waste		Decomposition duration	Waste		Decomposition duration
Vegetables		5 days –1 month	Leather shoes		25–40 years
Paper		2–5 months	Nylon fabric		30–40 years
Cotton T-shirt		6 months	Tin cans		50–100 years
Orange peels		6 months	Aluminium cans		80–100 years
Tree leaves		1 year	Glass bottles		1 million years
Wool socks		1–5 years	Styrofoam cup		500 years to forever
Plastic-coated paper milk cartons		5 years	Plastic bags		500 years to forever

Source: Science Learning Hub New Zealand [632]

For Algeria, it was possible to collect country specific data on waste composition. In the following table, the IPCC default value is also provided for comparison. The country specific data on waste composition is in the range of the IPCC default. The IPCC default values of Degradable organic carbon (DOC) were applied and is in the following table presented.

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[632] Available (23.01.2020) on https://www.sciencelearn.org.nz/resources/1543-measuring-biodegradability

Table 612 Composition of waste going to solid waste disposal sites.

	Food	**Garden**	**Paper**	**Wood**	**Textile**	**Disposable nappies**	**Plastics, other inert**	**Source**
Waste composition	**(share)**							
IPCC Default	44%	7%	10%	1%	3%	0%	35%	TABLE 2.3, Vol. 5, Chapter 2, 2006 2019 refinements to IPCC Guidelines
1950	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	Same data as the 2010s [633]
1951	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1952	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1953	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1954	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1955	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1956	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1957	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1958	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1959	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1960	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1961	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1962	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1963	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1964	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1965	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1966	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1967	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1968	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1969	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1970	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1971	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1972	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1973	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1974	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1975	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1976	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1977	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1978	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1979	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1980	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1981	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1982	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1983	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1984	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1985	62.7%	0.0%	9.5%	1.6%	10.4%	0.0%	15.8%	
1986	62.7%	0.0%	9.5%	1.6%	10.1%	0.2%	15.8%	
1987	62.7%	0.0%	9.5%	1.6%	9.9%	0.4%	15.8%	

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[633] lack of data in the food waste category; paper; wood; plastics and other inert waste before 2010; we used the same data as the 2010s

	Food	Garden	Paper	Wood	Textile	Disposable nappies	Plastics, other inert	Source
Waste composition	(share)							
1988	62.7%	0.0%	9.5%	1.6%	9.7%	0.6%	15.8%	
1989	62.7%	0.0%	9.5%	1.6%	9.5%	0.8%	15.8%	
1990	62.7%	0.0%	9.5%	1.6%	9.3%	1.0%	15.8%	
1991	62.7%	0.0%	9.5%	1.6%	9.1%	1.2%	15.8%	
1992	62.7%	0.0%	9.5%	1.6%	8.9%	1.4%	15.8%	
1993	62.7%	0.0%	9.5%	1.6%	8.7%	1.7%	15.8%	
1994	62.7%	0.0%	9.5%	1.6%	8.5%	1.9%	15.8%	
1995	62.7%	0.0%	9.5%	1.6%	8.3%	2.1%	15.8%	
1996	62.7%	0.0%	9.5%	1.6%	8.1%	2.3%	15.8%	
1997	62.7%	0.0%	9.5%	1.6%	7.9%	2.5%	15.8%	
1998	62.7%	0.0%	9.5%	1.6%	7.7%	2.7%	15.8%	
1999	62.7%	0.0%	9.5%	1.6%	7.5%	2.9%	15.8%	
2000	62.7%	0.0%	9.5%	1.6%	7.2%	3.1%	15.8%	
2001	62.7%	0.0%	9.5%	1.6%	7.0%	3.3%	15.8%	
2002	62.7%	0.0%	9.5%	1.6%	6.8%	3.5%	15.8%	
2003	62.7%	0.0%	9.5%	1.6%	6.6%	3.7%	15.8%	
2004	62.7%	0.0%	9.5%	1.6%	6.4%	3.9%	15.8%	
2005	62.7%	0.0%	9.5%	1.6%	6.2%	4.1%	15.8%	
2006	62.7%	0.0%	9.5%	1.6%	6.0%	4.3%	15.8%	
2007	62.7%	0.0%	9.5%	1.6%	5.8%	4.6%	15.8%	
2008	62.7%	0.0%	9.5%	1.6%	5.6%	4.8%	15.8%	
2009	62.7%	0.0%	9.5%	1.6%	5.4%	5.0%	15.8%	
2010	62.7%	0.0%	9.5%	1.6%	5.2%	5.2%	15.8%	the characterization campaign AND
2011	61.0%	0.0%	9.5%	1.6%	5.5%	5.4%	17.0%	
2012	59.4%	0.0%	9.6%	1.6%	5.8%	5.6%	18.1%	
2013	57.7%	0.0%	9.6%	1.5%	6.0%	5.8%	19.3%	
2014	54.4%	0.0%	9.8%	1.5%	6.6%	6.0%	21.7%	AND
2015	52.8%	0.0%	9.8%	1.5%	6.9%	6.2%	22.9%	
2016	51.1%	0.0%	9.9%	1.5%	7.2%	6.4%	24.1%	
2017	49.5%	0.0%	9.9%	1.5%	7.5%	6.6%	25.2%	
2018	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	AND
2019	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	
2020	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	

for the period (2011-2013), (2015-2017) we used the linear regression method to fill the lack of data; since the characterization campaign is carried out every 4 years
Caractérisation des déchets ménagers et assimilés dans les zones nord, semi-aride et aride d’Algérie 2014
Caractérisation des déchets ménagers et assimilés (campagne nationale 2018 / 2019)

7.3.2.2 Degradable organic carbon (DOC)

In the following table the applied degradable organic carbon (DOC) for various waste components are presented.

Table 613 Degradable organic carbon (DOC)

Degradable organic carbon (DOC) **(weight fraction, wet basis)**	**Food**	**Garden**	**Paper**	**Wood**	**Textile**	**Disposable nappies**	**Plastics, other inert**	**Source**
IPCC Default	0.15	0.2	0.4	0.43	0.24	0.24	0.15	Based on TABLE 2.4, Chapter 2, and EQUATION 3.7, Chapter 3, Vol. 5, 2006 IPCC Guidelines

EQUATION 3.7 Estimates DOC using default carbon content values (2006 IPCC GL, Vol. 5, Chap.3)

$$\boldsymbol{DOC = \sum_i DOC_i \times W_i}$$

Where:

DOC = fraction of degradable organic carbon in bulk waste, Gg C/Gg waste

DOCi = fraction of degradable organic carbon in waste type i

Wi = fraction of waste type i by waste category

Table 614 Default dry matter content, DOC content, total carbon content and fossil carbon fraction of different MSW components

MSW component	**Dry matter content in % of wet weight**[1]	**DOC content in % of wet waste**		**DOC content in % of dry waste**		**Total carbon content in % of dry weight**		**Fossil carbon fraction in % of total carbon**	
	Default	**Default**	**Range**	**Default**	**Range**[2]	**Default**	**Range**	**Default**	**Range**
Paper/cardboard	90	40	*36 - 45*	44	*40 - 50*	46	*42 - 50*	1	*0 - 5*
Textiles[3]	80	24	*20 - 40*	30	*25 - 50*	50	*25 - 50*	20	*0 - 50*
Food waste	40	15	*8 - 20*	38	*20 - 50*	38	*20 - 50*	-	-
Wood	85 4	43	*39 - 46*	50	*46 - 54*	50	*46 - 54*	-	-
Garden and Park waste	40	20	*18 - 22*	49	*45 - 55*	49	*45 - 55*	0	*0*
Nappies	40	24	*18 - 32*	60	*44 - 80*	70	*54 - 90*	10	*10*
Rubber and Leather	84	(39)[5]	*(39)*[5]	(47)[5]	*(47)*[5]	67	*67*	20	*20*
Plastics	100	-	-	-	-	75	*67 - 85*	100	*95 - 100*
Metal[6]	100	-	-	-	-	NA	*NA*	NA	*NA*
Glass[6]	100	-	-	-	-	NA	*NA*	NA	*NA*
Other, inert waste	90	-	-	-	-	3	*0 - 5*	100	*50 - 100*

Remark: for footnotes see 2006 IPCC Guidelines

Source: Table 2.4, Vol. 5, Chapter 2, 2006 IPCC Guidelines

7.3.2.3 Methane Correction Factor (MCF)

The Methane Correction Factor (MCF) reflects the way in which MSW is managed and the effect of management practices on CH_4 generation. MCF accounts for the fact that unmanaged SWDS produce less CH_4 from a given amount of waste than anaerobic managed SWDS. The methodology requires countries to provide data or estimates of the quantity of waste that is disposed of to each of categories of solid waste disposal sites. 2006 IPCC Guidelines provides default values for MCF (2006 IPCC, Vol.5: Waste Table 3.1, p.6.8).

Table 615 SWDS classification and methane correction factors (MCF)

Type of Site	Methane Correction Factor (MCF) Default Values	Source
(1) Managed – anaerobic	1.0	TABLE 3.1, Vol. 5, Chapter 3, 2019 Refinements to 2006 IPCC Guidelines
(2) Managed well – semi-aerobic	0.5	
(3) Managed poor – semi aerobic	0.7	
(4) Managed well – active-aeration	0.4	
(5) Managed poorly – active-aeration	0.7	
(6) Unmanaged – deep (>5 m waste) and /or high-water table	0.8	
(7) Unmanaged – shallow (<5 m waste)	0.4	
(8) Uncategorised SWDS	0.6	

7.3.2.4 Distribution of Waste by Waste Management Type

In the following table the distribution of waste by waste management type is presented.

Table 616 Distribution of Waste by Waste Management Typ in Algeria - Rural

Rural	Un-managed, shallow	Un-managed, deep	Managed – anaerobic	Managed well – semi-aerobic	Managed poor – semi aerobic	Managed well – active-aeration	Managed poorly – active-aeration	Uncategorised	Source
IPCC Default	25%	30%	25%	5%				15%	TABLE 2.3[634]
1950	80%	20%	0%	0%	0%	0%	0%	0%	during the period 1950-1962 Algeria experienced an unstable political situation, so we thought of attributing this distribution also to the number of the population and the standard of living
⋮ ⋮ ⋮	constant	constant	constant	constant	constant	constant	constant	constant	
1960	80%	20%	0%	NO	NO	NO	NO	NO	
1961	80%	20%	0%	NO	NO	NO	NO	NO	
1962	75%	25%	0%	NO	NO	NO	NO	NO	After the independence of Algeria in 1962, the density of metropolises and large cities increased rapidly, which induces a change in the distribution of waste by type of management with the increase in unmanaged deep landfills (ONS, 2011)
1963	70%	30%	0%	NO	NO	NO	NO	NO	
1964	65%	35%	0%	NO	NO	NO	NO	NO	
1965	60%	40%	0%	NO	NO	NO	NO	NO	
1966	60%	40%	0%	NO	NO	NO	NO	NO	
1967	60%	40%	0%	NO	NO	NO	NO	NO	
1968	60%	40%	0%	NO	NO	NO	NO	NO	
1969	60%	40%	0%	NO	NO	NO	NO	NO	
1970	60%	40%	0%	NO	NO	NO	NO	NO	
1971	60%	40%	0%	NO	NO	NO	NO	NO	from 1971 the standard of living of the Algerian population improved, thanks to the nationalization of hydrocarbons and the launch of industrial activity
1972	55%	45%	0%	NO	NO	NO	NO	NO	
1973	50%	50%	0%	NO	NO	NO	NO	NO	
1974	45%	55%	0%	NO	NO	NO	NO	NO	
1975	40%	60%	0%	NO	NO	NO	NO	NO	
1976	35%	65%	0%	NO	NO	NO	NO	NO	
1977	30%	70%	0%	NO	NO	NO	NO	NO	
1978	30%	70%	0%	NO	NO	NO	NO	NO	
1979	30%	70%	0%	NO	NO	NO	NO	NO	
1980	30%	70%	0%	NO	NO	NO	NO	NO	
1981	30%	70%	0%	NO	NO	NO	NO	NO	
1982	30%	70%	0%	NO	NO	NO	NO	NO	
1983	30%	70%	0%	NO	NO	NO	NO	NO	
1984	30%	70%	0%	NO	NO	NO	NO	NO	
1985	30%	70%	0%	NO	NO	NO	NO	NO	
1986	30%	70%	0%	NO	NO	NO	NO	NO	
1987	30%	70%	0%	NO	NO	NO	NO	NO	

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[634] Vol. 5, Chap. 2, 2019 Refinements to 2006 IPCC Guidelines

Rural	**Un-managed, shallow**	**Un-managed, deep**	**Managed – anaerobic**	**Managed well – semi-aerobic**	**Managed poor – semi aerobic**	**Managed well – active-aeration**	**Managed poorly – active-aeration**	**Uncategorised**	**Source**
IPCC Default	25%	30%	25%	5%				15%	TABLE 2.3[634]
1988	30%	70%	0%	NO	NO	NO	NO	NO	
1989	30%	70%	0%	NO	NO	NO	NO	NO	
1990	30%	70%	0%	NO	NO	NO	NO	NO	
1991	40%	60%	0%	NO	NO	NO	NO	NO	the absence of a national waste management strategy has led to the increase in shallow landfills
1992	40%	60%	0%	NO	NO	NO	NO	NO	
1993	40%	60%	0%	NO	NO	NO	NO	NO	
1994	40%	60%	0%	NO	NO	NO	NO	NO	
1995	40%	60%	0%	NO	NO	NO	NO	NO	
1996	40%	60%	0%	NO	NO	NO	NO	NO	
1997	40%	60%	0%	NO	NO	NO	NO	NO	
1998	35%	65%	0%	NO	NO	NO	NO	NO	
1999	35%	65%	0%	NO	NO	NO	NO	NO	
2000	35%	65%	0%	NO	NO	NO	NO	NO	
2001	35%	65%	0%	NO	NO	NO	NO	NO	From 2001 with the promulgation of the law relating to the management and control of waste, Algeria adopted the operation of controlled landfills.
2002	35%	65%	0%	NO	NO	NO	NO	NO	
2003	35%	65%	0%	NO	NO	NO	NO	NO	
2004	30%	65%	5%	NO	NO	NO	NO	NO	
2005	30%	65%	5%	NO	NO	NO	NO	NO	
2006	30%	65%	5%	NO	NO	NO	NO	NO	
2007	30%	65%	5%	NO	NO	NO	NO	NO	
2008	25%	65%	10%	NO	NO	NO	NO	NO	the commissioning of the first CET's in 2008. during the period 2008-2016, Algeria commissioned more than 70 CETs (report of the ministry in charge of the environment) www.sweep-net.org Regional network of exchange of information and expertise in the waste sector in the Mashreq and Maghreb countries
2009	23%	65%	12%	NO	NO	NO	NO	NO	
2010	20%	65%	15%	NO	NO	NO	NO	NO	
2011	20%	63%	17%	NO	NO	NO	NO	NO	
2012	17%	58%	25%	NO	NO	NO	NO	NO	
2013	12%	58%	30%	NO	NO	NO	NO	NO	
2014	10%	50%	40%	NO	NO	NO	NO	NO	
2015	10%	45%	45%	NO	NO	NO	NO	NO	
2016	6%	40%	54%	NO	NO	NO	NO	NO	at the national level, the rate of waste treated in the CETs is 54% and 46% in wild dumps (uncontrolled)
2017	5%	35%	60%	NO	NO	NO	NO	NO	
2018	5%	35%	60%	NO	NO	NO	NO	NO	
2019	5%	35%	60%	NO	NO	NO	NO	NO	
2020	5%	35%	60%	NO	NO	NO	NO	NO	

Table 617 Distribution of Waste by Waste Management Typ in Algeria - Urban[635]

Urban	Un-managed, shallow	Un-managed, deep	Managed – anaerobic	Managed well – semi-aerobic	Managed poor – semi aerobic	Managed well – active-aeration	Managed poorly – active-aeration	Uncate-gorised	Source
IPCC Default	25%	30%	25%	5%				15%	TABLE 2.3[636]
1950	80%	20%	0%	0%	0%	0%	0%	0%	during the period 1950-1962 Algeria experienced an unstable political situation, so we thought of attributing this distribution also to the number of the population and the standard of living
	constant	constant	constant	constant	constant	constant	constant	constant	
1960	80%	20%	0%	NO	NO	NO	NO	NO	
1961	80%	20%	0%	NO	NO	NO	NO	NO	
1962	75%	25%	0%	NO	NO	NO	NO	NO	After the independence of Algeria in 1962, the density of metropolises and large cities increased rapidly, which induces a change in the distribution of waste by type of management with the increase in unmanaged deep landfills (ONS, 2011)
1963	70%	30%	0%	NO	NO	NO	NO	NO	
1964	65%	35%	0%	NO	NO	NO	NO	NO	
1965	60%	40%	0%	NO	NO	NO	NO	NO	
1966	60%	40%	0%	NO	NO	NO	NO	NO	
1967	60%	40%	0%	NO	NO	NO	NO	NO	
1968	60%	40%	0%	NO	NO	NO	NO	NO	
1969	60%	40%	0%	NO	NO	NO	NO	NO	
1970	60%	40%	0%	NO	NO	NO	NO	NO	
1971	60%	40%	0%	NO	NO	NO	NO	NO	from 1971 the standard of living of the Algerian population improved, thanks to the nationalization of hydrocarbons and the launch of industrial activity
1972	55%	45%	0%	NO	NO	NO	NO	NO	
1973	50%	50%	0%	NO	NO	NO	NO	NO	
1974	45%	55%	0%	NO	NO	NO	NO	NO	
1975	40%	60%	0%	NO	NO	NO	NO	NO	
1976	35%	65%	0%	NO	NO	NO	NO	NO	
1977	30%	70%	0%	NO	NO	NO	NO	NO	
1978	30%	70%	0%	NO	NO	NO	NO	NO	
1979	30%	70%	0%	NO	NO	NO	NO	NO	
1980	30%	70%	0%	NO	NO	NO	NO	NO	
1981	30%	70%	0%	NO	NO	NO	NO	NO	
1982	30%	70%	0%	NO	NO	NO	NO	NO	
1983	30%	70%	0%	NO	NO	NO	NO	NO	
1984	30%	70%	0%	NO	NO	NO	NO	NO	
1985	30%	70%	0%	NO	NO	NO	NO	NO	
1986	30%	70%	0%	NO	NO	NO	NO	NO	
1987	30%	70%	0%	NO	NO	NO	NO	NO	
1988	30%	70%	0%	NO	NO	NO	NO	NO	
1989	30%	70%	0%	NO	NO	NO	NO	NO	
1990	30%	70%	0%	NO	NO	NO	NO	NO	
1991	40%	60%	0%	NO	NO	NO	NO	NO	the absence of a

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[635] national expert, ANCC

[636] Vol. 5, Chap. 2, 2019 Refinements to 2006 IPCC Guidelines

Urban	**Un-managed, shallow**	**Un-managed, deep**	**Managed – anaerobic**	**Managed well – semi-aerobic**	**Managed poor – semi aerobic**	**Managed well – active-aeration**	**Managed poorly – active-aeration**	**Uncategorised**	**Source**
IPCC Default	25%	30%	25%	5%				15%	TABLE 2.3[636]
1992	40%	60%	0%	NO	NO	NO	NO	NO	national waste management strategy has led to the increase in shallow landfills
1993	40%	60%	0%	NO	NO	NO	NO	NO	
1994	40%	60%	0%	NO	NO	NO	NO	NO	
1995	40%	60%	0%	NO	NO	NO	NO	NO	
1996	40%	60%	0%	NO	NO	NO	NO	NO	
1997	40%	60%	0%	NO	NO	NO	NO	NO	
1998	35%	65%	0%	NO	NO	NO	NO	NO	
1999	35%	65%	0%	NO	NO	NO	NO	NO	
2000	35%	65%	0%	NO	NO	NO	NO	NO	
2001	35%	65%	0%	NO	NO	NO	NO	NO	From 2001 with the promulgation of the law relating to the management and control of waste, Algeria adopted the operation of controlled landfills.
2002	35%	65%	0%	NO	NO	NO	NO	NO	
2003	35%	65%	0%	NO	NO	NO	NO	NO	
2004	30%	65%	5%	NO	NO	NO	NO	NO	
2005	30%	65%	5%	NO	NO	NO	NO	NO	
2006	30%	65%	5%	NO	NO	NO	NO	NO	
2007	30%	65%	5%	NO	NO	NO	NO	NO	
2008	25%	65%	10%	NO	NO	NO	NO	NO	the commissioning of the first CET's in 2008. during the period 2008-2016, Algeria commissioned more than 70 CETs (report of the ministry in charge of the environment) www.sweep-net.org Regional network of exchange of information and expertise in the waste sector in the Mashreq and Maghreb countries
2009	23%	65%	12%	NO	NO	NO	NO	NO	
2010	20%	65%	15%	NO	NO	NO	NO	NO	
2011	20%	63%	17%	NO	NO	NO	NO	NO	
2012	17%	58%	25%	NO	NO	NO	NO	NO	
2013	12%	58%	30%	NO	NO	NO	NO	NO	
2014	10%	50%	40%	NO	NO	NO	NO	NO	
2015	10%	45%	45%	NO	NO	NO	NO	NO	
2016	6%	40%	54%	NO	NO	NO	NO	NO	at the national level, the rate of waste treated in the CETs is 54% and 46% in wild dumps (uncontrolled)
2017	5%	35%	60%	NO	NO	NO	NO	NO	
2018	5%	35%	60%	NO	NO	NO	NO	NO	
2019	5%	35%	60%	NO	NO	NO	NO	NO	
2020	5%	35%	60%	NO	NO	NO	NO	NO	

7.3.2.5 Waste related parameter

Furthermore, the following default parameter are applied:

<u>DOC dissimilated (DOCf)</u>

Fraction of DOC dissimilated (DOCf) is an estimate of the fraction of carbon that is ultimately degraded and released from SWDS, and reflects the fact that some organic carbon does not degrade, or degrades very slowly, when deposited in SWDS. It is *good practice* to use a value of 0.5 (including lignin C) as the default (TABLE 3.1, Vol. 5, Chapter 3, 2006 IPCC Guidelines).

<u>Fraction of methane (F) in developed gas</u>

Most waste in SWDS generates a gas with approximately 50% CH_4. Only material including substantial amounts of fat or oil can generate gas with substantially more than 50 percent CH_4. Algeria is using the IPCC default value 0.5 for the fraction of CH_4 in landfill gas. (Vol. 5, Chapter 3, 2006 IPCC GL, page 3.15)

Delay time

In most solid waste disposal sites, waste is deposited continuously throughout the year, usually on a daily basis. However, there is evidence that production of CH_4 does not begin immediately after deposition of the waste. Algeria uses the default delay of six months. (Vol. 5, Chapter 3, 2006 IPCC Guidelines, page 3.19)

Oxidation factor (OX)

The oxidation factor (OX) reflects the amount of CH_4 from SWDS that is oxidized in the soil or other material covering the waste. (TABLE 3.2, Vol. 5, Chapter 3, 2006 IPCC Guidelines).

7.3.2.6 Methane recovery (R)

CH_4 generated at SWDS can be recovered and combusted in a flare or energy device.

In Algeria, no methane recovery (R) takes place.

7.3.2.7 Default methane generation rate

In the following table the applied default methane generation rates presented.

Table 618 Recommended default methane generation rate (k) values under Tier 1 [637]

Type of Waste		Climate Zone*							
		Boreal and Temperate (MAT ≤ 20°C)				Tropical[1] (MAT > 20°C)			
		Dry (MAP/PET < 1)		Wet (MAP/PET > 1)		Dry (MAP < 1000 mm)		Moist and Wet (MAP ≥ 1000 mm)	
		Default	Range[2]	Default	Range[2]	Default	Range[2]	Default	Range[2]
Slowly degrading waste	Paper/textiles waste	**0.04**	0.03[3,5] – 0.05[3,4]	0.06	0.05 – 0.07[3,5]	0.045	0.04 – 0.06	0.07	0.06 – 0.085
	Wood/ straw waste	**0.02**	0.01[3,4] – 0.03[6,7]	0.03	0.02 – 0.04	0.025	0.02 – 0.04	0.035	0.03 – 0.05
Moderately degrading waste	Other (non – food) organic putrescible/ Garden and park waste	**0.05**	0.04 – 0.06	0.1	0.06 – 0.1[8]	0.065	0.05 – 0.08	0.17	0.15 – 0.2
Rapidly degrading waste	Food waste/Sewage sludge	**0.06**	0.05 – 0.08	0.185[4]	0.1[3,4] – 0.2[9]	0.085	0.07 – 0.1	0.4	0.17 – 0.7[10]
Bulk Waste		**0.05**	0.04 – 0.06	0.09	0.08[8] – 0.1	0.065	0.05 – 0.08	0.17	0.15[11] – 0.2

Remark: for footnotes see 2006 IPCC Guidelines

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[637] Table 3.3, Vol. 5, Chapter 3, 2006 IPCC Guidelines

Table 619 Recommended default half-life (t1/2) values (YR) under Tier 1[638]

Type of Waste		Climate Zone*							
		Boreal and Temperate (MAT ≤ 20°C)				Tropical[1] (MAT > 20°C)			
		Dry (MAP/PET < 1)		Wet (MAP/PET > 1)		Dry (MAP < 1000 mm)		Moist and Wet (MAP ≥ 1000 mm)	
		Default	Range[2]	Default	Range[2]	Default	Range[2]	Default	Range[2]
Slowly degrading waste	**Paper/textiles waste**	**17**	14[3,5] – 23[3,4]	12	10 – 14[3,5]	15	12 – 17	10	8 – 12
	Wood/ straw waste	**35**	23[3,4] – 69[6,7]	23	17 – 35	28	17 – 35	20	14 – 23
Moderately degrading waste	**Other (non – food) organic putrescible/ Garden & park waste**	**14**	12 – 17	7	6 – 9[8]	11	9 – 14	4	3 – 5
Rapidly degrading waste	**Food waste/Sewage sludge**	**12**	9 – 14	44	3[3,4] – 6[9]	8	6 – 10	2	1[10] – 4
Bulk Waste		**14**	12 – 17	7	6 – 9[8]	11	9 – 14	4	3 – 5[11]

Remark: for footnotes see 2006 IPCC Guidelines

7.3.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 5.A *Solid Waste Disposal* are presented in the following table.

Table 620 Uncertainty for IPCC sub-category 5.A Solid Waste Disposal.

Uncertainty	CH_4	**Source**
Activity data (AD)	87%	TABLE 3.5 (UPDATED) 2019 Refinement to the 2006 IPCC GL, Vol. 5, Chap. 3.7
Emission factor (EF)	52%	
Combined Uncertainty (U)	101%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

7.3.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- time series consistency
- plausibility checks of dips and jumps.

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[638] Table 3.4, Vol. 5, Chapter 3, 2006 IPCC Guidelines

7.3.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category *5.A Solid Waste Disposal*.

Table 621 Recalculations done in IPCC sub-category 5.A Solid Waste Disposal

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
5.A.	Application of 2006 IPCC Guidelines: FOD model	method	Accuracy, comparability
5.A.	Use of rural and urban population	AD	Completeness, Accuracy, comparability
5.A.	Estimation of waste generation for the time series 1950 - 2018	AD	completeness
5.A.	Estimation of country specific waste composition	AD	Accuracy
5.A.	Estimation of country specific waste flow	AD	Accuracy
5.A.	Application of default values of 2006 IPCC Guidelines	EF	Accuracy, comparability

7.3.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 622 Planned improvements for IPCC sub-category 5.A Solid Waste Disposal

GHG source & sink category	Planned improvement	Type of improvement		Priority
5	Further investigation on waste flow: collection, disposal, recycling, incineration with energy and without energy recovery, open burning, composting, etc. ● By Wilaya and/or by Climate region ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ "Other" urban ● Evaluation of existing studies	AD	Accuracy Transparency Comparability Completeness Consistency	high
5	Further investigation on waste generation (rate) ● By Wilaya and/or by Climate region (see Table 619 & Table 618) ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ "Other" urban ● Evaluation of existing studies	AD		high
5	Further investigation on amount and waste management practices regarding clinic waste, sludge, hazardous waste, etc.	AD		medium
5	Further investigation on industrial waste generation and industrial waste management practices	AD		medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
5.A	In-depth analysis of existing data on waste collection and disposal from municipalities for application of higher TIER methodology (TIER 2): good quality country-specific activity data on current and historical waste disposal at SWDS (data for the last 30 years (or more))	AD		high
5.A	Further investigation on waste management practices (managed, unmanaged, unspecified) (see Table 615)	AD		high

7.4 Biological treatment of solid waste (IPCC category 5.B)

The following section describes GHG emissions resulting from biological treatment of solid waste, which originates from three different processes:

- Composting,
- anaerobic digestion of organic waste, and
- mechanical-biological (MB) treatment.

Composting and anaerobic digestion of organic waste, such as food waste, garden and park waste and sludge, is common in many countries. Advantages of the biological treatment include:

- reduced volume in the waste material,
- stabilization of the waste,
- destruction of pathogens in the waste material, and
- production of biogas for energy use.

The end products of the biological treatment can, depending on its quality, be recycled as fertilizer and soil amendment, or be disposed in Solid waste disposal sites (SWDS).

Anaerobic treatment is usually linked with methane (CH_4) recovery and combustion for energy, and thus the greenhouse gas emissions from the process should be reported in the Energy Sector.

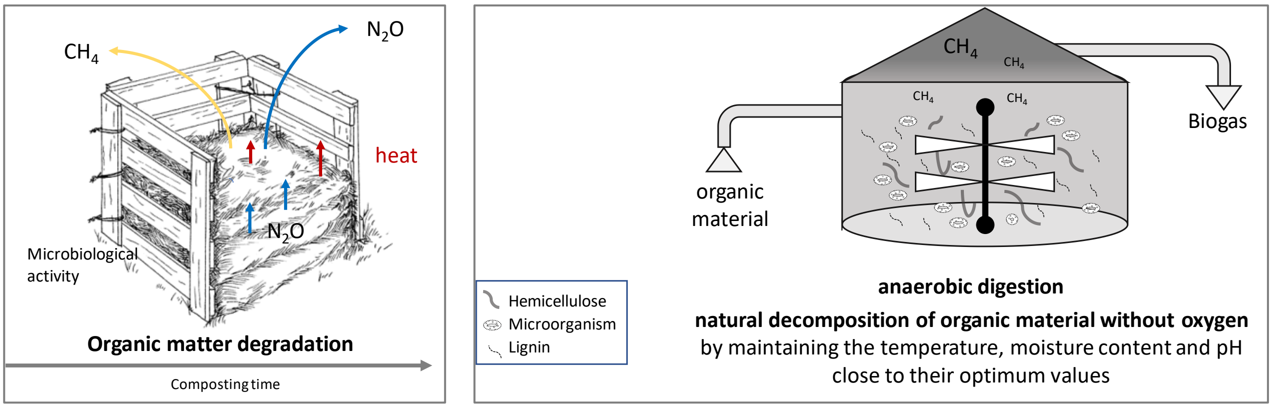

Figure 244 Scheme of composting and anaerobic digestion

Composting is a preferred method of solid waste disposal in rural area, mainly due to the high percentage of organic material in the waste composition. As no specific information on composting activities in Algeria were available, this sources has not been estimated.

Composting is a preferred method of solid waste disposal in many countries in the rural area, mainly due to the high percentage of organic material in the waste composition. As no specific information on composting activities in Algeria were available, the activity needed for estimating GHG emission from composting are based on expert judgement of national experts.

7.4.1 Category description

GHG emissions/ removals	CO_2	CH_4	N_2O
Estimated			
5.B.1. Composting	NA	✓	✓
5.B.2. Anaerobic digestion at biogas facilities	NA	NE	NE
Key Category	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential			
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF			

GHG emissions from 5.B.2. Anaerobic digestion at biogas facilities were not estimated due to lack of data. In this inventory cycle. (see chapter Planned improvements)

An overview of the GHG emissions from IPCC sub-category 5.B *Biological treatment of solid waste* is provided in the following figure and table. The share in total GHG emissions from 5.B *Biological treatment of solid waste* is 8.1% for the year 1990, 4.2% for the year 2005, and 2.5% for the year 2020. The share in National total CH_4 emissions from 5.B *Biological treatment of solid waste* is 2.3% for the year 1990, 2.3% for the year 2005, and 2.3% for the year 2020. The share in total N_2O emissions from 5.B *Biological treatment of solid waste* is 0.2% for the year 1990, 0.2% for the year 2005, and 0.1% for the year 2020.

In the period 1990 – 2020 the GHG emissions decreased by 22.5%. In the period 2005 – 2020 the GHG emissions decreased by 7.7% mainly due to increasing waste generation rate due to growing urban population, where composting activities are not practices that much.

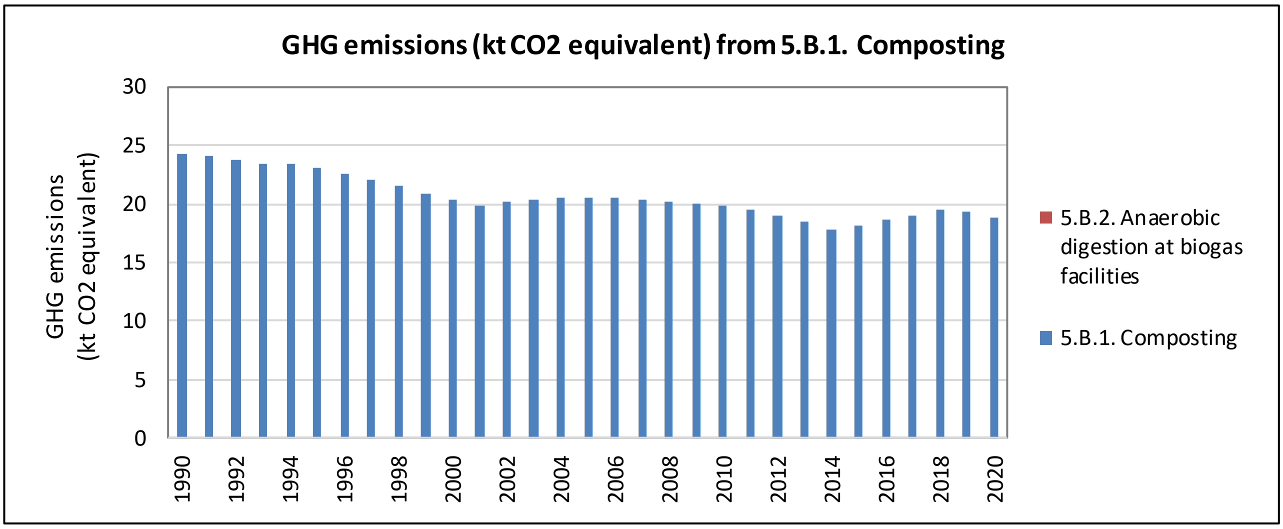

Figure 245 GHG Emissions from IPCC sub-category 5.B Biological treatment of solid waste - Total population

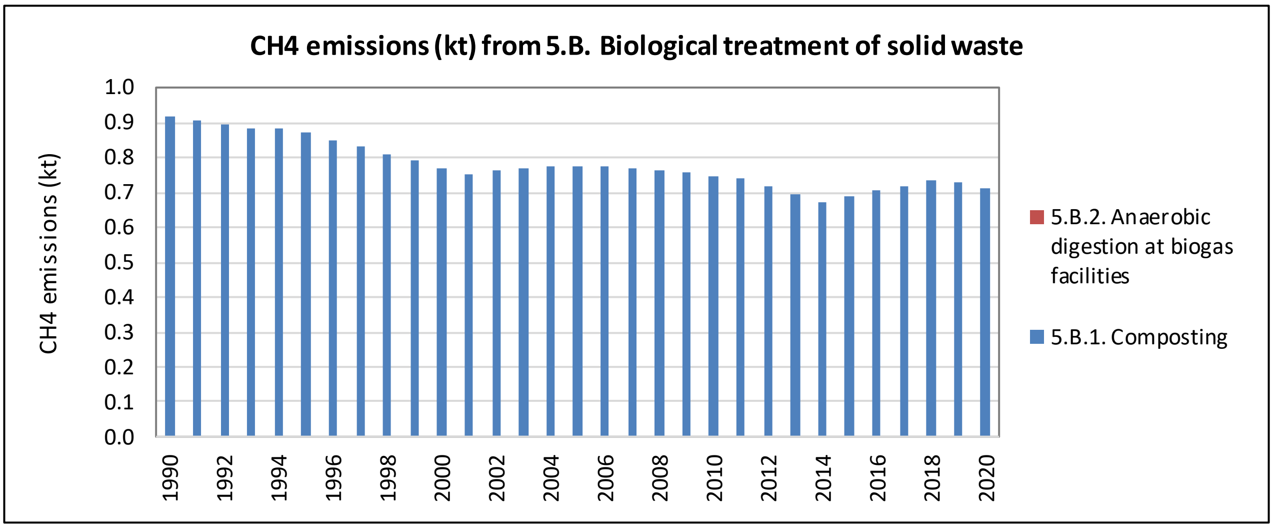

Figure 246 CH₄ Emissions from IPCC sub-category 5.B Biological treatment of solid waste - Total population

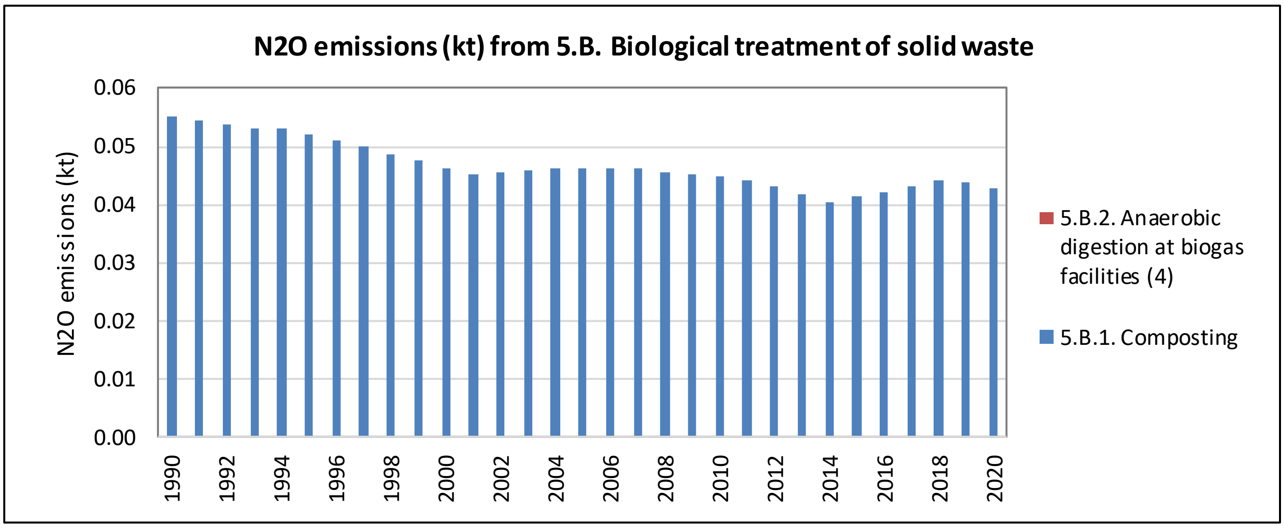

Figure 247 N_2O Emissions from IPCC sub-category 5.B Biological treatment of solid waste - Total population

Table 623 Emissions from IPCC sub-category 5.B Biological treatment of solid waste

GHG emissions	**5.B. Biological treatment of solid waste**	**5.B.1. Composting**		**5.B.2. Anaerobic digestion at biogas facilities**	
	Total GHG	**CH_4**	**N_2O**	**CH_4**	**N_2O**
	kt $_{CO_2\ equivalent}$	**kt**	**kt**	**kt**	**kt**
1990	24.39	0.9203	0.0552	NO	NO
1991	24.08	0.9087	0.0545	NO	NO
1992	23.76	0.8966	0.0538	NO	NO
1993	23.42	0.8838	0.0530	NO	NO
1994	23.47	0.8857	0.0531	NO	NO
1995	23.04	0.8693	0.0522	NO	NO
1996	22.55	0.8508	0.0510	NO	NO
1997	22.03	0.8313	0.0499	NO	NO
1998	21.50	0.8113	0.0487	NO	NO
1999	20.97	0.7915	0.0475	NO	NO
2000	20.45	0.7716	0.0463	NO	NO
2001	19.93	0.7520	0.0451	NO	NO
2002	20.16	0.7608	0.0456	NO	NO
2003	20.34	0.7675	0.0461	NO	NO
2004	20.47	0.7726	0.0464	NO	NO
2005	20.50	0.7735	0.0464	NO	NO
2006	20.47	0.7725	0.0463	NO	NO
2007	20.39	0.7695	0.0462	NO	NO
2008	20.17	0.7613	0.0457	NO	NO
2009	20.03	0.7559	0.0454	NO	NO
2010	19.83	0.7483	0.0449	NE	NE
2011	19.57	0.7385	0.0443	NE	NE
2012	19.02	0.7177	0.0431	NE	NE
2013	18.44	0.6957	0.0417	NE	NE
2014	17.79	0.6715	0.0403	NE	NE
2015	18.23	0.6880	0.0413	NE	NE
2016	18.66	0.7042	0.0422	NE	NE
2017	19.08	0.7199	0.0432	NE	NE
2018	19.46	0.7343	0.0441	NE	NE
2019	19.30	0.7284	0.0437	NE	NE
2020	18.91	0.7137	0.0428	NE	NE
Trend					
1990 – 2020	*-22.45%*	*-22.5%*	*-22.9%*	*NA*	*NA*
2005 – 2020	*-7.74%*	*-7.7%*	*-10.3%*	*NA*	*NA*
2019 - 2020	*-2.02%*	*-2.0%*	*5.3%*	*NA*	*NA*

7.4.2 Methodological issues

7.4.2.1 Choice of methods

For estimating the CH_4 and NO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[639] has been applied. CH_4 and NO_2 emissions from composting and anaerobic digestion of organic waste are result of the degradable organic carbon (DOC), composting is an aerobic process and a large fraction of the degradable organic carbon (DOC) in the waste material is converted into carbon dioxide (CO2). CH4 is formed in anaerobic sections of the compost, but it is oxidized to a large extent in the aerobic sections of the compost. The estimated CH4 released into the atmosphere ranges from less than 1 % to a few per cent of the initial carbon content in the material, Composting can also produce emissions of N2O. The range of the estimated emissions varies from less than 0.5% to 5% of the initial nitrogen content of the material (Petersen et al., 1998; Hellebrand 1998; Vesterinen, 1996; Beck-Friis, 2001; Detzel et al., 2003). Poorly working composts are likely to produce more both of CH4 and N2O (e.g., Vesterinen, 1996).

For estimating the CH_4 and N_2O emissions of biological treatment the default method given in Equations 4.1 and 4.2, has been applied, according to the 2006 IPCC Guidelines Tier 1 approach**Erreur ! Signet non défini.**

EQUATION 4.1 CH_4 Emissions from biological treatment (2006 IPCC GL, Vol. 5, Chap.4)

$$\boldsymbol{CH_4\ emissions = \sum_i (M_i \times EF_i) \times 10^{-3} - R}$$

Where:

CH_4 emissions = CH_4 emissions in inventory year (Gg)
M_i = mass of organic waste treated by biological treatment type i (Gg)
EFj = CH_4 emission factor (g CH_4/kg of waste treated)
i = composting or anaerobic digestion
R = total amount of CH_4 recovered in inventory year (Gg CH_4)

For estimating the N_2O emissions, the 2006 IPCC Guidelines Tier 1 approach**Erreur ! Signet non défini.** has been applied.

EQUATION 4.2 N_2O Emissions from biological treatment (2006 IPCC GL, Vol. 5, Chap.4)

$$\boldsymbol{N_2O\ emissions = \sum_i (M_i \times EF_i) \times 10^{-3}}$$

Where:

N_2O emissions = N_2O emissions in inventory year (Gg)
M_i = fraction of waste type/material of component j in the MSW (as wet weight open burned)
EF_i = aggregate CH_4 emission factor (g N_2O/Gg of waste)
i = category or type of waste open-burned, specified as follows:

7.4.2.2 Choice of activity data

As described in chapter 7.2.1 Country-specific issues above, there are no national data available for the years 1990 to 2020 on amounts of municipal waste generation, composting and backyard dumping. Based on the national population and country specific waste generation rates for urban and rural population the total amount of (mainly organic) waste which is composted.

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[639] Source: 2006 IPCC Guidelines, Volume 5: Waste, Chapter 4: Chapter 4: Biological Treatment of Solid Waste - 4.1.1 Choice of method

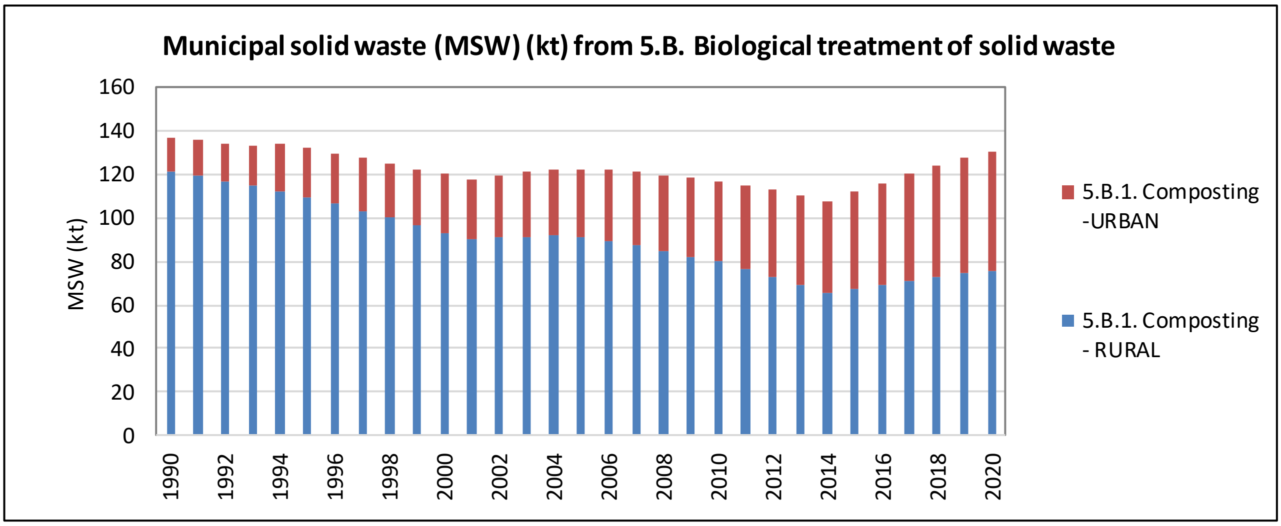

Figure 248 Amount of waste biological treated (composting) from urban and rural population

Table 624 Amount of waste biological treated (composting) from total, urban and rural population

	5.B.1. Composting			5.B.2. Anaerobic digestion at biogas facilities		
	Total MSW	MSW – urban	MSW – rural	Total MSW	MSW – urban	MSW – rural
	kt dm[640]	kt dm	kt dm	kt dm	kt dm	kt dm
1990	137,026	15,670	121,356	NO	NO	NO
1991	135,884	16,552	119,332	NO	NO	NO
1992	134,669	17,471	117,197	NO	NO	NO
1993	133,324	18,419	114,905	NO	NO	NO
1994	134,208	21,809	112,399	NO	NO	NO
1995	132,304	22,672	109,632	NO	NO	NO
1996	130,063	23,507	106,556	NO	NO	NO
1997	127,656	24,337	103,319	NO	NO	NO
1998	125,143	25,169	99,974	NO	NO	NO
1999	122,644	26,004	96,640	NO	NO	NO
2000	120,098	26,848	93,250	NO	NO	NO
2001	117,587	27,720	89,867	NO	NO	NO
2002	119,503	28,622	90,881	NO	NO	NO
2003	121,118	29,553	91,565	NO	NO	NO
2004	122,478	30,526	91,952	NO	NO	NO
2005	122,350	31,543	90,807	NO	NO	NO
2006	121,905	32,612	89,293	NO	NO	NO
2007	121,168	33,741	87,427	NO	NO	NO
2008	119,600	34,788	84,812	NO	NO	NO
2009	118,478	35,976	82,502	NO	NO	NO
2010	117,029	37,221	79,808	NO	NE	NE
2011	115,236	38,520	76,716	NO	NE	NE

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[640] kt dm = kilo tonnes dry matter = giga gram dry matter

	5.B.1. Composting			5.B.2. Anaerobic digestion at biogas facilities		
	Total MSW	MSW – urban	MSW – rural	Total MSW	MSW – urban	MSW – rural
	kt dm[640]	kt dm	kt dm	kt dm	kt dm	kt dm
2012	113,127	39,885	73,242	NO	NE	NE
2013	110,778	41,302	69,476	NO	NE	NE
2014	108,017	42,762	65,255	NO	NE	NE
2015	112,062	44,719	67,343	NO	NE	NE
2016	116,164	46,758	69,406	NO	NE	NE
2017	120,288	48,869	71,419	NO	NE	NE
2018	124,313	51,005	73,308	NO	NE	NE
2019	128,280	53,185	75,095	NO	NE	NE
2020	130,961	54,898	76,064	NO	NE	NE
Trend						
1990 – 2020	*-4.43%*	*250.34%*	*-37.32%*	NA	NA	NA
2005 – 2020	*7.04%*	*74.04%*	*-16.24%*	NA	NA	NA
2019 - 2020	*5.35%*	*7.63%*	*3.76%*	NA	NA	NA

Methane recovery (R)

CH_4 generated at composting facilities can be recovered and combusted in a flare or energy device.

In Algeria, no methane recovery (R) is in place.

Mechanical-biological (MB) treatment

In Algeria, no Mechanical-biological (MB) treatment takes place.

7.4.2.3 Choice of emission factors

Default emission factors for greenhouse gases were taken from IPCC 2006 Guidelines and are presented in the following table.

Table 625 GHG Emission factor TIER 1 for IPCC sub-category 5.b Biological treatment of waste

Type of biological treatment	**CH_4 Emission Factors (g CH_4/kg waste treated)**		**N_2O Emission Factors (g N_2O/kg waste treated)**		**Remarks**	**Source**
	EF on a wet weight basis	**type**	**EF on a wet weight basis**	**type**		
Composting	4	D	0.24	D	Assumptions on the waste treated: 25-50% DOC in dry matter, 2% N in dry matter, Moisture content 52%.	TABLE 4.1; Chap. 4, Vol. 5, 2006 IPCC GL, p 4.6

Note:

D	Default	CS	Country specific	PS	Plant specific	IEF	Implied emission factor

7.4.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 5.B *Biological treatment* are presented in the following table.

Table 626 Uncertainty for IPCC sub-category 5.B Biological treatment of solid waste.

Uncertainty	CH_4	N_2O	**Reference** 2006 IPCC GL, Vol. 5, Chap. 3.7
Activity data (AD)	87%	87%	Based on Table 3.5
Emission factor (EF)	50%	50%	Based on Table 3.4 & 3.5
Combined Uncertainty (U)	132%	173%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent with the data reported in the population statistics, which were used as surrogate data.

7.4.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency (plausibility checks of dips and jumps).

7.4.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category *5.B Biological treatment of solid waste*.

Table 627 Recalculations done since last submission to the UNFCCC in IPCC sub-category 5.B Biological treatment of solid waste

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
5.B.	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.B.	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.B.	Estimation of country specific waste composition	AD	Accuracy
5.B.	Application of default values of 2006 IPCC Guidelines	EF	Accuracy, comparability,

7.4.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 628 Planned improvements for IPCC sub-category 5.B Biological treatment of solid waste.

GHG source & sink category	Planned improvement	Type of improvement		Priority
5.B	Investigation on composting activities especially in the rural area and the use of compost in agriculture by wilaya / climate region	AD	Accuracy	High
5.B	Investigation on composting activities of sludge by wilaya / climate region	EF		Medium

5	Further investigation on waste flow: collection, disposal, recycling, Anaerobic digestion at biogas facilities and incineration with energy and without energy recovery, open burning, composting, etc.
	• By Wilaya and/or by Climate region
	  o Rural population
	  o Urban population
	    ▪ Agglomerate / big cities
	    ▪ “Other” urban
	• Evaluation of existing studies
		AD	Accuracy
			Transparency
			Comparability
			Completeness
			Consistency
				high

5	Further investigation on waste generation (rate)
	• By Wilaya and/or by Climate region (see Table 619 & Table 618)
	  o Rural population
	  o Urban population
	    ▪ Agglomerate / big cities
	    ▪ “Other” urban
	• Evaluation of existing studies
		AD		high

7.5 Incineration and Open Burning of Waste (IPCC category 5.C)

The following section describes GHG emissions resulting from waste incineration and open burning of waste, which originates from:

⇒ 5.C.1 Waste Incineration

⇒ 5.C.2 Open Burning of Waste

Emissions from waste incineration without energy recovery are reported in the Waste Sector, while emissions from incineration with energy recovery are reported in the Energy Sector, both with a distinction between fossil and biogenic CO_2 emissions.

Open burning of waste can be defined as the combustion of unwanted combustible materials such as paper, wood, plastics, textiles, rubber, waste oils and other debris in nature (open-air) or in open dumps, where smoke and other emissions are released directly into the air without passing through a chimney or stack. Open burning of municipal solid waste (MSW) is not well described and an underestimated source of air pollution in developing countries due to lack of information and country specific data:

- MSW generation rates
- fraction of waste, which is combustible,
- fraction of population burning waste outside their houses and fraction of MSW burned at dump sites.

According to the 2006 IPCC Guidelines waste incineration and open burning of waste produces emissions of CO_2, CH_4 and N_2O.

7.5.1 Category description

GHG emissions/ removals	**CO_2**	**CH_4**	**N_2O**
Estimated			
5.C.1 Waste incineration (Biogenic / Non-biogenic)			
5.C.1.a.i.Municipal Solid waste	NE	NE	NE
5.C.1.a.ii. Other			
5.C.1.a.ii.1. Industrial Waste	NE	NE	NE
5.C.1.a.ii.2. Sewage Sludge	NE	NE	NE
5.C.1.a.ii.3. Clinical Waste	NE	NE	NE
5.C.1.a.ii.4. Hazardous Waste	NE	NE	NE
5.C.1.a.ii.5. Other	NE	NE	NE
5.C.2 Open Burning of Waste (Biogenic / Non-biogenic)			
5.C.2.a.i.Municipal Solid waste	✓	✓	✓
5.C.2.a.ii. Other			
5.C.2.a.ii.1. Industrial Waste	NE	NE	NE
5.C.2.a.ii.2. Sewage Sludge	NE	NE	NE
5.C.2.a.ii.3. Clinical Waste	NE	NE	NE
5.C.2.a.ii.4. Hazardous Waste	NE	NE	NE
5.C.2.a.ii.5. Other	NE	NE	NE
Key Category			-
5.C.1 Waste incineration	-	-	-
5.C.2 Open Burning of Waste	-	-	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential			
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF			

GHG emissions from 5.C.1 Waste incineration were not estimated due to lack of data. In this inventory cycle, GHG emissions from 5.C.2 Open burning of Municipal Solid Waste (MSW) were estimated. GHG emissions from 5.C.2 Open burning of Municipal other waste than MSW were not estimated due to lack of data. (see chapter Planned improvements)

An overview of the GHG emission from burning of waste in IPCC sub-category 5.C Incineration and Open Burning of Waste is provided in the following figure and table.

In the period 1990 – 2020 the GHG emissions increased by 2.24%. mainly due to

- Increasing population;
- Increasing waste generation rate;
- Increasing needs of getting rid of the solid waste and at the same time missing waste management practice.

In the period 2005 – 2020 the GHG emissions decreased by -9.9% ;

- The evolution is marked by the promulgation of law 01-19 of December 12, 2001 relating to the management and control of waste,

- in 2004 Algeria adopted the controlled landfills as a disposal method;
- Closure and rehabilitation of wild dumps and development of master plans for waste management

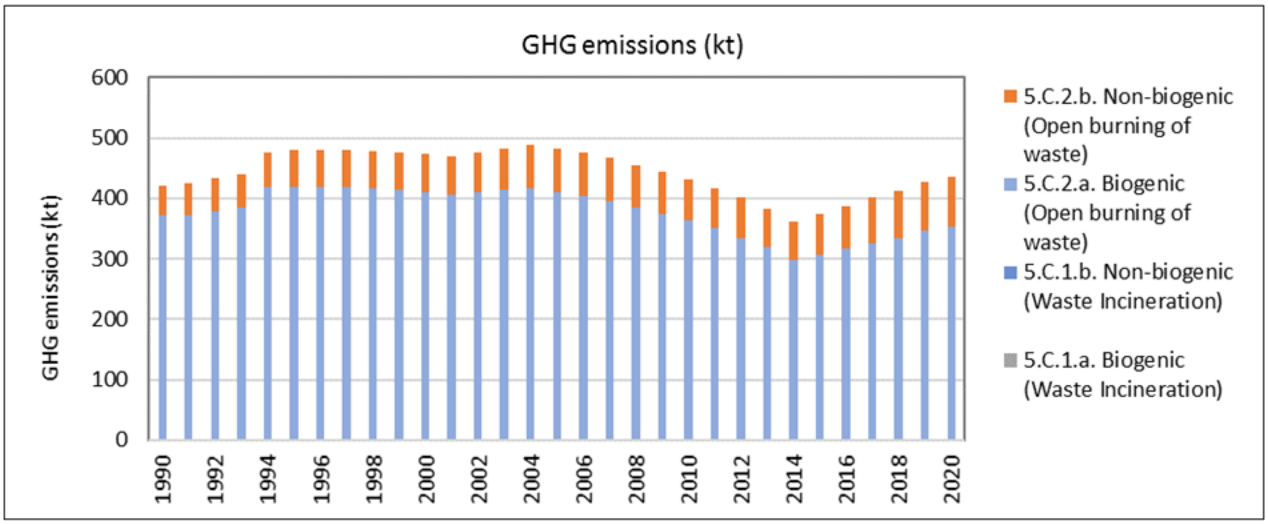

Figure 249 GHG Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

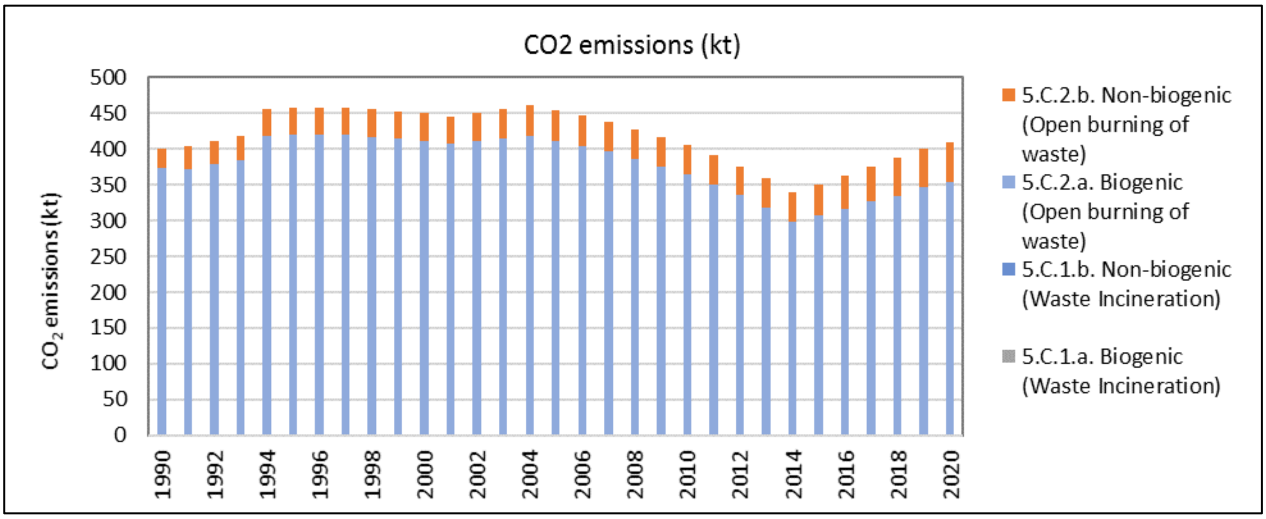

Figure 250 CO_2 Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

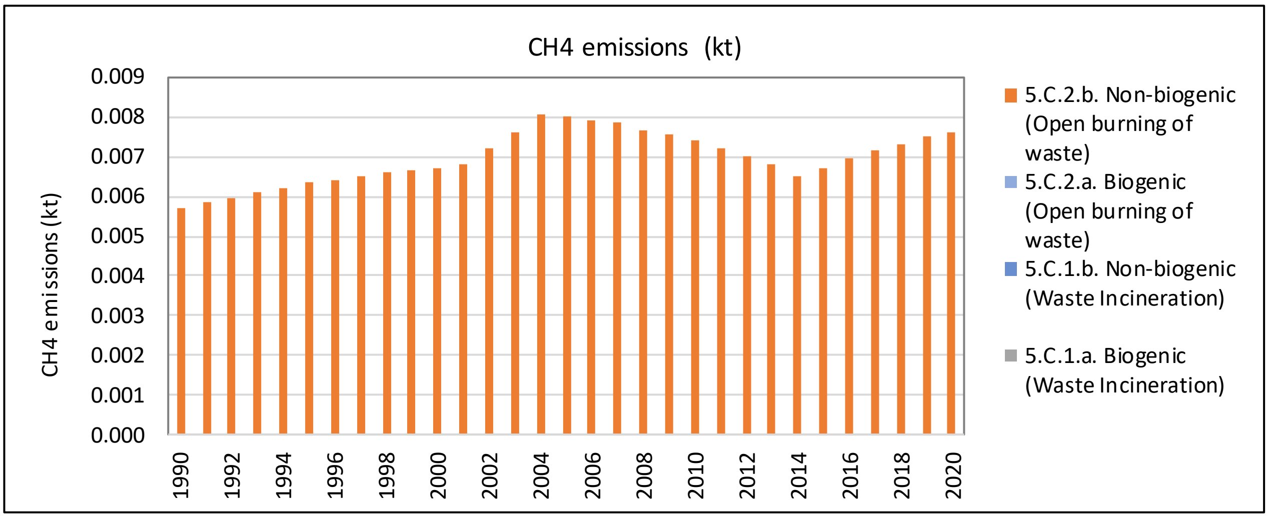

Figure 251 CH_4 Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

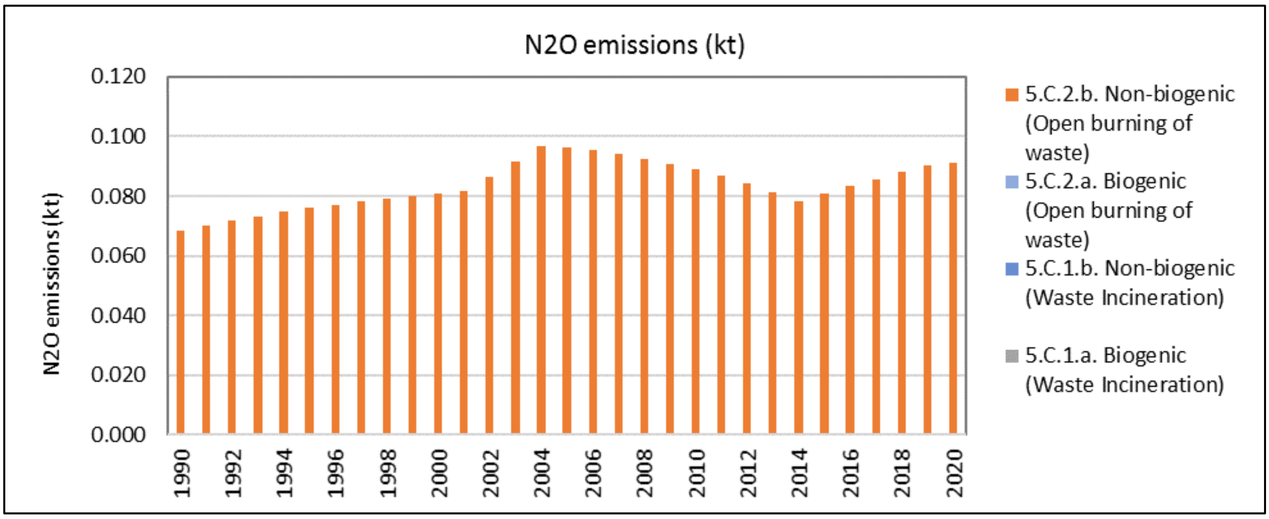

Figure 252 N_2O Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

Table 629 CO₂ Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

CO_2 Emissions	**5.C**	**5.C.1. Waste Incineration**	**5.C.2. Open burning of waste**	**5.C.2.a. Biogenic**	**5.C.2.a.i. MSW**	**5.C.2.a.ii. Other**	**5.C.2.b. Non-biogenic**	**5.C.2.b.i. MSW**	**5.C.2.b.ii. Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	399.95	NE	399.95	373.24	373.24	NE	26.71	26.71	NE
1991	403.84	NE	403.84	371.76	371.76	NE	32.07	32.07	NE
1992	411.51	NE	411.51	378.55	378.55	NE	32.96	32.96	NE
1993	418.49	NE	418.49	384.68	384.68	NE	33.81	33.81	NE
1994	454.66	NE	454.66	418.11	418.11	NE	36.55	36.55	NE
1995	456.88	NE	456.88	419.80	419.80	NE	37.07	37.07	NE
1996	457.41	NE	457.41	419.93	419.93	NE	37.48	37.48	NE
1997	456.77	NE	456.77	418.96	418.96	NE	37.81	37.81	NE
1998	455.11	NE	455.11	417.02	417.02	NE	38.09	38.09	NE
1999	452.62	NE	452.62	414.31	414.31	NE	38.31	38.31	NE
2000	449.25	NE	449.25	410.76	410.76	NE	38.49	38.49	NE
2001	445.25	NE	445.25	406.61	406.61	NE	38.64	38.64	NE
2002	450.71	NE	450.71	410.73	410.73	NE	39.98	39.98	NE
2003	455.62	NE	455.62	414.27	414.27	NE	41.36	41.36	NE
2004	460.11	NE	460.11	417.34	417.34	NE	42.77	42.77	NE
2005	454.06	NE	454.06	411.35	411.35	NE	42.71	42.71	NE
2006	446.82	NE	446.82	404.30	404.30	NE	42.52	42.52	NE
2007	438.43	NE	438.43	396.22	396.22	NE	42.21	42.21	NE
2008	426.95	NE	426.95	385.38	385.38	NE	41.57	41.57	NE
2009	416.47	NE	416.47	375.42	375.42	NE	41.05	41.05	NE
2010	404.62	NE	404.62	364.23	364.23	NE	40.38	40.38	NE
2011	390.83	NE	390.83	350.15	350.15	NE	40.68	40.68	NE
2012	375.63	NE	375.63	334.91	334.91	NE	40.72	40.72	NE
2013	359.17	NE	359.17	318.64	318.64	NE	40.52	40.52	NE
2014	338.90	NE	338.90	298.23	298.23	NE	40.66	40.66	NE
2015	350.90	NE	350.90	307.45	307.45	NE	43.45	43.45	NE
2016	363.06	NE	363.06	316.72	316.72	NE	46.34	46.34	NE
2017	375.28	NE	375.28	325.95	325.95	NE	49.32	49.32	NE
2018	387.18	NE	387.18	334.82	334.82	NE	52.36	52.36	NE
2019	400.02	NE	400.02	346.08	346.08	NE	53.93	53.93	NE
2020	408.90	NE	408.90	353.95	353.95	NE	54.96	54.96	NE
Trend									
1990-2020	*2.24%*	*NA*	*2.24%*	*-5.17%*	*-5.17%*	*NA*	*105.79%*	*105.79%*	*NA*
2005-2020	*-9.95%*	*NA*	*-9.95%*	*-13.96%*	*-13.96%*	*NA*	*28.67%*	*28.67%*	*NA*
2019-2020	*2.22%*	*NA*	*2.22%*	*2.27%*	*2.27%*	*NA*	*1.90%*	*1.90%*	*NA*

Table 630 CH$_4$ Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

CH$_4$ Emissions	**5.C**	**5.C.1. Waste Incineration**	**5.C.2. Open burning of waste**	**5.C.2.a. Biogenic**	**5.C.2.a.i. MSW**	**5.C.2.a.ii. Other**	**5.C.2.b. Non-biogenic**	**5.C.2.b.i. MSW**	**5.C.2.b.ii. Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	0.0057	NE	0.0057	IE	IE	NE	0.0057	0.0057	NE
1991	0.0058	NE	0.0058	IE	IE	NE	0.0058	0.0058	NE
1992	0.0060	NE	0.0060	IE	IE	NE	0.0060	0.0060	NE
1993	0.0061	NE	0.0061	IE	IE	NE	0.0061	0.0061	NE
1994	0.0062	NE	0.0062	IE	IE	NE	0.0062	0.0062	NE
1995	0.0063	NE	0.0063	IE	IE	NE	0.0063	0.0063	NE
1996	0.0064	NE	0.0064	IE	IE	NE	0.0064	0.0064	NE
1997	0.0065	NE	0.0065	IE	IE	NE	0.0065	0.0065	NE
1998	0.0066	NE	0.0066	IE	IE	NE	0.0066	0.0066	NE
1999	0.0067	NE	0.0067	IE	IE	NE	0.0067	0.0067	NE
2000	0.0067	NE	0.0067	IE	IE	NE	0.0067	0.0067	NE
2001	0.0068	NE	0.0068	IE	IE	NE	0.0068	0.0068	NE
2002	0.0072	NE	0.0072	IE	IE	NE	0.0072	0.0072	NE
2003	0.0076	NE	0.0076	IE	IE	NE	0.0076	0.0076	NE
2004	0.0080	NE	0.0080	IE	IE	NE	0.0080	0.0080	NE
2005	0.0080	NE	0.0080	IE	IE	NE	0.0080	0.0080	NE
2006	0.0079	NE	0.0079	IE	IE	NE	0.0079	0.0079	NE
2007	0.0078	NE	0.0078	IE	IE	NE	0.0078	0.0078	NE
2008	0.0077	NE	0.0077	IE	IE	NE	0.0077	0.0077	NE
2009	0.0076	NE	0.0076	IE	IE	NE	0.0076	0.0076	NE
2010	0.0074	NE	0.0074	IE	IE	NE	0.0074	0.0074	NE
2011	0.0072	NE	0.0072	IE	IE	NE	0.0072	0.0072	NE
2012	0.0070	NE	0.0070	IE	IE	NE	0.0070	0.0070	NE
2013	0.0068	NE	0.0068	IE	IE	NE	0.0068	0.0068	NE
2014	0.0065	NE	0.0065	IE	IE	NE	0.0065	0.0065	NE
2015	0.0067	NE	0.0067	IE	IE	NE	0.0067	0.0067	NE
2016	0.0069	NE	0.0069	IE	IE	NE	0.0069	0.0069	NE
2017	0.0071	NE	0.0071	IE	IE	NE	0.0071	0.0071	NE
2018	0.0073	NE	0.0073	IE	IE	NE	0.0073	0.0073	NE
2019	0.0075	NE	0.0075	IE	IE	NE	0.0075	0.0075	NE
2020	0.0076	NE	0.0076	IE	IE	NE	0.0076	0.0076	NE
Trend									
1990-2020	*33.50%*	*NA*	*33.50%*	*NA*	*NA*	*NA*	*33.50%*	*33.50%*	*NA*
2005-2020	*-4.98%*	*NA*	*-4.98%*	*NA*	*NA*	*NA*	*-4.98%*	*-4.98%*	*NA*
2019-2020	*1.29%*	*NA*	*1.29%*	*NA*	*NA*	*NA*	*1.29%*	*1.29%*	*NA*

Table 631 N_2O Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

N_2O Emissions	5.C	5.C.1. Waste Incineration	5.C.2. Open burning of waste	5.C.2.a. Biogenic	5.C.2.a.i. MSW	5.C.2.a.ii. Other	5.C.2.b. Non-biogenic	5.C.2.b.i. MSW	5.C.2.b.ii. Other
	kt	kt	kt	kt	kt	kt	kt	kt	kt
1990	0.0684	NE	0.0684	IE	IE	NE	0.0684	0.0684	NE
1991	0.0700	NE	0.0700	IE	IE	NE	0.0700	0.0700	NE
1992	0.0717	NE	0.0717	IE	IE	NE	0.0717	0.0717	NE
1993	0.0733	NE	0.0733	IE	IE	NE	0.0733	0.0733	NE
1994	0.0747	NE	0.0747	IE	IE	NE	0.0747	0.0747	NE
1995	0.0761	NE	0.0761	IE	IE	NE	0.0761	0.0761	NE
1996	0.0772	NE	0.0772	IE	IE	NE	0.0772	0.0772	NE
1997	0.0782	NE	0.0782	IE	IE	NE	0.0782	0.0782	NE
1998	0.0791	NE	0.0791	IE	IE	NE	0.0791	0.0791	NE
1999	0.0800	NE	0.0800	IE	IE	NE	0.0800	0.0800	NE
2000	0.0808	NE	0.0808	IE	IE	NE	0.0808	0.0808	NE
2001	0.0816	NE	0.0816	IE	IE	NE	0.0816	0.0816	NE
2002	0.0865	NE	0.0865	IE	IE	NE	0.0865	0.0865	NE
2003	0.0915	NE	0.0915	IE	IE	NE	0.0915	0.0915	NE
2004	0.0965	NE	0.0965	IE	IE	NE	0.0965	0.0965	NE
2005	0.0961	NE	0.0961	IE	IE	NE	0.0961	0.0961	NE
2006	0.0952	NE	0.0952	IE	IE	NE	0.0952	0.0952	NE
2007	0.0941	NE	0.0941	IE	IE	NE	0.0941	0.0941	NE
2008	0.0922	NE	0.0922	IE	IE	NE	0.0922	0.0922	NE
2009	0.0908	NE	0.0908	IE	IE	NE	0.0908	0.0908	NE
2010	0.0889	NE	0.0889	IE	IE	NE	0.0889	0.0889	NE
2011	0.0867	NE	0.0867	IE	IE	NE	0.0867	0.0867	NE
2012	0.0842	NE	0.0842	IE	IE	NE	0.0842	0.0842	NE
2013	0.0815	NE	0.0815	IE	IE	NE	0.0815	0.0815	NE
2014	0.0783	NE	0.0783	IE	IE	NE	0.0783	0.0783	NE
2015	0.0808	NE	0.0808	IE	IE	NE	0.0808	0.0808	NE
2016	0.0833	NE	0.0833	IE	IE	NE	0.0833	0.0833	NE
2017	0.0857	NE	0.0857	IE	IE	NE	0.0857	0.0857	NE
2018	0.0880	NE	0.0880	IE	IE	NE	0.0880	0.0880	NE
2019	0.0901	NE	0.0901	IE	IE	NE	0.0901	0.0901	NE
2020	0.0913	NE	0.0913	IE	IE	NE	0.0913	0.0913	NE
Trend									
1990-2020	*33.50%*	*NA*	*33.50%*	*NA*	*NA*	*NA*	*33.50%*	*33.50%*	*NA*
2005-2020	*-4.98%*	*NA*	*-4.98%*	*NA*	*NA*	*NA*	*-4.98%*	*-4.98%*	*NA*
2019-2020	*1.29%*	*NA*	*1.29%*	*NA*	*NA*	*NA*	*1.29%*	*1.29%*	*NA*

Table 632 GHG Emissions from IPCC sub-category 5.C. Incineration and open burning of waste

GHG Emissions	**5.C**	**5.C.1. Waste Incineration**	**5.C.2. Open burning of waste**	**5.C.2.a. Biogenic**	**5.C.2.a.i. MSW**	**5.C.2.a.ii. Other**	**5.C.2.b. Non-biogenic**	**5.C.2.b.i. MSW**	**5.C.2.b.ii. Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	420.46	NE	420.46	373.24	373.24	NE	47.22	47.22	NE
1991	424.85	NE	424.85	371.76	371.76	NE	53.09	53.09	NE
1992	433.01	NE	433.01	378.55	378.55	NE	54.47	54.47	NE
1993	440.47	NE	440.47	384.68	384.68	NE	55.79	55.79	NE
1994	477.09	NE	477.09	418.11	418.11	NE	58.97	58.97	NE
1995	479.70	NE	479.70	419.80	419.80	NE	59.90	59.90	NE
1996	480.57	NE	480.57	419.93	419.93	NE	60.64	60.64	NE
1997	480.23	NE	480.23	418.96	418.96	NE	61.27	61.27	NE
1998	478.84	NE	478.84	417.02	417.02	NE	61.81	61.81	NE
1999	476.61	NE	476.61	414.31	414.31	NE	62.31	62.31	NE
2000	473.49	NE	473.49	410.76	410.76	NE	62.73	62.73	NE
2001	469.72	NE	469.72	406.61	406.61	NE	63.12	63.12	NE
2002	476.66	NE	476.66	410.73	410.73	NE	65.94	65.94	NE
2003	483.08	NE	483.08	414.27	414.27	NE	68.81	68.81	NE
2004	489.09	NE	489.09	417.34	417.34	NE	71.75	71.75	NE
2005	482.89	NE	482.89	411.35	411.35	NE	71.54	71.54	NE
2006	475.40	NE	475.40	404.30	404.30	NE	71.10	71.10	NE
2007	466.67	NE	466.67	396.22	396.22	NE	70.45	70.45	NE
2008	454.63	NE	454.63	385.38	385.38	NE	69.25	69.25	NE
2009	443.70	NE	443.70	375.42	375.42	NE	68.29	68.29	NE
2010	431.30	NE	431.30	364.23	364.23	NE	67.07	67.07	NE
2011	416.86	NE	416.86	350.15	350.15	NE	66.71	66.71	NE
2012	400.91	NE	400.91	334.91	334.91	NE	66.00	66.00	NE
2013	383.62	NE	383.62	318.64	318.64	NE	64.97	64.97	NE
2014	362.39	NE	362.39	298.23	298.23	NE	64.16	64.16	NE
2015	375.15	NE	375.15	307.45	307.45	NE	67.70	67.70	NE
2016	388.05	NE	388.05	316.72	316.72	NE	71.33	71.33	NE
2017	401.00	NE	401.00	325.95	325.95	NE	75.04	75.04	NE
2018	413.58	NE	413.58	334.82	334.82	NE	78.76	78.76	NE
2019	427.06	NE	427.06	346.08	346.08	NE	80.98	80.98	NE
2020	436.29	NE	436.29	353.95	353.95	NE	82.35	82.35	NE
Trend									
1990-2020	*3.76%*	*NA*	*-5.17%*	*-5.17%*	*-5.17%*	*NA*	*74.38%*	*74.38%*	*NA*
2005-2020	*-9.65%*	*NA*	*-13.96%*	*-13.96%*	*-13.96%*	*NA*	*15.11%*	*15.11%*	*NA*
2019-2020	*2.16%*	*NA*	*2.27%*	*2.27%*	*2.27%*	*NA*	*1.70%*	*1.70%*	*NA*

7.5.2 Methodological issues

7.5.2.1 Choice of methods

For estimating the CO_2 emissions, the 2006 IPCC Guidelines Tier 1 approach[641] has been applied.

EQUATION 5.1 CO_2 Emission estimate based on the total amount of waste combusted (2006 IPCC Guidelines, Volume 5: Waste, Chap. 5)

$$\boldsymbol{CO_2\ emissions = M \sum_i (SW_i \times dm_i \times CF_i \times FCF_i \times OF_i) \times \frac{44}{12}}$$

Where:

CH_4 emissions = CH_4 emissions in inventory year (Gg)

WF_i = fraction of waste type of component j in the MSW (as wet weight open burned) see Table 642

dm_i = dry matter content in the waste (wet weight) open-burned (fraction) see Table 643

CF_i = fraction of carbon in the dry matter (total carbon content) (fraction) see Table 643

FCF_i = fraction of fossil carbon in the total carbon, (fraction) see Table 643

OF_i = oxidation factor (fraction)

44/12 = conversion factor from C to CO_2

i = type of waste open-burned specified as follows:

MSW	⇒ estimated
ISW: industrial solid waste	⇒ not estimated
HW: hazardous waste	⇒ not estimated
CW: clinical waste	⇒ not estimated
SS: sewage sludge	⇒ not estimated

For Municipal Solid waste (MSW), it is *good practice* to calculate the CO_2 emissions on the basis of waste types/material (such as paper, wood, plastics) in the waste open-burned.

EQUATION 5.2 CO_2 Emission estimate based on the total amount of waste combusted (2006 IPCC GL, Vol. 5: Waste, Chap. 5)

$$\boldsymbol{CO_2\ emissions = MSW \times \sum_j (WF_j \times dm_j \times CF_j \times FCF_j \times OF_j) \times \frac{44}{12}}$$

Where:

CO_2 Emissions = CO_2 emissions in inventory year (Gg)

MSW = total amount of municipal solid waste as wet weight open-burned (Gg)

WF_j = fraction of waste type/material of component j in the MSW (as wet weight open burned)

dm_j = dry matter content in the waste (wet weight) open-burned (fraction)

CFj = fraction of carbon in the dry matter (total carbon content) (fraction)

FCF_j = fraction of fossil carbon in the total carbon, (fraction)

OF_j = oxidation factor (fraction)

44/12 = conversion factor from C to CO_2

with: $\sum_j WF_j = 1$

j = component of the MSW open-burned such as paper/cardboard, textiles, food waste, wood, garden & park waste, disposable nappies, rubber and leather, plastics, metal, glass, other inert waste.

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[641] Source: 2006 IPCC Guidelines, Volume 5: Waste, Chapter 5: Incineration and Open Burning of Waste - 5.2.2 Choice of method for estimating CO_2 emissions

For estimating the CH_4 emissions the 2006 IPCC Guidelines Tier 1 approach[642] has been applied. CH_4 emissions from incineration and open burning of waste are a result of incomplete combustion. Important factors affecting the emissions are temperature, residence time, and air ratio (i.e., air volume in relation to the waste amount). The CH_4 emissions are particularly relevant for open burning, where a large fraction of carbon in the waste is not oxidized. The conditions can vary much, as waste is a very heterogeneous and a low quality fuel with variations in its calorific value.

EQUATION 5.4 CH_4 Emission estimate based on the total amount of waste combusted
(2006 IPCC GL, Vol. 5: Waste, Chap. 5)

$$\boldsymbol{CH_4\ emissions = \sum_i (IW_i \times EF_i) \times 10^{-6}}$$

Where:

CH_4 emissions = CH_4 emissions in inventory year (Gg)
MSW = total amount of municipal solid waste as wet weight open-burned (Gg)
WF_i = fraction of waste type/material of component j in the MSW (as wet weight open burned)
EFj = aggregate CH_4 emission factor (kg CH_4/Gg of waste)
10^{-6} = conversion factor from kilogram to gigagram
i = category or type of waste open-burned, specified as follows:

MSW: municipal solid waste ⇒ estimated
ISW: industrial solid waste ⇒ not estimated
HW: hazardous waste ⇒ not estimated
CW: clinical waste ⇒ not estimated
SS: sewage sludge ⇒ not estimated

For estimating the Nitrous oxide (N_2O) emissions the 2006 IPCC Guidelines Tier 1 approach[643] has been applied. N_2O is emitted in combustion processes at relatively low combustion temperatures between 500 and 950 °C.

EQUATION 5.5 N_2O emission estimate based on the total amount of waste combusted
(2006 IPCC GL, Vol. 5: Waste, Chap. 5)

$$\boldsymbol{N_2O\ emissions = \sum_i (IW_i \times EF_i) \times 10^{-6}}$$

Where:

N_2O emissions = N_2O emissions in inventory year (Gg)
IW_i = fraction of waste type/material of component j in the MSW (as wet weight open burned)
EF_i = aggregate N_2O emission factor (kg N_2O/Gg of waste)
10^{-6} = conversion factor from kilogram to gigagram
i = category or type of waste open-burned, specified as follows:

MSW: municipal solid waste ⇒ estimated
ISW: industrial solid waste ⇒ not estimated
HW: hazardous waste ⇒ not estimated
CW: clinical waste ⇒ not estimated
SS: sewage sludge ⇒ not estimated

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[642] 2006 IPCC Guidelines, Volume 5: Waste, Chapter 5: Incineration and Open Burning of Waste - 5.2.2 Choice of method for estimating CH#4# emissions

[643] 2006 IPCC Guidelines, Volume 5: Waste, Chapter 5: Incineration and Open Burning of Waste - 5.2.2 Choice of method for estimating N_2O emissions

7.5.2.2 Choice of activity data

As described in chapter 7.2.1 Country-specific issues above, there are no national data on amounts of municipal waste generation and open burned available for the years 1990 to 2020. Based on the national population and country specific waste generation rates for urban and rural population the total amount of waste which was open burned could be estimated.

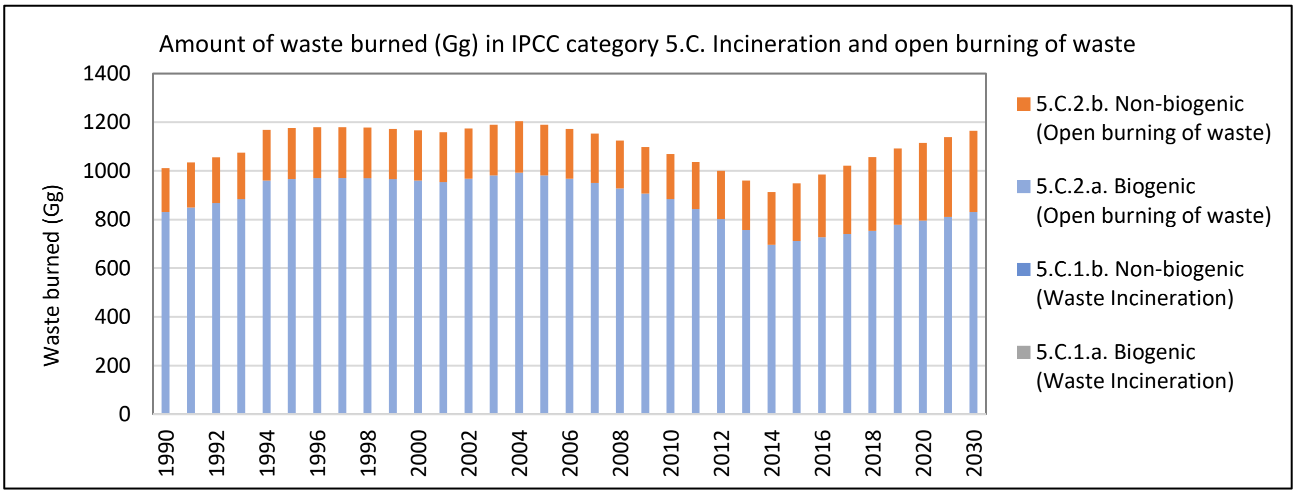

Figure 253 Municipal solid waste (MSW) open burned from urban and rural population

Table 633 Activity data from IPCC sub-category 5.C. Incineration and open burning of waste

Activity data	**5.C**	**5.C.1. Waste Incineration**	**5.C.2. Open burning of waste**	**5.C.2.a. Biogenic**	**5.C.2.a.i. MSW**	**5.C.2.a.ii. Other**	**5.C.2.b. Non-biogenic**	**5.C.2.b.i. MSW**	**5.C.2.b.ii. Other**
	kt	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**	**kt**
1990	1,011.66	NE	1,011.66	830.91	830.91	NE	180.75	180.75	NE
1991	1,034.01	NE	1,034.01	849.48	849.48	NE	184.53	184.53	NE
1992	1,055.26	NE	1,055.26	867.16	867.16	NE	188.10	188.10	NE
1993	1,074.81	NE	1,074.81	883.45	883.45	NE	191.36	191.36	NE
1994	1,168.64	NE	1,168.64	960.81	960.81	NE	207.83	207.83	NE
1995	1,176.23	NE	1,176.23	967.30	967.30	NE	208.93	208.93	NE
1996	1,179.52	NE	1,179.52	970.25	970.25	NE	209.27	209.27	NE
1997	1,179.81	NE	1,179.81	970.73	970.73	NE	209.08	209.08	NE
1998	1,177.47	NE	1,177.47	969.05	969.05	NE	208.42	208.42	NE
1999	1,173.01	NE	1,173.01	965.62	965.62	NE	207.39	207.39	NE
2000	1,166.26	NE	1,166.26	960.31	960.31	NE	205.95	205.95	NE
2001	1,157.88	NE	1,157.88	953.65	953.65	NE	204.23	204.23	NE
2002	1,174.57	NE	1,174.57	967.64	967.64	NE	206.93	206.93	NE
2003	1,189.93	NE	1,189.93	980.54	980.54	NE	209.39	209.39	NE
2004	1,204.26	NE	1,204.26	992.60	992.60	NE	211.66	211.66	NE
2005	1,190.39	NE	1,190.39	981.41	981.41	NE	208.98	208.98	NE
2006	1,173.34	NE	1,173.34	967.60	967.60	NE	205.74	205.74	NE
2007	1,153.20	NE	1,153.20	951.23	951.23	NE	201.97	201.97	NE
2008	1,124.86	NE	1,124.86	928.09	928.09	NE	196.78	196.78	NE
2009	1,099.09	NE	1,099.09	907.05	907.05	NE	192.04	192.04	NE
2010	1,069.61	NE	1,069.61	882.94	882.94	NE	186.67	186.67	NE
2011	1,036.84	NE	1,036.84	842.92	842.92	NE	193.92	193.92	NE
2012	1,000.12	NE	1,000.12	800.57	800.57	NE	199.55	199.55	NE
2013	959.79	NE	959.79	756.31	756.31	NE	203.47	203.47	NE
2014	913.14	NE	913.14	696.56	696.56	NE	216.58	216.58	NE
2015	948.67	NE	948.67	711.85	711.85	NE	236.82	236.82	NE
2016	984.86	NE	984.86	726.76	726.76	NE	258.10	258.10	NE
2017	1,021.40	NE	1,021.40	741.04	741.04	NE	280.36	280.36	NE
2018	1,057.27	NE	1,057.27	753.96	753.96	NE	303.31	303.31	NE
2019	1,092.07	NE	1,092.07	778.78	778.78	NE	313.29	313.29	NE
2020	1,116.06	NE	1,116.06	795.88	795.88	NE	320.18	320.18	NE
Trend									
1990-2020	*10.32%*	*NA*	*10.32%*	*-4.22%*	*-4.22%*	*NA*	*77.14%*	*77.14%*	*NA*
2005-2020	*-6.24%*	*NA*	*-6.24%*	*-18.90%*	*-18.90%*	*NA*	*53.21%*	*53.21%*	*NA*
2019-2020	*2.20%*	*NA*	*2.20%*	*2.20%*	*2.20%*	*NA*	*2.20%*	*2.20%*	*NA*

7.5.2.3 Choice of emission factors

Waste composition is one of the main factors influencing emissions from open burning of waste, as different waste types contain different amount of biogenic and fossil carbon content.

Waste types such as food waste, garden waste, paper and cardboard, wood, textiles, and nappies (disposable diapers) contain only biogenic carbon. Ash, dust, rubber and leather contain also certain amounts of non-fossil carbon. Some textiles, plastics (including plastics in disposable nappies), rubber and electronic waste contain the bulk part of fossil carbon in MSW. Paper (with coatings) and leather (synthetic) can also include small amounts of fossil carbon.

For Algeria, it was possible to collect country specific data on waste composition. The data used in the inventory are based on expert judgement by national experts from ANCC

. In the following table, the IPCC default value is also provided. The country specific data on waste composition is in the range of the IPCC default. The lower value for wood is due to lack of fuel for household. The lower value for food waste is due to the socio-economic situation of Algeria.

Table 634 Composition of waste going to solid waste disposal sites

	Food	**Garden**	**Paper**	**Wood**	**Textile**	**Disposable nappies**	**Plastics, other inert**	**Source**
Waste composition	**(share)**							
IPCC Default	44%	7%	10%	1%	3%	0%	35%	TABLE 2.3, Vol. 5, Chapter 2, 2006 2019 refinements to IPCC Guidelines
1990	62.7%	0.0%	9.5%	1.6%	9.3%	1.0%	15.8%	National Expert; ANCC
1991	62.7%	0.0%	9.5%	1.6%	9.1%	1.2%	15.8%	
1992	62.7%	0.0%	9.5%	1.6%	8.9%	1.4%	15.8%	
1993	62.7%	0.0%	9.5%	1.6%	8.7%	1.7%	15.8%	
1994	62.7%	0.0%	9.5%	1.6%	8.5%	1.9%	15.8%	
1995	62.7%	0.0%	9.5%	1.6%	8.3%	2.1%	15.8%	
1996	62.7%	0.0%	9.5%	1.6%	8.1%	2.3%	15.8%	
1997	62.7%	0.0%	9.5%	1.6%	7.9%	2.5%	15.8%	
1998	62.7%	0.0%	9.5%	1.6%	7.7%	2.7%	15.8%	
1999	62.7%	0.0%	9.5%	1.6%	7.5%	2.9%	15.8%	
2000	62.7%	0.0%	9.5%	1.6%	7.2%	3.1%	15.8%	
2001	62.7%	0.0%	9.5%	1.6%	7.0%	3.3%	15.8%	
2002	62.7%	0.0%	9.5%	1.6%	6.8%	3.5%	15.8%	
2003	62.7%	0.0%	9.5%	1.6%	6.6%	3.7%	15.8%	
2004	62.7%	0.0%	9.5%	1.6%	6.4%	3.9%	15.8%	
2005	62.7%	0.0%	9.5%	1.6%	6.2%	4.1%	15.8%	
2006	62.7%	0.0%	9.5%	1.6%	6.0%	4.3%	15.8%	
2007	62.7%	0.0%	9.5%	1.6%	5.8%	4.6%	15.8%	
2008	62.7%	0.0%	9.5%	1.6%	5.6%	4.8%	15.8%	
2009	62.7%	0.0%	9.5%	1.6%	5.4%	5.0%	15.8%	
2010	62.7%	0.0%	9.5%	1.6%	5.2%	5.2%	15.8%	
2011	61.0%	0.0%	9.5%	1.6%	5.5%	5.4%	17.0%	
2012	59.4%	0.0%	9.6%	1.6%	5.8%	5.6%	18.1%	
2013	57.7%	0.0%	9.6%	1.5%	6.0%	5.8%	19.3%	
2014	54.4%	0.0%	9.8%	1.5%	6.6%	6.0%	21.7%	
2015	52.8%	0.0%	9.8%	1.5%	6.9%	6.2%	22.9%	
2016	51.1%	0.0%	9.9%	1.5%	7.2%	6.4%	24.1%	
2017	49.5%	0.0%	9.9%	1.5%	7.5%	6.6%	25.2%	
2018	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	
2019	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	
2020	47.8%	0.0%	10.0%	1.5%	7.8%	6.8%	26.4%	

Default emission factors and default parameters for greenhouse gases were taken from IPCC 2006 Guidelines. It is *good practice* to apply these as no country-specific information is available.

Table 635 Default dry matter content, DOC content, total carbon content and fossil carbon fraction of different MSW components

MSW component	Dry matter content in % of wet weight [1] dm	Total carbon content in % of dry weight CF		Fossil carbon fraction in % of total carbon FCF	
	Default	**Default**	**Range**	**Default**	**Range**
Paper/cardboard	90	46	42 - 50	1	0 - 5
Textiles [3]	80	50	25 - 50	20	0 - 50
Food waste	40	38	20 - 50	-	-
Wood	85 4	50	46 - 54	-	-
Garden and Park waste	40	49	45 - 55	0	0
Nappies	40	70	54 - 90	10	10
Rubber and Leather	84	67	67	20	20
Plastics	100	75	67 - 85	100	95 - 100
Metal [6]	100	NA	NA	NA	NA
Glass [6]	100	NA	NA	NA	NA
Other, inert waste	90	3	0 - 5	100	50 - 100

Remark: for footnotes see 2006 IPCC Guidelines

Source: Table 2.4 (excerpt), Vol. 5, Chapter 2, 2006 IPCC Guidelines

Oxidation factor (OX)

The oxidation factor (OX) reflects the amount of CO_2 from open burning that is oxidized. The default oxidation factor of 58 % of carbon input was applied (TABLE 5.2, 2006 IPCC Guidelines Vol. 5, Chap. 5 (5.4.1)).

CH_4 emission factor

For open burning of waste, a CH_4 emission factor of 6500 g $_{CH4}$ / t MSW wet weight has been applied (2006 IPCC Guidelines Vol. 5, Chap. 5 (5.4.2)).

N_2O emission factor

For open burning of waste, a N_2O emission factor of 150 g $_{N2O}$ / t MSW wet weight has been applied (TABLE 5.6, 2006 IPCC Guidelines Vol. 5, Chap. 5 (5.4.3)).

7.5.3 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category *5.C. Incineration and open burning of waste* are presented in the following table.

Table 636 Uncertainty for IPCC sub-category 5.C. Incineration and open burning of waste.

Uncertainty	CO_2	CH_4	N_2O	Reference
Activity data (AD)	87%	87%	87%	2006 IPCC GL, Vol. 5, Chap. 3.7 Based on Table 3.5
Emission factor (EF)	25%	100%	100%	2006 IPCC Guidelines Vol. 5, Chap. 5 (5.7.1)
Combined Uncertainty (U)	90%	132%	132%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent with the data reported in the population statistics, GDP statistics, which were used as surrogate data.

7.5.4 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency
- plausibility checks of dips and jumps.

7.5.5 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category *5.C. Incineration and open burning of waste*.

Table 637 Recalculations done since NC & BUR in IPCC sub-category 5.C. Incineration and open burning of waste

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
5.C.	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.C.	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.C.	Estimation of country specific waste composition	AD	Accuracy
5.C.	Application of default values of 2006 IPCC Guidelines	EF	Accuracy, comparability

7.5.6 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 638 Planned improvements for IPCC sub-category 5.C. Incineration and open burning of waste

GHG source & sink category	Planned improvement	Type of improvement		Priority
5.C	Investigation on composting activities especially in the rural area the open burning is practiced by wilaya / climate region	AD	Accuracy	High
5.c	Investigation on incineration (with and without energy recovery) and open burning activities of • Industrial solid wastes • Hazardous waste • Clinical waste • Sewage sludge • Other by wilaya / climate region	EF		Medium
5	Further investigation on waste flow: collection, disposal, recycling, Anaerobic digestion at biogas facilities and incineration with energy and without energy recovery, open burning, composting, etc. • By Wilaya and/or by Climate region ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD	Accuracy Transparency Comparability Completeness Consistency	high
5	Further investigation on waste generation (rate) • By Wilaya and/or by Climate region (see Table 619 & Table 618) ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD		High

7.6 Wastewater Treatment and Discharge (IPCC category 5.D)

7.6.1 Category description

GHG emissions/ removals	CO_2	CH_4	N_2O
Estimated			
5.D.1. Domestic wastewater	NA	✓	✓
Recovery	NA	NE	NE
5.D.2. Industrial wastewater	NA	NE	NE
Recovery	NA	NE	NE
5.D.3. Other	NA	NE	NE
Recovery	NA	NE	NE
Key Category	-	LA 1990 & 2020	-
A '✓' indicates: emissions from this sub-category have been estimated. Notation keys: IE -included elsewhere, NO – not occurrent, NE -not estimated, NA -not applicable, C – confidential			
LA – Level Assessment (in year) without LULUCF; TA – Trend Assessment without LULUCF			

This chapter includes the CH_4 and N_2O emissions estimations from *domestic and Industrial wastewater* Treatment and Discharge. The IPCC category 5.D *wastewater* Treatment and Discharge is for CH_4 a Key Category

The following section describes GHG emissions resulting from Wastewater Treatment and Discharge. According to 2006 IPCC Guidelines wastewater can be a source of methane (CH_4) when treated or disposed anaerobically. It can also be a source of nitrous oxide (N_2O) emissions. Carbon dioxide (CO_2) emissions from wastewater are not considered because these are of biogenic origin and should not be included in national total emissions.

Nitrous Oxide (N_2O)

There are two sources of N_2O emissions:

- Indirect N_2O emissions from discharge of effluent into waterways, lakes and sea.
- Direct N_2O emissions from treatment plants which are low compared to indirect emissions

Nitrous oxide (N_2O) is associated with the degradation of nitrogen components in the wastewater, e.g., urea, nitrate and protein. Domestic wastewater includes human sewage mixed with other household wastewater, which can include effluent from shower drains, sink drains, washing machines, etc.

Methane (CH_4)

Wastewater as well as its sludge components can produce CH_4 if it degrades anaerobically. The extent of CH_4 production depends primarily on the quantity of degradable organic material in the wastewater, the temperature, and the type of treatment system. With increases in temperature, the rate of CH_4 production increases. This is especially important in uncontrolled systems and in warm climates.

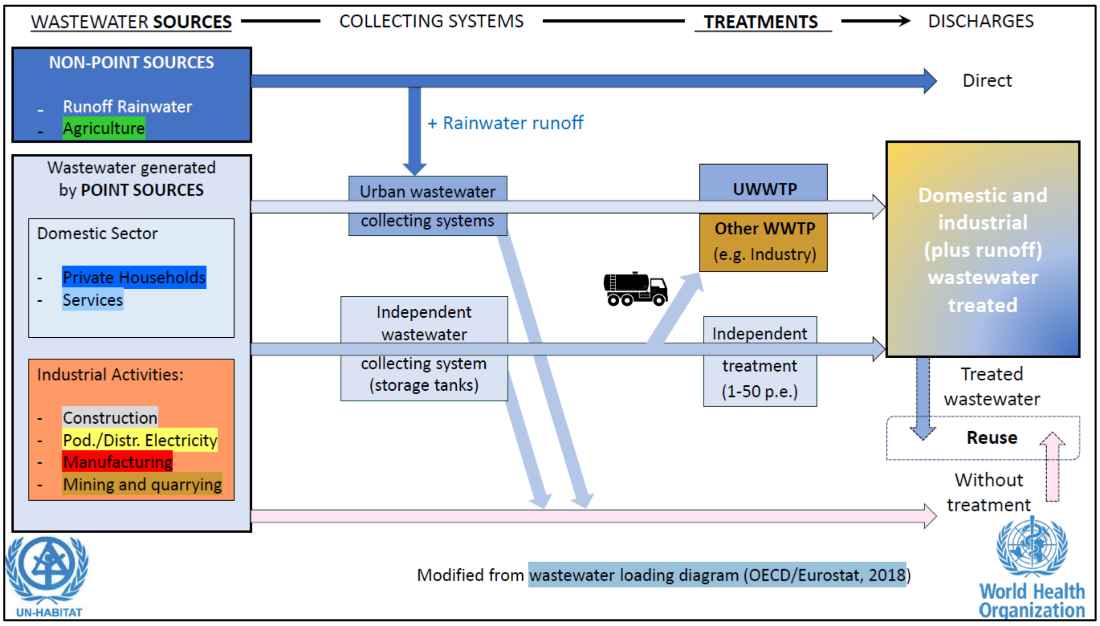

Figure 254 Wastewater flow

Wastewater is defined as

- domestic effluent consisting of blackwater (excreta, urine and fecal sludge) and grey-water (kitchen and bathing wastewater), or
- water from commercial establishments and institutions, including hospitals, or
- industrial effluent, storm water and other urban run-off.

Sanitation services have, mainly understandably, been given less priority than water supply since people tend to grant more urgency to the provision of water. Access to improved sanitation can have different interpretations from one country to another. Septic tanks, latrines, river and lake discharge and sewer are om many developing countries the main domestic treatment and discharge facilities. In 2020, among the five treatment and discharge systems were the commonest.

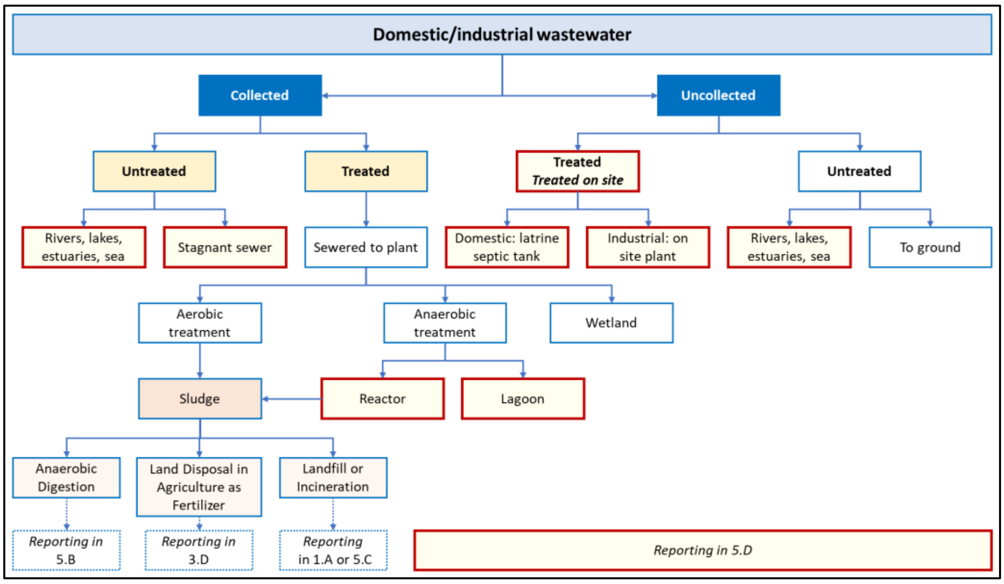

Figure 255 Wastewater treatment systems and discharge pathways[644]

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[644] According to 2006 IPCC Guidelines, Volume 5: Waste, Chapter 6: Wastewater Treatment and Discharge - Figure 6.1

Further differentiation was done according to the split provided in the 2006 IPCC Guidelines[645].

Type of treatment and discharge pathway or system	**Comments**
Untreated system	
Open defecation	
River and lake discharge	Rivers with high organics loadings can turn anaerobic.
Stagnant sewer	calculated in order to have always 100%
Treated system	
Flowing sewer (open or closed)	Fast moving, clean. (Insignificant amounts of CH_4 from pump stations, etc)
Centralized, aerobic treatment plant	Must be well managed. Some CH_4 can be emitted from settling basins and other pockets.
Centralized, aerobic treatment plant	Not well managed. Overloaded.
Anaerobic digester for sludge	CH_4 recovery is not considered here.
Anaerobic reactor	CH_4 recovery is not considered here.
Anaerobic shallow lagoon	Depth less than 2 metres use expert judgment.
Anaerobic deep lagoon	Depth more than 2 metres
Septic system	Half of BOD settles in anaerobic tank.
Latrine (family)	Dry climate, ground water table lower than latrine, small family (3-5 persons)
Latrine (many user)	Dry climate, ground water table lower than latrine, communal (many users)
Latrine	Wet climate/flush water use, ground water table higher than latrine
Latrine	Regular sediment removal for fertilizer

Short Overview of situation in Algeria

Wastewater treatment has become an imperative. Indeed, the development of human activities is inevitably accompanied by an increasing production of polluting waste. Water resources are not inexhaustible. Their degradation, under the effect of polluted water discharges, can not only seriously damage the environment, but also lead to the risk of shortages. Sanitation therefore serves to preserve the resource and the natural heritage. As part of the implementation of the national sanitation policy, the National Office for Sanitation (ONA) is responsible on the national territory for the operation, maintenance, renewal, extension and construction of sanitation works and infrastructure. Thus, he assures:

- Protection and safeguarding of water resources and environment.
- The fight against all sources of water pollution.
- The preservation of public health.

The ONA with its Three (03) Sanitation Departments, Thirteen (13) areas, (44) Sanitation Units in (44) wilayas, (165) Sanitation Centers and two (02) Works and Rehabilitation Units. Also ensures on behalf of the State, the project management and delegated work concerning the projects of studies, realization of rehabilitation,

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[645] Table 6.3, Chap. 6.2.2.2, Volume 5, 2006 IPCC Guidelines

diagnoses of the purification stations, the purification networks and collection of rainwater as well as lifting stations

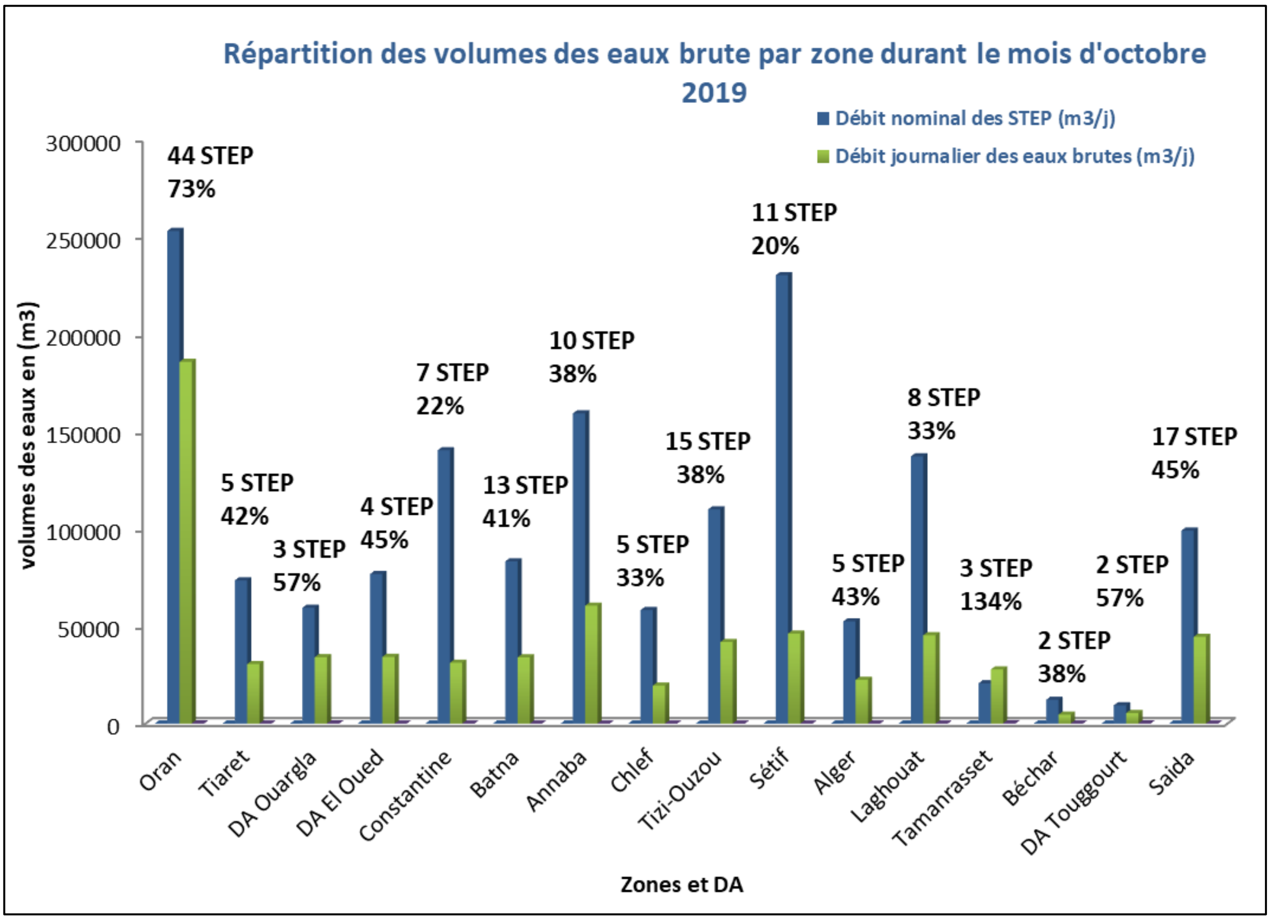

Figure 256 Breakdown of raw water volumes by area during the month of October 2019[646]

In the period 1990 to 2020 GHG emissions from the category wastewater treatment and discharge decreased by 27.6% from 1716.7 **kt** CO_2 eq in 1990 to 2189.8 **kt** CO_2 eq in 2020. In the period 2005 to 2020 GHG emissions from the Waste sector decreased by 1.4%. The decreasing trend in CH_4 emissions was due to increasing number of population connected to sewage systems and waste water treatment plants (WWTPs). The significant increase of N_2O emissions was due to growing population and higher per capita protein consumption. In the following table are the CH_4 and N_2O emission presented.

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[646] http://ona-dz.org/Exploitation-et-maintenance.html Ministère des Ressources en Eau / Office National de l'Assainissement (ONA) - Direction de l'Exploitation et de la Maintenance (2019) : TABLEAU DE BORD EXPLOITATION DU MOIS D'OCTOBRE 2019

Table 639 GHG Emissions from 5.D Wastewater Treatment and Discharge

	EMISSIONS				RECOVERY	
	GHG	CH_4	N_2O		CH_4	
			Plants	Effluent	Amount of CH_4 flared	Amount of CH_4 for Energy Recovery
Unit	kt CO_2 equivalent	kt	kt	kt	kt	kt
1990	1,716.70	58.36	NE	0.87	NO	NO
1991	1,668.53	56.17	NE	0.89	NO	NO
1992	1,705.13	57.38	NE	0.91	NO	NO
1993	1,733.47	58.26	NE	0.93	NO	NO
1994	1,759.93	59.07	NE	0.95	NO	NO
1995	1,798.09	59.77	NE	1.02	NO	NO
1996	1,829.23	60.20	NE	1.09	NO	NO
1997	1,856.01	60.45	NE	1.16	NO	NO
1998	1,884.01	60.74	NE	1.23	NO	NO
1999	1,909.38	60.90	NE	1.30	NO	NO
2000	1,934.04	61.02	NE	1.37	NO	NO
2001	1,966.94	61.44	NE	1.45	NO	NO
2002	2,001.20	61.89	NE	1.52	NO	NO
2003	2,088.10	64.51	NE	1.60	NO	NO
2004	2,130.29	65.40	NE	1.66	NO	NO
2005	2,220.70	68.29	NE	1.72	NO	NO
2006	2,256.82	69.30	NE	1.76	NO	NO
2007	2,349.20	72.61	NE	1.79	NO	NO
2008	2,284.28	69.78	NE	1.81	NO	NO
2009	2,298.53	69.66	NE	1.87	NO	NO
2010	2,245.36	66.90	NE	1.92	NO	NO
2011	2,181.88	63.25	NE	2.02	NO	NO
2012	2,138.13	60.60	NE	2.09	NO	NO
2013	2,091.85	57.67	NE	2.18	NO	NO
2014	2,124.62	58.01	NE	2.26	NO	NO
2015	2,148.89	58.00	NE	2.34	NO	NO
2016	2,170.28	57.94	NE	2.42	NO	NO
2017	2,218.55	59.47	NE	2.46	NO	NO
2018	2,179.49	57.62	NE	2.48	NO	NO
2019	2,185.75	57.29	NE	2.53	NO	NO
2020	2,189.80	57.15	NE	2.55	NO	NO
Trend						
1990 - 2020	27.56%	-2.06%	NA	195.20%	NA	NA
2005 - 2020	-1.39%	-16.31%	NA	48.19%	NA	NA
2019 - 2020	0.19%	-0.23%	NA	0.98%	NA	NA

Table 640 CH_4 Emissions from 5.D Wastewater Treatment and Discharge

	CH_4 emissions				
	5.D Wastewater treatment and discharge		5.D.1. Domestic wastewater	5.D.2. Industrial wastewater	5.D.3. Other
Unit	**kt CO_2 equivalent**	**kt CH_4**	**kt**	**kt**	**kt**
1990	1,458.92	58.36	58.36	IE	NE
1991	1,404.35	56.17	56.17	IE	NE
1992	1,434.48	57.38	57.38	IE	NE
1993	1,456.40	58.26	58.26	IE	NE
1994	1,476.65	59.07	59.07	IE	NE
1995	1,494.37	59.77	59.77	IE	NE
1996	1,505.12	60.20	60.20	IE	NE
1997	1,511.30	60.45	60.45	IE	NE
1998	1,518.43	60.74	60.74	IE	NE
1999	1,522.49	60.90	60.90	IE	NE
2000	1,525.45	61.02	61.02	IE	NE
2001	1,536.01	61.44	61.44	IE	NE
2002	1,547.24	61.89	61.89	IE	NE
2003	1,612.65	64.51	64.51	IE	NE
2004	1,634.98	65.40	65.40	IE	NE
2005	1,707.19	68.29	68.29	IE	NE
2006	1,732.45	69.30	69.30	IE	NE
2007	1,815.19	72.61	72.61	IE	NE
2008	1,744.47	69.78	69.78	IE	NE
2009	1,741.53	69.66	69.66	IE	NE
2010	1,672.41	66.90	66.90	IE	NE
2011	1,581.29	63.25	63.25	IE	NE
2012	1,514.94	60.60	60.60	IE	NE
2013	1,441.64	57.67	57.67	IE	NE
2014	1,450.25	58.01	58.01	IE	NE
2015	1,450.11	58.00	58.00	IE	NE
2016	1,448.56	57.94	57.94	IE	NE
2017	1,486.69	59.47	59.47	IE	NE
2018	1,440.60	57.62	57.62	IE	NE
2019	1,432.17	57.29	57.29	IE	NE
2020	1,428.83	57.15	57.15	IE	NE
Trend					
1990 - 2020	-2.06%	-2.06%	-2.06%	NA	NA
2005 - 2020	-16.31%	-16.31%	-16.31%	NA	NA
2019 - 2020	-0.23%	-0.23%	-0.23%	NA	NA

Table 454 N_2O Emissions from 5.D Wastewater Treatment and Discharge

	N_2O emissions				
	5.D Wastewater treatment and discharge		**5.D.1. Domestic wastewater**	**5.D.2. Industrial wastewater**	**5.D.3. Other**
Unit	**kt CO_2 equivalent**	**N_2O kt**	**kt**	**kt**	**kt**
1990	257.78	0.87	0.87	IE	NE
1991	264.18	0.89	0.89	IE	NE
1992	270.65	0.91	0.91	IE	NE
1993	277.07	0.93	0.93	IE	NE
1994	283.27	0.95	0.95	IE	NE
1995	303.73	1.02	1.02	IE	NE
1996	324.11	1.09	1.09	IE	NE
1997	344.70	1.16	1.16	IE	NE
1998	365.59	1.23	1.23	IE	NE
1999	386.90	1.30	1.30	IE	NE
2000	408.59	1.37	1.37	IE	NE
2001	430.93	1.45	1.45	IE	NE
2002	453.96	1.52	1.52	IE	NE
2003	475.44	1.60	1.60	IE	NE
2004	495.32	1.66	1.66	IE	NE
2005	513.51	1.72	1.72	IE	NE
2006	524.37	1.76	1.76	IE	NE
2007	534.00	1.79	1.79	IE	NE
2008	539.81	1.81	1.81	IE	NE
2009	557.00	1.87	1.87	IE	NE
2010	572.95	1.92	1.92	IE	NE
2011	600.60	2.02	2.02	IE	NE
2012	623.19	2.09	2.09	IE	NE
2013	650.20	2.18	2.18	IE	NE
2014	674.37	2.26	2.26	IE	NE
2015	698.78	2.34	2.34	IE	NE
2016	721.72	2.42	2.42	IE	NE
2017	731.87	2.46	2.46	IE	NE
2018	738.90	2.48	2.48	IE	NE
2019	753.58	2.53	2.53	IE	NE
2020	760.97	2.55	2.55	IE	NE
Trend					
1990 - 2020	195.20%	195.20%	195.20%	NA	NA
2005 - 2020	48.19%	48.19%	48.19%	NA	NA
2019 - 2020	0.98%	0.98%	0.98%	NA	NA

7.6.2 Methodological issues - CH_4 emissions

7.6.2.1 Choice of methods – CH_4 emissions

The steps for *good practice* in inventory preparation for CH_4 from domestic wastewater are as follows:

Step 1: Use Equation 6.3 to estimate total organically degradable carbon in wastewater (TOW).

Step 2: Select the pathway and systems (See Figure 255 Wastewater treatment systems and discharge pathways (Figure 6.1 in 2006 IPCC GL, Vol. 5, Chapter 6) according to country activity data. Use Equation 6.2 to obtain the emission factor for each domestic wastewater treatment/discharge pathway or system.

Step 3: Use Equation 6.1 to estimate emissions, adjust for possible sludge removal and/or CH_4 recovery and sum the results for each pathway/system.

CH_4 emissions from domestic wastewater for each treatment/discharge pathway or system, j

Equation 6.1, 2019 Refinement to the 2006 IPCC GL, Vol. 5, Chapter 6, page 6.17

$$CH_4\, emissions = \left[\left(TOW_j - S_j\right) * EF_j - R_j\right]$$

where

CH_4 Emissions = CH_4 emissions from treatment/discharge pathway or system, j, in year, kg CH_4/yr

TOW = organics in wastewater of treatment/discharge pathway or system, j, in year, kg BOD/yr

S_j = organic component removed from wastewater (in the form of sludge) from treatment/discharge pathway or system, j, in inventory year, kg BOD/y

Ui = fraction of population in income group i in inventory year, See Table 6.5.

j = each treatment/discharge pathway or system

EF_j = emission factor, kg CH_4 / kg BOD

R_j = amount of CH_4 recovered in inventory year, kg CH_4/yr

Due to lack of data, currently it is assumed that sludge was removed. Therefore, the emission from sludge are included in 5.D.

Total CH_4 emissions from domestic wastewater treatment and discharge

Equation 6.1A, 2019 Refinement to the 2006 IPCC GL, Vol. 5, Chapter 6, page 6.17

$$CH_4\, emissions = \sum_j [CH_4\, emission] * [10^{-6}]$$

where

CH_4 Emissions = CH_4 emissions in inventory year, kg CH_4/yr

CH_4 Emissions_j = CH_4 emissions from treatment/discharge pathway or system, j, in year, kg CH_4/yr

j = each treatment/discharge pathway or system

10-6 = conversion of kg to Gg

7.6.2.2 Choice of CH_4 emission factor

CH_4 Emission Factor for each Domestic Wastewater Treatment/Discharge Pathway or System

Equation 6.2, 2006 IPCC GL, Vol. 5, Chapter 6, page 6.12

$$EF_J = B_o * MCF_j$$

where

EF_j = emission factor, kg CH_4/kg BOD

j = each treatment/discharge pathway or system

Bo = maximum CH_4 producing capacity, kg CH_4/kg BOD

MCF_j = methane correction factor (fraction)

Table 641 Producing capacity (B_o) for domestic wastewater

Parameter	Value	Source
Bo Producing capacity for domestic wastewater	0.6 kg CH_4/kg BOD	IPCC default TABLE 6.2, 2006 IPCC GL, Vol. 5, Chapter 6, page 6.12

Table 642 Default MCF values and resultant EFs for domestic wastewater by type of treatment system and discharge pathway

Type of treatment and discharge pathway or system	Comments	MCF [1]	MCF [1]	EF[2]	EF[2]
			Range	kg CH_4/kg BOD	kg CH_4/kg COD
Discharge from treated or untreated system					
Discharge to aquatic environments (Tier 1)	Most aquatic environments including rivers are supersaturated in CH_4. Nutrient oversupply will increase CH_4 emissions. Environments where carbon accumulates in sediments have higher potential for methane generation.	0.11	(0.004 – 0.27)	0.068	0.028
Discharge to aquatic environments other than reservoirs, lakes, and estuaries (Tier 2)	Most aquatic environments including rivers are supersaturated in CH_4. Nutrient oversupply will increase CH_4 emissions.	0.035	(0.004 – 0.06)	0.021	0.009
Discharge to reservoirs, lakes, and estuaries (Tier 2)	Environments where carbon accumulates in sediments have higher potential for methane generation.	0.19	(0.08 – 0.27)	0.114	0.048
Discharge to soil	Sludge and/or wastewater discharge to soil may be a source of CH_4 for fertilisation	Emissions reported in Volume 4			
Stagnant sewer	Open and warm	0.5	(0.4 – 0.8)	0.3	0.125
Flowing sewer (open or closed)	Fast moving, clean. (Insignificant amounts of CH_4 from pump stations, etc.)	0		0	0
Wastewater treatment system					

Type of treatment and discharge pathway or system	**Comments**	**MCF [1]**	**MCF [1]**	**EF[2]**	**EF[2]**
			Range	**kg CH_4/kg BOD**	**kg CH_4/kg COD**
Centralised, aerobic treatment plant	Some CH_4 can be emitted from settling basins and other anaerobic pockets. May also emit CH_4 generated in upstream sewer networks during turbulent and/or aerobic treatment processes. For treatment plants that are receiving wastewater beyond the design capacity, inventory compilers should judge the amount of organic material removed in sludge accordingly.	0.03	(0.003 – 0.09)	0.018	0.0075
Anaerobic reactor (e.g., upflow anaerobic sludge blanket digestion (UASB))	CH_4 recovery is not considered here.	0.8	(0.8 – 1.0)	0.48	0.2
Anaerobic shallow lagoon and facultative lagoons	Depth less than 2 metres, use expert judgment.	0.2	(0 – 0.3)	0.12	0.05
Anaerobic deep lagoon	Depth more than 2 metres	0.8	(0.8 – 1.0)	0.48	0.2
Constructed wetlands	See *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*: Wetlands (IPCC 2014)				
Septic tank	Septic tanks emit CH_4	0.5	(0.4 – 0.72)	0.3	0.125
Septic tank + land dispersal field	Septic tanks emit CH_4; negligible emissions come from land dispersal field	0.5	(0.4 – 0.72)	0.3	0.125
Latrine	Dry climate, ground water table lower than latrine, small family (3–5 persons)	0.1	(0.05 – 0.15)	0.06	0.025
Latrine	Dry climate, ground water table lower than latrine, communal (many users)	0.5	(0.4 – 0.6)	0.3	0.125
Latrine	Wet climate/flush water use, ground water table higher than latrine	0.7	(0.7 – 1.0)	0.42	0.175

Source: TABLE 6.3 (updated) Default MCF values and resultant EFs for domestic wastewater by type of treatment system and discharge pathway, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, Chapter 6

7.6.2.3 Choice of activity data – CH_4 emission

The activity data for this source category is the total amount of organically degradable material in the wastewater (TOW). This parameter is a function of human population and BOD generation per person. It is expressed in terms of biochemical oxygen demand (kg BOD/year). The equation for TOW is:

Total Organically Degradable Material In Domestic Wastewater

Equation 6.3, 2019 Refinement to the 2006 IPCC GL, Vol. 5, Chapter 6, page 6.22

$$TOW = P * BOD * 0.001 * I * 365$$

Total organics in domestic wastewater by treatment/discharge pathway or system

Equation 6.3A, 2019 Refinement 2006 IPCC GL, Vol. 5, Chapter 6, page 6.22

$$TOW_i = \sum_i \left[TOW * U_i * T_{ij} * I_j\right]$$

Where:

TOWj = total organics in wastewater in inventory year, kg BOD/yr, for income group i and treatment/discharge pathway or system, j.

TOW = total organics in wastewater in inventory year, kg BOD/yr..

U_i = fraction of population in income group i in inventory year. See Table 6.5.

T_{ij} = degree of utilisation of treatment/discharge pathway or system, j, for each income group fraction

I_j = correction factor for additional industrial BOD discharged into treatment/discharge pathway or system j

for collected the default is 1.25,
for uncollected the default is 1.00.

⇒ It was is assumed that industrial wastewater is discharged, therefore for I the default factor 1.25 was used.

⇒ A country specific BOD_5 of 50 g/person/day is used.[647]ONA

⇒ TOW in wastewater prior to treatment or wastewater that is discharged without treatment and TOW in treated wastewater effluent are treated as treated TOW in wastewater. (See planned improvement)

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[647] Office National d'Assinissement .

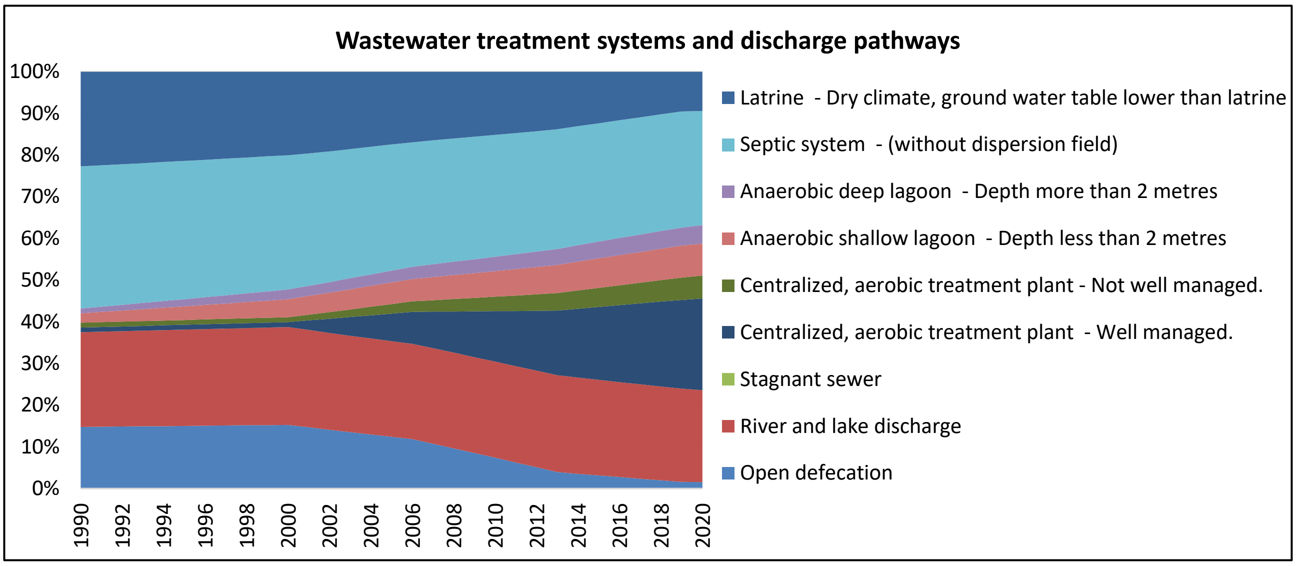

Figure 257 Distribution of rural population on Wastewater treatment systems and discharge pathways

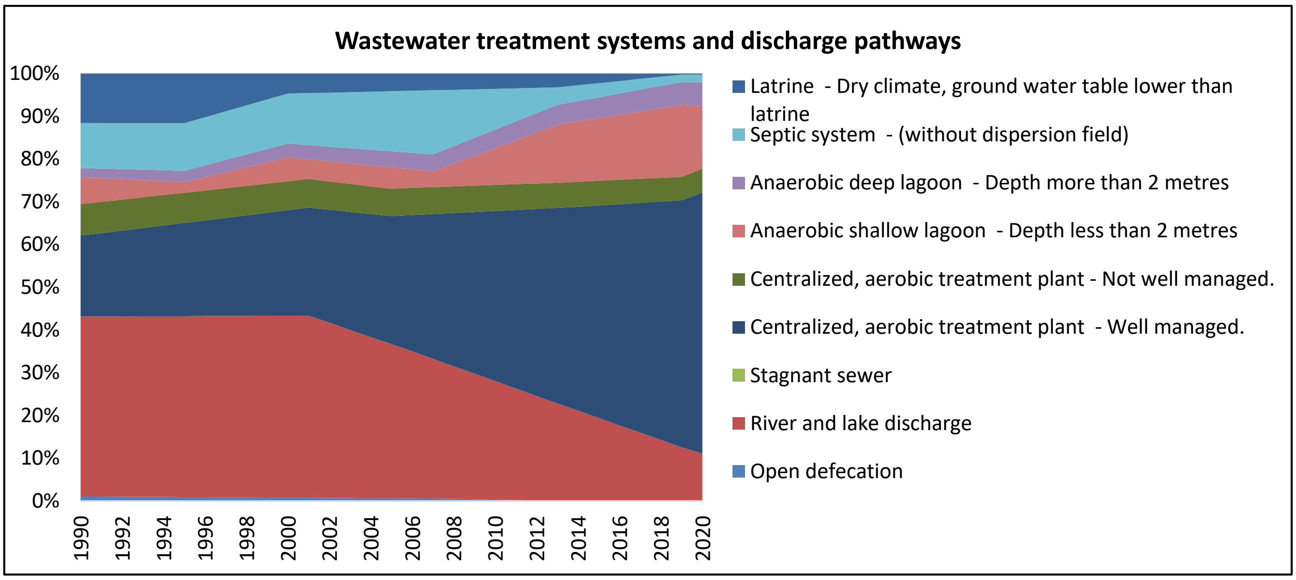

Figure 258 Distribution of urban population on Wastewater treatment systems and discharge pathways

Table 643 Total population and share of population connected to WWTP, using septic tanks or latrines.

	Total Population	**Urban Population**	**Percentage of Population - Urban Areas**		**Rural Population**	**Percentage of Population - Rural Areas**		**Average protein supply (g/cap/day) (3-year average)**	**Source**
			High income	**Middle & low income**					
Unit	**1000s**	**1000s**	**%**	**%**	**1000s**	**%**		**g/capita/day**	
1990	25,022	12,992	10%	41.9%	12,030	48.1%		*54.79*	As of 1994
1991	25,643	13,518	10%	42.7%	12,125	47.3%		*54.79*	
1992	26,271	14,057	10%	43.5%	12,214	46.5%		*54.79*	
1993	26,894	14,604	10%	44.3%	12,290	45.7%		54.79	
1994	27,496	15,149	10%	45.1%	12,347	44.9%		54.79	1st NC
1995	28,060	15,682	10%	45.9%	12,378	44.1%		57.57	interpolation
1996	28,566	16,192	10%	46.7%	12,374	43.3%		60.35	
1997	29,045	16,694	10%	47.5%	12,351	42.5%		63.12	
1998	29,507	17,194	10%	48.3%	12,313	41.7%		65.90	
1999	29,965	17,690	10%	49.0%	12,275	41.0%		68.67	
2000	30,416	18,190	10%	49.8%	12,226	40.2%		71.45	
2001	30,879	18,704	10%	50.6%	12,175	39.4%		74.22	
2002	31,357	19,234	10%	51.3%	12,123	38.7%		77.0	*FAO estimate*[648] *Food Security and Nutrition - Suite of Food Security Indicators*
2003	31,848	19,779	10%	52.1%	12,069	37.9%		79.4	
2004	32,364	20,348	10%	52.9%	12,016	37.1%		81.4	
2005	32,906	20,941	10%	53.6%	11,965	36.4%		83.0	
2006	33,481	21,564	10%	54.4%	11,917	35.6%		83.3	
2007	34,096	22,221	10%	55.2%	11,875	34.8%		83.3	
2008	34,591	22,809	10%	55.9%	11,782	34.1%		83.0	
2009	35,268	23,484	10%	56.6%	11,784	33.4%		84.0	
2010	35,978	24,189	10%	57.2%	11,789	32.8%		84.7	
2011	36,717	24,923	10%	57.9%	11,794	32.1%		87.0	

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[648] https://www.fao.org/faostat/en/#data

	Total Population	**Urban Population**	**Percentage of Population - Urban Areas**		**Rural Population**	**Percentage of Population - Rural Areas**		**Average protein supply (g/cap/day) (3-year average)**	**Source**
			High income	**Middle & low income**					
Unit	**1000s**	**1000s**	**%**	**%**	**1000s**	**%**		**g/capita/day**	
2012	37,495	25,694	10%	58.5%	11,801	31.5%		88.4	*FAO estimate*[649] *Food Security and Nutrition* *-* *Suite of Food Security Indicators*
2013	38,297	26,491	10%	59.2%	11,806	30.8%		90.3	
2014	39,114	27,309	10%	59.8%	11,805	30.2%		91.7	
2015	39,963	28,161	10%	60.5%	11,802	29.5%		93.0	
2016	40,836	29,040	10%	61.1%	11,796	28.9%		94.0	
2017	41,721	29,939	10%	61.8%	11,782	28.2%		93.3	
2018	42,578	30,829	10%	62.4%	11,749	27.6%		92.3	
2019	43,424	31,723	10%	63.1%	11,701	26.9%		92.3	
2020	43,850	32,317	10%	63.7%	11,533	26.3%		92.3	
1990 - 2020	73.5%	144.2%			-2.7%				
2005 - 2020	33.3%	54.3%			-3.6%				
2019 - 2020	1.0%	1.9%			-1.4%				
Source	*ONS*		*UNSTAT* *Expert jugement - 10% High income*			*UNSTAT*			

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[649] https://www.fao.org/faostat/en/#data

Table 644 Urban population connected to WWTP, using septic tanks or latrines, and other discharge pathways

			1990	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
			46.0	*46.4*	*46.8*	*46.8*	*45.3*	*43.8*	*42.3*	*40.8*	*39.3*	*37.8*	*36.2*	*34.7*	*33.1*	*31.6*	*30.0*	*28.5*	*27.0*	*25.5*	*24.0*	*22.5*	*21.0*	*19.5*	*20.0*
Untreated or treated systems	Open defecation	%	1.0	0.9	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	River and lake discharge	%	40.0	40.0	40.0	40.0	38	37	35	34	32	31	29	27	26	24	23	21	19	18	16	15	13	12	10.0
	Stagnant sewer	%																							
	Sewers - *closed and underground*	%	5.0	5.5	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	10.0
	Sewers - *open*	%																							
		%	*54.0*	*53.6*	*53.3*	*53.2*	*54.7*	*56.2*	*57.7*	*59.2*	*60.7*	*62.2*	*63.8*	*65.3*	*66.9*	*68.4*	*70.0*	*71.5*	*73.0*	*74.5*	*76.0*	*77.5*	*79.0*	*80.5*	*80.0*
Collected and treated	Centralized, aerobic treatment plant - *Well managed*	%	18.0	20.6	23.2	23.7	24.8	25.9	26.9	28.0	29.8	31.6	33.4	35.2	37.0	38.8	40.6	42.4	44.2	46.0	47.8	49.6	51.4	53.2	55.0
	Centralized, aerobic treatment plant - *Plants with nutrient removal*	%																							
	Centralized, aerobic treatment plant - *Not well managed*	%	7.0	6.7	6.3	6.3	6.2	6.1	6.1	6.0	5.9	5.9	5.8	5.7	5.7	5.6	5.5	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0
	Aerobic shallow ponds	%																							
	Aerobic shallow ponds - *Poorly designed / managed*	%																							
	Anaerobic digester for sludge	%																							
	Anaerobic reactor	%																							
	Anaerobic shallow lagoon - *Depth less than 2 m*	%	6.0	2.4	5.3	4.4	4.4	4.5	4.6	4.7	4.0	3.4	5.0	6.5	8.0	9.5	11.1	12.6	13.1	13.6	14.0	14.5	15.0	15.5	13.2
	Facultative lagoons	%																							
	Anaerobic deep lagoon - *Depth more than 2 m*	%	2.0	2.5	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0

			1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Uncollected	Septic system - *without dispersion field*	%	10.0	10.5	11.0	11.4	11.9	12.3	12.7	13.1	13.6	14.0	12.3	10.6	8.9	7.2	5.5	3.8	3.4	3.1	2.7	2.3	2.0	1.6	1.6
	Septic system - *including a septic tank & a soil dispersal system*	%																							
	Latrine - *Dry climate, ground water table lower than latrine*	%	11.0	11.0	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.5	2.1	1.6	1.2	0.7	0.2	0.2
	Latrine (many user) - *Dry climate, ground water table lower than latrine, communal*	%																							
	Latrine - *Wet climate/flush water use, ground water table higher than latrine*	%																							
	Latrine - *Regular sediment removal for fertilizer*	%																							
			100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
			🟥	JMP-WASH[650]			🟨	interpolation			🟦	expert judgement			🟪	as of 2019			🟩	constant					

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[650] The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) has reported country, regional and global estimates of progress on drinking water, sanitation and hygiene (WASH) since 1990.

Table 645 Rural population connected to WWTP, using septic tanks or latrines, and other discharge pathways

			1990	**1995**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
		%	45.0	46.4	47.9	47.0	46.0	45.3	44.5	43.7	42.9	42.1	41.3	40.5	39.7	38.9	38.1	37.3	36.4	35.5	34.6	33.7	32.9	32.0	30.5
Untreated or treated systems	Open defecation	%	13.0	13.0	13.0	12.6	12.1	11.7	11.3	10.8	10.4	9.4	8.4	7.4	6.4	5.4	4.4	3.4	3.1	2.7	2.4	2.1	1.8	1.4	1.4
	River and lake discharge	%	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	Stagnant sewer	%																							
	Sewers - *closed and underground*	%	12.0	13.4	14.9	14.4	13.9	13.6	13.2	12.8	12.5	12.7	12.9	13.1	13.3	13.5	13.7	13.9	13.4	12.8	12.2	11.7	11.1	10.5	9.1
	Sewers - *open*	%																							
		%	55.0	53.6	52.1	53.0	54.0	54.7	55.5	56.3	57.1	57.9	58.7	59.5	60.3	61.1	61.9	62.7	63.6	64.5	65.4	66.3	67.1	68.0	69.5
Collected and treated	Centralized, aerobic treatment plant - *Well managed*	%	1.0	1.0	1.0	2.0	2.9	3.9	4.8	5.8	6.7	7.7	8.6	9.6	10.5	11.5	12.4	13.4	14.3	15.3	16.2	17.2	18.1	19.1	20.0
	Centralized, aerobic treatment plant - *Plants with nutrient removal*	%																							
	Centralized, aerobic treatment plant - *Not well managed*	%	1.0	1.0	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
	Aerobic shallow ponds	%																							
	Aerobic shallow ponds - *Poorly designed / managed*	%																							
	Anaerobic digester for sludge	%																							
	Anaerobic reactor	%																							
	Anaerobic shallow lagoon - *Depth less than 2 m*	%	2.0	2.8	3.7	3.8	4.0	4.2	4.3	4.5	4.7	4.8	5.0	5.2	5.3	5.5	5.7	5.8	6.0	6.2	6.3	6.5	6.7	6.8	7.0
	Facultative lagoons	%																							
	Anaerobic deep lagoon - *Depth more than 2 m*	%	1.0	1.5	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0

			1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Uncollected	Septic system *- without dispersion field*	%	30.0	28.7	27.4	27.2	27.0	26.8	26.6	26.4	26.2	25.9	25.7	25.5	25.3	25.1	24.9	24.7	24.7	24.8	24.8	24.8	24.9	24.9	24.9
	Septic system *- including a septic tank and a soil dispersal system*	%																							
	Latrine *- Dry climate, ground water table lower than latrine*	%	20.0	18.5	17.1	16.8	16.5	16.1	15.6	15.2	14.8	14.4	14.0	13.6	13.1	12.7	12.3	11.9	11.3	10.8	10.2	9.7	9.1	8.5	8.5
	Latrine (many user) *- Dry climate, ground water table lower than latrine, communal*	%																							
	Latrine *- Wet climate/flush water use, ground water table higher than latrine*	%																							
	Latrine *- Regular sediment removal for fertilizer*	%																							
			100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

🟥	JMP-WASH[651]	🟨	interpolation	🟦	expert judgement	🟪	as of 2019	🟩	constant

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[651] The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) has reported country, regional and global estimates of progress on drinking water, sanitation and hygiene (WASH) since 1990.

7.6.3 Methodological issues – N_2O emissions

7.6.3.1 Choice of methods – N_2O emissions

The N_2O emissions are estimated according to TIER 1 methodology from 2006 IPCC GL:

Total N_2O emissions from wastewater effluent

Equation 6.7, 2006 IPCC GL, Vol. 5, Chapter 6, page 6.25

$$N_2O\ emissions = N_{effluent} * EF_{effluent} * \frac{44}{28}$$

Where

N_2O emissions = N_2O emissions in inventory year, kg N_2O/yr
$N_{EFFLUENT}$ = nitrogen in the effluent discharged to aquatic environments, kg N/yr
$EF_{EFFLUENT}$ = emission factor for N_2O emissions from discharged to wastewater, kg N_2O-N/kg N
44/28 = The factor 44/28 is the conversion of kg N_2O-N into kg N_2O.

7.6.3.2 Choice of N_2O emission factor

The default IPCC emission factor for N_2O emissions from domestic wastewater nitrogen effluent is 0.005 kg N_2O-N/kg N.

7.6.3.3 Choice of activity data – N_2O emission

The N_2O emissions are estimated according to TIER 1 methodology from 2006 IPCC GL:

N_2O Emission Factor for each Domestic Wastewater Treatment/Discharge Pathway or System

Equation 6.2, 2006 IPCC GL, Vol. 5, Chapter 6, page 6.12

$$N_{Effluent} = (P * Protein * F_{NRP} * F_{non-con}) - N_{sludge}$$

Where:

$N_{EFFLUENT}$ = total annual amount of nitrogen in the wastewater effluent, kg N/yr
P = human population
Protein = annual per capita protein consumption, kg/person/yr
F_{NPR} = fraction of nitrogen in protein, default = 0.16, kg N/kg protein
$F_{NON-CON}$ = factor for non-consumed protein added to the wastewater
$F_{IND-COM}$ = factor for industrial and commercial co-discharged protein into the sewer system
N_{SLUDGE} = nitrogen removed with sludge (default = zero), kg N/yr

7.6.4 Uncertainty assessment and time-series consistency

The uncertainties for activity data and emission factors used for IPCC category 5.D *Wastewater Treatment and Discharge* are presented in the following table. The following parameters are believed to be very uncertain:

- The degrees to which wastewater in developing countries is treated in latrines, septic tanks, or removed by sewer, for urban high, urban low income groups and rural population (Ti,,j).
- The fraction of sewers that are 'open', as well as the degree to which open sewers in developing countries are anaerobic and will emit CH_4. This will depend on retention time and temperature, and on other factors including the presence of a facultative layer and possibly components that are toxic to anaerobic bacteria (e.g., certain industrial wastewater discharges).
- The amount of industrial TOW that is discharged into open or closed domestic sewers for each country is very difficult to quantify.

Table 646 Uncertainty for IPCC sub-category 5.D Wastewater Treatment and Discharge.

Uncertainty	**CH_4**	**N_2O**	**Reference** 2006 IPCC GL, Vol. 5, Chap. 6
Activity data (AD)	71%		Table 6.7
		71%	Table 6.11
Emission factor (EF)	129%		Table 6.7
		261%	Table 6.11
Combined Uncertainty (U)	142%	270%	$U_{total} = \sqrt{U_{AD}^2 + U_{EF}^2}$

The time-series are considered to be consistent.

7.6.5 Category-specific QA/QC and verification

The following source-specific QA/QC activities were performed out:

- Checked of calculations by spreadsheets
    - documented sources,
    - use of units,
    - strictly defined interfaces between spreadsheets/calculation modules,
    - unique structure of sheets which do the same,
    - record keeping, use of write protection,
    - unique use of formulas, special cases are documented/highlighted,
    - quick-control checks for data consistency through all steps of calculation.
- cross-checked from different sources: national statistic, WHO/UNICEF
- cross checks with other relevant sectors are performed to avoid double counting or omissions;
- time series consistency
- plausibility checks of dips and jumps.

7.6.6 Category-specific recalculations including explanatory information and justifications

The following table presents the main revisions and recalculations done since the last submission to the UNFCCC and relevant to IPCC sub-category *5.D Wastewater Treatment and Discharge*.

Table 647 Recalculations done since last submission to the UNFCCC in IPCC sub-category 5.D Wastewater Treatment and Discharge

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
5.D.	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.D.	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.D.	Estimation of country specific wastewater treatment systems and pathways	AD	Accuracy
5.D.	Application of default values of 2019 • Refinements to the 2006 IPCC Guidelines • 2006 IPCC Guidelines	EF	Accuracy, comparability,

7.6.7 Category-specific planned improvements

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 648 Planned improvements for IPCC sub-category 5.D Wastewater Treatment and Discharge

GHG source & sink category	Planned improvement	Type of improvement		Priority
5.D	Investigation on wastewater flow: collection – treatment and discharge pathways and systems • Wilayas / climate zone • Urban population (high / low income) • Rural population	AD	Accuracy Transparency Comparability Completeness Consistency	High
5.D	Estimation of amount of wastewater treated • Wilayas / climate zone • Urban population (high / low income) • Rural population	AD		High
5.D	Use of metadata prepared for and submitted to WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP)	AD		High
5.D	Investigation of flow and amount of industrial wastewater	AD		High
5.D	Sludge separation and annual amount of sludge removal that is • dumped • applied to soil (agriculture) • incinerated	AD		High
5.D	Investigation of protein consumption	AD		Medium
5.D	Implementation of 2019 refinements to 2006 IPCC Guidelines:			High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	• N_2O emissions from domestic wastewater treatment plants • N_2O emissions from domestic wastewater effluent • TOW in wastewater prior to treatment or wastewater that is discharged without treatment • TOW in treated wastewater effluent are treated as treated TOW in wastewater.			

8 Other (IPCC sector 6)

The IPCC sector 6 does not exists in Algeria.

9 Indirect carbon dioxide and nitrous oxide emissions

The estimation of indirect carbon dioxide and nitrous oxide emissions was not performed in this inventory cycle due to lack of resources. However, a short qualitative description is provided.

9.1 SO2 emissions

The main source for SO2 emissions in Algeria is the IPCC category 1.A Fuel Combustion Activities with

- IPCC category 1.A.3.b Road Transport, here in particular diesel-powered passenger cars and heavy duty traffic;
- IPCC category 1.A.1 Energy Industries and IPCC category 1.A.2 Manufacturing Industries and Construction.

The small amount of SO2 emissions are a result of the fugitive emissions from oil- and gas exploration. In general, the Algerian oil- and gas deposits are low in Sulphur.

A significant amount of SO2 emissions result from IPCC sector 2 Industrial processes and product use (IPPU), here mainly from 2.B Chemical Industry and 2.C Metal Production.

The sectors 3 Agriculture and Waste are minor sources for SO_2 emissions.

9.2 NOx Emissions

The main source for NOx emissions in Algeria is the IPCC category 1.A Fuel Combustion Activities with

- IPCC category 1.A.3.b Road Transport, here in particular diesel-powered passenger cars and heavy duty traffic;
- IPCC category 1.A.2 Manufacturing Industries and Construction.

Another main source for NOx emissions is the 2.B Chemical industry with ammonia production and nitric acid production.

The sector 3 Agriculture also contributes with a notable share to the national total NOx emissions. The NOx emissions are a result of the application of N-fertilizers and animal manure on agricultural soils (3.D.)

The sector 5 Waste is a minor source for NOx emissions.

9.3 NMVOC Emissions

The main source for NMVOC emissions in Algeria is the

- IPCC category 1.B.2 Fugitive emissions - Oil and natural gas, here in particular the segment distribution;
- IPCC category 1.A.3.b Road Transport, here in particular gasoline-powered passenger cars

The IPCC sectors 2 Industrial Processes and Product Use (IPPU) contribute also significantly to the national total NMVOC emissions, here mainly 2.D.3.a. Solvent use (Domestic Solvent use, Coating Application, Degreasing and Dry Cleaning and Chemical Products) as well as 2.D.3.b. Road paving with asphalt and 2.D.3.c. Asphalt roofing

Another source for NMVOC is the sector 3 Agriculture, here in particular

- IPCC category 3.B Manure Management as a result of intensive feeding situation (especially silage feeding);
- IPCC category 3.D Agricultural Soil as a result of animal manure application on agricultural soils, grazing animals and fertilizer application

The sector 5 Waste is a minor source for NMVOC emissions.

9.4 CO Emissions

The main source for CO emissions in Algeria is the IPCC category 1.A Fuel Combustion Activities with

- IPCC categories 1.A.4 Others sectors Construction, here in particular residential heating.
- IPCC category 1.A.3.b Road Transport, here in particular vehicles without catalysators
- IPCC categories 1.A.1 Energy Industries and 1.A.2 Manufacturing Industries and Construction.

Another small source for CO emissions is the IPCC sectors 2 Industrial Processes and Product Use (IPPU), here in particular the IPCC categories 2.B Chemical industry and 2.C Metal industry.

The sectors sector 3 Agriculture and 5 Waste are a minor source for CO emissions.

9.5 Category-specific planned improvements related to estimation of indirect carbon dioxide and nitrous oxide emissions

Considering the potential contribution of identified improvements in the total GHG emissions and the corresponding resources needed to make these improvements effective, developments presented in following table will be explored.

Table 649 Planned improvements for estimation of indirect carbon dioxide and nitrous oxide emissions.

GHG source & sink category	Planned improvement	Type of improvement		Priority
All sectors	Estimation of indirect carbon dioxide and nitrous oxide emissions using the methodology of the EMEP/EEA air pollutant emission inventory guidebook 2019[652].	Meth	Accuracy Completeness Consistency Transparency Comparability	high
All sectors	Collection of appropriate activity data if activity data collected for the GHG inventory are not appropriate	AD		medium
All sectors	Collection of plant specific (PS) and/or country specific (CS) emission factors Using default emission factors for TIER 1 methodology or in case of non-available PS and/or CS emission factors	EF		high

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[652] EUROPEAN ENVIRONMENT AGENCY - EEA (2019): EMEP/EEA air pollutant emission inventory guidebook 2019. EEA Report No 21/2019. Copenhagen, Denmark. Available (12 January 2021) on https://www.eea.europa.eu/publications/emep-eea-guidebook-2016

10 Recalculations and Improvements

Recalculations of previously submitted inventory data are performed with the only purpose to improve the GHG inventory. This chapter quantifies the changes in emissions for all greenhouse gases compared to the previous submission.

10.1 Explanations and justifications for recalculations

Compiling an emission inventory includes data collecting, data transfer and data processing. Data has to be collected from different sources, for instance national statistics, plant operators, studies, personal information or other publications. The provided data must be transferred from different data formats and units into a unique electronic format to be processed further. The calculation of emissions by applying methodologies on the collected data and the final computing of time series into a predefined reporting format are further steps in the preparation of the final submission.

Finally, the submission must be delivered in due time. Even though a QA/QC system gives assistance so that potential error sources are minimized it is sometimes necessary to make some revisions (called recalculations) under the following circumstances:

- An emission source was not considered in the previous inventory.
- A source/data supplier has delivered new data. The causes might be: Previous data were preliminary data only (by estimation, extrapolation), improvements in methodology.
- Occurrence of errors in data transfer or processing: wrong data, unit-conversion, software errors, etc.
- Methodological changes: a new methodology must be applied to fulfil the reporting obligations caused by one of the following reasons:
  - to decrease uncertainties.
  - an emission source becomes a key source.
  - consistent input data needed for applying the methodology is no longer accessible.
  - input data for more detailed methodology is now available.
  - the methodology is no longer appropriate.

Detailed information on recalculations and their justifications can be found in the following subchapters as well as the corresponding Sector-specific Chapters of the sectors Energy, IPPU, Agriculture, LULUCF and Waste, in which all methodological changes and activity data updates that led to recalculations of emissions with respect to the previous submission are listed.

10.1.1 Recalculations made in IPCC sector 1 Energy.

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.3.1.a.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.3.1.a.ii	Fuel consumption data (activity data) were revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.3.1.a.ii	Revision of NCV	AD	Accuracy Comparability
1.3.1.a.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.3.d.i	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.d.i	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.3.d.i	Revision of NCV Default → country specific: Gasoil/diesel, fuel oil	AD	Accuracy Comparability
1.A.3.d.i	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.1.a	Revision of NCV and application of country specific GCV and NCV	AD	Accuracy
1.A.1.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy
1.A.1.a	Application of 2006 IPCC Guidelines 1994: revision of CH_4 EF 1994: Country specific (CS) CO_2 emission factors are derived on the assumption of 100% oxidation. 2000: Country specific (CS) CO_2 emission factors are derived on the assumption of 100% oxidation.	EF	Comparability
1.A.2.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.1.b	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.1.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.1.b	Revision of NCV Default → country specific: Natural gas, Refiniery gas	AD	Accuracy Comparability
1.A.1.b	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.1.b	Country specific (CS) CO_2 emission factors for Natural gas	EF	Accuracy Comparability
1.3.1.a.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.3.1.a.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.3.1.a.ii	Revision of NCV: Default → country specific: jet kerosene	AD	Accuracy Comparability
1.3.1.a.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.3.b	Application of 2006 IPCC Guidelines methodology	EF	Comparability

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.3.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.b	Revision of NCV - Default → country specific: motor gasoline, gasoil/diesel, LPG	AD	Accuracy Comparability
1.A.3.b	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.3.c	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.c	Revision of NCV Default → country specific: Gasoil/diesel, motor gasoline	AD	Accuracy Comparability
1.A.3.d.ii	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.d.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.d.ii	Revision of NCV - Default → country specific: Motor gasoline, Gasoil/diesel	AD	Accuracy Comparability
1.A.3.d.ii	Application of Emission factors (EF) of 2006 IPCC Guidelines Including the assumption of 100% oxidation	EF	Accuracy Comparability
1.A.3.e.i	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.3.e.i	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance	AD	Accuracy Transparency
1.A.3.e.i	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel, LPG	AD	Accuracy Comparability
1.A.4.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.4.a	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.a	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.4.a	Revision of CH_4 EF Country specific (CS) CO_2 emission factors for Natural gas	EF	Accuracy Comparability
1.A.4.a	Assumption of 100% oxidation	EF	Accuracy Comparability
1.A.4.a	Application of 2006 IPCC Guidelines methodology	EF	Comparability
1.A.4.b	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.b	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.4.b	Revision of CH_4 EF Country specific (CS) CO_2 emission factors for Natural gas	EF	Accuracy Comparability
1.A.4.b	Assumption of 100% oxidation	EF	Accuracy Comparability
1.A.4.c	Application of 2006 IPCC Guidelines methodology	EF	Comparability

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.A.4.c	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance and use of data from UN statistics – energy statistics	AD	Accuracy Transparency
1.A.4.c	Revision of NCV Default → country specific: Natural gas, Gasoil/diesel	AD	Accuracy Comparability
1.A.4.c	Revision of CH_4 EF Country specific (CS) CO_2 emission factors for Natural gas	EF	Accuracy Comparability
1.A.4.c	Assumption of 100% oxidation	EF	Accuracy Comparability
1.B.1.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.1.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.1.b.ii	Fuel consumption data (activity data) was revised due to revised fuel consumption data / revision of energy Balance Use of data from UN statistics	AD	Accuracy Completeness
1.B.2.a.i	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.i	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.i	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.i	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2 Application of reporting guidance for leaks, venting and flaring	AD	Completeness Comparability Transparency
1.B.2.a.i	Use of country-specific GCV and country-specific density	AD	Accuracy
1.B.2.a.iii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.iii	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.iii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.iii	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2	AD	Completeness
1.B.2.a.iii	Use of country-specific GCV and density	AD	Accuracy
1.B.2.a.iv	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.iv	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.iv	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
			Comparability Completeness
1.B.2.a.iv	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2	AD	Completeness
1.B.2.a.iv	Use of country-specific GCV and density for several fuels	AD	Accuracy
1.B.2.a.v	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.a.v	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.a.v	Revision of activity data due to updated energy statistics and use of data from UN statistics	AD	Accuracy Comparability Completeness
1.B.2.a.v	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2	AD	Completeness
1.B.2.b.i	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.i	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.i	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.b.i	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2 Application of reporting guidance for leaks, venting and flaring	AD	Completeness Comparability Transparency
1.B.2.b.i	Use of country-specific GCV	AD	Accuracy
1.B.2.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.ii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness
1.B.2.b.ii	Estimation of emissions for sources which were not included in the estimations of NC1 and NC2 Application of reporting guidance for leaks, venting and flaring	AD	Completeness Comparability Transparency
1.B.2.b.iii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.iii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.iii	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
1.B.2.b.v	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness
1.B.2.b.v	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency
1.B.2.b.v	Revision of activity data due to updated energy statistics and use of data of UN statistics	AD	Accuracy Comparability Completeness

10.1.2 Recalculations made in IPCC sector 2 IPPU

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.A.1	2006 IPCC Guidelines TIER 2 methodology was applied	method	Accuracy
2.A.1	Revision of cement production data in national statistics	AD	Accuracy
2.A.2	Application of 2006 IPCC Guidelines	method	Accuracy Comparability
2.A.2	Application of default emission factors of 2006 IPCC Guidelines	EF	Accuracy Transparency
2.A.2	Revision of activity data	AD	Accuracy
2.B.2	Application of 2006 IPCC Guidelines methodology	EF	Accuracy Comparability
2.B.2	Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines 1994 & 2020: revision of N_2O EF from 5.5 kg N_2O/ t HNO_3 to 9 kg N_2O/ t HNO_3	EF	Accuracy Completeness Transparency
2.B.8.b	Application of 2006 IPCC Guidelines methodology	method	Accuracy
2.B.8.b	Emission factor from 2006 IPCC Guidelines: 1994 & 2020: revision of CH_4 EF from 2.0 kg CH_4 / tonne methanol produced to 2.3 kg CH_4 / tonne methanol produced	EF	Accuracy Comparability
2.B.8.a	Revision of activity data	AD	Accuracy consistency
2.B.8.b	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.B.8.b	Emission factor from 2006 IPCC Guidelines: 1994 & 2020: revision of CH_4 EF from 1.0 kg CH_4 / tonne Ethylene produced to 6 kg CH_4 / tonne Ethylene produced	EF	Accuracy
2.C.1	Application of methodology of 2006 IPCC Guidelines	method	Accuracy Comparability
2.C.1	Application of 2006 IPCC Guidelines	EF	Accuracy Comparability

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
2.F.1.a	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.a	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability
2.F.1.a	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.a	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability
2.F.1.a	Revision of activity data using surrogate data instead of import information	AD	Accuracy
2.F.1.e	Application of 2006 IPCC Guidelines methodology	method	Accuracy Comparability
2.F.1.e	Application of guidance on methodology, parameter (AD) and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Comparability
2.F.1.e	Revision of activity data using surrogate data instead of import information	AD	Accuracy
2.G.1	Application of 2006 IPCC Guidelines methodology	method	Comparability
2.G.1	Use of emission factor of 2006 IPCC	EF	Comparability
2.G.1	Extrapolation using surrogate data for preparation the time-series 1970-2020	AD	Accuracy Transparency Completeness

10.1.3 Recalculations made in IPCC sector 3 Agriculture

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
3.A.1	Application of 2006 IPCC Guidelines and 2019 refinement	Method	Accurency Comparability
3.A.1	use of default emission factor of 2019 refinement to the 2006 IPCC Guidelines and	EF	Accurency Comparability
3.A.1.a.	split of cattle in dairy in BLM. BLL and BLA for TIER 2	AD	Accurency Comparability
3.B	application of 2006 IPCC Guidelines	method	Comparability
3.B	use of CH_4 default emission factor of 2006 IPCC Guidelines	EF	Comparability
3.B	use of N_2O default emission factor (direct emission) of 2006 IPCC Guidelines	EF	Comparability
3.B	use of N_2O default emission factor (indirect emission) of 2006 IPCC Guidelines	EF	Comparability
3.D	application of 2006 IPCC Guidelines	method	Comparability
3.D.1	use of N_2O default emission factor (direct emission) of 2006 IPCC Guidelines	EF	Comparability

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
3.F	Application of methodology of 2019 Refinements to the 2006 IPCC Guidelines 2006	Met	Comparability Transparency Accuracy
3.F	Revision of share of crop residues burnt in field Revision of Dry matter fraction Consideration of more crops	AD	Comparability Transparency Accuracy

10.1.4 Recalculations made in IPCC sector 4 LULUCF

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
4	No revisions were performed.	-	-

10.1.5 Recalculations made in IPCC sector 5 Waste

GHG source & sink category	Revisions of data	Type of revision	Type of improvement
5.A	Application of 2006 IPCC Guidelines: FOD model	method	Accuracy, comparability
5.A	Use of rural and urban population	AD	Completeness, Accuracy, comparability
5.A	Estimation of waste generation for the time series 1950 - 2018	AD	completeness
5.A	Estimation of country specific waste composition	AD	Accuracy
5.A	Estimation of country specific waste flow	AD	Accuracy
5.A	Application of default values of 2006 IPCC Guidelines	EF	Accuracy, comparability
5.B	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.B	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.B	Estimation of country specific waste composition	AD	Accuracy
5.B	Application of default values of 2006 IPCC Guidelines	EF	Accuracy, comparability,
5.C	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.C	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.C	Estimation of country specific waste composition	AD	Accuracy
5.D	Application of 2006 IPCC methodology	method	Accuracy, comparability
5.D	Estimation of waste generation for the time series 1950 - 2020	AD	completeness
5.D	Estimation of country specific wastewater treatment systems and pathways	AD	Accuracy
5.D	Application of default values of 2019 • Refinements to the 2006 IPCC Guidelines • 2006 IPCC Guidelines	EF	Accuracy, comparability,

10.2 Implications for emission and removal levels

A short analysis on the implications for emission and removal levels was performed.

In the following tables are provided for the years 1994 and 2000 a comparison of the GHG emissions (in kt CO_2 equivalent) per sector of the 1st National Communication (NC1) and 2nd National Communication (NC2).

Table 650 Recalculation of the year 1994: Implications for emission and removal levels

			NC 1	BUR 2023
			1994	1994
		GWP IPCC 4AR	**GHG emissions**	**GHG emissions**
1	1 Energy	kt CO_2 equivalent	72,224.64	72,812.40
2	2 Industrial Processes	kt CO_2 equivalent	4,756.00	10,238.08
3	3 Solvent and Other Product Use	kt CO_2 equivalent	0.00	NA
4	4 Agriculture	kt CO_2 equivalent	12,246.00	11,680.50
5	5 Land-Use Change & Forestry	kt CO_2 equivalent	12,990.00	NE
6	6 Waste	kt CO_2 equivalent	5,548.00	3,884.40
	GHG Emissions	kt CO_2 equivalent	**107,764.64**	**98,615.39**

Table 651 Recalculation of the year 2000: Implications for emission and removal levels

			NC 2	BUR 2023
			2000	2000
		GWP IPCC 4AR	**GHG emissions**	**GHG emissions**
1	1 Energy	kt CO_2 equivalent	91,586.98	101,081.04
2	2 Industrial Processes	kt CO_2 equivalent	5,446.85	12,866.49
3	3 Solvent and Other Product Use	kt CO_2 equivalent	0.00	NA
4	4 Agriculture	kt CO_2 equivalent	7,162.80	12,288.63
5	5 Land-Use Change & Forestry	kt CO_2 equivalent	6,342.84	NE
6	6 Waste	kt CO_2 equivalent	12,854.00	4,738.64
	GHG Emissions	kt CO_2 equivalent	**123,393.47**	**130,974.80**

In the following table are provided the results (in kt and kt CO_2 equivalent) per gas and sector of the 1st National Communication (NC1) and 2nd National Communication (NC2) using the global warming potential (GWP) of the 2nd Assessment Report (SAR) and 4th assessment report.

Table 652 National Total GHG emissions for 1994 based on 1st National Communication (NC1) using the GWP IPCC SAR and GWP IPCC 4AR

1st National Communication (NC1) 1994				**CO_2 Emissions**	**CH_4 Emissions**	**N_2O Emissions**	**GHG emissions**
	1	Energy	kt	59,245.74	515.58	0.30	
	2	Industrial Processes	kt	4,458.0	0.0	1.0	
	3	Solvent and Other Product Use	kt	0.0	NA	0.0	
	4	Agriculture	kt	NE	168.0	27.0	
	5	Land-Use Change & Forestry	kt	12,167.0	21.0	1.0	
	6	Waste	kt	NE	210.0	1.0	
		TOTAL	kt	**75,870.7**	**914.6**	**30.3**	
		GWP IPCC SAR		1	21	310	
GWP SAR	1	Energy	kt CO_2 equivalent	59,245.74	10,827.18	93.00	70,165.92
	2	Industrial Processes	kt CO_2 equivalent	4,458.00	0.00	310.00	4,768.00
	3	Solvent and Other Product Use	kt CO_2 equivalent	0.00		0.00	0.00
	4	Agriculture	kt CO_2 equivalent		3,528.00	8,370.00	11,898.00
	5	Land-Use Change & Forestry	kt CO_2 equivalent	12,167.00	441.00	310.00	12,918.00
	6	Waste	kt CO_2 equivalent		4,410.00	310.00	4,720.00
		GHG Emissions	kt CO_2 equivalent	**75,870.74**	**19,206.18**	**9,393.00**	**104,469.92**
		GWP IPCC 4AR		1	25	298	
GWP 4AR	1	Energy	kt CO_2 equivalent	59,245.74	12,889.50	89.40	72,224.64
	2	Industrial Processes	kt CO_2 equivalent	4,458.00	0.00	298.00	4,756.00
	3	Solvent and Other Product Use	kt CO_2 equivalent	0.00		0.00	0.00
	4	Agriculture	kt CO_2 equivalent		4,200.00	8,046.00	12,246.00
	5	Land-Use Change & Forestry	kt CO_2 equivalent	12,167.00	525.00	298.00	12,990.00
	6	Waste	kt CO_2 equivalent		5,250.00	298.00	5,548.00
		GHG Emissions (4AR)	kt CO_2 equivalent	**75,870.74**	**22,864.50**	**9,029.40**	**107,764.64**

Table 653 National Total GHG emissions for 2000 based on 2nd National Communication (NC2) using the GWP IPCC SAR and GWP IPCC 4AR

2nd National Communication (NC1) 2000				**CO_2 Emissions**	**CH_4 Emissions**	**N_2O Emissions**	**GHG emissions**
	1	Energy	kt	66,410.00	1,001.0	0.51	
	2	Industrial Processes	kt	5,157.0	0.3	0.95	
	3	Solvent and Other Product Use	kt	0.0	NA	0.00	
	4	Agriculture	kt	NE	184.0	8.60	
	5	Land-Use Change & Forestry	kt	6,019.0	12.0	0.08	
	6	Waste	kt	26.0	382.0	11.00	
		TOTAL	kt	**77,612.0**	**1,579.3**	**21.14**	
		GWP IPCC SAR		1	21	310	
GWP SAR	1	Energy	kt CO_2 equivalent	66,410.00	21,021.00	158.10	87,589.10
	2	Industrial Processes	kt CO_2 equivalent	5,157.00	5.67	294.50	5,457.17
	3	Solvent and Other Product Use	kt CO_2 equivalent	0.00		0.00	0.00
	4	Agriculture	kt CO_2 equivalent		3,864.00	2,666.00	6,530.00
	5	Land-Use Change & Forestry	kt CO_2 equivalent	6,019.00	252.00	24.80	6,295.80
	6	Waste	kt CO_2 equivalent	26.00	8,022.00	3,410.00	11,458.00
		GHG Emissions	kt CO_2 equivalent	**77,612.00**	**33,164.67**	**6,553.40**	**117,330.07**
		GWP IPCC 4AR		1	25	298	
GWP 4AR	1	Energy	kt CO_2 equivalent	66,410.00	25,025.00	151.98	91,586.98
	2	Industrial Processes	kt CO_2 equivalent	5,157.00	6.75	283.10	5,446.85
	3	Solvent and Other Product Use	kt CO_2 equivalent	0.00		0.00	0.00
	4	Agriculture	kt CO_2 equivalent		4,600.00	2,562.80	7,162.80
	5	Land-Use Change & Forestry	kt CO_2 equivalent	6,019.00	300.00	23.84	6,342.84
	6	Waste	kt CO_2 equivalent	26.00	9,550.00	3,278.00	12,854.00
		GHG Emissions	kt CO_2 equivalent	**77,612.00**	**39,481.75**	**6,299.72**	**123,393.47**

10.3 Implications for emission and removal trends, including time-series consistency

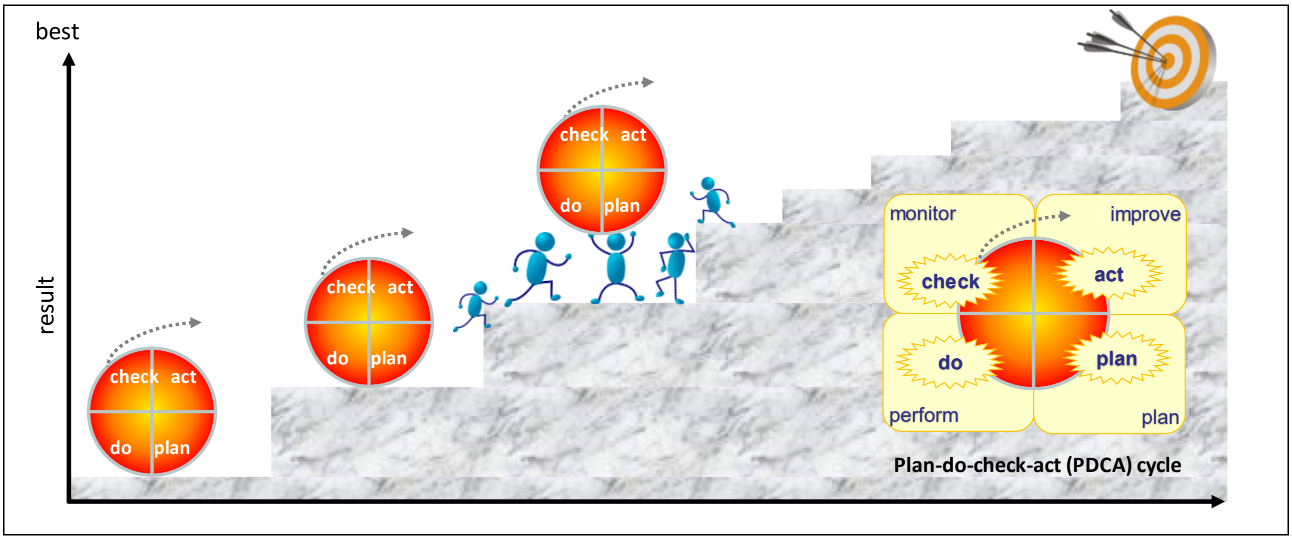
National total GHG emissions were estimated for the year

- 1994 in the 1st National Communication (NC1)
- 2000 in the 2nd National Communication (NC2).

An analysis of the implications for emission and removal trends, including time-series consistency could not be performed as no time series 1990 – 1994 and/or 1990 – 2000 was available.

10.4 Planned improvements

In the following table the planned improvements are listed. Depending on the resources and priorities, the improvements will be implemented within the next inventory cycles.



10.4.1 Planned improvements for Cross-cutting topics

	Planned improvement	Type of improvement		Priority
QA/QC	Further development of Quality management system / QA/QC plan of the GHG inventory system • QA/QC plan • Preparation of sector-specific quality assurance / control (QA/QC) checklists • QA and review procedures • Verification activities		Accuracy Transparency Comparability Consistency Completeness	high
QA/QC	Training related to Internal documentation			
QA/QC	Capacity building in application of QA/QC related procedures and documentation			high
QA/QC	Training related to planned improvements • Use of template 'planned improvements' • Defining of planned improvements • documentation • prioritizing			high
QA/QC	Capacity building for the QA/QC representative regarding ISO 9000 or related standards			high
Key category analysis	Further development of the Excel-based Key category analysis (KCA) tool ⇒ Capacity building in application of the KCA tool			high
Key category analysis	Further development of the Excel-based Uncertainty Analysis Tool provided by the 2019 Refinement to the 2006 IPCC Guidelines ⇒ Capacity building in application of the Uncertainty Analysis Tool			high

	Planned improvement	**Type of improvement**		**Priority**
Reporting	Capacity building for National Inventory Compiler and Report coordinator • Preparation of Non-Annex I table • Preparation of CRT tables • Analysis of GHG data • Preparation of National Inventory Report including annexes		Accuracy Transparency Comparability Consistency Completeness	high
Data Management	Capacity building for data manager • Data Management System Functions • Building up and maintenance of data management system • Sharing data among individuals and inventory related agencies and organizations; • Linkage to existing technical systems • Archiving of historical data and information			high
Sector experts	Capacity building for sector experts • 2006 IPCC training provided by the CGE (Consultative Group of Experts (CGE) • Participation in Training programs for the o Technical analysis of Biennial Update Reports o Review of Information submitted by Annex I Parties o Review of submissions under the Paris Agreement • Participation in o Technical analysis under international consultation and analysis (ICA) for non-Annex I o Review of Information submitted by Annex I Parties • Participation in bilateral / multilateral training and /or supporting initiatives o Partnership on Transparency in the Paris Agreement PATA o Energy Statistics Course (IEA)			High
General	Capacity building for staff involved in GHG inventory preparation • Excel training, from entry level to advanced skills o Using formulas o visualization o Automatization o Preparation of templates • Word training, from entry level to advanced skills o Formatting o Visualization of trends o Working with big files			

10.4.2 Planned improvements for IPCC sector 1 Energy

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.a.i 1.A.3.a.ii	Preparation of a consistent timeseries of activity data - National Energy balance - for the period 1990 – 2020 for all aviation related fuels: Jet Kerosene, Aviation Gasoline, Jet Gasoline, other	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Investigation regarding fuel consumption of aviation gasoline used by small planes and helicopters.	AD	Accuracy Completeness Comparability	high
1.A.3.a.i 1.A.3.a.ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC GL, Vol. 2, Chapter 3 Mobile Combustion (3.6.1.3 Choice of activity data). ⇒ Improvement of Energy balance: allocation of Jet kerosene used in international aviation and Jet kerosene exported	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Collection of data on aircraft movement for Tier 2 or 3 methodology and verification activities	AD	Accuracy Completeness Transparency	medium
1.A.3.a.i 1.A.3.a.ii	Application of Tier 2 methodology • Estimate fuel consumption for LTO and cruise for ○ international aviation ○ domestic aviation • Estimate emissions from LTO and cruise phases for ○ international aviation ○ domestic aviation	M EF	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all navigation related fuels ○ motor gasoline, gas/diesel oil, fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC Guidelines, Volume 2, Chapter 3: Mobile Combustion, 3.5.1.3 Choice of activity data.	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Data on fuel consumption by fuel type and engine type • Surveys of shipping companies (including ferry and freight) • Surveys of individual port and marine authorities	AD	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.d.i 1.A.3.d.ii	• Ship movement data and standard passenger and freight ferry schedules • Fishery boot movements	AD	Transparency	medium
1.A.3.d.i 1.A.3.d.ii	Application of Tier 2 methodology • Estimate fuel consumption for movements and cruise for navigation. • Estimate emissions for movements and cruise for navigation.	M EF	Accuracy Completeness Comparability Transparency Consistency	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A	Preparation of a consistent timeseries of activity data - National Energy balance - for the period 1990 – 2020 for all fuels	AD	Accuracy Comparability Transparency Consistency	high
1.A	Identification of fuel used as feedstock, reductant and/or non-energy products	AD	Accuracy Comparability Transparency Consistency Completness	high
1.A.1.a.i	Preparation of country specific GCV and NCV per year instead of using a constant value for whole timeseries	AD	Completeness Transparency	high
1.A.1.a.ii 1.A.1.a.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion	AD	Completeness Transparency	high
1.A.1.a	Further refinement of the country specific emission factor (CS EF) based on plant specific data for each year	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.a	Carbon content (%) of gas/diesel oil, residual fuel oil, and natural gas etc. for preparing country specific emission factor (CS EF) ⇒ **CS EF**$_{CO2}$ [t/TJ] = (C [%] • 44 • Ox)/(NCV [TJ/t] • 12• 100)	EF	Accuracy Transparency	medium
1.A.1.a	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.a	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.a	Input – output analysis: Electricity supply, gross production, imports, exports and net imports [GWh]	AD	Transparency	High
1.A.1.a.ii 1.A.1.a.iii	Survey for use of fuels in Heat Plants and CHP	AD	Completeness	medium
1.A.1.a 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.1.a	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.b	Preparation of country specific GCV and NCV per year instead of using a constant value for whole timeseries	AD	Completeness Transparency	high
1.A.1.b	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion	AD	Completeness Transparency	high
1.A.1.b	Further refinement of the country specific CO_2 emission factor (CS EF) for natural gas based on plant specific data for each year	EF	Accuracy Transparency	high

GHG source & sink category	Planned improvement	Type of improvement		Priority
			Consistency Completeness Comparability	
1.A.1.b	Carbon content (%) of gas/diesel oil, residual fuel oil, and natural gas etc. for preparing country specific emission factor (CS EF) $\Rightarrow$ **CS EF$_{CO2}$** [t/TJ] = (C [%] • 44 • Ox)/(NCV [TJ/t] • 12• 100)	EF	Accuracy Transparency	medium
1.A.1.b	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.b	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.b	Preparation of an overview of national refinery sector - processes and functional units including related emissions[653] • fundamental processes, • separation processes, • conversion processes • refining processes • extractions • other processes	AD	Transparency Completeness Accuracy	high
1.A.1.c.i	Revision of the energy balance (1990-2020): improvement of data set by collection of plant specific data: • Consumption of various fuels for combustion – hardcoal / coking coal, coke oven gas (COG) • Production data of coke oven coke • Import and use of imported hardcoal / coking coal and coke oven coke	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.c.i	Investigation of carbon content of • coke oven coke produced • imported coke oven coke (relevant for 2.C.1)	EF	Accuracy Transparency	high
1.A.1.c.i	Application of Tier 2 methodology of 2019 Refinement to the 2006 IPCC Guidelines	EF	Accuracy	high
1.A.1.c.i	Investigation of the guidance of the • by-product recovery technology in coke production • outputs of coke production process: ○ products ○ by-products: coke oven gas (COG), tars and benzenes, flaring of coke oven gas (COG)	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.1.c.i	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.c.ii	Preparation of country specific GCV and NCV per year instead of using a constant value and/or default NCV for whole timeseries	AD	Completeness Transparency	high
1.A.1.c.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion – refinery gas, natural gas, etc.	AD	Completeness Transparency	high
1.A.1.c.ii	Investigation of carbon oxidation factor and destruction efficiency (completeness of combustion of the fuel): carbon oxidation factor is intended to reflect carbon that is emitted as soot or ash	EF	Accuracy Transparency Consistency	high

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[653] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

GHG source & sink category	Planned improvement	Type of improvement		Priority
			Completeness Comparability	
1.A.1.c.ii	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.c.ii	Preparation of an overview of segment Oil and gas extraction - processes and equipment used including related emissions[654]	AD	Transparency Completeness Accuracy	high
1.A.1.c.iii.1	Cross-check of national and international data sources on charcoal production (4) Raw materials for carbonization: fuelwood & wood residue, type of wood (5) charcoal making technologies (6) efficiencies of various types of kiln	AD	Consistency Transparency	medium
1.A.1.c.iii.1	Cross-check of national data and international data (e.g., FAO) on charcoal production	AD	Consistency Transparency	medium
1.A.1.c.iii.2 1.A.1.c.iii.3	Preparation of country specific GCV and NCV per year instead of using a constant value and/or default NCV for whole timeseries	AD	Completeness Transparency	high
1.A.1.c.iii.2 1.A.1.c.iii.3	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: Consumption of various fuels for combustion in energy industries according to Energy balance	AD	Completeness Transparency	high
1.A.1.c.iii.2	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.A.1.c.iii.2 1.A.1.c.iii.3	Preparation of an overview of segment Gas liquification - processes and equipment used including related emissions[655]	AD	Transparency Completeness Accuracy	High
1.A.3.a.i 1.A.3.a.ii	Energy balance Revision of the energy balance (1990-2020) for all aviation related fuels • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all aviation related fuels ○ Jet kerosene ○ aviation gasoline ○ Investigation regarding fuel consumption of aviation gasoline used by small planes and helicopters.	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	• Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC GL, Vol. 2, Chap. 3: Mobile Combustion, 3.6.1.3 Choice of activity data. Improvement of Energy balance: allocation of Jet kerosene used in *International* or *Domestic aviation* and Jet kerosene exported	AD	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.a.i 1.A.3.a.ii	Collection of data on aircraft movement • international aviation • domestic aviation	AD	Accuracy Completeness Comparability Transparency	medium

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[654] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

[655] For e.g. according to Table 3.1: Environmental accounts of refinery processes, Best Available Techniques (BAT) Reference Document for the Refining of Mineral Oil and Gas (2015); available on 22.09-2022 on https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/REF_BREF_2015.pdf

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.a.i 1.A.3.a.ii	Application of Tier 2 methodology • Estimate fuel consumption for LTO and cruise for ○ *International aviation* ○ domestic aviation • Estimate emissions from LTO and cruise phases for ○ *International aviation* domestic *aviation*	M EF	Accuracy Completeness Comparability Transparency Consistency	high
1.A.3.b	Application of Tier 2 (or higher) using the COPERT model[656]	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Collection of road transport related data for 1990 - 2020 Vehicle fleet: • Collect data on vehicle fleet in operation per category ○ Passenger transport ○ Freight transport • Collect or estimate data on vehicle fleet split per ○ fuel (energy) type ○ segment subcategories ○ technology/Euro standard • Collect or estimate data on vehicle fleet split per age distributions • Mileage: Collect or assume typical values for average annual distance driven for each vehicle (sub)category • Speeds: Estimate average travelling speeds in urban areas, rural areas and highways; Activity shares: Estimate share of activity (mileage) in urban areas (35%), rural areas (35%) and highways (30%);	AD	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Fuel (energy) consumption - Energy balance Revision of the energy balance (1990-2020): improvement of time series completeness and consistency by collection of plant specific data (consumption and production, NCV, carbon content)	EF	Accuracy Transparency Consistency Completeness Comparability	high
1.A.3.b	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Transparency	Medium
1.A.3.b	Information about imported second hand vehicles	AD	Accuracy Transparency	Medium
1.A.3.c	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all railway related fuels ○ motor gasoline, ○ gas/diesel oil fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.c	Application of Tier 2 methodology (or higher) and development of country-specific emission factors for locomotives collection of information regarding engine types	M EF	Accuracy Completeness Comparability Transparency Consistency	medium

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[656] COPERT is the EU standard vehicle emissions calculator. It uses vehicle population, mileage, speed and other data such as ambient temperature and calculates emissions and energy consumption for a specific country or region.
https://www.emisia.com/utilities/copert/

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.A.3.c	Collection of activity data related to locomotives • number of locomotives by type • annual hours of use of locomotive • average rated power of locomotive	M EF	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.c	Collection of activity data related to emission standards	AD	Transparency	medium
1.A.3.d.i 1.A.3.d.ii	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption and production, NCV, carbon content) • for all navigation related fuels ○ motor gasoline, ○ gas/diesel oil ○ fuel oil	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Application of *good practice* approach to separate the activity data (fuel consumption) consistent with the definition of Table 3.6 of the 2006 IPCC Guidelines, Volume 2, Chapter 3: Mobile Combustion, 3.5.1.3 Choice of activity data.	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.d.i 1.A.3.d.ii	Data on fuel consumption by fuel type and engine type • Surveys of shipping companies (including ferry and freight) • Surveys of individual port and marine authorities	AD	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.d.i 1.A.3.d.ii	• Ship movement data and standard passenger and freight ferry schedules • Fishery boot movements	AD	Transparency	medium
1.A.3.d.i 1.A.3.d.ii	Application of Tier 2 methodology • Estimate fuel consumption for movements and cruise for navigation. • Estimate emissions for movements and cruise for navigation.	M EF	Accuracy Completeness Comparability Transparency Consistency	medium
1.A.3.e.i	Revision of the energy balance (1990-2020) • improvement of time series completeness and consistency (consumption, NCV, carbon content) • for all used fuels ○ motor gasoline, gas/diesel oil natural gas	AD	Accuracy Comparability Transparency Consistency	high
1.A.3.e.i 1.A.2.g.vii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Accuracy Completeness Comparability Transparency	low
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a, 1.A.4.b, 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.a.i 1.A.4.a.ii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Completeness Comparability	low
1.A.4.a	Energy balance - Use of other biomass than fuel wood ▪ bio-gasoline or bio-gas/diesel oil including MTBE, AddBlue, etc.	AD	Completeness	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
	▪ Wood charcoal			
1.A.4.a	Determination ▪ CS NCV for biomass considering moisture content ▪ Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.a	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air conditioning, etc.) ▪ energy-saving devices and technologies	AD EF	Transparency	Medium / low
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a, 1.A.4.b, 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.b.i 1.A.4.b.ii	Energy balance - Survey on use of fuels in stationary and Off-road vehicles and other machinery	AD	Completeness Comparability	low
1.A.4.b	Energy balance - Use of other biomass than fuel wood ▪ bio-gasoline or bio-gas/diesel oil including MTBE, AddBlue, etc. ▪ Wood charcoal	AD	Completeness	medium
1.A.4.b	Determination ▪ CS NCV for biomass considering moisture content Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.b	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air conditioning, etc.) ▪ energy-saving devices and technologies	AD EF	Transparency	Medium / low
1.A.4	Revision of the energy balance (1990-2009): Distribution of fuel consumption from all categories (1.A.4.a, 1.A.4.b, 1.A.4.c) within category 1.A.4 Other Sectors	AD	Accuracy Transparency	Medium
1.A.4.c.i 1.A.4.c.ii 1.A.4.c.iii	Energy balance - Survey on use of fuels in • Stationary • Off-road vehicles and other machinery • Fishing	AD	Completeness Comparability	Medium
1.A.4.b	Energy balance - Use of other biomass than fuel wood Wood charcoal	AD	Completeness	medium
1.A.4.b	Determination ▪ CS NCV for biomass considering moisture content ▪ Carbon content (%) of biomass	EF	Accuracy Transparency	Medium
1.A.4.b	Survey on ▪ thermal insulation of the buildings ▪ type of use of the building ▪ comfort requirements (air conditioning, etc.) ▪ energy-saving devices and technologies	AD EF	Transparency	Medium / low
1.B.1.b.ii	Application of methodology of the 2006 IPCC guidelines	M	Comparability Completeness	medium
1.B.1.b.ii	Application of guidance on methodology and emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	EF	Accuracy Completeness Transparency	medium
1.B.1.b.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: • Consumption of hard coal and/or cocking coal • Production of coke oven coke • Production, consumption and flaring coke oven coke gas	AD	Accuracy Completeness Transparency Consistency	high

GHG source & sink category	Planned improvement	Type of improvement		Priority
	(COG)			
1.B.1.b.ii	Information about fitted/non-fitted equipment for flue gas cleaning, improvement in combustion	EF non-GHG	Accuracy Transparency	Medium
1.B.1.b.ii	Invenstigation of the coke oven technology applied and the level of maintenance	AD	Transparency	High
1.B.2.a.i	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production of crude oil, natural gas liquids (NGL)/ condensate and GPL aux champs	AD	Completeness Consistency Transparency	high
1.B.2.a.i	Application of Tier 2 method for CO_2 and CH_4 for flaring	M	Accuracy Comparability	medium
1.B.2.a.i	Use of activity data from installation: amount of gas flared	AD	Accuracy	medium
1.B.2.a.i	Development of country-specific EF for CO_2 and CH_4	EF	Accuracy	medium
1.B.2.a.i	Preparation of data set related to oil well population and oil wells drilled	AD	Transparency	medium
1.B.2.a.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production of crude oil, natural gas liquids (NGL)/ condensate and GPL aux champs	AD	Completeness Consistency Transparency	high
1.B.2.a.iii	Application of Tier 2 method for CH_4	M	Accuracy Comparability	medium
1.B.2.a.iii	Estimation of fugitive emissions from transport activities with tanker trucks and Rail Cars and from tank feeds	AD	Completness	high
1.B.2.a.iii	Estimation of fugitive emissions from loading activities at the tanker terminal related to import and export of crude oil, condensate and GPL auy champs	AD	Completness	High
	Investigation related to pipeline transport: material of pipelines, maintenance, breakdown/accidents	AD	Completness	High
1.B.2.a.iv	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: refining of crude oil and natural gas liquids (NGL)/ condensate	AD	Completeness Consistency Transparency	high
1.B.2.a.iv	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.a.iv	Use of activity data from installation: amount of gas flared	AD	Accuracy	medium
1.B.2.a.iv	Preparation of an overview of process units related to e.g., hydrogen production, bitumen, asphalt blowing, etc. and technology applied	AD	Transparency Completeness	high
1.B.2.a.v	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of plant specific data: consumption of gasoline, gas/diesel, jet kerosene	AD	Completeness Consistency Transparency	high
1.B.2.a.v	Application of Tier 2 method for CO_2 and CH_4 for flaring	M	Accuracy Comparability	medium
1.B.2.a.v	Use of activity data from installation: amount of gas flared	AD	Accuracy	medium
1.B.2.a.v	Development of country-specific EF for CO_2 and CH_4	EF	Accuracy	medium
1.B.2.a.v	Investigation regarding technology applied at gas station	EF	Accuracy	medium
1.B.2.b.i	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.i	Application of Tier 2 method for CH_4 for venting	M	Accuracy	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
			Comparability	
1.B.2.b.i	Use of activity data from installation: amount of gas vented and flared	AD	Accuracy	medium
1.B.2.b.i	Preparation of data set related to natural gas well population and/or natural gas wells drilled in a year	AD	Transparency	medium
1.B.2.b.ii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: production natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.ii	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.ii	Preparation of data set related to active well population	AD	Transparency Accuracy	medium
1.B.2.b.ii	Investigation on share of activities occurring with lower-emitting or higher-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.b.iii	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site-specific data: production and processing of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.iii	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.iii	Preparation of data set related to applied technology for natural gas processing	AD	Transparency	medium
1.B.2.b.iii	Estimation of fugitive emissions from sour gas processing Preparation of data set related to sour gas processing	AD	Completeness	high
1.B.2.b.iii	Investigation on share of • most activities occurring with higher- emitting technologies and practices • most activities occurring with lower-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.b.iii	Use of activity data from installation: amount of gas vented and flared	AD	Accuracy	medium
1.B.2.b.iv	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site-specific data: production and Transmission and Storage of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.iv	Application of Tier 2 method	M	Accuracy Comparability	medium
1.B.2.b.iv	Preparation of data set related to pipeline length which are in operation	AD	Transparency	high
1.B.2.b.iv	Preparation of data set related to applied equipment and technology for natural gas transmission and storage	AD	Transparency	medium
1.B.2.b.iv	Investigation for transmission and storage on share of • most activities occurring with higher- emitting technologies and practices most activities occurring with lower-emitting technologies and practices	AD	Accuracy Transparency	high
1.B.2.b.v	Revision of the energy balance (1990-2020): improvement of time series consistency by collection of site specific data: gas distribution of natural gas (including LNG)	AD	Completeness Consistency Transparency	high
1.B.2.b.v	Application of Tier 2 method	M	Accuracy Comparability	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
1.B.2.b.v	Preparation of data set related to pipeline length which are in operation	AD	Transparency	high
1.B.2.b.v	Preparation of data set related to applied equipment, technology, and material for natural gas distribution	AD	Transparency	medium
1.B.2.b.v	Investigation for gas distribution on share of • less than 50% plastic pipelines, or limited or no leak detection and repair programs greater than 50% plastic pipelines, and leak detection and repair programs are in use	AD	Accuracy Transparency	high
1.B.2.b.v	Investigation regarding short term surface storage	AD	Accuracy Transparency	high
1.B.2.b.v	Investigation regarding town gas distribution	AD	Accuracy Transparency	high
1.B.2.b.v	Investigation regarding town gas distribution	AD	Accuracy Transparency	High

10.4.3 Planned improvements for IPCC sector 2 IPPU

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.1	Application of TIER 2 or higher methodology	M	Accuracy	high
2.A.1	Revision of activity data (1990-2020): improvement of time series consistency by collection of plant specific acticvity data from all cement plants • Production of clinker • Production of cement per type • Clinker fraction • CaO composition of clinker and the MgO content • CaO content of the raw material inputs	AD	Accuracy Transparency Completeness Consistency Comparabiliy	high
2.A.1	Investigation on amount of cement kiln dust (CKD) which is recycled or not returned to the kiln	AD	Accuracy Transparency	High
2.A.1	Revision of activity data (1990-2020): improvement of time series consistency • for imports for consumption of clinker • exports of clinker	AD	Accuracy Transparency Comparabiliy	high
2.A.1	Cross-check of national and international data sources	AD	Accuracy Transparency	Medium
2.A.1	Percentage share in cement kiln dust (CKD) which is recycled	AD	Accuracy, Transparency, Comparability	Medium
2.A.2	Application Tier 2 method or higher	meth	Accuracy Comparability	Medium
2.A.2	Collection of production data for 1990 - 2020 • plant specific production data • types of lime produced • carbonates consumed including their chemical composition and calcination achieved	AD	Accuracy Comparability Consistency Completenes Transparency	Medium
2.A.2	Analysis of industries that produce non-marketed lime, e.g., sugar production, pulp and paper manufacturing facilities, metallurgy, water softeners.	AD	Accuracy Transparency	Medium
2.A.2	Investigation regarding lime kiln dust (LKD) production, its composition and use.	AD	Accuracy Transparency	Medium
2.A.3	Application Tier 2 methodology or higher	meth	Accuracy Comparability	Medium
2.A.3	Collection of production data for 1990 - 2020 • plant specific production data • types of glass produced carbonates consumed	AD	Accuracy Comparability Consistency Completenes Transparency	Medium
2.A.3	Investigation of glass production processes used in the country	AD	Accuracy Transparency	Medium
2.A.3	Investigation regarding cullet ration (recycled glass)	AD	Accuracy Transparency	Medium
2.A.3	Application Tier 2 methodology or higher	meth	Accuracy Comparability	Medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.A.3	Collection of production data for 1990 - 2020 • plant specific production data • types of glass produced carbonates consumed	AD	Accuracy Comparability Consistency Completenes Transparency	Medium
2.A.3	Investigation of glass production processes used in the country	AD	Accuracy Transparency	Medium
2.A.3	Investigation regarding cullet ration (recycled glass)	AD	Accuracy Transparency	Medium
2.A.4	Survey on process uses of carbonates and collection of activity data related to activites of • Production og ceramics • Other uses of soda ash • Non-metallurgical magnesium production Other .	AD	Completness	Medium
2.B.2	Collection of plant specific activity data (1990-2020): • utilization factor per line nitric acid production per line	AD	Accuracy Completeness Transparency	high
2.B.2	Collection of plant-specific measurements: N_2O generation and destruction factors	EF	Accuracy Transparency Consistency Completeness Comparability	High
2.B.2	Application of Tier 2 methodology or higher	meth	Accuracy	medium
2.B.8.a	Application of Tier 2 methodology or higher and /or Preparation of a carbon mass balance calculations according to Tier 2 carbon mass balance flow diagram (Figure 3.10, 2006 IPCC GL, Vol. 3 IPPU, Chapter 3)	meth	Accuracy	medium
2.B.8.a	Collection of plant specific activity data (1990-2020): • production capacity data per plant • methanol production per plant feedstock used	AD	Accuracy Completeness Consistency Transparency comparability	medium
2.B.8.a	Collection of information related to process applied for methanol production including plant specific parameter	EF	Accuracy Transparency	medium
2.B.8.b	Application of Tier 2 methodology or higher and /or Preparation of a carbon mass balance calculations according to Tier 2 carbon mass balance flow diagram (Figure 3.10, 2006 IPCC GL, Vol. 3 IPPU, Chapter 3)	meth	Accuracy	medium
2.B.8.b	Collection of plant specific activity data (1990-2020): • production capacity data per plant • Ethylene production per plant • feedstock used	AD	Accuracy Completeness Consistency Transparency comparability	medium
2.B.8.b	Collection of information related to process applied for Ethylene production including plant specific parameter	EF	Accuracy Transparency	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.B.8.c - 2.B.8.c	Investigation if the production of the following product took/takes place in Algeria: • Ethylene Dichloride and Vinyl Chloride Monomer • Ethylene Oxide, • Acrylonitrile, or • Carbon Black	AD	Accuracy Completeness Transparency	
2.B.2	Collection of plant specific activity data (1990-2020): • production capacity data per plant • urea production per plant	AD	Accuracy Completeness Consistency Transparency Comparability	high
2.B.2	Collection of amount of CO_2 used/recovered for downstream	AD	Accuracy	medium
2.C.1	Preparation of overview of processes and techniquies including changes of the time and application of abatement technology applied in Algeria • Coke production • Sinter production • Pelletizing • Blast furnace – pig iron production • Steelmaking in Basic oxygen Firnanace (BOF) • Electric Arc Furnace (EAF) • Secondary iron production	AD	Transparency completness	high
2.C.1	Application of TIER 2 or higher mehthodology			

2.C.1	Collection of plant specific data
	• National coke production using coal
	  o preparation of consistent and complete time series of import coal
	  o determination of coal charastiritics
	• Coke used
	  o national production
	  o imports
	• Coke oven gas production, consumption and exhaust gases
	• Pig iron production in Blast oxygen furnace (BOF)
	• Blast oxygen furnace (BOF) gas production, consumption and exhaust gases
	• Steel production in
	  o Basic Oxygen Furnace (BOF)
	  o Electric Arc Furnace (EAF)
	• Fuel combustion data related to each process			

2.C.1	Collection of plant specific data to prepare countra specific Emission factor • material-specific carbon contents for iron and steel production (tonnes C/tonne) • exhaust gases from blast furnace gas and metallurgical coke production Electrode consumption amounts			
2.C.5	Application of TIER 2 or higher methodology of 2006 IPCC GL	AD	Accuracy	medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.C.5	Preparation of country specific emission factor (CS EF) for TIER 2 methodology - Collection of total amount of reducing agents and other carbon containing process materials used for Lead production in the country 1. Or - facility-specific measured emissions data	AD	Accuracy Completeness Consistency Transparency Comparability	medium
2.C.1, 2.C.5, 2.C.6	Investigation on the metallurgical coke/coal reductant used in different processes to avoid double counting or omission.	AD	Accuracy Completeness Consistency Transparency	high
2.C.5	Investigation on type of furnace was used in the lead production	AD	Transparency	medium
2.C.5, 2.C.6	Investigation a simultaneous treatment of lead and zinc concentrates in the pyrometallurgical process involving the use of an Imperial Smelting Furnace toke place: the process results in the simultaneous production of lead and zinc and the release of non-energy CO_2 emissions. -> double counting	AD	Accuracy Transparency	medium
2.C.6	Application of TIER 2 or higher methodology of 2006 IPCC GL	AD	Accuracy	High
2.C.6	Preparation of country specific emission factor (CS EF) for TIER 2 methodology - Collection of total amount of reducing agents and other carbon containing process materials used for zinc production in the country 2. or facility-specific measured emissions data	AD	Accuracy Completeness Consistency Transparency Comparability	high
2.C.1, 2.C.5, 2.C.6	Investigation on the metallurgical coke/coal reductant used in different processes to avoid double counting or omission.	AD	Accuracy Completeness Consistency Transparency	High
2.C.5, 2.C.6	Investigation a simultaneous treatment of lead and zinc concentrates in the pyrometallurgical process involving the use of an Imperial Smelting Furnace toke place: the process results in the simultaneous production of lead and zinc and the release of non-energy CO_2 emissions. -> double counting	AD	Accuracy Transparency	medium
2.D.1	Collection of activity data for the whole time series 1990 – 2020 and incorporation in the Energy balance	AD	Accuracy Transparency Completeness	Medium
2.D.2	Collection of activity data for the entire times series 19000-2020 and incorporation in the national Energy balance	AD	Accuracy Transparency Completeness	Medium
2.D.3	Analysis of subcategories which are occurring (see Table 473)	AD	Accuracy Transparency	High / Medium

GHG source & sink category	Planned improvement	Type of improvement		Priority
2.D.3	Investigation of data on production, import and export of the solvents and solvent containing products for the recent years and for pillar years (e.g., 1990, 1995, 2000, 2005, 2010) (see Table 473)	AD	Accuracy Transparency	High / Medium
2.F.1.a	In-depth analysis of data on historic and current equipment ⇨ Containing fluids / gases ⇨ Container size ⇨ Life time ⇨ usage pattern ⇨ maintenance ⇨ disposal recovery	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.a	In-depth analysis of production, import & export of commodities of HS code 8418 'Refrigerator and freezer' ⇨ Containing fluids / gases Container size	AD	Accuracy Transparency Completeness Comparability	High
2.F.1	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[657] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High
2.F.1	In-depth analysis of (a) data on historic and current equipment (b) production, import & export of commodities of • HS code 8415 'Air-condition' HS code 8418 'Refrigerator and freezer'	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	In-depth analysis of (a) data on historic and current equipment (b) production, import & export of commodities of • Containing fluids / gases • Container size • Life time • usage pattern • maintenance disposal	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	Analysis of mobile air-conditioning units/equipment	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.b	Application of methodology (TIER 2 or higher) of 2006 IPCC Guidelines and 2019 Refinements to the 2006 IPCC Guidelines Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.5 Refrigeration and air conditioning) Page 7.43.	AD	Accuracy Transparency Completeness Comparability Consistency	High
2.F.1.c	In-depth analysis of data on historic and current equipment used in in industries ⇨ containing fluids / gases	AD	Accuracy Transparency Completeness	High

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[657] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

GHG source & sink category	Planned improvement	Type of improvement		Priority
	⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal recovery efficiency		Comparability	
2.F.1.c	In-depth analysis of production, import & export of relevant applicants and vehicles ⇨ containing fluids / gases ⇨ container size and charge (weight) container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[658] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.d	In-depth analysis of data on historic and current equipment, applicants and vehicles, railcars and ships ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.d	In-depth analysis of production, import & export of commodities of HS code 8418 'Refrigerator and freezer' ⇨ containing fluids / gases ⇨ container size and charge (weight) container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines[659] and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.e	In-depth analysis of data on historic and current equipment used in vehicles of the road transport, trains, ships, planes and off-road vehicles ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.e	In-depth analysis of production, import & export of relevant applicants and vehicles ⇨ containing fluids / gases	AD	Accuracy Transparency Completeness	High

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[658] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

[659] 2006 IPCC Guidelines. Vol. 3: IPPU, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances.

GHG source & sink category	Planned improvement	Type of improvement		Priority
	⇨ container size and charge (weight) container prefilled and/or filled upon use		Comparability	
2.F.1.e	In-depth analysis of second hand market	AD	Accuracy Transparency	High
2.F.1	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.f	In-depth analysis of data on historic and current equipment and application ⇨ containing fluids / gases ⇨ container size and charge (weight) ⇨ container prefilled and/or filled upon use ⇨ life time ⇨ usage pattern ⇨ maintenance and service routine ⇨ disposal recovery efficiency	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.f	In-depth analysis of production, import & export of commodities of HS code 8415 'Air-condition' ⇨ containing fluids / gases ⇨ container size and charge (weight) container prefilled and/or filled upon use	AD	Accuracy Transparency Completeness Comparability	High
2.F.1.f	In-depth analysis of second hand market	AD	Accuracy Transparency	High
2.F.1.f	Application of Tier 2 methodology or higher of 2006 IPCC Guidelines and Application of guidance on methodology and Emission factors provided by the 2019 Refinements to the 2006 IPCC guidelines.	AD	Accuracy Transparency Completeness Comparability	High
2.F.2	Analysis of Foam Blowing Agents, e.g., • the amount of chemical used in foam manufacturing in a country and not subsequently exported the amount of chemical contained in foam imported	AD	Accuracy Transparency Completeness Comparability	High
2.F.2	Investigation on applications • Polyurethane – Integral Skin / Polyurethane – Continuous Panel / Discontinuous Panel / Appliance / Injected / etc. • One Component Foam (OCF) • Extruded Polystyrene (XPS) Phenolic – Discontinuous Block / Discontinuous Laminate	AD	Accuracy Transparency Completeness Comparability	High
2.F.2	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.4 FOAM BLOWING AGENTS) Page 7.32.	AD	Accuracy Transparency Completeness Comparability	High
2.F.3	Investigation of import and use of fire protection products and fire protection equipment	AD	Accuracy Transparency Completeness	High
2.F.3	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting	AD	Accuracy Transparency Completeness	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	Substances. (7.6 FIRE PROTECTION) Page 7.61.		Comparability	
2.F.4	Investigation of • Domestic aerosol production Imported aerosol production	AD	Accuracy Transparency Completeness	High
2.F.4	Investigation of the use and consumption (by chemical composition) of products containing HFC and/or PFC for cleaning: (i) Metered Dose Inhalers (MDIs); (ii) Personal Care Products (e.g., hair care, deodorant, shaving cream); (iii) Household Products (e.g., air-fresheners, oven and fabric cleaners); (iv) Industrial Products (e.g., special cleaning sprays such as those for operating electrical contact, lubricants, pipe-freezers); (v) Other General Products (e.g., silly string, tyre inflators, klaxons).	AD	Accuracy Transparency Completeness	High
2.F.4	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.3 AEROSOLS (PROPELLANTS AND SOLVENTS)) Page 7.28.	AD	Accuracy Transparency Completeness Comparability	High
2.F.5	Investigation of the use and consumption (by chemical composition) of solvents containing HFC and/or PFC products for (i) Precision Cleaning, (ii) Electronics Cleaning, (iii) Metal Cleaning, (iv) Deposition applications).	AD	Accuracy Transparency Completeness	High
2.F.5	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.3 AEROSOLS (PROPELLANTS AND SOLVENTS) Page 7.28.	AD	Accuracy Transparency Completeness Comparability	High
2.F.6	Investigation of the use and consumption (by chemical composition) of various products containing HFC and/or PFC	AD	Accuracy Transparency Completeness	High
2.F.6	Application of methodology of 2006 IPCC Guidelines, Volume 3: Industrial Processes and Product Use, Chapter 7: Emissions of Fluorinated Substitutes for Ozone Depleting Substances. (7.7 OTHER APPLICATIONS) Page 7.66.	AD	Accuracy Transparency Completeness Comparability	High
2.G.1.a	Identification of ‘Electrical Equipment Manufacture sector’ and relevant manufactures, equipment remakers and servicing companies, importers, exporters and distributers related to • Manufacture of ▪ gas insulated switchgear (GIS),	AD	Completeness Transparency	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	▪ gas circuit breakers (GCB), ▪ high voltage gas-insulated lines (GIL), ▪ outdoor gas-insulated instrument transformers, ▪ reclosers, ▪ switches, and ▪ ring main units of both types /differentiated to **sealed and closed pressure systems**, resp. up to and above 52kV ▪ other equipment including but not limited to cast resin instrument transformers and certain types of bushings using SF_6 either as gas for the casting process or as a blowing agent; • Manufacturer of gas-insulated power transformers (GIT) *The SF_6 distribution chain from producers and distributors to manufacturing facilities.*			

2.G.1.a	• Collection of activity data ’SF_6 consumption’ and compilation of time series 1970 – 2020 from identified stakeholders of the ‘Electrical Equipment Manufacture sector’ using information on
	  • purchases of SF_6,
	  • their returns of SF_6 to chemical producers, and
	  • changes in their inventory of SF_6 in containers.
	• Performing completeness checks by including information from chemical producers and/or distributors on their sales to equipment manufacturers (less any returns).
	• Ensure confidentiality for single stakeholder but also for entire ‘Electrical Equipment Manufacture sector’
	Ensure data collection (practicability) for future years
		AD	Completeness
			Transparency
			Comparability
			Accuracy
				High

2.G.1.a	Preparation of plant or country specific emission factor for pillar years Emission factors for the Tier 2 method are generally developed on the basis of data collected from representative manufacturers and utilities that track emissions by life cycle stage, essentially using the Tier 3, pure mass-balance method at their facilities for at least one year.	EF	Completeness Transparency Comparability Accuracy	High
2.G.1.a	Estimation emission of SF_6 from ‘Electrical Equipment Manufacture sector’	Meth	Completeness Transparency Comparability	High
2.G.1.a	Investigation of PFC used in ‘Electrical Equipment Manufacture in the country. If yes, • Collect annual, country-wide consumption of PFC by equipment manufacturers • *Manufacture sector comprises (see above)* Estimation of emissions from 2.G.1.a *(see above)*	AD	Completeness Transparency	High
2.G.1.a	Investigation of electrical equipment manufacturers using PFC were in the country. If yes, • Annual, country-wide consumption of PFC by equipment manufacturers • Estimation of emissions from 2.G.1.a	AD	Completeness Transparency	High
2.G.1.a	Investigation of electrical equipment manufacturers using PFC were in the country Collection of activity data for PFC	AD	Accuracy Transparency Completeness	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	The IPCC category 2.G.1.a *Manufacture of Electrical Equipment* does not existed in Algeria: it is assumed that no manufacture of electrical equipment, which was filled with PFC and/or SF_6 in country, took place. Annual, country-wide consumption of PFC by equipment manufacturers			
2.G.2	Analysis of production, import and export of ‘other products’ containing SF_6 and PFCs, e.g., • SF_6 and PFCs used in military applications • SF_6 used in sound-proof windows • SF_6 used in shoes	AD	Accuracy Transparency Completeness Comparability	High
2.G.2	Estimation of SF_6 and PFCs emissions from use of ‘other products’ containing SF_6 and PFCs according to 2006 IPCC Guidelines, Vol. 3, Chapter 8: Other Product Manufacture and Use (8.3 Use of SF_6 and PFCs in other products)	AD	Accuracy Transparency Completeness Comparability	High

10.4.4 Planned improvement for IPCC sector 3 Agriculture

GHG source & sink category	Planned improvement	Type of improvement		Priority
3.A	Correction of technical mistakes in calculation	AD, EF	Completeness	high
3.A. 3.B. 3.D.	Husbandry and Management Practice with consideration • characteristics of Livestock Husbandry for the whole time series: ○ breed, ○ age distribution, ○ weight ○ milk wool yield, ○ wool yield, ○ working hours • characteristics of manure management practice: ○ stall / housed and Housing period ○ pasture/range/paddock (flat/hilly) ○ grazing large areas (flat/hilly) ○ daily spread ○ solid storage ○ dry lot ○ liquid/slurry with/without natural crust cover ○ uncovered anaerobic lagoon ○ pit storage below animal confinements ○ anaerobic digester ○ burned for fuel ○ cattle and swine deep bedding ○ composting aerobic treatment	AD	Accuracy Consistency Comparability Transparency Completeness	high
3.A. 3.B.	Manure management by temperature for sheep, goats, horses, mules, and asses, and poultry	AD	Accuracy Comparability Transparency	medium
3.A.2	Estimation of methane emissions applying TIER 2 approach as these sub-categories are key categories	method	Transparency Comparability	high
3.A.1.j 3.B. 3.D	Survey and/or research on Livestock which is not included in current statistics: e.g., buffalo, fur bearing animals	AD	Completeness	Medium
3.B	Survey and/or research on VS excretion rates		Accuracy	medium
3.D	F_{SN} - Annual amount of applied synthetic fertilizer consumption applied to soils ▪ amount and type (fertilizers by product and/or nutrient) of annual amount of applied synthetic fertilizer	AD	Accuracy Consistency Transparency	high
3.D	F_{ON} - annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils • amount of animal manure and N content, • amount of compost and N content, • amount of sewage sludge and N content (cross-check with Waste Sector to ensure there is no double counting),	AD	Accuracy Consistency Transparency	high

GHG source & sink category	Planned improvement	Type of improvement		Priority
	annual amount of other organic amendments used as fertiliser (e.g., rendering waste, guano, brewery waste, etc.) and N content			
3.D	(1) Area$_{(T)}$ - Total annual area harvested of crops (types) (2) Yield$_{\_Fresh(T)}$ - Harvested fresh yield for crop T (3) Area burnt $_{(T)}$ - annual area of crop T burned (4) Dry matter (d.m.) fraction (DRY) • grains: e.g., wheat (split in winter and summer harvest), barley, oats, rice, rye, millet, maize (corn), sorghum, spelt, teff, (wild) rice, etc. • beans & pulses: e.g., beans, lentils, peas, etc. • tubers: e.g., (sweet) potato, yam, cassava, sweet lupins, etc. • root crops: beets-roots, sugar beet, pigweed, sunflower, mustard, carrots, etc. • N-fixing forages • Non-N-fixing forages • Perennial grasses Grass-clover mixtures	AD	Accuracy Consistency Transparency	high
3.D	SOC$_0$ - soil organic carbon stock in the last year of an inventory time period (tonnes C) SOC$_{(0-T)}$ - soil organic carbon stock at the beginning of the inventory time period (tonnes C) *See Planned Improvements for LULUCF*	AD	Accuracy Transparency Consistency Comparability Completeness	medium
3.D	(1) number of head of livestock species/category T fraction of total annual N excretion for each livestock (2) species/category T that is deposited on pasture, range and paddock (PRP) (3) annual average N excretion per head of species/category T *see Planned Improvements for 3.B. Enteric Fermentation and 3.A. Manure management*	AD	Accuracy Consistency	High
3.D	F$_{SN}$ - Annual amount of applied synthetic fertilizer consumption applied to soils amount and type (fertilizers by product and/or nutrient) of annual amount of applied synthetic fertilizer	AD	Accuracy Consistency Transparency	high
3.D	F$_{ON}$ - annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils • amount of animal manure and N content, • amount of compost and N content, • amount of sewage sludge and N content (cross-check with Waste Sector to ensure there is no double counting), annual amount of other organic amendments used as fertiliser (e.g., rendering waste, guano, brewery waste, etc.) and N content	AD	Accuracy Consistency Transparency	high
3.D	(1) Area$_{(T)}$ - Total annual area harvested of crops (types) (2) Yield$_{\_Fresh(T)}$ - Harvested fresh yield for crop T (3) Area burnt $_{(T)}$ - annual area of crop T burned	AD	Accuracy Consistency Transparency	high

GHG source & sink category	Planned improvement	Type of improvement		Priority
	(4) Dry matter (d.m.) fraction (DRY) • grains: e.g., wheat (split in winter and summer harvest), barley, oats, rice, rye, millet, maize (corn), sorghum, spelt, teff, (wild) rice, etc. • beans & pulses: e.g., beans, lentils, peas, etc. • tubers: e.g., (sweet) potato, yam, cassava, sweet lupins, etc. • root crops: beets-roots, sugar beet, pigweed, sunflower, mustard, carrots, etc. • N-fixing forages • Non-N-fixing forages • Perennial grasses Grass-clover mixtures			
3.D	SOC_0 - soil organic carbon stock in the last year of an inventory time period (tonnes C) $SOC_{(0-T)}$ - soil organic carbon stock at the beginning of the inventory time period (tonnes C) *See Planned Improvements for LULUCF*	AD	Accuracy Transparency Consistency Comparability Completeness	medium
3.D	(1) number of head of livestock species/category T fraction of total annual N excretion for each livestock (2) species/category T that is deposited on pasture, range and paddock (PRP) (3) annual average N excretion per head of species/category T *see Planned Improvements for 3.B. Enteric Fermentation and 3.A. Manure management*	AD	Accuracy Consistency	High
3.F	Correction of technical mistakes in calculation	AD	Accuracy	medium
3.F	Consideration of cultivated crops and crop residues which are burnt and if possible, by provinces • Crops where crop residues are burned • Use of crop residues: biofuel, domestic livestock feed, building materials, burning in the field etc. • Dry matter fraction Estimation of above-ground (and below ground) biomass, dead organic matter (dead wood and litter)	AD	Transparency Accuracy	medium
3.F	Cross-check with FAO statistics[660] (Emissions – Agriculture) where emissions from crop residues were estimated	EMI	Consistency	medium
3.H	Collection of activity data for the time series 1990 – 2020	AD	Accuracy Completeness	medium

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[660] Available (03. March 2019) on http://www.fao.org/faostat/en/#data/GA

10.4.5 Planned improvements for IPCC sector 4 LULUCF

GHG source & sink category	Planned improvement	Type of improvement		Priority
4 LULUCF General	Development a national land classification system applicable to all six land-use categories (Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land) and further subdivide by climate, soil type and/or ecological regions (i.e., strata) • land use definitions • Land cover classification and Land cover data/map covering information 20 years before 1990 • Climate classification based on elevation, mean annual temperature (MAT), mean annual precipitation (MAP), mean annual precipitation to potential evapotranspiration ratio (MAP: PET), and frost occurrence. • ecological zones • soil classification for mineral soil types based on USDA taxonomy • area burned • information of type, age, and condition of biomass ➔ Planned Improvement for ▪ Emission and removals from LULUCF ▪ Complete data set including information including historical data ▪ Improvement of (agricultural) statistics including historical data (time series development) ▪ Country-specific parameter and emissions factors ▪ Input data for TIER 1 / TIER 2 methodology of 2006 IPCC GL	AD EF method	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Forest	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining forest and converted to Forest • Forest inventory and/or forest management system/Area of plantation/forests • Area annually affected by disturbances including frequency of disturbances (pest and disease outbreaks, flooding, fires, etc.). • Area annually affected by harvest (harvest categories, commercial harvest, fuelwood consumption, traditional fuelwood use and other wood use.) • Assessment of changes in carbon stock in DOM • Conversion of ○ unmanaged to managed forest. ○ native forest into a new forest type; • Intensification of forest management activities (i.e. site preparation, tree planting and rotation length changes; changes in harvesting practices • Harvested Wood Products: Waste deposit, sawn wood, wood panels, paper, energy purpose	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Cropland	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • estimates of land areas remaining cropland or converted to Cropland • information on Cropland ○ arable and tillable land, rice fields, and agroforestry systems ○ annual and perennial crops as well as temporary fallow land ○ crop-pasture rotation (mixed system) ○ land areas of growing stock and harvested land with	AD EF	Transparency Accuracy Completeness Comparability Consistency	High

GHG source & sink category	Planned improvement	Type of improvement		Priority
	perennial woody crops including information of Broad subcategories (i.e. fruit orchards, plantation crops, agroforestry system) and related Specific subcategories			
4 LULUCF Grassland	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • estimates of land areas remaining grassland or converted to grassland • share of land-use categories: Steppe/tundra/prairie grassland, Semi-arid grassland, Sub-tropical/ tropical grassland, Woodland/Savannah, Shrubland • information on use/management systems • area under managed organic soils	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Wetland	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • Estimates of land areas remaining wetland or converted to wetland • Wetland use, protection and wetland management • Area under managed organic soils • Peat extraction	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Settlements	Survey with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • estimates of land areas remaining settlement or converted to settlement • information on use/management systems	AD EF	Transparency Accuracy Completeness Comparability Consistency	High
4 LULUCF Other land	Survey and/or research with consideration of (a) regional and district diversity, (b) characterisation by climate and/or soil type and/or (c) ecological regions (i.e., strata) • estimates of land areas remaining Other land or converted to Other Land • information on the use/management system	AD EF	Transparency Accuracy Completeness Comparability Consistency	High

10.4.6 Planned improvements for IPCC sector 5 Waste

GHG source & sink category	Planned improvement	Type of improvement		Priority
5.A	Further investigation on waste flow: collection, disposal, recycling, Anaerobic digestion at biogas facilities and incineration with energy and without energy recovery, open burning, composting, etc. • By Wilaya and/or by Climate region ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD	Accuracy Transparency Comparability Completeness Consistency	high
5.A	Further investigation on waste generation (rate) • By Wilaya and/or by Climate region (see Table 619 & Table 618) ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD		high
5.A	Further investigation on amount and waste management practices regarding clinic waste, sludge, hazardous waste, etc.	AD		medium
5.A	Further investigation on industrial waste generation and industrial waste management practices	AD		medium
5.A	In-depth analysis of existing data on waste collection and disposal from municipalities for application of higher TIER methodology (TIER 2): good quality country-specific activity data on current and historical waste disposal at SWDS (data for the last 30 years (or more))	AD		high
5.A	Further investigation on waste management practices (managed, unmanaged, unspecified) (see Table 615)	AD		high
5.B	Investigation on composting activities especially in the rural area and the use of compost in agriculture by wilaya / climate region	AD	Accuracy	High
5.B	Investigation on composting activities of sludge by wilaya / climate region	EF		Medium
5.B	Further investigation on waste flow: collection, disposal, recycling, Anaerobic digestion at biogas facilities and incineration with energy and without energy recovery, open burning, composting, etc. • By Wilaya and/or by Climate region ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD	Accuracy Transparency Comparability Completeness Consistency	high
5.B	Further investigation on waste generation (rate) • By Wilaya and/or by Climate region (see Table 619	AD		high

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
	& Table 618) ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies			
5.C	Investigation on composting activities especially in the rural area the open burning is practiced by wilaya / climate region	AD	Accuracy	High
5.C	Investigation on incineration (with and without energy recovery) and open burning activities of • Industrial solid wastes • Hazardous waste • Clinical waste • Sewage sludge • Other by wilaya / climate region	EF		Medium
5.C	Further investigation on waste flow: collection, disposal, recycling, incineration with energy and without energy recovery, open burning, composting, etc. • By Wilaya and/or by Climate region ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD	Accuracy Transparency Comparability Completeness Consistency	high
5.C	Further investigation on waste generation (rate) • By Wilaya and/or by Climate region (see Table 619 & Table 618) ○ Rural population ○ Urban population ▪ Agglomerate / big cities ▪ “Other” urban • Evaluation of existing studies	AD		High
5.D	Investigation on wastewater flow: collection – treatment and discharge pathways and systems • Wilayas / climate zone • Urban population (high / low income) Rural population	AD	Accuracy Transparency Comparability Completeness Consistency	High
5.D	Estimation of amount of wastewater treated • Wilayas / climate zone • Urban population (high / low income) • Rural population	AD		High
5.D	Use of metadata prepared for and submitted to WHO/UNICEF Joint Monitoring Program for Water Supply, Sanitation and Hygiene (JMP)	AD		High
5.D	Investigation of flow and amount of industrial wastewater	AD		High
5.D	Sludge separation and annual amount of sludge removal that is	AD		High

GHG source & sink category	**Planned improvement**	**Type of improvement**		**Priority**
	• dumped • applied to soil (agriculture) incinerated			
5.D	Investigation of protein consumption	AD		Medium
5.D	Implementation of 2019 refinements to 2006 IPCC Guidelines: • N_2O emissions from domestic wastewater treatment plants • N_2O emissions from domestic wastewater effluent • TOW in wastewater prior to treatment or wastewater that is discharged without treatment • TOW in treated wastewater effluent are treated as treated TOW in wastewater.			High

11 Annexes to the National Inventory Report (NIR)

11.1 Annex I: Key categories

In the following table is provided information on the level of disaggregation.

Table 654 Information on the level of disaggregation for KCA of the GHG inventory 1990 and 2020

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 1 a gaseous	Public Electricity and Heat Production	CO_2	Gg	9266	35252
1 A 1 a gaseous	Public Electricity and Heat Production	CH_4	Gg CO_2 eq	4	16
1 A 1 a gaseous	Public Electricity and Heat Production	N_2O	Gg CO_2 eq	49	187
1 A 1 a liquid	Public Electricity and Heat Production	CO_2	Gg	413	611
1 A 1 a liquid	Public Electricity and Heat Production	CH_4	Gg CO_2 eq	0	1
1 A 1 a liquid	Public Electricity and Heat Production	N_2O	Gg CO_2 eq	5	7
1 A 1 a other	Public Electricity and Heat Production	CO_2	Gg	NO	NO
1 A 1 a other	Public Electricity and Heat Production	CH_4	Gg CO_2 eq	NE	NE
1 A 1 a other	Public Electricity and Heat Production	N_2O	Gg CO_2 eq	NE	NE
1 A 1 a solid	Public Electricity and Heat Production	CO_2	Gg	NO	NO
1 A 1 a solid	Public Electricity and Heat Production	CH_4	Gg CO_2 eq	NE	NE
1 A 1 a solid	Public Electricity and Heat Production	N_2O	Gg CO_2 eq	NE	NE
1 A 1 b gaseous	Petroleum Refining	CO_2	Gg	1139	1433
1 A 1 b gaseous	Petroleum Refining	CH_4	Gg CO_2 eq	1	1
1 A 1 b gaseous	Petroleum Refining	N_2O	Gg CO_2 eq	6	8
1 A 1 b liquid	Petroleum Refining	CO_2	Gg	813	953
1 A 1 b liquid	Petroleum Refining	CH_4	Gg CO_2 eq	0	0
1 A 1 b liquid	Petroleum Refining	N_2O	Gg CO_2 eq	4	5
1 A 1 b other	Petroleum Refining	CO_2	Gg	NO	NO
1 A 1 b other	Petroleum Refining	CH_4	Gg CO_2 eq	NO	NO
1 A 1 b other	Petroleum Refining	N_2O	Gg CO_2 eq	NO	NO
1 A 1 b solid	Petroleum Refining	CO_2	Gg	NO	NO
1 A 1 b solid	Petroleum Refining	CH_4	Gg CO_2 eq	NO	NO
1 A 1 b solid	Petroleum Refining	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 1 gaseous	Manufacture of solid fuels	CO_2	Gg	NO	NO
1 A 1 c 1 gaseous	Manufacture of solid fuels	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 1 gaseous	Manufacture of solid fuels	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 1 liquid	Manufacture of solid fuels	CO_2	Gg	NO	NO
1 A 1 c 1 liquid	Manufacture of solid fuels	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 1 liquid	Manufacture of solid fuels	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 1 other	Manufacture of solid fuels	CO_2	Gg	NO	NO
1 A 1 c 1 other	Manufacture of solid fuels	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 1 other	Manufacture of solid fuels	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 1 solid	Manufacture of solid fuels	CO_2	Gg	319	NE
1 A 1 c 1 solid	Manufacture of solid fuels	CH_4	Gg CO_2 eq	1	NE

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 1 c 1 solid	Manufacture of solid fuels	N_2O	Gg CO_2 eq	17	NE
1 A 1 c 2 gaseous	Oil and gas extraction	CO_2	Gg	NO	NO
1 A 1 c 2 gaseous	Oil and gas extraction	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 2 gaseous	Oil and gas extraction	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 2 liquid	Oil and gas extraction	CO_2	Gg	NE	15982
1 A 1 c 2 liquid	Oil and gas extraction	CH_4	Gg CO_2 eq	NE	7
1 A 1 c 2 liquid	Oil and gas extraction	N_2O	Gg CO_2 eq	NE	83
1 A 1 c 2 other	Oil and gas extraction	CO_2	Gg	NO	NO
1 A 1 c 2 other	Oil and gas extraction	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 2 other	Oil and gas extraction	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 2 solid	Oil and gas extraction	CO_2	Gg	NO	NO
1 A 1 c 2 solid	Oil and gas extraction	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 2 solid	Oil and gas extraction	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 3 gaseous	Other energy industries	CO_2	Gg	9827	739
1 A 1 c 3 gaseous	Other energy industries	CH_4	Gg CO_2 eq	4	0
1 A 1 c 3 gaseous	Other energy industries	N_2O	Gg CO_2 eq	51	4
1 A 1 c 3 liquid	Other energy industries	CO_2	Gg	NE	5307
1 A 1 c 3 liquid	Other energy industries	CH_4	Gg CO_2 eq	NE	2
1 A 1 c 3 liquid	Other energy industries	N_2O	Gg CO_2 eq	NE	27
1 A 1 c 3 other	Other energy industries	CO_2	Gg	NO	NO
1 A 1 c 3 other	Other energy industries	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 3 other	Other energy industries	N_2O	Gg CO_2 eq	NO	NO
1 A 1 c 3 solid	Other energy industries	CO_2	Gg	NO	NO
1 A 1 c 3 solid	Other energy industries	CH_4	Gg CO_2 eq	NO	NO
1 A 1 c 3 solid	Other energy industries	N_2O	Gg CO_2 eq	NO	NO
1 A 2 a gaseous	Iron and Steel	CO_2	Gg	IE	2048
1 A 2 a gaseous	Iron and Steel	CH_4	Gg CO_2 eq	IE	1
1 A 2 a gaseous	Iron and Steel	N_2O	Gg CO_2 eq	IE	11
1 A 2 a liquid	Iron and Steel	CO_2	Gg	IE	157
1 A 2 a liquid	Iron and Steel	CH_4	Gg CO_2 eq	IE	0
1 A 2 a liquid	Iron and Steel	N_2O	Gg CO_2 eq	IE	2
1 A 2 a other	Iron and Steel	CO_2	Gg	NO	NO
1 A 2 a other	Iron and Steel	CH_4	Gg CO_2 eq	NO	NO
1 A 2 a other	Iron and Steel	N_2O	Gg CO_2 eq	NO	NO
1 A 2 a solid	Iron and Steel	CO_2	Gg	NO	NO
1 A 2 a solid	Iron and Steel	CH_4	Gg CO_2 eq	NO	NO
1 A 2 a solid	Iron and Steel	N_2O	Gg CO_2 eq	NO	NO
1 A 2 b gaseous	Non-ferrous metals	CO_2	Gg	IE	IE
1 A 2 b gaseous	Non-ferrous metals	CH_4	Gg CO_2 eq	IE	IE
1 A 2 b gaseous	Non-ferrous metals	N_2O	Gg CO_2 eq	IE	IE
1 A 2 b liquid	Non-ferrous metals	CO_2	Gg	IE	IE
1 A 2 b liquid	Non-ferrous metals	CH_4	Gg CO_2 eq	IE	IE

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 2 b liquid	Non-ferrous metals	N_2O	Gg CO_2 eq	IE	IE
1 A 2 b other	Non-ferrous metals	CO_2	Gg	IE	IE
1 A 2 b other	Non-ferrous metals	CH_4	Gg CO_2 eq	IE	IE
1 A 2 b other	Non-ferrous metals	N_2O	Gg CO_2 eq	IE	IE
1 A 2 b solid	Non-ferrous metals	CO_2	Gg	IE	IE
1 A 2 b solid	Non-ferrous metals	CH_4	Gg CO_2 eq	IE	IE
1 A 2 b solid	Non-ferrous metals	N_2O	Gg CO_2 eq	IE	IE
1 A 2 c gaseous	Chemicals	CO_2	Gg	IE	101
1 A 2 c gaseous	Chemicals	CH_4	Gg CO_2 eq	IE	0
1 A 2 c gaseous	Chemicals	N_2O	Gg CO_2 eq	IE	1
1 A 2 c liquid	Chemicals	CO_2	Gg	IE	58
1 A 2 c liquid	Chemicals	CH_4	Gg CO_2 eq	IE	0
1 A 2 c liquid	Chemicals	N_2O	Gg CO_2 eq	IE	1
1 A 2 c other	Chemicals	CO_2	Gg	NO	NO
1 A 2 c other	Chemicals	CH_4	Gg CO_2 eq	NO	NO
1 A 2 c other	Chemicals	N_2O	Gg CO_2 eq	NO	NO
1 A 2 c solid	Chemicals	CO_2	Gg	NO	NO
1 A 2 c solid	Chemicals	CH_4	Gg CO_2 eq	NO	NO
1 A 2 c solid	Chemicals	N_2O	Gg CO_2 eq	NO	NO
1 A 2 d gaseous	Pulp, paper and print	CO_2	Gg	IE	IE
1 A 2 d gaseous	Pulp, paper and print	CH_4	Gg CO_2 eq	IE	IE
1 A 2 d gaseous	Pulp, paper and print	N_2O	Gg CO_2 eq	IE	IE
1 A 2 d liquid	Pulp, paper and print	CO_2	Gg	IE	IE
1 A 2 d liquid	Pulp, paper and print	CH_4	Gg CO_2 eq	IE	IE
1 A 2 d liquid	Pulp, paper and print	N_2O	Gg CO_2 eq	IE	IE
1 A 2 d other	Pulp, paper and print	CO_2	Gg	IE	IE
1 A 2 d other	Pulp, paper and print	CH_4	Gg CO_2 eq	IE	IE
1 A 2 d other	Pulp, paper and print	N_2O	Gg CO_2 eq	IE	IE
1 A 2 d solid	Pulp, paper and print	CO_2	Gg	IE	IE
1 A 2 d solid	Pulp, paper and print	CH_4	Gg CO_2 eq	IE	IE
1 A 2 d solid	Pulp, paper and print	N_2O	Gg CO_2 eq	IE	IE
1 A 2 e gaseous	Food processing, beverages and tobacco	CO_2	Gg	IE	1330
1 A 2 e gaseous	Food processing, beverages and tobacco	CH_4	Gg CO_2 eq	IE	1
1 A 2 e gaseous	Food processing, beverages and tobacco	N_2O	Gg CO_2 eq	IE	7
1 A 2 e liquid	Food processing, beverages and tobacco	CO_2	Gg	IE	4
1 A 2 e liquid	Food processing, beverages and tobacco	CH_4	Gg CO_2 eq	IE	0
1 A 2 e liquid	Food processing, beverages and tobacco	N_2O	Gg CO_2 eq	IE	0
1 A 2 e other	Food processing, beverages and tobacco	CO_2	Gg	NO	NO
1 A 2 e other	Food processing, beverages and tobacco	CH_4	Gg CO_2 eq	NO	NO
1 A 2 e other	Food processing, beverages and tobacco	N_2O	Gg CO_2 eq	NO	NO
1 A 2 e solid	Food processing, beverages and tobacco	CO_2	Gg	NO	NO
1 A 2 e solid	Food processing, beverages and tobacco	CH_4	Gg CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 2 e solid	Food processing, beverages and tobacco	N_2O	Gg CO_2 eq	NO	NO
1 A 2 f gaseous	Non-metallic minerals	CO_2	Gg	IE	7882
1 A 2 f gaseous	Non-metallic minerals	CH_4	Gg CO_2 eq	IE	4
1 A 2 f gaseous	Non-metallic minerals	N_2O	Gg CO_2 eq	IE	42
1 A 2 f liquid	Non-metallic minerals	CO_2	Gg	IE	48
1 A 2 f liquid	Non-metallic minerals	CH_4	Gg CO_2 eq	IE	0
1 A 2 f liquid	Non-metallic minerals	N_2O	Gg CO_2 eq	IE	0
1 A 2 f other	Non-metallic minerals	CO_2	Gg	NO	NO
1 A 2 f other	Non-metallic minerals	CH_4	Gg CO_2 eq	NO	NO
1 A 2 f other	Non-metallic minerals	N_2O	Gg CO_2 eq	NO	NO
1 A 2 f solid	Non-metallic minerals	CO_2	Gg	NO	NO
1 A 2 f solid	Non-metallic minerals	CH_4	Gg CO_2 eq	NO	NO
1 A 2 f solid	Non-metallic minerals	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 1 gaseous	Manufacturing of machinery	CO_2	Gg	NO	NO
1 A 2 g 1 gaseous	Manufacturing of machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 1 gaseous	Manufacturing of machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 1 liquid	Manufacturing of machinery	CO_2	Gg	NO	NO
1 A 2 g 1 liquid	Manufacturing of machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 1 liquid	Manufacturing of machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 1 other	Manufacturing of machinery	CO_2	Gg	NO	NO
1 A 2 g 1 other	Manufacturing of machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 1 other	Manufacturing of machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 1 solid	Manufacturing of machinery	CO_2	Gg	NO	NO
1 A 2 g 1 solid	Manufacturing of machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 1 solid	Manufacturing of machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 2 gaseous	Manufacturing of transport equipment	CO_2	Gg	IE	IE
1 A 2 g 2 gaseous	Manufacturing of transport equipment	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 2 gaseous	Manufacturing of transport equipment	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 2 liquid	Manufacturing of transport equipment	CO_2	Gg	IE	IE
1 A 2 g 2 liquid	Manufacturing of transport equipment	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 2 liquid	Manufacturing of transport equipment	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 2 other	Manufacturing of transport equipment	CO_2	Gg	IE	IE
1 A 2 g 2 other	Manufacturing of transport equipment	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 2 other	Manufacturing of transport equipment	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 2 solid	Manufacturing of transport equipment	CO_2	Gg	IE	IE
1 A 2 g 2 solid	Manufacturing of transport equipment	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 2 solid	Manufacturing of transport equipment	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 3 gaseous	Mining (excluding fuels) and quarrying	CO_2	Gg	NO	NO
1 A 2 g 3 gaseous	Mining (excluding fuels) and quarrying	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 3 gaseous	Mining (excluding fuels) and quarrying	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 3 liquid	Mining (excluding fuels) and quarrying	CO_2	Gg	NO	NO
1 A 2 g 3 liquid	Mining (excluding fuels) and quarrying	CH_4	Gg CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 2 g 3 liquid	Mining (excluding fuels) and quarrying	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 3 other	Mining (excluding fuels) and quarrying	CO_2	Gg	NO	NO
1 A 2 g 3 other	Mining (excluding fuels) and quarrying	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 3 other	Mining (excluding fuels) and quarrying	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 3 solid	Mining (excluding fuels) and quarrying	CO_2	Gg	NO	NO
1 A 2 g 3 solid	Mining (excluding fuels) and quarrying	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 3 solid	Mining (excluding fuels) and quarrying	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 4 gaseous	Wood and wood products	CO_2	Gg	NO	NO
1 A 2 g 4 gaseous	Wood and wood products	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 4 gaseous	Wood and wood products	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 4 liquid	Wood and wood products	CO_2	Gg	NO	NO
1 A 2 g 4 liquid	Wood and wood products	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 4 liquid	Wood and wood products	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 4 other	Wood and wood products	CO_2	Gg	NO	NO
1 A 2 g 4 other	Wood and wood products	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 4 other	Wood and wood products	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 4 solid	Wood and wood products	CO_2	Gg	NO	NO
1 A 2 g 4 solid	Wood and wood products	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 4 solid	Wood and wood products	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 5 gaseous	Construction	CO_2	Gg	IE	11
1 A 2 g 5 gaseous	Construction	CH_4	Gg CO_2 eq	IE	0
1 A 2 g 5 gaseous	Construction	N_2O	Gg CO_2 eq	IE	0
1 A 2 g 5 liquid	Construction	CO_2	Gg	IE	2254
1 A 2 g 5 liquid	Construction	CH_4	Gg CO_2 eq	IE	2
1 A 2 g 5 liquid	Construction	N_2O	Gg CO_2 eq	IE	27
1 A 2 g 5 other	Construction	CO_2	Gg	NO	NO
1 A 2 g 5 other	Construction	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 5 other	Construction	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 5 solid	Construction	CO_2	Gg	NO	NO
1 A 2 g 5 solid	Construction	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 5 solid	Construction	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 6 gaseous	Textile and leather	CO_2	Gg	IE	95
1 A 2 g 6 gaseous	Textile and leather	CH_4	Gg CO_2 eq	IE	0
1 A 2 g 6 gaseous	Textile and leather	N_2O	Gg CO_2 eq	IE	1
1 A 2 g 6 liquid	Textile and leather	CO_2	Gg	IE	IE
1 A 2 g 6 liquid	Textile and leather	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 6 liquid	Textile and leather	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 6 other	Textile and leather	CO_2	Gg	NO	NO
1 A 2 g 6 other	Textile and leather	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 6 other	Textile and leather	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 6 solid	Textile and leather	CO_2	Gg	NO	NO
1 A 2 g 6 solid	Textile and leather	CH_4	Gg CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 2 g 6 solid	Textile and leather	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 7 diesel oil	Off-road vehicles and other machinery	CO_2	Gg	IE	IE
1 A 2 g 7 diesel oil	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 7 diesel oil	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 7 gaseous	Off-road vehicles and other machinery	CO_2	Gg	NO	NO
1 A 2 g 7 gaseous	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 7 gaseous	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 7 gasoline	Off-road vehicles and other machinery	CO_2	Gg	IE	IE
1 A 2 g 7 gasoline	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 7 gasoline	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 7 LPG	Off-road vehicles and other machinery	CO_2	Gg	IE	IE
1 A 2 g 7 LPG	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	IE	IE
1 A 2 g 7 LPG	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	IE	IE
1 A 2 g 7 other fossil	Off-road vehicles and other machinery	CO_2	Gg	NO	NO
1 A 2 g 7 other fossil	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 7 other fossil	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 7 other liquid	Off-road vehicles and other machinery	CO_2	Gg	NO	NO
1 A 2 g 7 other liquid	Off-road vehicles and other machinery	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 7 other liquid	Off-road vehicles and other machinery	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 8 gaseous	Other	CO_2	Gg	2748	3488
1 A 2 g 8 gaseous	Other	CH_4	Gg CO_2 eq	1	2
1 A 2 g 8 gaseous	Other	N_2O	Gg CO_2 eq	14	18
1 A 2 g 8 liquid	Other	CO_2	Gg	1588	536
1 A 2 g 8 liquid	Other	CH_4	Gg CO_2 eq	2	0
1 A 2 g 8 liquid	Other	N_2O	Gg CO_2 eq	19	5
1 A 2 g 8 other	Other	CO_2	Gg	NO	NO
1 A 2 g 8 other	Other	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 8 other	Other	N_2O	Gg CO_2 eq	NO	NO
1 A 2 g 8 solid	Other	CO_2	Gg	NO	NO
1 A 2 g 8 solid	Other	CH_4	Gg CO_2 eq	NO	NO
1 A 2 g 8 solid	Other	N_2O	Gg CO_2 eq	NO	NO
1 A 3 a aviation gasoline	Domestic aviation	CO_2	Gg	NO	NO
1 A 3 a aviation gasoline	Domestic aviation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 a aviation gasoline	Domestic aviation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 a jet kerosene	Domestic aviation	CO_2	Gg	477	761
1 A 3 a jet kerosene	Domestic aviation	CH_4	Gg CO_2 eq	0	0
1 A 3 a jet kerosene	Domestic aviation	N_2O	Gg CO_2 eq	1	2
1 A 3 b diesel oil	Road transportation	CO_2	Gg	6956	23750

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 3 b diesel oil	Road transportation	CH_4	Gg CO_2 eq	9	31
1 A 3 b diesel oil	Road transportation	N_2O	Gg CO_2 eq	109	372
1 A 3 b gaseous	Road transportation	CO_2	Gg	NO	NO
1 A 3 b gaseous	Road transportation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 b gaseous	Road transportation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 b gasoline	Road transportation	CO_2	Gg	6414	9796
1 A 3 b gasoline	Road transportation	CH_4	Gg CO_2 eq	50	76
1 A 3 b gasoline	Road transportation	N_2O	Gg CO_2 eq	195	297
1 A 3 b LPG	Road transportation	CO_2	Gg	NO	2349
1 A 3 b LPG	Road transportation	CH_4	Gg CO_2 eq	NO	65
1 A 3 b LPG	Road transportation	N_2O	Gg CO_2 eq	NO	2
1 A 3 b other fossil	Road transportation	CO_2	Gg	NO	NO
1 A 3 b other fossil	Road transportation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 b other fossil	Road transportation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 b other liquid	Road transportation	CO_2	Gg	NO	NO
1 A 3 b other liquid	Road transportation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 b other liquid	Road transportation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 c gaseous	Railways	CO_2	Gg	NO	NE
1 A 3 c gaseous	Railways	CH_4	Gg CO_2 eq	NO	NE
1 A 3 c gaseous	Railways	N_2O	Gg CO_2 eq	NO	NE
1 A 3 c liquid	Railways	CO_2	Gg	IE	56
1 A 3 c liquid	Railways	CH_4	Gg CO_2 eq	IE	0
1 A 3 c liquid	Railways	N_2O	Gg CO_2 eq	IE	1
1 A 3 c other fossil	Railways	CO_2	Gg	NO	NO
1 A 3 c other fossil	Railways	CH_4	Gg CO_2 eq	NO	NO
1 A 3 c other fossil	Railways	N_2O	Gg CO_2 eq	NO	NO
1 A 3 c solid	Railways	CO_2	Gg	NO	NE
1 A 3 c solid	Railways	CH_4	Gg CO_2 eq	NO	NE
1 A 3 c solid	Railways	N_2O	Gg CO_2 eq	NO	NE
1 A 3 d diesel oil	Domestic Navigation	CO_2	Gg	NO	377
1 A 3 d diesel oil	Domestic Navigation	CH_4	Gg CO_2 eq	NO	1
1 A 3 d diesel oil	Domestic Navigation	N_2O	Gg CO_2 eq	NO	14
1 A 3 d gaseous	Domestic Navigation	CO_2	Gg	NO	NO
1 A 3 d gaseous	Domestic Navigation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 d gaseous	Domestic Navigation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 d gasoline	Domestic Navigation	CO_2	Gg	NO	NO
1 A 3 d gasoline	Domestic Navigation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 d gasoline	Domestic Navigation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 d other fossil	Domestic Navigation	CO_2	Gg	NO	NO
1 A 3 d other fossil	Domestic Navigation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 d other fossil	Domestic Navigation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 d other liquid	Domestic Navigation	CO_2	Gg	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 3 d other liquid	Domestic Navigation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 d other liquid	Domestic Navigation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 d Residual fuel oil	Domestic Navigation	CO_2	Gg	NO	157
1 A 3 d Residual fuel oil	Domestic Navigation	CH_4	Gg CO_2 eq	NO	0
1 A 3 d Residual fuel oil	Domestic Navigation	N_2O	Gg CO_2 eq	NO	3
1 A 3 e gaseous	Other transportation	CO_2	Gg	IE	1229
1 A 3 e gaseous	Other transportation	CH_4	Gg CO_2 eq	IE	1
1 A 3 e gaseous	Other transportation	N_2O	Gg CO_2 eq	IE	6
1 A 3 e liquid	Other transportation	CO_2	Gg	IE	IE
1 A 3 e liquid	Other transportation	CH_4	Gg CO_2 eq	IE	IE
1 A 3 e liquid	Other transportation	N_2O	Gg CO_2 eq	IE	IE
1 A 3 e other fossil	Other transportation	CO_2	Gg	NO	NO
1 A 3 e other fossil	Other transportation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 e other fossil	Other transportation	N_2O	Gg CO_2 eq	NO	NO
1 A 3 e solid	Other transportation	CO_2	Gg	NO	NO
1 A 3 e solid	Other transportation	CH_4	Gg CO_2 eq	NO	NO
1 A 3 e solid	Other transportation	N_2O	Gg CO_2 eq	NO	NO
1 A 4 a gaseous	Commercial/institutional	CO_2	Gg	IE	2202
1 A 4 a gaseous	Commercial/institutional	CH_4	Gg CO_2 eq	IE	5
1 A 4 a gaseous	Commercial/institutional	N_2O	Gg CO_2 eq	IE	58
1 A 4 a liquid	Commercial/institutional	CO_2	Gg	IE	3335
1 A 4 a liquid	Commercial/institutional	CH_4	Gg CO_2 eq	IE	11
1 A 4 a liquid	Commercial/institutional	N_2O	Gg CO_2 eq	IE	132
1 A 4 a other	Commercial/institutional	CO_2	Gg	NO	NO
1 A 4 a other	Commercial/institutional	CH_4	Gg CO_2 eq	NO	NO
1 A 4 a other	Commercial/institutional	N_2O	Gg CO_2 eq	NO	NO
1 A 4 a solid	Commercial/institutional	CO_2	Gg	NO	NO
1 A 4 a solid	Commercial/institutional	CH_4	Gg CO_2 eq	NO	NO
1 A 4 a solid	Commercial/institutional	N_2O	Gg CO_2 eq	NO	NO
1 A 4 b gaseous	Residential	CO_2	Gg	2455	22061
1 A 4 b gaseous	Residential	CH_4	Gg CO_2 eq	5	49
1 A 4 b gaseous	Residential	N_2O	Gg CO_2 eq	65	586
1 A 4 b liquid	Residential	CO_2	Gg	4993	3674
1 A 4 b liquid	Residential	CH_4	Gg CO_2 eq	14	7
1 A 4 b liquid	Residential	N_2O	Gg CO_2 eq	169	87
1 A 4 b other	Residential	CO_2	Gg	NO	NO
1 A 4 b other	Residential	CH_4	Gg CO_2 eq	NO	NO
1 A 4 b other	Residential	N_2O	Gg CO_2 eq	NO	NO
1 A 4 b solid	Residential	CO_2	Gg	NO	NO
1 A 4 b solid	Residential	CH_4	Gg CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 A 4 b solid	Residential	N_2O	Gg CO_2 eq	NO	NO
1 A 4 c gaseous	Agriculture/forestry/fishing	CO_2	Gg	IE	47
1 A 4 c gaseous	Agriculture/forestry/fishing	CH_4	Gg CO_2 eq	IE	0
1 A 4 c gaseous	Agriculture/forestry/fishing	N_2O	Gg CO_2 eq	IE	1
1 A 4 c liquid	Agriculture/forestry/fishing	CO_2	Gg	IE	102
1 A 4 c liquid	Agriculture/forestry/fishing	CH_4	Gg CO_2 eq	IE	0
1 A 4 c liquid	Agriculture/forestry/fishing	N_2O	Gg CO_2 eq	IE	3
1 A 4 c other	Agriculture/forestry/fishing	CO_2	Gg	NO	NO
1 A 4 c other	Agriculture/forestry/fishing	CH_4	Gg CO_2 eq	NO	NO
1 A 4 c other	Agriculture/forestry/fishing	N_2O	Gg CO_2 eq	NO	NO
1 A 4 c solid	Agriculture/forestry/fishing	CO_2	Gg	NO	NO
1 A 4 c solid	Agriculture/forestry/fishing	CH_4	Gg CO_2 eq	NO	NO
1 A 4 c solid	Agriculture/forestry/fishing	N_2O	Gg CO_2 eq	NO	NO
1 A 5 gaseous	Other	CO_2	Gg	NE	NE
1 A 5 gaseous	Other	CH_4	Gg CO_2 eq	NE	NE
1 A 5 gaseous	Other	N_2O	Gg CO_2 eq	NE	NE
1 A 5 liquid	Other	CO_2	Gg	NE	NE
1 A 5 liquid	Other	CH_4	Gg CO_2 eq	NE	NE
1 A 5 liquid	Other	N_2O	Gg CO_2 eq	NE	NE
1 A 5 other	Other	CO_2	Gg	NO	NO
1 A 5 other	Other	CH_4	Gg CO_2 eq	NO	NO
1 A 5 other	Other	N_2O	Gg CO_2 eq	NO	NO
1 A 5 solid	Other	CO_2	Gg	NO	NO
1 A 5 solid	Other	CH_4	Gg CO_2 eq	NO	NO
1 A 5 solid	Other	N_2O	Gg CO_2 eq	NO	NO
1 B 1	Coal mining and handling	CO_2	Gg	NO	NO
1 B 1	Coal mining and handling	CH_4	Gg CO_2 eq	NO	NO
1 B 1	Coal mining and handling	N_2O	Gg CO_2 eq	NA	NA
1 B 1 b	Fuel transformation	CO_2	Gg	NE	NE
1 B 1 b	Fuel transformation	CH_4	Gg CO_2 eq	1	NE
1 B 1 b	Fuel transformation	N_2O	Gg CO_2 eq	NA	NA
1 B 2 a	Oil	CO_2	Gg	96	102
1 B 2 a	Oil	CH_4	Gg CO_2 eq	600	553
1 B 2 a	Oil	N_2O	Gg CO_2 eq	0	0
1 B 2 b	Natural gas	CO_2	Gg	223	374
1 B 2 b	Natural gas	CH_4	Gg CO_2 eq	11106	20299
1 B 2 b	Natural gas	N_2O	Gg CO_2 eq	NA	NA
1 B 2 c	Venting and flaring	CO_2	Gg	6594	7887
1 B 2 c	Venting and flaring	CH_4	Gg CO_2 eq	989	1183
1 B 2 c	Venting and flaring	N_2O	Gg CO_2 eq	23	27
1 C	CO_2 Transport and storage	CO_2	Gg	NO	NO
1 C	CO_2 Transport and storage	CH_4	Gg CO_2 eq	NA	NA

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
1 C	CO_2 Transport and storage	N_2O	Gg CO_2 eq	NA	NA
2 A 1	Cement production	CO_2	Gg	2636	8725
2 A 2	Lime production	CO_2	Gg	19	29
2 A 3	Glass Production	CO_2	Gg	6	1
2 A 4	Other Process Uses of Carbonates	CO_2	Gg	NE	NE
2 B 1	Ammonia Production	CO_2	Gg	622	0
2 B 1	Ammonia Production	CH_4	Gg CO_2 eq	NA	NA
2 B 1	Ammonia Production	N_2O	Gg CO_2 eq	NA	NA
2 B 10	Other	CO_2	Gg	NO	NO
2 B 10	Other	CH_4	Gg CO_2 eq	NO	NO
2 B 10	Other	N_2O	Gg CO_2 eq	NO	NO
2 B 2	Nitric Acid Production	CO_2	Gg	NA	NA
2 B 2	Nitric Acid Production	CH_4	Gg CO_2 eq	NA	NA
2 B 2	Nitric Acid Production	N_2O	Gg CO_2 eq	428	39
2 B 3	Adipic Acid Production	CO_2	Gg	NO	NO
2 B 3	Adipic Acid Production	CH_4	Gg CO_2 eq	NA	NA
2 B 3	Adipic Acid Production	N_2O	Gg CO_2 eq	NO	NO
2 B 4	Caprolactam, Glyoxal and Glyoxylic Acid Production	CO_2	Gg	NE	NE
2 B 4	Caprolactam, Glyoxal and Glyoxylic Acid Production	CH_4	Gg CO_2 eq	NA	NA
2 B 4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	Gg CO_2 eq	NO	NO
2 B 5	Carbide Production	CO_2	Gg	NE	NE
2 B 5	Carbide Production	CH_4	Gg CO_2 eq	NO	NO
2 B 5	Carbide Production	N_2O	Gg CO_2 eq	NA	NA
2 B 6	Titanium Dioxide Production	CO_2	Gg	NO	NO
2 B 6	Titanium Dioxide Production	CH_4	Gg CO_2 eq	NA	NA
2 B 6	Titanium Dioxide Production	N_2O	Gg CO_2 eq	NA	NA
2 B 7	Soda Ash Production	CO_2	Gg	NO	NO
2 B 7	Soda Ash Production	CH_4	Gg CO_2 eq	NA	NA
2 B 7	Soda Ash Production	N_2O	Gg CO_2 eq	NA	NA
2 B 8	Petrochemical and Carbon Black Production	CO_2	Gg	160	69
2 B 8	Petrochemical and Carbon Black Production	CH_4	Gg CO_2 eq	17	6
2 B 8	Petrochemical and Carbon Black Production	N_2O	Gg CO_2 eq	NA	NA
2 C 1	Iron and Steel Production	CO_2	Gg	2965	1627
2 C 1	Iron and Steel Production	CH_4	Gg CO_2 eq	1	0
2 C 1	Iron and Steel Production	N_2O	Gg CO_2 eq	NA	NA
2 C 2	Ferroalloys Production	CO_2	Gg	NO	NO
2 C 2	Ferroalloys Production	CH_4	Gg CO_2 eq	NO	NO
2 C 2	Ferroalloys Production	N_2O	Gg CO_2 eq	NA	NA
2 C 3	Aluminium production	CO_2	Gg	NO	NO
2 C 3	Aluminium production	CH_4	Gg CO_2 eq	NA	NA
2 C 3	Aluminium production	N_2O	Gg CO_2 eq	NA	NA
2 C 4	Magnesium production	CO_2	Gg	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
2 C 4	Magnesium production	CH_4	Gg CO_2 eq	NA	NA
2 C 4	Magnesium production	N_2O	Gg CO_2 eq	NA	NA
2 C 5	Lead Production	CO_2	Gg	3540	NO
2 C 5	Lead Production	CH_4	Gg CO_2 eq	NA	NA
2 C 5	Lead Production	N_2O	Gg CO_2 eq	NA	NA
2 C 6	Zinc Production	CO_2	Gg	3397	365
2 C 6	Zinc Production	CH_4	Gg CO_2 eq	NA	NA
2 C 6	Zinc Production	N_2O	Gg CO_2 eq	NA	NA
2 C 7	Other	CO_2	Gg	NO	NO
2 C 7	Other	CH_4	Gg CO_2 eq	NO	NO
2 C 7	Other	N_2O	Gg CO_2 eq	NO	NO
2 D 1	Lubricant Use	CO_2	Gg	NE	NE
2 D 1	Lubricant Use	CH_4	Gg CO_2 eq	0	0
2 D 1	Lubricant Use	N_2O	Gg CO_2 eq	0	0
2 D 2	Paraffin Wax Use	CO_2	Gg	NE	NE
2 D 2	Paraffin Wax Use	CH_4	Gg CO_2 eq	0	0
2 D 2	Paraffin Wax Use	N_2O	Gg CO_2 eq	0	0
2 D 3	Other	CO_2	Gg	NE	NE
2 D 3	Other	CH_4	Gg CO_2 eq	0	0
2 D 3	Other	N_2O	Gg CO_2 eq	0	0
2 E 1	Integrated Circuit or Semiconductor	CO_2	Gg	NA	NA
2 E 1	Integrated Circuit or Semiconductor	CH_4	Gg CO_2 eq	NA	NA
2 E 1	Integrated Circuit or Semiconductor	N_2O	Gg CO_2 eq	0	0
2 E 2	TFT Flat Panel Display	CO_2	Gg	NA	NA
2 E 2	TFT Flat Panel Display	CH_4	Gg CO_2 eq	NA	NA
2 E 2	TFT Flat Panel Display	N_2O	Gg CO_2 eq	0	0
2 E 5	Other	CO_2	Gg	NA	NA
2 E 5	Other	CH_4	Gg CO_2 eq	NA	NA
2 E 5	Other	N_2O	Gg CO_2 eq	0	0
2 F 1	Refrigeration and air conditioning	HFC	kt CO_2 eq	NA	1206
2 G 1	Electrical equipment	SF_6	kt CO_2 eq	0	36
2 G 3	N_2O from Product Uses	CO_2	Gg	NA	NA
2 G 3	N_2O from Product Uses	CH_4	Gg CO_2 eq	NA	NA
2 G 3	N_2O from Product Uses	N_2O	Gg CO_2 eq	0	0
2 G 4	Other	CO_2	Gg	NE	NE
2 G 4	Other	CH_4	Gg CO_2 eq	0	0
2 G 4	Other	N_2O	Gg CO_2 eq	0	0
2 H 1	Pulp and Paper Industry	CO_2	Gg	NO	NO
2 H 1	Pulp and Paper Industry	CH_4	Gg CO_2 eq	NO	NO
2 H 1	Pulp and Paper Industry	N_2O	Gg CO_2 eq	0	0
2 H 2	Food and Beverages Industry	CO_2	Gg	NO	NO
2 H 2	Food and Beverages Industry	CH_4	Gg CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
2 H 2	Food and Beverages Industry	N_2O	Gg CO_2 eq	0	0
2 H 3	Other	CO_2	Gg	NO	NO
2 H 3	Other	CH_4	Gg CO_2 eq	NO	NO
2 H 3	Other	N_2O	Gg CO_2 eq	0	0
3 A 1	Dairy cattle	CH_4	kt CO_2 eq	1742	2366
3 A 2	Sheep	CH_4	kt CO_2 eq	3392	5924
3 A 3	Swine	CH_4	kt CO_2 eq	NO	NO
3 A 4 a	Buffalo	CH_4	kt CO_2 eq	NO	NO
3 A 4 b	Camels	CH_4	kt CO_2 eq	141	500
3 A 4 c	Deer	CH_4	kt CO_2 eq	NO	NO
3 A 4 d	Goats	CH_4	kt CO_2 eq	1112	2209
3 A 4 e	Horses	CH_4	kt CO_2 eq	37	NO
3 A 4 f	Mules and asses	CH_4	kt CO_2 eq	100	NO
3 A 4 g	Poultry	CH_4	kt CO_2 eq	NA	NA
3 A 4 h	Other	CH_4	kt CO_2 eq	NO	NO
3 B 1	Cattle	CH_4	kt CO_2 eq	51	66
3 B 1	Cattle	N_2O	kt CO_2 eq	787	984
3 B 2	Sheep	CH_4	kt CO_2 eq	664	1159
3 B 2	Sheep	N_2O	kt CO_2 eq	1633	2828
3 B 3	Swine	CH_4	kt CO_2 eq	NO	NO
3 B 3	Swine	N_2O	kt CO_2 eq	NO	NO
3 B 4 a	Buffalo	CH_4	kt CO_2 eq	NO	NO
3 B 4 a	Buffalo	N_2O	kt CO_2 eq	NO	NO
3 B 4 b	Camels	CH_4	kt CO_2 eq	6	21
3 B 4 b	Camels	N_2O	kt CO_2 eq	13	47
3 B 4 c	Deer	CH_4	kt CO_2 eq	NO	NO
3 B 4 c	Deer	N_2O	kt CO_2 eq	NO	NO
3 B 4 d	Goats	CH_4	kt CO_2 eq	21	42
3 B 4 d	Goats	N_2O	kt CO_2 eq	437	867
3 B 4 e	Horses	CH_4	kt CO_2 eq	3	NE
3 B 4 e	Horses	N_2O	kt CO_2 eq	0	0
3 B 4 f	Mules and Asses	CH_4	kt CO_2 eq	9	NE
3 B 4 f	Mules and Asses	N_2O	kt CO_2 eq	64	0
3 B 4 g	Poultry	CH_4	kt CO_2 eq	37	69
3 B 4 g	Poultry	N_2O	kt CO_2 eq	22	42
3 B 4 h	Other	CH_4	kt CO_2 eq	NO	NO
3 B 4 h	Other	N_2O	kt CO_2 eq	NE	NE
3 C 1	Irrigated	CH_4	kt CO_2 eq	NO	NO
3 C 1	Irrigated	N_2O	kt CO_2 eq	NA	NA
3 C 2	Rain-fed	CH_4	kt CO_2 eq	NO	NO
3 C 2	Rain-fed	N_2O	kt CO_2 eq	NA	NA
3 C 3	Deep water	CH_4	kt CO_2 eq	NO	NO

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
3 C 3	Deep water	N_2O	kt CO_2 eq	NA	NA
3 C 4	Other	CH_4	kt CO_2 eq	NO	NO
3 C 4	Other	N_2O	kt CO_2 eq	NA	NA
3 D 1 a	Inorganic N fertilizers	CH_4	kt CO_2 eq	NA	NA
3 D 1 a	Inorganic N fertilizers	N_2O	kt CO_2 eq	295	329
3 D 1 b	Organic N fertilizers	CH_4	kt CO_2 eq	NA	NA
3 D 1 b	Organic N fertilizers	N_2O	kt CO_2 eq	495	1821
3 D 1 c	Urine and dung deposited by grazing animals	CH_4	kt CO_2 eq	NA	NA
3 D 1 c	Urine and dung deposited by grazing animals	N_2O	kt CO_2 eq	37	61
3 D 1 d	Crop residues	CH_4	kt CO_2 eq	NA	NA
3 D 1 d	Crop residues	N_2O	kt CO_2 eq	46	139
3 D 1 e	Mineralization/immobilization	CH_4	kt CO_2 eq	NA	NA
3 D 1 e	Mineralization/immobilization	N_2O	kt CO_2 eq	NE	NE
3 D 1 f	Cultivation of organic soils	CH_4	kt CO_2 eq	NA	NA
3 D 1 f	Cultivation of organic soils	N_2O	kt CO_2 eq	NE	NE
3 D 1 g	Other	CH_4	kt CO_2 eq	NA	NA
3 D 1 g	Other	N_2O	kt CO_2 eq	NO	NO
3 D 2	Indirect N_2O Emissions from managed soils	CH_4	kt CO_2 eq	NA	NA
3 D 2	Indirect N_2O Emissions from managed soils	N_2O	kt CO_2 eq	NA	NA
3 E 1	Forest land	CH_4	kt CO_2 eq	NO	NO
3 E 1	Forest land	N_2O	kt CO_2 eq	NO	NO
3 E 2	Grassland	CH_4	kt CO_2 eq	NO	NO
3 E 2	Grassland	N_2O	kt CO_2 eq	NO	NO
3 F	Field burning of agricultural residues	CH_4	kt CO_2 eq	66	78
3 F	Field burning of agricultural residues	N_2O	kt CO_2 eq	20	24
3 G	Liming	CO_2	Gg	NO	NO
3 G	Liming	CH_4	kt CO_2 eq	NA	NA
3 G	Liming	N_2O	kt CO_2 eq	NA	NA
3 H	Urea application	CO_2	Gg	NE	NE
3 H	Urea application	CH_4	kt CO_2 eq	NA	NA
3 H	Urea application	N_2O	kt CO_2 eq	NA	NA
3 I	Other carbon-containing fertilizers	CO_2	Gg	NO	NO
3 I	Other carbon-containing fertilizers	CH_4	kt CO_2 eq	NA	NA
3 I	Other carbon-containing fertilizers	N_2O	kt CO_2 eq	NA	NA
3 J	Other	CO_2	Gg	NO	NO
3 J	Other	CH_4	kt CO_2 eq	NA	NA
3 J	Other	N_2O	kt CO_2 eq	NA	NA
5 A	Solid waste disposal	CH_4	kt CO_2 eq	1278	6476
5 B	Biological treatment of solid waste	CH_4	kt CO_2 eq	23	18
5 B	Biological treatment of solid waste	N_2O	kt CO_2 eq	16	13
5 C	Incineration and open burning of waste	CO_2	Gg	400	409
5 C	Incineration and open burning of waste	CH_4	kt CO_2 eq	0	0

IPCC Category Code	IPCC Category	Gas	Unit	1990	2020
5 C	Incineration and open burning of waste	N_2O	kt CO_2 eq	20	27
5 D	Wastewater treatment and discharge	CH_4	kt CO_2 eq	1459	1429
5 D	Wastewater treatment and discharge	N_2O	kt CO_2 eq	258	761
5 E	Other	CH_4	kt CO_2 eq	0	0
5 E	Other	N_2O	kt CO_2 eq	NO	NO
4A_CO2	4A	CO2	kt CO_2 eq	5,632	9,046
4A_CH4	4A	CH_4	kt CO_2 eq	47	68
4A_N2O	4A	N_2O	kt CO_2 eq	31	45

11.2 Annex II: Uncertainty assessment

In the following tables, format and outline of the Table 3.3 of volume 1 of the 2006 IPCC Guidelines, is provided the Uncertainty assessment for the GHG inventory 1990 – 2020.

Table 655 Uncertainty assessment for the GHG inventory 1990 - 2020

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
1.A.1.a	Public Electricity and Heat Production, Gaseous	CO_2	9,266.35	35,251.74	2.0	N	2.0	N	3	0.201	0.144	0.366	1.0	1.0	2.1
1.A.1.a	Public Electricity and Heat Production, Gaseous	CH_4	4.13	15.71	2.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Public Electricity and Heat Production, Gaseous	N_2O	49.22	187.26	2.0	N	150.0	N	150	0.016	0.001	0.002	0.4	0.0	0.2
1.A.1.a	Public Electricity and Heat Production, Liquid	CO_2	412.65	610.55	7.0	N	2.0	N	7	0.000	0.004	0.006	0.0	0.1	0.0
1.A.1.a	Public Electricity and Heat Production, Liquid	CH_4	0.42	0.62	7.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Public Electricity and Heat Production, Liquid	N_2O	4.98	7.37	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.b	Petroleum Refining, Gaseous	CO_2	1,139.10	1,432.96	5.0	N	2.0	N	5	0.001	0.012	0.015	0.0	0.1	0.0
1.A.1.b	Petroleum Refining, Gaseous	CH_4	0.51	0.64	5.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.b	Petroleum Refining, Gaseous	N_2O	6.05	7.61	5.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.b	Petroleum Refining, Liquid	CO_2	812.59	953.11	7.0	N	2.0	N	7	0.001	0.010	0.010	0.0	0.1	0.0
1.A.1.b	Petroleum Refining, Liquid	CH_4	0.35	0.41	7.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.b	Petroleum Refining, Liquid	N_2O	4.20	4.93	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
1.A.1.c.i	Manufacture of solid fuels, Solid	CO_2	318.89	0.00	10.0	N	10.0	N	14	0.000	0.008	0.000	0.0	0.0	0.0
1.A.1.c.i	Manufacture of solid fuels, Solid	CH_4	1.39	0.00	10.0	N	400.0	N	400	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Oil and gas extraction, Gaseous	CO_2	0.00	0.00	5.0	N	2.0	N	5	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Oil and gas extraction, Gaseous	CH_4	0.00	0.00	5.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Oil and gas extraction, Gaseous	N_2O	0.00	0.00	5.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Oil and gas extraction, Liquid	CO_2	0.00	15,982.03	7.0	N	2.0	N	7	0.273	0.166	0.166	0.5	1.6	2.9
1.A.1.a	Oil and gas extraction, Liquid	CH_4	0.00	6.94	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Oil and gas extraction, Liquid	N_2O	0.00	82.68	7.0	N	187.0	N	187	0.005	0.001	0.001	0.2	0.0	0.1
1.A.1.a	Other energy industries, Gaseous	CO_2	9,826.72	738.58	5.0	N	2.0	N	5	0.000	0.228	0.008	0.0	0.1	0.0
1.A.1.a	Other energy industries, Gaseous	CH_4	4.30	0.33	5.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Other energy industries, Gaseous	N_2O	51.27	3.92	5.0	N	187.0	N	187	0.000	0.001	0.000	0.0	0.0	0.0
1.A.1.a	Other energy industries, Liquid	CO_2	0.00	5,307.35	7.0	N	2.0	N	7	0.030	0.055	0.055	0.2	0.5	0.3
1.A.1.a	Other energy industries, Liquid	CH_4	0.00	2.30	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.1.a	Other energy industries, Liquid	N_2O	0.00	27.46	7.0	N	187.0	N	187	0.001	0.000	0.000	0.1	0.0	0.0
1.A.2	Manufacturing industries and construction, Gaseous	CO_2	2,748.13	14,954.15	5.0	N	2.0	N	5	0.131	0.089	0.155	0.4	1.1	1.4

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
1.A.2	Manufacturing industries and construction, Gaseous	CH_4	1.20	6.64	5.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.2	Manufacturing industries and construction, Gaseous	N_2O	14.34	79.11	5.0	N	187.0	N	187	0.004	0.000	0.001	0.2	0.0	0.0
1.A.2	Manufacturing industries and construction, Liquid	CO_2	1,588.49	3,057.90	7.0	N	2.0	N	7	0.010	0.006	0.032	0.1	0.3	0.1
1.A.2	Manufacturing industries and construction, Liquid	CH_4	1.61	3.00	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.2	Manufacturing industries and construction, Liquid	N_2O	19.16	35.78	7.0	N	187.0	N	187	0.001	0.000	0.000	0.1	0.0	0.0
1.A.3a	Domestic aviation, Liquid	CO_2	477.32	760.78	5.0	N	5.0	N	7	0.001	0.004	0.008	0.1	0.1	0.0
1.A.3a	Domestic aviation, Liquid	CH_4	0.08	0.13	5.0	N	82.0	N	82	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3a	Domestic aviation, Liquid	N_2O	0.99	1.59	5.0	N	133.0	N	133	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3b	Road transportation, Diesel oil	CO_2	6,956.41	23,749.86	7.0	N	3.0	N	8	0.661	0.080	0.247	1.0	2.4	7.0
1.A.3b	Road transportation, Diesel oil	CH_4	9.15	31.25	7.0	N	150.0	N	150	0.000	0.000	0.000	0.1	0.0	0.0
1.A.3b	Road transportation, Diesel oil	N_2O	109.11	372.50	7.0	N	200.0	N	200	0.112	0.001	0.004	1.1	0.0	1.2
1.A.3b	Road transportation, Motor gasoline	CO_2	6,413.70	9,795.89	7.0	N	3.0	N	8	0.112	0.052	0.102	0.4	1.0	1.2
1.A.3b	Road transportation, Motor gasoline	CH_4	49.88	76.19	7.0	N	150.0	N	150	0.003	0.000	0.001	0.2	0.0	0.0

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			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
1.A.3b	Road transportation, Motor gasoline	N_2O	194.71	297.39	7.0	N	200.0	N	200	0.072	0.002	0.003	0.9	0.0	0.8
1.A.3b	Road transportation, LPG	CO_2	0.00	2,348.61	7.0	N	3.0	N	8	0.006	0.024	0.024	0.1	0.2	0.1
1.A.3b	Road transportation, LPG	CH_4	0.00	64.89	7.0	N	150.0	N	150	0.002	0.001	0.001	0.1	0.0	0.0
1.A.3b	Road transportation, LPG	N_2O	0.00	773.49	7.0	N	200.0	N	200	0.484	0.008	0.008	2.3	0.1	5.2
1.A.3c	Railways, Liquid	CO_2	0.00	56.37	7.0	N	2.0	N	7	0.000	0.001	0.001	0.0	0.0	0.0
1.A.3c	Railways, Liquid	CH_4	0.00	0.08	7.0	N	90.0	N	90	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3c	Railways, Liquid	N_2O	0.00	0.94	7.0	N	100.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, Diesel oil	CO_2	0.00	376.60	7.0	N	3.0	N	8	0.000	0.004	0.004	0.0	0.0	0.0
1.A.3d	Domestic navigation, Diesel oil	CH_4	0.00	1.22	7.0	N	50.0	N	50	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, Diesel oil	N_2O	0.00	14.50	7.0	N	135.0	N	135	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, gasoline	CO_2	0.00	0.00	7.0	N	3.0	N	8	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, gasoline	CH_4	0.00	0.00	7.0	N	50.0	N	50	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, gasoline	N_2O	0.00	0.00	7.0	N	135.0	N	135	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, Residual fuel oil	CO_2	0.00	156.63	7.0	N	3.0	N	8	0.000	0.002	0.002	0.0	0.0	0.0
1.A.3d	Domestic navigation, Residual fuel oil	CH_4	0.00	0.22	7.0	N	50.0	N	50	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3d	Domestic navigation, Residual fuel oil	N_2O	0.00	2.61	7.0	N	135.0	N	135	0.000	0.000	0.000	0.0	0.0	0.0

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
1.A.3e	Other Transportation, Gaseous	CO_2	0.00	1,229.34	5.0	N	2.0	N	5	0.001	0.013	0.013	0.0	0.1	0.0
1.A.3e	Other Transportation, Gaseous	CH_4	0.00	0.54	5.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3e	Other Transportation, Gaseous	N_2O	0.00	6.41	5.0	N	187.0	N	187	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3e	Other Transportation, Liquid	CO_2	0.00	0.00	7.0	N	2.0	N	7	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3e	Other Transportation, Liquid	CH_4	0.00	0.00	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.3e	Other Transportation, Liquid	N_2O	0.00	0.00	7.0	N	187.0	N	187	0.000	0.000	0.000	0.0	0.0	0.0
1.A.4	Other sectors, Gaseous	CO_2	2,454.98	24,310.22	5.0	N	2.0	N	5	0.346	0.193	0.252	0.7	1.8	3.7
1.A.4	Other sectors, Gaseous	CH_4	5.47	54.17	5.0	N	150.0	N	150	0.001	0.000	0.001	0.1	0.0	0.0
1.A.4	Other sectors, Gaseous	N_2O	65.20	645.67	5.0	N	187.0	N	187	0.295	0.005	0.007	1.8	0.0	3.1
1.A.4	Other sectors, Liquid	CO_2	4,992.68	7,110.64	7.0	N	2.0	N	7	0.054	0.046	0.074	0.2	0.7	0.6
1.A.4	Other sectors, Liquid	CH_4	14.18	18.65	7.0	N	150.0	N	150	0.000	0.000	0.000	0.0	0.0	0.0
1.A.4	Other sectors, Liquid	N_2O	169.00	222.27	7.0	N	200.0	N	200	0.040	0.002	0.002	0.7	0.0	0.4
1.A.4	Other sectors, Biomass	CH_4	3.98	3.57	15.0	N	10.0	N	18	0.000	0.000	0.000	0.0	0.0	0.0
1.A.4	Other sectors, Biomass	N_2O	47.49	42.54	15.0	N	20.0	N	25	0.000	0.001	0.000	0.0	0.0	0.0
1.B.1	Coal mining and handling	CH_4	0.00	0.00	10.0	N	300.0	N	300	0.000	0.000	0.000	0.0	0.0	0.0
1.B.2	Oil and Natural gas and other emissions from energy	CO_2	6,912.49	8,362.22	8.0	N	200.0	N	200	56.578	0.079	0.087	24.5	1.0	603.6

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
	production														
1.B.2	Oil and Natural gas and other emissions from energy production	CH_4	12,695.69	22,035.25	8.0	N	120.0	N	120	141.833	0.076	0.229	38.8	2.6	1513.1
1.B.2	Oil and Natural gas and other emissions from energy production	N_2O	22.61	27.04	8.0	N	1000.0	N	1000	0.015	0.000	0.000	0.4	0.0	0.2
2.A.1	Cement production	CO_2	2,636.19	8,725.07	3.0	N	7.00	N	7.62	0.089	0.027	0.091	0.9	0.4	1.0
2.A.2	Lime production	CO_2	18.89	28.62	5.0	N	15.0	N	15.81	0.000	0.000	0.000	0.0	0.0	0.0
2.A.3	Glass production	CO_2	5.87	1.35	5.0	N	60.0	N	60.21	0.000	0.000	0.000	0.0	0.0	0.0
2.B.1	Ammonia production	CO_2	621.93	0.00	7.0	N	5.0	N	8.60	0.000	0.015	0.000	0.0	0.0	0.0
2.B.2	Nitric acid production	N_2O	427.99	39.41	2.0	N	40.0	N	40.05	0.000	0.010	0.000	0.0	0.0	0.0
2.B.8.a	Methanol production	CO_2	62.31	68.61	7.0	N	30.0	N	31	0.000	0.001	0.001	0.0	0.0	0.0
2.B.8.a	Methanol production	CH_4	5.35	5.89	7.0	N	10.0	N	12	0.000	0.000	0.000	0.0	0.0	0.0
2.B.8.b	Ethylene Production	CO_2	97.23	0.00	7.0	N	32.0	N	33	0.000	0.002	0.000	0.0	0.0	0.0
2.B.8.b	Ethylene Production	CH_4	11.81	0.00	7.0	N	10.0	N	12	0.000	0.000	0.000	0.0	0.0	0.0
2.B.10	Urea Production	CO_2	0.00	0.00	7.00	N	5.00	N	8.60	0.000	0.000	0.000	0.0	0.0	0.0
2.C.1	Iron and steel production	CO_2	2,965.20	1,627.08	35.0	N	1.0	N	35.01	0.066	0.054	0.017	0.0	0.8	0.7
2.C.1	Iron and steel production	CH_4	1.50	0.48	10.0	N	400.0	N	400	0.000	0.000	0.000	0.0	0.0	0.0
2.C.5	Lead Production	CO_2	3,540.00	0.00	10.0	N	20.0	N	22	0.000	0.085	0.000	0.0	0.0	0.0
2.C.6	Zinc Production	CO_2	3,397.00	365.07	10.0	N	50.0	N	51	0.007	0.078	0.004	0.3	0.1	0.1
2.D.1	Lubricant use	CO_2	0.00	0.00	10.0	N	50.0	N	51	0.000	0.000	0.000	0.0	0.0	0.0

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
2.F.1	Refrigeration and air conditioning	HFCs	0.00	1,206.05	102.0	N	1.0	N	102.00	0.306	0.013	0.013	0.0	1.8	3.3
2.G.1	Electrical equipment	SF_6	0.16	36.19	110.0	N	1.0	N	110	0.000	0.000	0.000	0.0	0.1	0.0
3 A 1	Enteric fermentation - cattle	CH_4	1,741.79	2,365.75	28.5	N	20.0	N	34.82	0.137	0.017	0.025	0.7	1.0	1.5
3 A 2	Enteric fermentation - Sheep	CH_4	3,391.98	5,923.57	20.0	N	40.0	N	45	1.417	0.020	0.061	3.5	1.7	15.1
3 A 4 b	Enteric fermentation - Camels	CH_4	140.82	500.50	20.0	N	40.0	N	45	0.010	0.002	0.005	0.3	0.1	0.1
3 A 4 d	Enteric fermentation - Goats	CH_4	1,112.40	2,208.68	20.0	N	40.0	N	45	0.197	0.004	0.023	1.3	0.6	2.1
3 A 4 e	Enteric fermentation - Horses	CH_4	37.02	0.00	20.0	N	40.0	N	45	0.000	0.001	0.000	0.0	0.0	0.0
3 A 4 f	Enteric fermentation - Mules and asses	CH_4	99.74	0.00	20.0	N	40.0	N	45	0.000	0.002	0.000	0.0	0.0	0.0
3 B 1	Manure management - Dairy cattle	CH_4	51.32	66.20	32.0	N	30.0	N	44	0.000	0.001	0.001	0.0	0.0	0.0
3 B 1	Manure management - Dairy cattle	N_2O	787.11	983.77	32.0	N	30.0	N	44	0.038	0.009	0.010	0.4	0.5	0.4
3 B 2	Manure management - Sheep	CH_4	663.65	1,158.96	22.0	N	30.0	N	37	0.038	0.004	0.012	0.5	0.4	0.4
3 B 2	Manure management - Sheep	N_2O	1,632.83	2,828.26	22.0	N	30.0	N	37	0.224	0.010	0.029	1.2	0.9	2.4
3 B 4 b	Manure management - Camels	CH_4	5.88	20.89	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 B 4 b	Manure management - Camels	N_2O	13.13	46.67	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 B 4 d	Manure management - Goats	CH_4	21.01	41.72	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
3 B 4 d	Manure management - Goats	N_2O	436.62	866.92	22.0	N	30.0	N	37	0.021	0.001	0.009	0.4	0.3	0.2
3 B 4 e	Manure management - Horses	CH_4	3.37	0.00	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 B 4 e	Manure management - Horses	N_2O	0.22	0.00	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 B 4 f	Manure management - Mules and asses	CH_4	8.98	0.00	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 B 4 f	Manure management - Mules and asses	N_2O	64.08	0.00	22.0	N	30.0	N	37	0.000	0.002	0.000	0.0	0.0	0.0
3 B 4 g	Manure management - Poultry	CH_4	37.05	69.39	22.0	N	30.0	N	37	0.000	0.000	0.001	0.0	0.0	0.0
3 B 4 g	Manure management - Poultry	N_2O	22.40	41.95	22.0	N	30.0	N	37	0.000	0.000	0.000	0.0	0.0	0.0
3 D 1 a	Inorganic N fertilizers	N_2O	295.02	328.74	20.0	N	200.0	N	201	0.088	0.004	0.003	1.0	0.1	0.9
3 D 1 b	Organic N fertilizers	N_2O	495.36	1,821.48	20.0	N	200.0	N	201	2.707	0.007	0.019	5.3	0.5	28.9
3 D 1 c	Urine and dung deposited by grazing animals	N_2O	36.81	60.71	20.0	N	200.0	N	201	0.003	0.000	0.001	0.2	0.0	0.0
3 D 1 d	Crop residues	N_2O	45.77	139.00	20.0	N	100.0	N	102	0.004	0.000	0.001	0.2	0.0	0.0
3 F	Field burning of agricultural residues	CH_4	66.08	77.99	100.0	N	50.0	N	112	0.002	0.001	0.001	0.1	0.1	0.0
3 F	Field burning of agricultural residues	N_2O	20.42	24.10	100.0	N	50.0	N	112	0.000	0.000	0.000	0.0	0.0	0.0
3 H	Urea application	CH_4	0.00	0.00	20.0	N	50.0	N	54	0.000	0.000	0.000	0.0	0.0	0.0
5.A	Solid waste disposal	CH_4	1,278.19	6,475.52	87.0	N	52.0	N	101	8.700	0.037	0.067	4.9	8.3	92.8
5.B	Biological treatment of solid waste	CH_4	23.01	17.84	87.0	N	50.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0

IPCC category code	IPCC category name	Gas	Base year emissions or removals	Year t emissions or removals	Activity data uncertainty	AD uncertainties correlated across	Emission factor /estimation parameter uncertainty	EF uncertainties correlated across	Combined uncertainty	Contribution to variance by category in year t	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by EF* uncertainty	Uncertainty in trend in national emissions introduced by AD uncertainty	Uncertainty introduced into the trend in total national emissions
			kt CO_2 equivalent	kt CO_2 equivalent	%		%		%	%	%	%	%	%	%
5.B	Biological treatment of solid waste	N_2O	16.46	12.76	87.0	N	50.0	N	100	0.000	0.000	0.000	0.0	0.0	0.0
5.C	Incineration and open burning of waste	CO_2	399.95	408.90	87.0	N	25.0	N	91	0.028	0.005	0.004	0.2	0.5	0.3
5.C	Incineration and open burning of waste	CH_4	0.14	0.19	87.0	N	100.0	N	133	0.000	0.000	0.000	0.0	0.0	0.0
5.C	Incineration and open burning of waste	N_2O	20.38	27.20	87.0	N	100.0	N	133	0.000	0.000	0.000	0.0	0.0	0.0
5.C	Wastewater treatment and discharge	CH_4	1,458.92	1,428.83	71.0	N	129.0	N	147	0.894	0.020	0.015	2.7	1.5	9.5
5.D	Wastewater treatment and discharge	N_2O	257.78	760.97	71.0	N	261.0	N	270	0.856	0.002	0.008	2.9	0.8	9.1
Total			95,948.77	220,544.85					12388	217.122					2316.3
Results							Percentage uncertainty in total inventory:			14.7				Trend uncertainty	48.1

11.3 Annex III: GHG emission inventory tables for years 1990 - 2020

Table 656 GHG emissions inventory per category and gas for years 1990 – 2020

GHG (kt CO2 eq)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total (without LULUCF)	96 673.41	98 660.53	101 524.17	104 341.12	100 924.45	104 442.61	104 683.09	107 717.29	114 221.47	121 643.16	129 457.02
Total (net emissions)	88 978.03	90 898.47	94 331.93	99 459.81	111 124.49	99 171.10	96 852.79	100 647.26	108 655.10	116 083.48	123 339.22
1. Energy	68 196.34	71 671.76	73 232.53	76 685.20	75 121.46	77 500.76	78 530.90	81 749.95	85 939.95	91 791.23	99 563.26
1.A. Fuel combustion	47 254.00	50 246.44	52 788.94	55 622.32	54 559.72	54 257.45	53 845.11	55 177.93	57 573.54	59 559.40	71 051.36
1.A.1. Energy industries	21 381.27	22 577.05	22 559.54	26 799.23	27 595.67	27 896.54	27 828.33	28 593.85	29 807.75	30 820.07	38 832.22
1.A.2. Manufacturing industries and construction	4 344.70	4 628.60	4 754.53	4 286.99	4 204.04	4 338.37	4 365.93	5 254.39	5 380.83	5 220.31	5 298.90
1.A.3. Transport	14 214.35	12 683.30	15 682.13	13 306.50	11 741.92	11 181.53	10 807.38	10 521.25	10 911.32	11 341.41	15 157.17
1.A.4. Other sectors	7 313.69	10 357.50	9 792.75	11 229.60	11 018.09	10 841.01	10 843.47	10 808.45	11 473.64	12 177.61	11 763.07
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	20 942.34	21 425.31	20 443.59	21 062.89	20 561.75	23 243.31	24 685.79	26 572.02	28 366.41	32 231.83	28 511.91
1.B.1. Solid fuels	0.77	0.89	1.06	0.82	0.78	0.78	0.32	0.56	0.64	0.65	0.50
1.B.2. Oil and natural gas and other emissions	20 941.57	21 424.43	20 442.53	21 062.06	20 560.97	23 242.53	24 685.47	26 571.45	28 365.77	32 231.18	28 511.41
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	13 791.41	12 116.32	12 671.39	11 662.56	10 238.08	11 281.45	10 200.17	9 792.48	11 315.39	12 359.18	12 866.49
2.A. Mineral industry	2 660.95	2 661.19	2 981.50	2 922.80	2 562.19	2 853.81	3 136.17	3 005.18	3 283.40	3 228.19	3 650.17
2.B. Chemical industry	1 226.61	1 217.88	1 227.99	1 220.06	1 217.30	1 246.60	1 244.04	1 263.38	1 275.00	1 501.94	1 631.06
2.C. Metal industry	9 903.69	8 237.07	8 461.69	7 519.46	6 457.64	7 179.51	5 817.50	5 520.45	6 752.34	7 622.85	7 577.95
2.D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	0.69	1.22	2.12	3.09	4.20	5.71	6.76
2.G. Other product manufacture and use	0.16	0.18	0.21	0.24	0.27	0.31	0.34	0.39	0.43	0.49	0.56
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	11 230.85	11 377.41	12 002.50	12 258.14	11 680.50	11 627.16	11 777.04	11 862.36	12 514.68	12 897.41	12 288.63
3.A. Enteric fermentation	6 523.74	6 245.40	6 617.61	6 737.64	6 458.42	6 514.52	6 595.88	6 698.23	6 935.69	7 237.19	6 963.58
3.B. Manure management	3 747.65	3 590.06	3 768.34	3 859.99	3 702.41	3 687.49	3 698.37	3 739.87	3 897.75	4 014.45	3 821.04
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	872.95	1 416.49	1 487.43	1 589.49	1 473.06	1 331.41	1 349.72	1 383.94	1 552.81	1 577.37	1 466.63
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	86.50	125.46	129.12	71.02	46.62	93.75	133.07	40.31	128.43	68.40	37.37
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	-7 695.39	-7 762.06	-7 192.24	-4 881.31	10 200.04	-5 271.52	-7 830.31	-7 070.03	-5 566.36	-5 559.68	-6 117.80
4.A. Forest land	-7 695.39	-7 762.06	-7 192.24	-4 881.31	10 200.04	-5 271.52	-7 830.31	-7 070.03	-5 566.36	-5 559.68	-6 117.80
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	3 454.82	3 495.04	3 617.75	3 735.21	3 884.40	4 033.24	4 174.98	4 312.50	4 451.45	4 595.33	4 738.64
5.A. Solid waste disposal	1 278.19	1 362.70	1 441.15	1 523.37	1 609.41	1 718.18	1 828.70	1 940.62	2 053.81	2 175.40	2 298.03
5.B. Biological treatment of solid waste	39.46	38.96	38.45	37.90	37.98	37.27	36.48	35.65	34.79	33.94	33.08
5.C. Incineration and open burning of waste	420.46	424.85	433.01	440.47	477.09	479.70	480.57	480.23	478.84	476.61	473.49
5.D. Wastewater treatment and discharge	1 716.70	1 668.53	1 705.13	1 733.47	1 759.93	1 798.09	1 829.23	1 856.01	1 884.01	1 909.38	1 934.04
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:											
1.D.1. International bunkers	1 026.04	1 103.17	977.41	1 523.57	1 718.44	1 920.95	1 823.55	1 611.48	1 557.42	1 554.61	1 883.71
1.D.1.a. Aviation	481.38	481.38	481.38	481.38	601.73	752.16	782.25	782.25	812.34	812.34	1 113.20
1.D.1.b. Navigation	544.65	621.79	496.03	1 042.19	1 116.71	1 168.79	1 041.30	829.23	745.08	742.27	770.51
1.D.2. Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.D.3. CO$_2$ emissions from biomass	0.06	0.04	0.04	0.07	0.07	0.07	0.07	0.10	0.10	0.10	0.10

GHG (kt CO2 eq)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total (without LULUCF)	**124 756.19**	**134 167.20**	**136 523.21**	**142 446.68**	**149 019.92**	**145 967.00**	**150 773.32**	**154 361.41**	**157 542.14**	**185 059.74**	**185 978.34**
Total (net emissions)	**116 948.46**	**125 911.71**	**128 501.55**	**136 575.40**	**142 419.37**	**138 226.04**	**144 988.04**	**146 915.47**	**150 263.08**	**177 039.89**	**176 275.22**
1. Energy	**91 367.61**	**95 799.61**	**98 289.93**	**102 075.34**	**108 563.27**	**105 613.83**	**110 008.05**	**113 094.73**	**113 165.48**	**140 890.42**	**143 563.78**
1.A. Fuel combustion	60 810.67	63 798.17	65 293.26	68 898.59	72 653.16	73 673.29	78 184.85	81 507.20	83 047.59	109 419.73	113 146.82
1.A.1. Energy industries	30 310.54	31 097.24	31 842.35	33 112.32	32 918.73	33 039.38	32 890.02	33 936.01	35 377.42	51 510.83	49 889.75
1.A.2. Manufacturing industries and construction	5 794.70	6 032.72	6 124.80	6 394.13	5 636.18	7 510.67	8 316.58	8 502.56	7 182.09	9 787.34	10 043.50
1.A.3. Transport	12 353.30	13 091.09	13 795.47	14 442.77	15 111.41	21 636.05	24 040.37	26 228.69	27 725.33	32 217.28	35 541.07
1.A.4. Other sectors	12 352.13	13 577.12	13 530.64	14 949.37	18 986.84	11 487.19	12 937.88	12 839.94	12 762.75	15 904.29	17 672.49
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	30 556.95	32 001.45	32 996.67	33 176.75	35 910.11	31 940.53	31 823.20	31 587.53	30 117.90	31 470.68	30 416.96
1.B.1. Solid fuels	0.56	0.91	0.81	0.93	0.70	0.83	0.69	0.69	0.14	NE	NE
1.B.2. Oil and natural gas and other emissions	30 556.39	32 000.53	32 995.85	33 175.82	35 909.41	31 939.70	31 822.51	31 586.83	30 117.76	31 470.68	30 416.96
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**15 759.82**	**20 714.85**	**20 034.67**	**21 134.58**	**21 190.26**	**20 127.51**	**19 995.53**	**20 683.15**	**22 524.48**	**21 197.30**	**18 711.01**
2.A. Mineral industry	3 648.86	3 742.90	3 435.86	4 599.98	5 346.57	6 133.88	6 637.72	7 276.83	7 832.98	7 310.01	7 884.16
2.B. Chemical industry	1 591.53	1 806.20	1 901.45	1 867.17	1 918.82	1 802.44	1 903.94	1 934.54	2 001.51	2 251.80	2 301.00
2.C. Metal industry	10 511.13	15 081.88	14 604.80	14 553.53	13 811.84	12 062.93	11 316.71	11 339.48	12 534.53	11 317.78	8 159.81
2.D. Non-energy products from fuels and solvent use	IE	72.52	77.41	93.27	83.19	87.85	84.31	69.57	80.24	89.15	69.16
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	7.68	10.65	14.38	19.79	28.60	38.72	50.63	59.90	71.72	224.30	291.73
2.G. Other product manufacture and use	0.63	0.70	0.77	0.84	1.24	1.70	2.23	2.82	3.49	4.26	5.17
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**12 738.10**	**12 594.68**	**12 917.22**	**13 773.12**	**13 558.66**	**14 319.76**	**14 600.43**	**14 300.68**	**15 359.38**	**16 327.75**	**16 907.35**
3.A. Enteric fermentation	7 271.54	7 167.77	7 337.03	7 660.08	7 812.72	8 089.87	8 258.17	8 187.72	8 635.15	9 172.44	9 532.42
3.B. Manure management	3 845.32	3 889.16	3 972.70	4 073.68	4 184.90	4 394.16	4 509.90	4 454.97	4 728.35	4 994.96	5 190.02
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	1 534.59	1 470.97	1 502.45	1 930.70	1 477.98	1 741.31	1 730.81	1 605.50	1 839.10	1 996.13	2 034.07
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	86.65	66.77	105.04	108.65	83.06	94.42	101.56	52.49	112.25	100.95	91.34
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NE	NE	NE	NE	NE	NE	NE	NE	44.53	63.27	59.50
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	**-7 807.73**	**-8 255.49**	**-8 021.66**	**-5 871.28**	**-6 600.55**	**-7 740.95**	**-5 785.28**	**-7 445.95**	**-7 279.06**	**-8 019.85**	**-9 703.12**
4.A. Forest land	-7 807.73	-8 255.49	-8 021.66	-5 871.28	-6 600.55	-7 740.95	-5 785.28	-7 445.95	-7 279.06	-8 019.85	-9 703.12
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**4 890.65**	**5 058.06**	**5 281.39**	**5 463.65**	**5 707.73**	**5 905.90**	**6 169.31**	**6 282.86**	**6 492.79**	**6 644.27**	**6 796.20**
5.A. Solid waste disposal	2 421.74	2 547.57	2 677.30	2 811.15	2 970.97	3 140.55	3 320.45	3 511.31	3 718.15	3 935.52	4 165.79
5.B. Biological treatment of solid waste	32.25	32.62	32.91	33.13	33.17	33.12	33.00	32.64	32.41	32.09	31.67
5.C. Incineration and open burning of waste	469.72	476.66	483.08	489.09	482.89	475.40	466.67	454.63	443.70	431.30	416.86
5.D. Wastewater treatment and discharge	1 966.94	2 001.20	2 088.10	2 130.29	2 220.70	2 256.82	2 349.20	2 284.28	2 298.53	2 245.36	2 181.88
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:											
1.D.1. International bunkers	**1 507.59**	**2 088.07**	**1 816.91**	**1 677.83**	**1 963.53**	**2 164.22**	**2 161.91**	**2 210.15**	**2 272.29**	**1 015.81**	**804.50**
1.D.1.a. Aviation	908.61	1 326.82	1 140.28	637.83	926.67	1 086.12	1 065.06	1 191.43	1 353.89	NE	NE
1.D.1.b. Navigation	598.98	761.26	676.63	1 039.99	1 036.86	1 078.10	1 096.84	1 018.72	918.39	1 015.81	804.50
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**0.14**	**0.11**	**0.11**	**0.14**	**0.12**	**0.14**	**0.09**	**0.10**	**0.05**	**0.05**

GHG (kt CO2 eq)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total (without LULUCF)	**191 046.73**	**194 923.94**	**204 144.47**	**219 675.35**	**215 558.58**	**217 302.68**	**226 457.54**	**231 547.31**	**219 074.40**
Total (net emissions)	**186 968.71**	**183 852.47**	**194 526.80**	**207 295.10**	**204 092.35**	**207 459.08**	**216 046.75**	**220 446.22**	**208 731.99**
1. Energy	**150 591.82**	**154 267.74**	**160 713.29**	**174 192.64**	**172 059.43**	**174 787.84**	**181 494.12**	**186 453.72**	**173 840.54**
1.A. Fuel combustion	120 267.72	124 931.74	130 070.06	143 505.08	139 253.34	141 766.92	148 607.57	154 945.08	144 636.14
1.A.1. Energy industries	51 406.77	51 487.05	53 678.67	60 929.16	57 288.63	59 036.79	59 408.17	59 584.75	55 584.80
1.A.2. Manufacturing industries and construction	9 387.58	12 216.95	12 391.98	13 880.45	13 958.08	13 381.24	14 248.35	18 551.10	18 198.65
1.A.3. Transport	40 074.03	40 879.96	43 026.83	45 834.85	44 643.50	44 208.48	44 922.18	44 903.97	39 366.94
1.A.4. Other sectors	19 399.33	20 347.78	20 972.58	22 860.61	23 363.13	25 140.41	30 028.86	31 905.27	31 485.75
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	30 324.10	29 336.00	30 643.23	30 687.57	32 806.10	33 020.92	32 886.55	31 508.64	29 204.40
1.B.1. Solid fuels	NE	NE	0.02	NE	NE	NE	0.01	0.01	NE
1.B.2. Oil and natural gas and other emissions	30 324.10	29 336.00	30 643.22	30 687.57	32 806.10	33 020.92	32 886.54	31 508.63	29 204.40
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**15 786.95**	**14 994.14**	**16 556.10**	**18 125.65**	**16 009.75**	**15 123.31**	**17 303.70**	**16 991.61**	**16 526.41**
2.A. Mineral industry	7 796.00	7 968.03	8 288.39	8 598.86	9 228.53	9 888.20	10 086.06	9 601.94	8 755.03
2.B. Chemical industry	2 594.52	2 247.70	3 402.65	3 808.53	2 680.25	2 342.84	3 654.30	4 464.27	4 474.02
2.C. Metal industry	4 917.78	4 178.45	4 135.94	4 561.54	2 847.99	1 776.22	2 286.91	1 713.05	1 992.63
2.D. Non-energy products from fuels and solvent use	58.96	63.68	64.86	68.39	70.75	57.19	61.91	71.34	62.50
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	413.40	528.56	654.74	1 076.51	1 167.40	1 040.16	1 191.00	1 111.67	1 206.05
2.G. Other product manufacture and use	6.29	7.73	9.53	11.82	14.83	18.70	23.52	29.34	36.19
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**17 696.15**	**18 506.06**	**19 442.91**	**19 610.96**	**19 437.17**	**19 014.28**	**19 054.22**	**19 241.69**	**19 575.24**
3.A. Enteric fermentation	9 931.82	10 439.89	10 968.58	11 018.95	10 916.70	10 751.56	10 697.05	10 805.37	10 998.49
3.B. Manure management	5 414.63	5 691.68	5 969.75	6 051.84	5 998.89	5 866.21	5 905.53	5 977.82	6 124.74
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	2 196.03	2 234.75	2 348.47	2 377.80	2 334.82	2 272.45	2 341.85	2 345.90	2 349.92
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	108.21	95.74	88.64	94.91	119.30	124.05	109.79	112.60	102.10
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	45.47	44.00	67.47	67.47	67.47	NE	NE	NE	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	**-4 078.02**	**-11 071.47**	**-9 617.67**	**-12 380.25**	**-11 466.23**	**-9 843.60**	**-10 410.80**	**-11 101.09**	**-10 342.42**
4.A. Forest land	-4 078.02	-11 071.47	-9 617.67	-12 380.25	-11 466.23	-9 843.60	-10 410.80	-11 101.09	-10 342.42
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**6 971.82**	**7 155.99**	**7 432.16**	**7 746.10**	**8 052.22**	**8 377.25**	**8 605.51**	**8 860.28**	**9 132.21**
5.A. Solid waste disposal	4 402.00	4 650.69	4 916.36	5 192.56	5 463.70	5 726.83	5 980.95	6 216.25	6 475.52
5.B. Biological treatment of solid waste	30.78	29.83	28.79	29.50	30.19	30.87	31.49	31.23	30.60
5.C. Incineration and open burning of waste	400.91	383.62	362.39	375.15	388.05	401.00	413.58	427.06	436.29
5.D. Wastewater treatment and discharge	2 138.13	2 091.85	2 124.62	2 148.89	2 170.28	2 218.55	2 179.49	2 185.75	2 189.80
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:									
1.D.1. International bunkers	**825.60**	**1 280.70**	**1 206.82**	**1 111.22**	**744.12**	**736.42**	**667.48**	**81.80**	**299.47**
1.D.1.a. Aviation	NE	406.91	376.36	246.04	NE	NE	NE	NE	NE
1.D.1.b. Navigation	825.60	873.79	830.47	865.18	744.12	736.42	667.48	81.80	299.47
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**0.03**	**0.03**	**0.01**	**0.01**	**0.01**	**0.02**	**0.05**	**0.03**	**0.03**

CO2 (kt)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total (without LULUCF)	**63 603.17**	**64 979.36**	**67 873.32**	**69 794.33**	**67 364.59**	**68 239.59**	**66 890.45**	**67 988.20**	**72 041.98**	**75 869.04**	**86 996.39**	**80 399.60**	**88 468.52**
Total (net emissions)	**55 829.99**	**57 180.53**	**60 617.63**	**64 739.09**	**76 625.09**	**62 850.74**	**59 036.74**	**60 856.37**	**66 381.12**	**70 195.96**	**80 691.89**	**72 540.78**	**80 172.28**
1. Energy	**49 858.61**	**52 905.33**	**55 237.36**	**58 159.65**	**57 118.69**	**56 953.67**	**56 688.45**	**58 199.16**	**60 736.76**	**63 529.47**	**74 157.59**	**64 718.66**	**67 876.12**
1.A. Fuel combustion	46 819.95	49 842.82	52 317.27	55 175.97	54 145.65	53 861.41	53 457.27	54 793.96	57 180.46	59 153.25	70 579.22	60 390.52	63 353.60
1.A.1. Energy industries	21 356.12	22 550.58	22 532.87	26 768.78	27 564.31	27 865.01	27 797.30	28 561.99	29 774.38	30 786.04	38 790.76	30 277.20	31 062.53
1.A.2. Manufacturing industries and construction	4 336.62	4 620.22	4 745.94	4 279.01	4 196.34	4 330.21	4 357.68	5 244.46	5 370.63	5 210.57	5 288.67	5 783.64	6 020.99
1.A.3. Transport	13 847.43	12 355.13	15 285.08	12 944.10	11 411.84	10 869.63	10 503.28	10 225.27	10 610.28	11 030.10	14 786.63	12 029.95	12 752.91
1.A.4. Other sectors	7 279.79	10 316.89	9 753.38	11 184.07	10 973.15	10 796.56	10 799.01	10 762.24	11 425.17	12 126.54	11 713.17	12 299.73	13 517.16
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	3 038.66	3 062.51	2 920.09	2 983.68	2 973.04	3 092.26	3 231.18	3 405.21	3 556.29	4 376.22	3 578.37	4 328.15	4 522.52
1.B.1. Solid fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B.2. Oil and natural gas and other emissions	3 038.66	3 062.51	2 920.09	2 983.68	2 973.04	3 092.26	3 231.18	3 405.21	3 556.29	4 376.22	3 578.37	4 328.15	4 522.52
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**13 344.62**	**11 670.20**	**12 224.45**	**11 216.19**	**9 791.24**	**10 829.04**	**9 744.59**	**9 332.27**	**10 850.11**	**11 886.94**	**12 389.55**	**15 235.69**	**20 141.69**
2.A. Mineral industry	2 660.95	2 661.19	2 981.50	2 922.80	2 562.19	2 853.81	3 136.17	3 005.18	3 283.40	3 228.19	3 650.17	3 648.86	3 742.90
2.B. Chemical industry	781.47	773.43	782.74	775.44	772.89	797.27	792.29	807.49	815.58	1 037.19	1 162.66	1 076.99	1 245.93
2.C. Metal industry	9 902.20	8 235.58	8 460.21	7 517.95	6 456.16	7 177.96	5 816.13	5 519.60	6 751.13	7 621.56	7 576.71	10 509.84	15 080.34
2.D. Non-energy products from fuels and solvent use	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	72.52
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	**-7 773.18**	**-7 798.83**	**-7 255.69**	**-5 055.25**	**9 260.50**	**-5 388.85**	**-7 853.71**	**-7 131.83**	**-5 660.86**	**-5 673.07**	**-6 304.50**	**-7 858.82**	**-8 296.24**
4.A. Forest land	-7 773.18	-7 798.83	-7 255.69	-5 055.25	9 260.50	-5 388.85	-7 853.71	-7 131.83	-5 660.86	-5 673.07	-6 304.50	-7 858.82	-8 296.24
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**399.95**	**403.84**	**411.51**	**418.49**	**454.66**	**456.88**	**457.41**	**456.77**	**455.11**	**452.62**	**449.25**	**445.25**	**450.71**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	399.95	403.84	411.51	418.49	454.66	456.88	457.41	456.77	455.11	452.62	449.25	445.25	450.71
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:													
1.D.1. International bunkers	**1 016.50**	**1 016.50**	**1 016.50**	**1 016.50**	**1 135.83**	**1 285.00**	**1 314.83**	**1 314.83**	**1 344.66**	**1 344.66**	**1 642.99**	**1 440.13**	**1 854.80**
1.D.1.a. Aviation	477.32	477.32	477.32	477.32	596.65	745.82	775.65	775.65	805.48	805.48	1 103.81	900.95	1 315.62
1.D.1.b. Navigation	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18
1.D.2. Multilateral operations	NO	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**0.06**	**0.04**	**0.04**	**0.07**	**0.07**	**0.07**	**0.07**	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**	**0.14**

CO2 (kt)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (without LULUCF)	**89 455.53**	**94 179.37**	**98 049.60**	**97 049.74**	**101 304.56**	**105 150.82**	**108 230.07**	**132 738.87**	**133 664.22**	**137 364.34**	**140 931.40**	**147 690.39**
Total (net emissions)	**81 408.28**	**88 214.73**	**91 360.92**	**89 263.29**	**95 383.37**	**97 633.47**	**100 879.68**	**124 651.27**	**123 908.12**	**132 985.02**	**129 830.54**	**137 972.30**
1. Energy	**69 589.47**	**73 259.85**	**77 134.75**	**77 262.05**	**81 715.13**	**84 938.97**	**86 202.86**	**112 230.74**	**115 775.04**	**122 596.71**	**127 100.43**	**132 435.19**
1.A. Fuel combustion	64 834.31	68 421.96	72 137.39	73 106.43	77 550.56	80 838.29	82 342.62	108 609.75	112 273.79	119 290.13	123 901.69	128 988.15
1.A.1. Energy industries	31 807.14	33 075.24	32 882.22	33 003.24	32 854.07	33 898.64	35 339.44	51 454.07	49 835.17	51 352.46	51 433.42	53 622.40
1.A.2. Manufacturing industries and construction	6 112.81	6 381.73	5 623.81	7 496.41	8 300.72	8 486.77	7 172.50	9 772.08	10 027.41	9 374.30	12 199.06	12 374.46
1.A.3. Transport	13 442.33	14 078.17	14 729.91	21 160.25	23 503.49	25 654.62	27 110.49	31 532.86	34 794.78	39 222.48	39 983.00	42 079.35
1.A.4. Other sectors	13 472.02	14 886.82	18 901.46	11 446.53	12 892.29	12 798.26	12 720.20	15 850.75	17 616.42	19 340.88	20 286.21	20 911.94
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	4 755.17	4 837.89	4 997.36	4 155.61	4 164.56	4 100.68	3 860.24	3 620.99	3 501.25	3 306.59	3 198.74	3 447.04
1.B.1. Solid fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B.2. Oil and natural gas and other emissions	4 755.17	4 837.89	4 997.36	4 155.61	4 164.56	4 100.68	3 860.24	3 620.99	3 501.25	3 306.59	3 198.74	3 447.04
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**19 410.43**	**20 459.41**	**20 460.79**	**19 340.88**	**19 151.00**	**19 784.89**	**21 566.21**	**20 040.24**	**17 438.86**	**14 346.52**	**13 427.81**	**14 848.84**
2.A. Mineral industry	3 435.86	4 599.98	5 346.57	6 133.88	6 637.72	7 276.83	7 832.98	7 310.01	7 884.16	7 796.00	7 968.03	8 288.39
2.B. Chemical industry	1 293.91	1 214.23	1 220.71	1 057.97	1 114.19	1 100.12	1 119.55	1 324.43	1 326.32	1 574.34	1 218.13	2 360.14
2.C. Metal industry	14 603.25	14 551.93	13 810.31	12 061.18	11 314.79	11 338.37	12 533.44	11 316.66	8 159.23	4 917.22	4 177.97	4 135.46
2.D. Non-energy products from fuels and solvent use	77.41	93.27	83.19	87.85	84.31	69.57	80.24	89.15	69.16	58.96	63.68	64.86
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**44.53**	**63.27**	**59.50**	**45.47**	**44.00**	**67.47**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NE	NE	NE	NE	NE	NE	44.53	63.27	59.50	45.47	44.00	67.47
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	**-8 047.24**	**-5 964.64**	**-6 688.68**	**-7 786.45**	**-5 921.18**	**-7 517.35**	**-7 350.39**	**-8 087.60**	**-9 756.11**	**-4 379.32**	**-11 100.85**	**-9 718.10**
4.A. Forest land	-8 047.24	-5 964.64	-6 688.68	-7 786.45	-5 921.18	-7 517.35	-7 350.39	-8 087.60	-9 756.11	-4 379.32	-11 100.85	-9 718.10
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**455.62**	**460.11**	**454.06**	**446.82**	**438.43**	**426.95**	**416.47**	**404.62**	**390.83**	**375.63**	**359.17**	**338.90**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	455.62	460.11	454.06	446.82	438.43	426.95	416.47	404.62	390.83	375.63	359.17	338.90
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
1.D.1. International bunkers	**1 669.84**	**1 171.63**	**1 458.03**	**1 616.14**	**1 595.26**	**1 720.55**	**1 881.65**	**539.18**	**539.18**	**539.18**	**942.66**	**912.36**
1.D.1.a. Aviation	1 130.66	632.45	918.85	1 076.96	1 056.08	1 181.37	1 342.47	NE	NE	NE	403.48	373.18
1.D.1.b. Navigation	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18	539.18
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**0.11**	**0.11**	**0.14**	**0.12**	**0.14**	**0.09**	**0.10**	**0.05**	**0.05**	**0.03**	**0.03**	**0.01**

CO2 (kt)	2015	2016	2017	2018	2019	2020
Total (without LULUCF)	**162 134.30**	**155 782.96**	**157 419.96**	**166 217.31**	**172 187.87**	**161 161.23**
Total (net emissions)	**149 739.41**	**144 269.28**	**147 424.91**	**155 800.24**	**161 047.04**	**150 706.32**
1. Energy	**145 732.54**	**141 590.16**	**144 056.06**	**150 826.64**	**157 024.24**	**146 555.90**
1.A. Fuel combustion	142 345.22	138 119.66	140 650.76	147 459.46	153 759.94	143 577.84
1.A.1. Energy industries	60 863.66	57 229.39	58 975.39	59 347.21	59 522.21	55 527.47
1.A.2. Manufacturing industries and construction	13 860.62	13 937.78	13 363.44	14 231.09	18 526.92	18 174.19
1.A.3. Transport	44 826.02	43 656.80	43 245.99	43 944.18	43 904.25	38 487.63
1.A.4. Other sectors	22 794.92	23 295.69	25 065.94	29 936.98	31 806.56	31 388.54
1.A.5. Other	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	3 387.33	3 470.50	3 405.30	3 367.18	3 264.30	2 978.06
1.B.1. Solid fuels	NE	NE	NE	NE	NE	NE
1.B.2. Oil and natural gas and other emissions	3 387.33	3 470.50	3 405.30	3 367.18	3 264.30	2 978.06
1.C. CCS	NO	NO	NO	NO	NO	NO
2. IPPU	**15 983.39**	**13 762.26**	**12 988.62**	**15 003.49**	**14 763.62**	**14 196.43**
2.A. Mineral industry	8 598.86	9 228.53	9 888.20	10 086.06	9 601.94	8 755.03
2.B. Chemical industry	2 755.08	1 615.47	1 267.49	2 569.09	3 377.77	3 386.75
2.C. Metal industry	4 561.06	2 847.51	1 775.74	2 286.43	1 712.57	1 992.15
2.D. Non-energy products from fuels and solvent use	68.39	70.75	57.19	61.91	71.34	62.50
2.E. Electronic industry	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA
3. Agriculture	**67.47**	**67.47**	**NE**	**NE**	**NE**	**NE**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA
3.G. Liming	NO	NO	NO	NO	NO	NO
3.H. Urea application	67.47	67.47	NE	NE	NE	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA
4. LULUCF	**-12 394.88**	**-11 513.68**	**-9 995.05**	**-10 417.07**	**-11 140.82**	**-10 454.91**
4.A. Forest land	-12 394.88	-11 513.68	-9 995.05	-10 417.07	-11 140.82	-10 454.91
4.B. Cropland	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NE	NE	NE	NE	NE	NE
4.H. Other	NE	NE	NE	NE	NE	NE
5. Waste	**350.90**	**363.06**	**375.28**	**387.18**	**400.02**	**408.90**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	350.90	363.06	375.28	387.18	400.02	408.90
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA
5.E. Other	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:						
1.D.1. International bunkers	**783.15**	**539.18**	**539.18**	**539.18**	**539.18**	**539.18**
1.D.1.a. Aviation	243.97	NE	NE	NE	NE	NE
1.D.1.b. Navigation	539.18	539.18	539.18	539.18	539.18	539.18
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**0.01**	**0.01**	**0.02**	**0.05**	**0.03**	**0.03**

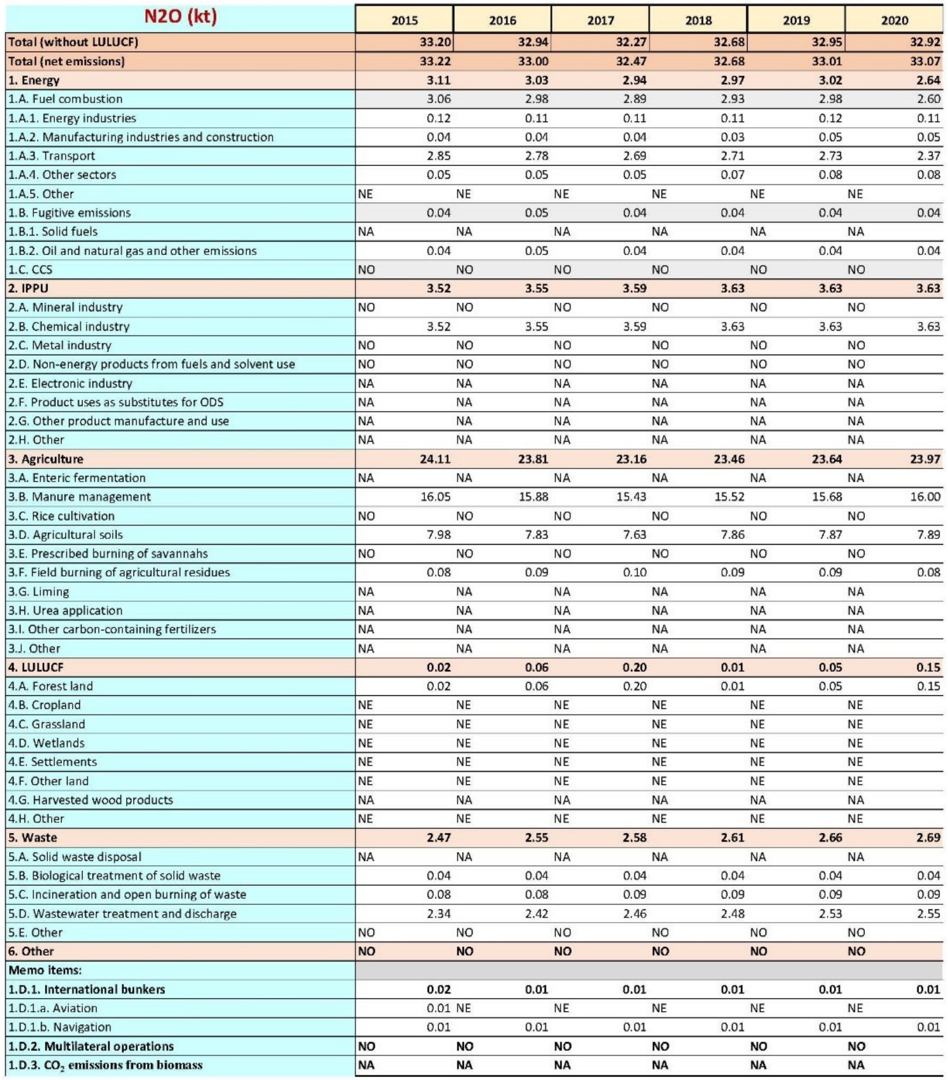
CH4 (kt)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total (without LULUCF)	**1 125.94**	**1 134.17**	**1 121.81**	**1 152.85**	**1 124.22**	**1 234.85**	**1 296.01**	**1 370.51**	**1 454.91**	**1 591.98**	**1 467.65**	**1 538.34**	**1 589.46**
Total (net emissions)	**1 127.81**	**1 135.05**	**1 123.34**	**1 157.04**	**1 146.87**	**1 237.68**	**1 296.57**	**1 372.00**	**1 457.19**	**1 594.71**	**1 472.15**	**1 539.57**	**1 590.44**
1. Energy	**719.54**	**737.90**	**704.73**	**727.22**	**707.41**	**809.77**	**861.89**	**930.48**	**996.31**	**1 118.14**	**1 001.64**	**1 053.32**	**1 103.70**
1.A. Fuel combustion	3.89	3.89	4.27	4.54	4.35	4.23	4.22	4.36	4.48	4.63	4.87	4.88	5.28
1.A.1. Energy industries	0.47	0.50	0.51	0.56	0.58	0.58	0.55	0.58	0.61	0.62	0.75	0.61	0.65
1.A.2. Manufacturing industries and construction	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.14	0.14	0.14	0.14	0.15	0.16
1.A.3. Transport	2.36	2.12	2.52	2.54	2.36	2.24	2.27	2.29	2.30	2.37	2.51	2.60	2.73
1.A.4. Other sectors	0.95	1.16	1.12	1.32	1.30	1.29	1.29	1.35	1.42	1.50	1.46	1.52	1.75
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	715.65	734.01	700.46	722.68	703.06	805.54	857.66	926.13	991.83	1 113.51	996.77	1 048.44	1 098.42
1.B.1. Solid fuels	0.03	0.04	0.04	0.03	0.03	0.03	0.01	0.02	0.03	0.03	0.02	0.02	0.04
1.B.2. Oil and natural gas and other emissions	715.62	733.97	700.42	722.65	703.03	805.51	857.65	926.10	991.81	1 113.49	996.75	1 048.42	1 098.38
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**0.75**	**0.72**	**0.75**	**0.73**	**0.72**	**0.68**	**0.53**	**0.44**	**0.37**	**0.35**	**0.26**	**0.27**	**0.27**
2.A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	0.69	0.66	0.69	0.67	0.66	0.62	0.48	0.41	0.32	0.29	0.21	0.22	0.21
2.C. Metal industry	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.03	0.05	0.05	0.05	0.05	0.06
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**295.24**	**283.95**	**300.40**	**304.83**	**291.76**	**295.03**	**299.38**	**300.67**	**314.52**	**324.78**	**312.04**	**325.68**	**320.92**
3.A. Enteric fermentation	260.95	249.82	264.70	269.51	258.34	260.58	263.84	267.93	277.43	289.49	278.54	290.86	286.71
3.B. Manure management	31.65	30.30	31.76	33.15	32.00	31.58	31.48	31.51	33.17	33.20	32.36	32.17	32.17
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	2.64	3.83	3.95	2.17	1.42	2.86	4.07	1.23	3.92	2.09	1.14	2.65	2.04
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NA	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. LULUCF	**1.88**	**0.89**	**1.53**	**4.19**	**22.65**	**2.83**	**0.56**	**1.49**	**2.28**	**2.73**	**4.50**	**1.23**	**0.98**
4.A. Forest land	1.88	0.89	1.53	4.19	22.65	2.83	0.56	1.49	2.28	2.73	4.50	1.23	0.98
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**110.41**	**111.60**	**115.93**	**120.08**	**124.33**	**129.38**	**134.21**	**138.91**	**143.71**	**148.71**	**153.72**	**159.07**	**164.56**
5.A. Solid waste disposal	51.13	54.51	57.65	60.93	64.38	68.73	73.15	77.62	82.15	87.02	91.92	96.87	101.90
5.B. Biological treatment of solid waste	0.92	0.91	0.90	0.88	0.89	0.87	0.85	0.83	0.81	0.79	0.77	0.75	0.76
5.C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5.D. Wastewater treatment and discharge	58.36	56.17	57.38	58.26	59.07	59.77	60.20	60.45	60.74	60.90	61.02	61.44	61.89
5.E. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:													
1.D.1. International bunkers	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**
1.D.1.a. Aviation	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1.D.1.b. Navigation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

CH4 (kt)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (without LULUCF)	**1 636.62**	**1 661.25**	**1 780.38**	**1 675.11**	**1 688.96**	**1 682.18**	**1 663.51**	**1 757.73**	**1 742.40**	**1 772.43**	**1 766.95**	**1 843.64**
Total (net emissions)	**1 637.24**	**1 663.50**	**1 782.50**	**1 676.21**	**1 692.23**	**1 683.90**	**1 665.23**	**1 759.37**	**1 743.68**	**1 779.69**	**1 767.66**	**1 846.06**
1. Energy	**1 134.25**	**1 138.40**	**1 242.00**	**1 116.17**	**1 111.67**	**1 104.86**	**1 055.87**	**1 120.64**	**1 083.78**	**1 088.55**	**1 053.90**	**1 096.51**
1.A. Fuel combustion	5.37	5.64	6.30	5.44	6.00	6.05	6.18	7.23	7.71	8.37	8.91	9.21
1.A.1. Energy industries	0.65	0.69	0.67	0.67	0.66	0.68	0.67	0.99	0.95	0.96	0.95	1.00
1.A.2. Manufacturing industries and construction	0.16	0.17	0.16	0.20	0.22	0.22	0.15	0.23	0.24	0.20	0.27	0.27
1.A.3. Transport	2.87	2.97	3.09	3.24	3.62	3.78	3.97	4.38	4.84	5.41	5.76	6.03
1.A.4. Other sectors	1.69	1.81	2.38	1.33	1.50	1.36	1.39	1.63	1.68	1.79	1.93	1.91
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	1 128.88	1 132.76	1 235.69	1 110.73	1 105.67	1 098.81	1 049.69	1 113.41	1 076.07	1 080.18	1 044.99	1 087.30
1.B.1. Solid fuels	0.03	0.04	0.03	0.03	0.03	0.03	0.01	NE	NE	NE	NE	0.00
1.B.2. Oil and natural gas and other emissions	1 128.85	1 132.72	1 235.67	1 110.69	1 105.65	1 098.78	1 049.68	1 113.41	1 076.07	1 080.18	1 044.99	1 087.30
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**0.33**	**0.31**	**0.28**	**0.31**	**0.29**	**0.21**	**0.28**	**0.26**	**0.29**	**0.28**	**0.20**	**0.27**
2.A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	0.27	0.25	0.22	0.24	0.21	0.17	0.23	0.21	0.27	0.26	0.18	0.25
2.C. Metal industry	0.06	0.06	0.06	0.07	0.08	0.04	0.04	0.04	0.02	0.02	0.02	0.02
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**329.67**	**343.92**	**350.19**	**362.94**	**370.80**	**366.11**	**388.21**	**411.76**	**427.69**	**446.20**	**468.45**	**491.52**
3.A. Enteric fermentation	293.48	306.40	312.51	323.59	330.33	327.51	345.41	366.90	381.30	397.27	417.60	438.74
3.B. Manure management	32.98	34.19	35.15	36.46	37.37	37.00	39.38	41.78	43.61	45.62	47.93	50.07
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	3.21	3.32	2.54	2.89	3.10	1.60	3.43	3.08	2.79	3.31	2.93	2.71
3.G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.H. Urea application	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. LULUCF	**0.62**	**2.25**	**2.12**	**1.10**	**3.28**	**1.72**	**1.72**	**1.63**	**1.28**	**7.26**	**0.71**	**2.42**
4.A. Forest land	0.62	2.25	2.12	1.10	3.28	1.72	1.72	1.63	1.28	7.26	0.71	2.42
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**172.37**	**178.63**	**187.91**	**195.70**	**206.20**	**211.00**	**219.15**	**225.07**	**230.63**	**237.40**	**244.40**	**255.34**
5.A. Solid waste disposal	107.09	112.45	118.84	125.62	132.82	140.45	148.73	157.42	166.63	176.08	186.03	196.65
5.B. Biological treatment of solid waste	0.77	0.77	0.77	0.77	0.77	0.76	0.76	0.75	0.74	0.72	0.70	0.67
5.C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
5.D. Wastewater treatment and discharge	64.51	65.40	68.29	69.30	72.61	69.78	69.66	66.90	63.25	60.60	57.67	58.01
5.E. Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
1.D.1. International bunkers	**0.06**	**0.05**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
1.D.1.a. Aviation	0.01	0.00	0.01	0.01	0.01	0.01	0.01	NE	NE	NE	0.00	0.00
1.D.1.b. Navigation	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

CH4 (kt)	2015	2016	2017	2018	2019	2020
Total (without LULUCF)	**1 862.37**	**1 951.15**	**1 968.29**	**1 971.54**	**1 935.95**	**1 874.45**
Total (net emissions)	**1 862.72**	**1 952.29**	**1 971.94**	**1 971.69**	**1 936.91**	**1 877.16**
1. Energy	**1 101.35**	**1 182.68**	**1 194.24**	**1 191.30**	**1 141.18**	**1 059.95**
1.A. Fuel combustion	9.87	9.79	10.15	11.04	11.92	11.36
1.A.1. Energy industries	1.15	1.05	1.09	1.09	1.11	1.02
1.A.2. Manufacturing industries and construction	0.30	0.31	0.28	0.28	0.38	0.38
1.A.3. Transport	6.34	6.31	6.45	6.81	7.41	6.98
1.A.4. Other sectors	2.08	2.13	2.33	2.86	3.02	2.98
1.A.5. Other	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	1 091.47	1 172.88	1 184.10	1 180.25	1 129.26	1 048.59
1.B.1. Solid fuels	NE	NE	NE	0.00	0.00	NE
1.B.2. Oil and natural gas and other emissions	1 091.47	1 172.88	1 184.10	1 180.25	1 129.26	1 048.59
1.C. CCS	NO	NO	NO	NO	NO	NO
2. IPPU	**0.25**	**0.26**	**0.23**	**0.17**	**0.22**	**0.25**
2.A. Mineral industry	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	0.23	0.24	0.21	0.15	0.20	0.24
2.C. Metal industry	0.02	0.02	0.02	0.02	0.02	0.02
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA
3. Agriculture	**494.36**	**491.01**	**484.55**	**482.47**	**487.87**	**497.35**
3.A. Enteric fermentation	440.76	436.67	430.06	427.88	432.21	439.94
3.B. Manure management	50.70	50.70	50.70	51.23	52.21	54.29
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	NO	NO	NO	NO	NO	NO
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	2.90	3.65	3.79	3.35	3.44	3.12
3.G. Liming	NO	NO	NO	NO	NO	NO
3.H. Urea application	NO	NO	NO	NO	NO	NO
3.I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO
3.J. Other	NO	NO	NO	NO	NO	NO
4. LULUCF	**0.35**	**1.14**	**3.65**	**0.15**	**0.96**	**2.71**
4.A. Forest land	0.35	1.14	3.65	0.15	0.96	2.71
4.B. Cropland	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE
5. Waste	**266.40**	**277.20**	**289.27**	**297.60**	**306.67**	**316.90**
5.A. Solid waste disposal	207.70	218.55	229.07	239.24	248.65	259.02
5.B. Biological treatment of solid waste	0.69	0.70	0.72	0.73	0.73	0.71
5.C. Incineration and open burning of waste	0.01	0.01	0.01	0.01	0.01	0.01
5.D. Wastewater treatment and discharge	58.00	57.94	59.47	57.62	57.29	57.15
5.E. Other	0.00	0.00	0.00	0.00	0.00	0.00
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:						
1.D.1. International bunkers	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
1.D.1.a. Aviation	0.00	NE	NE	NE	NE	NE
1.D.1.b. Navigation	0.05	0.05	0.05	0.05	0.05	0.05
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

N2O (kt)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total (without LULUCF)	**16.52**	**17.88**	**18.81**	**19.21**	**18.30**	**17.89**	**18.09**	**18.33**	**19.47**	**20.03**	**19.34**	**19.76**	**19.97**
Total (net emissions)	**16.62**	**17.92**	**18.89**	**19.44**	**19.55**	**18.04**	**18.12**	**18.41**	**19.60**	**20.18**	**19.58**	**19.83**	**20.02**
1. Energy	**1.17**	**1.07**	**1.26**	**1.16**	**1.07**	**1.02**	**0.99**	**0.97**	**0.99**	**1.03**	**1.22**	**1.06**	**1.11**
1.A. Fuel combustion	1.13	1.03	1.22	1.12	1.02	0.97	0.95	0.92	0.94	0.97	1.18	1.00	1.05
1.A.1. Energy industries	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.08	0.06	0.06
1.A.2. Manufacturing industries and construction	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
1.A.3. Transport	1.03	0.92	1.12	1.00	0.91	0.86	0.83	0.80	0.82	0.85	1.03	0.87	0.91
1.A.4. Other sectors	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.06	0.06
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.06	0.06
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	**1.44**	**1.44**	**1.44**	**1.44**	**1.44**	**1.46**	**1.48**	**1.50**	**1.52**	**1.53**	**1.55**	**1.71**	**1.86**
2.A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	1.44	1.44	1.44	1.44	1.44	1.46	1.48	1.50	1.52	1.53	1.55	1.71	1.86
2.C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**12.92**	**14.36**	**15.08**	**15.56**	**14.72**	**14.27**	**14.40**	**14.58**	**15.61**	**16.03**	**15.06**	**15.42**	**15.34**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	9.92	9.51	9.98	10.17	9.74	9.72	9.77	9.91	10.30	10.69	10.11	10.20	10.35
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	2.93	4.75	4.99	5.33	4.94	4.47	4.53	4.64	5.21	5.29	4.92	5.15	4.94
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	0.07	0.10	0.10	0.06	0.04	0.07	0.11	0.03	0.10	0.05	0.03	0.07	0.05
3.G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	**0.10**	**0.05**	**0.08**	**0.23**	**1.25**	**0.16**	**0.03**	**0.08**	**0.13**	**0.15**	**0.25**	**0.07**	**0.05**
4.A. Forest land	0.10	0.05	0.08	0.23	1.25	0.16	0.03	0.08	0.13	0.15	0.25	0.07	0.05
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**0.99**	**1.01**	**1.03**	**1.06**	**1.08**	**1.15**	**1.22**	**1.28**	**1.35**	**1.43**	**1.50**	**1.57**	**1.66**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
5.C. Incineration and open burning of waste	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09
5.D. Wastewater treatment and discharge	0.87	0.89	0.91	0.93	0.95	1.02	1.09	1.16	1.23	1.30	1.37	1.45	1.52
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:													
1.D.1. International bunkers	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.04**	**0.04**	**0.04**	**0.04**	**0.04**	**0.05**	**0.04**	**0.05**
1.D.1.a. Aviation	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.04
1.D.1.b. Navigation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

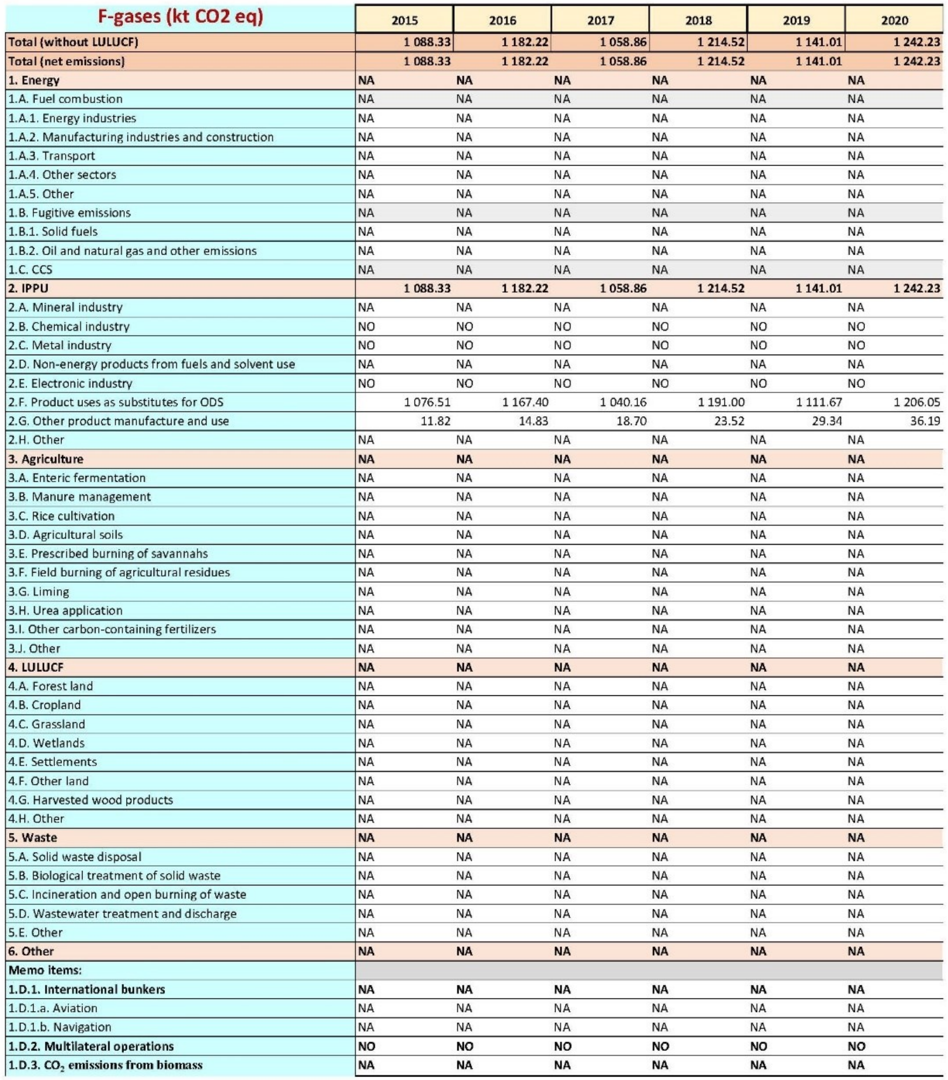
N2O (kt)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (without LULUCF)	20.59	22.53	21.58	23.49	24.13	23.80	25.67	27.35	28.38	30.04	31.15	32.55
Total (net emissions)	20.63	22.66	21.70	23.55	24.32	23.90	25.76	27.44	28.45	30.44	31.19	32.68
1. Energy	1.16	1.19	1.27	1.50	1.68	1.79	1.90	2.16	2.33	2.62	2.75	2.90
1.A. Fuel combustion	1.09	1.13	1.20	1.45	1.63	1.74	1.85	2.11	2.28	2.58	2.71	2.86
1.A.1. Energy industries	0.06	0.07	0.07	0.06	0.07	0.07	0.07	0.11	0.10	0.10	0.10	0.11
1.A.2. Manufacturing industries and construction	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0.04
1.A.3. Transport	0.94	0.97	1.02	1.32	1.50	1.61	1.73	1.93	2.10	2.40	2.53	2.67
1.A.4. Other sectors	0.06	0.06	0.09	0.02	0.03	0.03	0.03	0.04	0.05	0.05	0.04	0.04
1.A.5. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.05
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.05
1.C. CCS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. IPPU	2.02	2.17	2.32	2.48	2.63	2.79	2.94	3.09	3.25	3.40	3.44	3.48
2.A. Mineral industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	2.02	2.17	2.32	2.48	2.63	2.79	2.94	3.09	3.25	3.40	3.44	3.48
2.C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	15.69	17.37	16.12	17.61	17.89	17.27	18.82	20.03	20.66	21.80	22.65	23.78
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	10.56	10.80	11.09	11.69	12.00	11.85	12.56	13.26	13.76	14.34	15.08	15.83
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	5.04	6.48	4.96	5.84	5.81	5.39	6.17	6.70	6.83	7.37	7.50	7.88
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	0.08	0.09	0.07	0.07	0.08	0.04	0.09	0.08	0.07	0.09	0.08	0.07
3.G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	0.03	0.12	0.12	0.06	0.18	0.10	0.10	0.09	0.07	0.40	0.04	0.13
4.A. Forest land	0.03	0.12	0.12	0.06	0.18	0.10	0.10	0.09	0.07	0.40	0.04	0.13
4.B. Cropland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	1.73	1.81	1.87	1.90	1.93	1.95	2.01	2.06	2.15	2.22	2.31	2.38
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
5.C. Incineration and open burning of waste	0.09	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08
5.D. Wastewater treatment and discharge	1.60	1.66	1.72	1.76	1.79	1.81	1.87	1.92	2.02	2.09	2.18	2.26
5.E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:												
1.D.1. International bunkers	0.05	0.03	0.04	0.04	0.04	0.05	0.05	0.01	0.01	0.01	0.03	0.02
1.D.1.a. Aviation	0.03	0.02	0.03	0.03	0.03	0.03	0.04	NE	NE	NE	0.01	0.01
1.D.1.b. Navigation	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1.D.2. Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.D.3. CO_2 emissions from biomass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



N2O (kt)	2015	2016	2017	2018	2019	2020
Total (without LULUCF)	**33.20**	**32.94**	**32.27**	**32.68**	**32.95**	**32.92**
Total (net emissions)	**33.22**	**33.00**	**32.47**	**32.68**	**33.01**	**33.07**
1. Energy	**3.11**	**3.03**	**2.94**	**2.97**	**3.02**	**2.64**
1.A. Fuel combustion	3.06	2.98	2.89	2.93	2.98	2.60
1.A.1. Energy industries	0.12	0.11	0.11	0.11	0.12	0.11
1.A.2. Manufacturing industries and construction	0.04	0.04	0.04	0.03	0.05	0.05
1.A.3. Transport	2.85	2.78	2.69	2.71	2.73	2.37
1.A.4. Other sectors	0.05	0.05	0.05	0.07	0.08	0.08
1.A.5. Other	NE	NE	NE	NE	NE	NE
1.B. Fugitive emissions	0.04	0.05	0.04	0.04	0.04	0.04
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	0.04	0.05	0.04	0.04	0.04	0.04
1.C. CCS	NO	NO	NO	NO	NO	NO
2. IPPU	**3.52**	**3.55**	**3.59**	**3.63**	**3.63**	**3.63**
2.A. Mineral industry	NO	NO	NO	NO	NO	NO
2.B. Chemical industry	3.52	3.55	3.59	3.63	3.63	3.63
2.C. Metal industry	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NO	NO	NO	NO	NO	NO
2.E. Electronic industry	NA	NA	NA	NA	NA	NA
2.F. Product uses as substitutes for ODS	NA	NA	NA	NA	NA	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NA	NA
2.H. Other	NA	NA	NA	NA	NA	NA
3. Agriculture	**24.11**	**23.81**	**23.16**	**23.46**	**23.64**	**23.97**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA
3.B. Manure management	16.05	15.88	15.43	15.52	15.68	16.00
3.C. Rice cultivation	NO	NO	NO	NO	NO	NO
3.D. Agricultural soils	7.98	7.83	7.63	7.86	7.87	7.89
3.E. Prescribed burning of savannahs	NO	NO	NO	NO	NO	NO
3.F. Field burning of agricultural residues	0.08	0.09	0.10	0.09	0.09	0.08
3.G. Liming	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA
4. LULUCF	**0.02**	**0.06**	**0.20**	**0.01**	**0.05**	**0.15**
4.A. Forest land	0.02	0.06	0.20	0.01	0.05	0.15
4.B. Cropland	NE	NE	NE	NE	NE	NE
4.C. Grassland	NE	NE	NE	NE	NE	NE
4.D. Wetlands	NE	NE	NE	NE	NE	NE
4.E. Settlements	NE	NE	NE	NE	NE	NE
4.F. Other land	NE	NE	NE	NE	NE	NE
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA
4.H. Other	NE	NE	NE	NE	NE	NE
5. Waste	**2.47**	**2.55**	**2.58**	**2.61**	**2.66**	**2.69**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	0.04	0.04	0.04	0.04	0.04	0.04
5.C. Incineration and open burning of waste	0.08	0.08	0.09	0.09	0.09	0.09
5.D. Wastewater treatment and discharge	2.34	2.42	2.46	2.48	2.53	2.55
5.E. Other	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:						
1.D.1. International bunkers	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
1.D.1.a. Aviation	0.01	NE	NE	NE	NE	NE
1.D.1.b. Navigation	0.01	0.01	0.01	0.01	0.01	0.01
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

F-gases (kt CO2 eq)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total (without LULUCF)	0.16	0.18	0.21	0.24	0.96	1.53	2.47	3.47	4.63	6.19	7.32	8.31	11.34
Total (net emissions)	0.16	0.18	0.21	0.24	0.96	1.53	2.47	3.47	4.63	6.19	7.32	8.31	11.34
1. Energy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A. Fuel combustion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.1. Energy industries	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.2. Manufacturing industries and construction	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.3. Transport	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.4. Other sectors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.5. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B. Fugitive emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.C. CCS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. IPPU	0.16	0.18	0.21	0.24	0.96	1.53	2.47	3.47	4.63	6.19	7.32	8.31	11.34
2.A. Mineral industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F. Product uses as substitutes for ODS	NO	NO	NO	NO	0.69	1.22	2.12	3.09	4.20	5.71	6.76	7.68	10.65
2.G. Other product manufacture and use	0.16	0.18	0.21	0.24	0.27	0.31	0.34	0.39	0.43	0.49	0.56	0.63	0.70
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.A. Forest land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.B. Cropland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.C. Grassland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.D. Wetlands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.E. Settlements	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.F. Other land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo items:													
1.D.1. International bunkers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.1.a. Aviation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.1.b. Navigation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.2. Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.D.3. CO_2 emissions from biomass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

F-gases (kt CO2 eq)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total (without LULUCF)	15.14	20.63	29.83	40.41	52.86	62.72	75.21	228.57	296.89	419.68	536.29	664.27
Total (net emissions)	15.14	20.63	29.83	40.41	52.86	62.72	75.21	228.57	296.89	419.68	536.29	664.27
1. Energy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A. Fuel combustion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.1. Energy industries	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.2. Manufacturing industries and construction	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.3. Transport	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.4. Other sectors	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.A.5. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B. Fugitive emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.C. CCS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. IPPU	15.14	20.63	29.83	40.41	52.86	62.72	75.21	228.57	296.89	419.68	536.29	664.27
2.A. Mineral industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F. Product uses as substitutes for ODS	14.38	19.79	28.60	38.72	50.63	59.90	71.72	224.30	291.73	413.40	528.56	654.74
2.G. Other product manufacture and use	0.77	0.84	1.24	1.70	2.23	2.82	3.49	4.26	5.17	6.29	7.73	9.53
2.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.G. Liming	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4. LULUCF	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.A. Forest land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.B. Cropland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.C. Grassland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.D. Wetlands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.E. Settlements	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.F. Other land	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4.H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.E. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Memo items:												
1.D.1. International bunkers	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.1.a. Aviation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.1.b. Navigation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1.D.2. Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.D.3. CO_2 emissions from biomass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA



F-gases (kt CO2 eq)	2015	2016	2017	2018	2019	2020
Total (without LULUCF)	**1 088.33**	**1 182.22**	**1 058.86**	**1 214.52**	**1 141.01**	**1 242.23**
Total (net emissions)	**1 088.33**	**1 182.22**	**1 058.86**	**1 214.52**	**1 141.01**	**1 242.23**
1. Energy	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
1.A. Fuel combustion	NA	NA	NA	NA	NA	NA
1.A.1. Energy industries	NA	NA	NA	NA	NA	NA
1.A.2. Manufacturing industries and construction	NA	NA	NA	NA	NA	NA
1.A.3. Transport	NA	NA	NA	NA	NA	NA
1.A.4. Other sectors	NA	NA	NA	NA	NA	NA
1.A.5. Other	NA	NA	NA	NA	NA	NA
1.B. Fugitive emissions	NA	NA	NA	NA	NA	NA
1.B.1. Solid fuels	NA	NA	NA	NA	NA	NA
1.B.2. Oil and natural gas and other emissions	NA	NA	NA	NA	NA	NA
1.C. CCS	NA	NA	NA	NA	NA	NA
2. IPPU	**1 088.33**	**1 182.22**	**1 058.86**	**1 214.52**	**1 141.01**	**1 242.23**
2.A. Mineral industry	NA	NA	NA	NA	NA	NA
2.B. Chemical industry	NO	NO	NO	NO	NO	NO
2.C. Metal industry	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	NA	NA	NA	NA	NA	NA
2.E. Electronic industry	NO	NO	NO	NO	NO	NO
2.F. Product uses as substitutes for ODS	1 076.51	1 167.40	1 040.16	1 191.00	1 111.67	1 206.05
2.G. Other product manufacture and use	11.82	14.83	18.70	23.52	29.34	36.19
2.H. Other	NA	NA	NA	NA	NA	NA
3. Agriculture	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
3.A. Enteric fermentation	NA	NA	NA	NA	NA	NA
3.B. Manure management	NA	NA	NA	NA	NA	NA
3.C. Rice cultivation	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NA	NA	NA	NA	NA
3.E. Prescribed burning of savannahs	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	NA	NA	NA	NA	NA
3.G. Liming	NA	NA	NA	NA	NA	NA
3.H. Urea application	NA	NA	NA	NA	NA	NA
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NA	NA	NA	NA	NA
4. LULUCF	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
4.A. Forest land	NA	NA	NA	NA	NA	NA
4.B. Cropland	NA	NA	NA	NA	NA	NA
4.C. Grassland	NA	NA	NA	NA	NA	NA
4.D. Wetlands	NA	NA	NA	NA	NA	NA
4.E. Settlements	NA	NA	NA	NA	NA	NA
4.F. Other land	NA	NA	NA	NA	NA	NA
4.G. Harvested wood products	NA	NA	NA	NA	NA	NA
4.H. Other	NA	NA	NA	NA	NA	NA
5. Waste	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
5.A. Solid waste disposal	NA	NA	NA	NA	NA	NA
5.B. Biological treatment of solid waste	NA	NA	NA	NA	NA	NA
5.C. Incineration and open burning of waste	NA	NA	NA	NA	NA	NA
5.D. Wastewater treatment and discharge	NA	NA	NA	NA	NA	NA
5.E. Other	NA	NA	NA	NA	NA	NA
6. Other	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo items:						
1.D.1. International bunkers	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
1.D.1.a. Aviation	NA	NA	NA	NA	NA	NA
1.D.1.b. Navigation	NA	NA	NA	NA	NA	NA
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
1.D.3. CO_2 emissions from biomass	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Table 657 Summary tables of the GHG emissions inventory for years 1990 – 2020

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1990

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	55 829.99	28 195.26	4 952.61	NA	NE	NE	0.16	NE	88 978.03
1. Energy	49 858.61	17 988.40	349.33	NA	NA	NA	NA	NA	68 196.34
1.A. Fuel combustion	46 819.95	97.22	336.83	NA	NA	NA	NA	NA	47 254.00
1.A.1. Energy industries	21 356.12	11.65	13.50	NA	NA	NA	NA	NA	21 381.27
1.A.2. Manufacturing industries and construction	4 336.62	2.81	5.27	NA	NA	NA	NA	NA	4 344.70
1.A.3. Transport	13 847.43	59.12	307.80	NA	NA	NA	NA	NA	14 214.35
1.A.4. Other sectors	7 279.79	23.63	10.27	NA	NA	NA	NA	NA	7 313.69
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 038.66	17 891.18	12.50	NA	NA	NA	NA	NA	20 942.34
1.B.1. Solid fuels	NE	0.77	NA	NA	NA	NA	NA	NA	0.77
1.B.2. Oil and natural gas and other emissions from energy production	3 038.66	17 890.41	12.50	NA	NA	NA	NA	NA	20 941.57
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	13 344.62	18.65	427.99	NA	NE	NE	0.16	NE	13 791.41
2.A. Mineral industry	2 660.95	NO	NO	NA	NA	NA	NA	NA	2 660.95
2.B. Chemical industry	781.47	17.16	427.99	NO	NO	NO	NO	NO	1 226.61
2.C. Metal industry	9 902.20	1.50	NO	NA	NO	NO	NO	NO	9 903.69
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	NA	NE	NE	NO	NE	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.16	NE	0.16
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	NE	7 381.08	3 849.77	NA	NA	NA	NA	NA	11 230.85
3.A. Enteric fermentation	NA	6 523.74	NA	NA	NA	NA	NA	NA	6 523.74
3.B. Manure management	NA	791.26	2 956.40	NA	NA	NA	NA	NA	3 747.65
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	872.95	NA	NA	NA	NA	NA	872.95
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	66.08	20.42	NA	NA	NA	NA	NA	86.50
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NA	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	-7 773.18	46.88	30.91	NA	NA	NA	NA	NA	-7 695.39
4.A. Forest land	-7 773.18	46.88	30.91	NA	NA	NA	NA	NA	-7 695.39
4.B. Cropland	NE	NE	NE	NA	NA	NA	NA	NA	NE
4.C. Grassland	NE	NE	NE	NA	NA	NA	NA	NA	NE
4.D. Wetlands	NE	NE	NE	NA	NA	NA	NA	NA	NE
4.E. Settlements	NE	NE	NE	NA	NA	NA	NA	NA	NE
4.F. Other land	NE	NE	NE	NA	NA	NA	NA	NA	NE
4.G. Harvested wood products	NE	NA	NA	NA	NA	NA	NA	NA	NE
4.H. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
5. Waste	399.95	2 760.26	294.61	NA	NA	NA	NA	NA	3 454.82
5.A. Solid waste disposal	NA	1 278.19	NA	NA	NA	NA	NA	NA	1 278.19
5.B. Biological treatment of solid waste	NA	23.01	16.46	NA	NA	NA	NA	NA	39.46
5.C. Incineration and open burning of waste	399.95	0.14	20.38	NA	NA	NA	NA	NA	420.46
5.D. Waste water treatment and discharge	NA	1 458.92	257.78	NA	NA	NA	NA	NA	1 716.70
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO
Memo items:									
1.D.1. International bunkers	1 016.50	1.33	8.21	NA	NA	NA	NA	NA	1 026.04
1.D.1.a. Aviation	477.32	0.08	3.98	NA	NA	NA	NA	NA	481.38
1.D.1.b. Navigation	539.18	1.24	4.23	NA	NA	NA	NA	NA	544.65
1.D.2. Multilateral operations	NO	NO	NO	NA	NA	NA	NA	NA	NO
1.D.3. CO_2 emissions from biomass	0.06	NA	NA	NA	NA	NA	NA	NA	0.06
1.D.4. CO_2 captured	NO	NA	NA	NA	NA	NA	NA	NA	NO
5.F.1. Long-term storage of C in waste disposal sites	NE	NA	NA	NA	NA	NA	NA	NA	NE
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	
Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	96 673.41
Total CO_2 equivalent emissions with LULUCF	88 978.03
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	96 673.41
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	88 978.03

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions.

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1991

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) [2]								
Total (net emissions) [1]	**57 180.53**	**28 376.30**	**5 341.45**	**NA**	**NE**	**NE**	**0.18**	**NE**	**90 898.47**
1. Energy	**52 905.33**	**18 447.49**	**318.94**	**NA**	**NA**	**NA**	**NA**	NA	**71 671.76**
1.A. Fuel combustion	49 842.82	97.26	306.37	NA	NA	NA	NA	NA	50 246.44
1.A.1. Energy industries	22 550.58	12.38	14.09	NA	NA	NA	NA	NA	22 577.05
1.A.2. Manufacturing industries and construction	4 620.22	2.94	5.44	NA	NA	NA	NA	NA	4 628.60
1.A.3. Transport	12 355.13	52.98	275.19	NA	NA	NA	NA	NA	12 683.30
1.A.4. Other sectors	10 316.89	28.96	11.65	NA	NA	NA	NA	NA	10 357.50
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 062.51	18 350.24	12.57	NA	NA	NA	NA	NA	21 425.31
1.B.1. Solid fuels	NE	0.89	NA	NA	NA	NA	NA	NA	0.89
1.B.2. Oil and natural gas and other emissions from energy production	3 062.51	18 349.35	12.57	NA	NA	NA	NA	NA	21 424.43
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**11 670.20**	**17.95**	**427.99**	**NA**	**NE**	**NE**	**0.18**	**NE**	**12 116.32**
2.A. Mineral industry	2 661.19	NO	NO	NA	NA	NA	NA	NA	2 661.19
2.B. Chemical industry	773.43	16.47	427.99	NO	NO	NO	NO	NO	1 217.88
2.C. Metal industry	8 235.58	1.49	NO	NA	NO	NO	NO	NO	8 237.07
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	NA	NE	NE	NO	NE	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.18	NE	0.18
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 098.79**	**4 278.62**	**NA**	**NA**	**NA**	**NA**	**NA**	**11 377.41**
3.A. Enteric fermentation	NA	6 245.40	NA	NA	NA	NA	NA	NA	6 245.40
3.B. Manure management	NA	757.55	2 832.51	NA	NA	NA	NA	NA	3 590.06
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 416.49	NA	NA	NA	NA	NA	1 416.49
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	95.84	29.62	NA	NA	NA	NA	NA	125.46
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry [1]	**-7 798.83**	**22.16**	**14.61**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 762.06**
4.A. Forest land	-7 798.83	22.16	14.61	**NA**	**NA**	**NA**	**NA**	**NA**	-7 762.06
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**403.84**	**2 789.91**	**301.30**	**NA**	**NA**	**NA**	**NA**	**NA**	**3 495.04**
5.A. Solid waste disposal	NA	1 362.70	NA	NA	NA	NA	NA	NA	1 362.70
5.B. Biological treatment of solid waste	NA	22.72	16.25	NA	NA	NA	NA	NA	38.96
5.C. Incineration and open burning of waste	403.84	0.15	20.87	NA	NA	NA	NA	NA	424.85
5.D. Waste water treatment and discharge	NA	1 404.35	264.18	NA	NA	NA	NA	NA	1 668.53
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 092.85**	**1.51**	**8.82**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 103.17**
1.D.1.a. Aviation	477.32	0.08	3.98	NA	NA	NA	NA	NA	481.38
1.D.1.b. Navigation	615.52	1.42	4.84	NA	NA	NA	NA	NA	621.79
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.04**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.04**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**98 660.53**
Total CO_2 equivalent emissions with LULUCF	**90 898.47**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**98 660.53**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**90 898.47**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1992

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**60 617.63**	**28 083.56**	**5 630.53**	**NA**	**NE**	**NE**	**0.21**	**NE**	**94 331.93**
1. Energy	**55 237.36**	**17 618.26**	**376.92**	**NA**	**NA**	**NA**	**NA**	NA	**73 232.53**
1.A. Fuel combustion	52 317.27	106.73	364.95	NA	NA	NA	NA	NA	52 788.94
1.A.1. Energy industries	22 532.87	12.64	14.03	NA	NA	NA	NA	NA	22 559.54
1.A.2. Manufacturing industries and construction	4 745.94	3.02	5.57	NA	NA	NA	NA	NA	4 754.53
1.A.3. Transport	15 285.08	63.10	333.95	NA	NA	NA	NA	NA	15 682.13
1.A.4. Other sectors	9 753.38	27.97	11.39	NA	NA	NA	NA	NA	9 792.75
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	2 920.09	17 511.53	11.97	NA	NA	NA	NA	NA	20 443.59
1.B.1. Solid fuels	NE	1.06	NA	NA	NA	NA	NA	NA	1.06
1.B.2. Oil and natural gas and other emissions from energy production	2 920.09	17 510.47	11.97	NA	NA	NA	NA	NA	20 442.53
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**12 224.45**	**18.74**	**427.99**	**NA**	**NE**	**NE**	**0.21**	**NE**	**12 671.39**
2.A. Mineral industry	2 981.50	NO	NO	NA	NA	NA	NA	NA	2 981.50
2.B. Chemical industry	782.74	17.27	427.99	NO	NO	NO	NO	NO	1 227.99
2.C. Metal industry	8 460.21	1.48	NO	NA	NO	NO	NO	NO	8 461.69
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	NA	NE	NE	NO	NE	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.21	NE	0.21
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 510.12**	**4 492.38**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 002.50**
3.A. Enteric fermentation	NA	6 617.61	NA	NA	NA	NA	NA	NA	6 617.61
3.B. Manure management	NA	793.88	2 974.46	NA	NA	NA	NA	NA	3 768.34
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 487.43	NA	NA	NA	NA	NA	1 487.43
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	98.63	30.48	NA	NA	NA	NA	NA	129.12
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 255.69**	**38.24**	**25.21**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 192.24**
4.A. Forest land	-7 255.69	38.24	25.21	**NA**	**NA**	**NA**	**NA**	**NA**	-7 192.24
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**411.51**	**2 898.20**	**308.04**	**NA**	**NA**	**NA**	**NA**	**NA**	**3 617.75**
5.A. Solid waste disposal	NA	1 441.15	NA	NA	NA	NA	NA	NA	1 441.15
5.B. Biological treatment of solid waste	NA	22.42	16.03	NA	NA	NA	NA	NA	38.45
5.C. Incineration and open burning of waste	411.51	0.15	21.36	NA	NA	NA	NA	NA	433.01
5.D. Waste water treatment and discharge	NA	1 434.48	270.65	NA	NA	NA	NA	NA	1 705.13
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**968.31**	**1.23**	**7.87**	**NA**	**NA**	**NA**	**NA**	**NA**	**977.41**
1.D.1.a. Aviation	477.32	0.08	3.98	NA	NA	NA	NA	NA	481.38
1.D.1.b. Navigation	490.99	1.14	3.90	NA	NA	NA	NA	NA	496.03
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.04**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.04**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**101 524.17**
Total CO_2 equivalent emissions with LULUCF	**94 331.93**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**101 524.17**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**94 331.93**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions.

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1993

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) [2]								
Total (net emissions) [1]	**64 739.09**	**28 926.01**	**5 794.47**	**NA**	**NE**	**NE**	**0.24**	**NE**	**99 459.81**
1. Energy	**58 159.65**	**18 180.39**	**345.16**	**NA**	**NA**	**NA**	**NA**	NA	**76 685.20**
1.A. Fuel combustion	55 175.97	113.41	332.94	NA	NA	NA	NA	NA	55 622.32
1.A.1. Energy industries	26 768.78	14.12	16.32	NA	NA	NA	NA	NA	26 799.23
1.A.2. Manufacturing industries and construction	4 279.01	2.78	5.20	NA	NA	NA	NA	NA	4 286.99
1.A.3. Transport	12 944.10	63.44	298.96	NA	NA	NA	NA	NA	13 306.50
1.A.4. Other sectors	11 184.07	33.07	12.45	NA	NA	NA	NA	NA	11 229.60
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	2 983.68	18 066.98	12.22	NA	NA	NA	NA	NA	21 062.89
1.B.1. Solid fuels	NE	0.82	NA	NA	NA	NA	NA	NA	0.82
1.B.2. Oil and natural gas and other emissions from energy production	2 983.68	18 066.16	12.22	NA	NA	NA	NA	NA	21 062.06
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**11 216.19**	**18.15**	**427.99**	**NA**	**NE**	**NE**	**0.24**	**NE**	**11 662.56**
2.A. Mineral industry	2 922.80	NO	NO	NA	NA	NA	NA	NA	2 922.80
2.B. Chemical industry	775.44	16.64	427.99	NO	NO	NO	NO	NO	1 220.06
2.C. Metal industry	7 517.95	1.51	NO	NA	NO	NO	NO	NO	7 519.46
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	NA	NE	NE	NO	NE	NA
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.24	NE	0.24
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 620.63**	**4 637.51**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 258.14**
3.A. Enteric fermentation	NA	6 737.64	NA	NA	NA	NA	NA	NA	6 737.64
3.B. Manure management	NA	828.73	3 031.26	NA	NA	NA	NA	NA	3 859.99
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 589.49	NA	NA	NA	NA	NA	1 589.49
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	54.25	16.77	NA	NA	NA	NA	NA	71.02
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry [1]	**-5 055.25**	**104.82**	**69.12**	**NA**	**NA**	**NA**	**NA**	**NA**	**-4 881.31**
4.A. Forest land	-5 055.25	104.82	69.12	**NA**	**NA**	**NA**	**NA**	**NA**	-4 881.31
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**418.49**	**3 002.02**	**314.70**	**NA**	**NA**	**NA**	**NA**	**NA**	**3 735.21**
5.A. Solid waste disposal	NA	1 523.37	NA	NA	NA	NA	NA	NA	1 523.37
5.B. Biological treatment of solid waste	NA	22.09	15.80	NA	NA	NA	NA	NA	37.90
5.C. Incineration and open burning of waste	418.49	0.15	21.83	NA	NA	NA	NA	NA	440.47
5.D. Waste water treatment and discharge	NA	1 456.40	277.07	NA	NA	NA	NA	NA	1 733.47
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

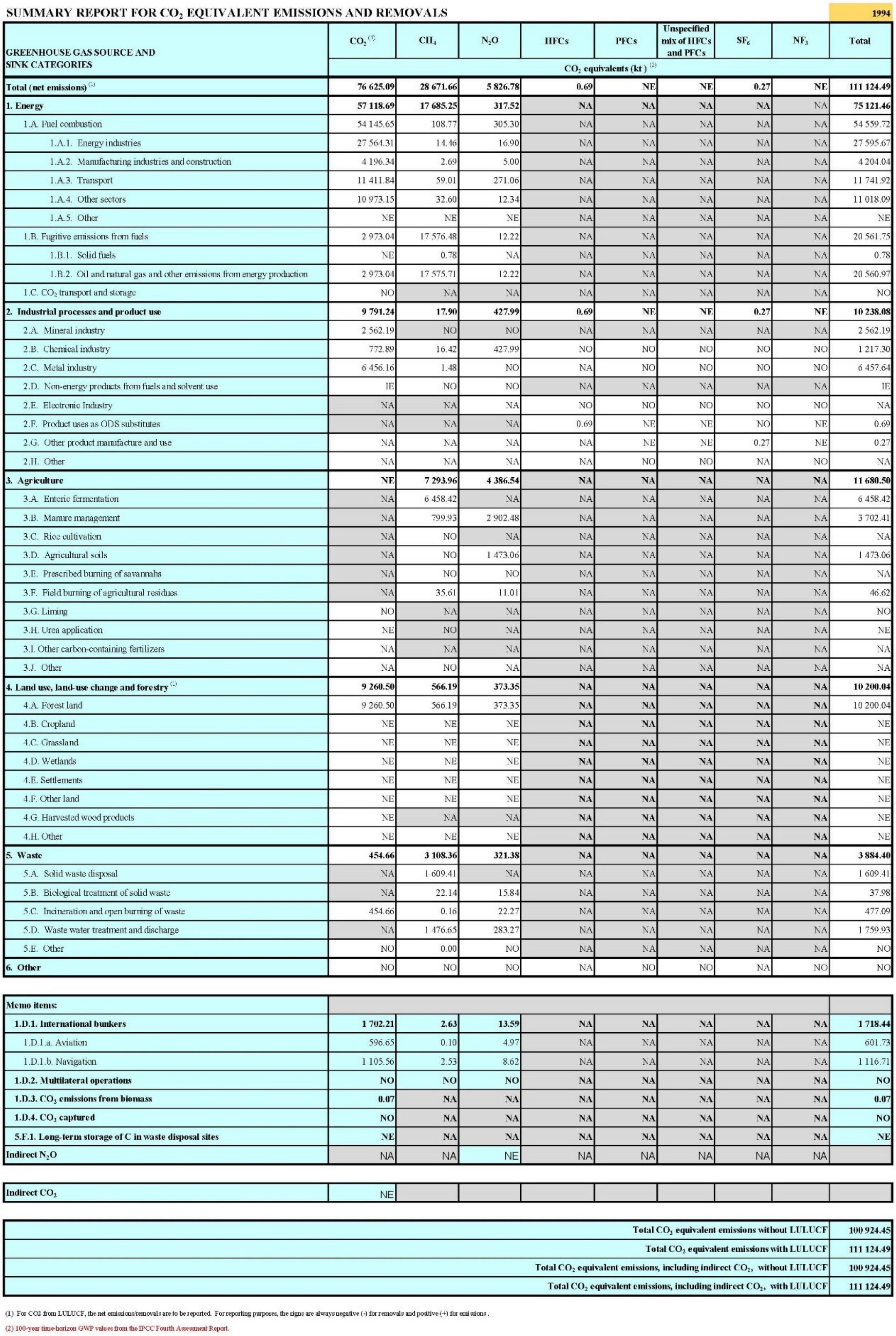
Memo items:									
1.D.1. International bunkers	**1 509.11**	**2.44**	**12.01**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 523.57**
1.D.1.a. Aviation	477.32	0.08	3.98	NA	NA	NA	NA	NA	481.38
1.D.1.b. Navigation	1 031.79	2.36	8.04	NA	NA	NA	NA	NA	1 042.19
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.07**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.07**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**104 341.12**
Total CO_2 equivalent emissions with LULUCF	**99 459.81**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**104 341.12**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**99 459.81**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1994

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**76 625.09**	**28 671.66**	**5 826.78**	**0.69**	**NE**	**NE**	**0.27**	**NE**	**111 124.49**
1. Energy	**57 118.69**	**17 685.25**	**317.52**	**NA**	**NA**	**NA**	**NA**	NA	**75 121.46**
1.A. Fuel combustion	54 145.65	108.77	305.30	NA	NA	NA	NA	NA	54 559.72
1.A.1. Energy industries	27 564.31	14.46	16.90	NA	NA	NA	NA	NA	27 595.67
1.A.2. Manufacturing industries and construction	4 196.34	2.69	5.00	NA	NA	NA	NA	NA	4 204.04
1.A.3. Transport	11 411.84	59.01	271.06	NA	NA	NA	NA	NA	11 741.92
1.A.4. Other sectors	10 973.15	32.60	12.34	NA	NA	NA	NA	NA	11 018.09
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	2 973.04	17 576.48	12.22	NA	NA	NA	NA	NA	20 561.75
1.B.1. Solid fuels	NE	0.78	NA	NA	NA	NA	NA	NA	0.78
1.B.2. Oil and natural gas and other emissions from energy production	2 973.04	17 575.71	12.22	NA	NA	NA	NA	NA	20 560.97
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**9 791.24**	**17.90**	**427.99**	**0.69**	**NE**	**NE**	**0.27**	**NE**	**10 238.08**
2.A. Mineral industry	2 562.19	NO	NO	NA	NA	NA	NA	NA	2 562.19
2.B. Chemical industry	772.89	16.42	427.99	NO	NO	NO	NO	NO	1 217.30
2.C. Metal industry	6 456.16	1.48	NO	NA	NO	NO	NO	NO	6 457.64
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	0.69	NE	NE	NO	NE	0.69
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.27	NE	0.27
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 293.96**	**4 386.54**	**NA**	**NA**	**NA**	**NA**	**NA**	**11 680.50**
3.A. Enteric fermentation	NA	6 458.42	NA	NA	NA	NA	NA	NA	6 458.42
3.B. Manure management	NA	799.93	2 902.48	NA	NA	NA	NA	NA	3 702.41
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 473.06	NA	NA	NA	NA	NA	1 473.06
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	35.61	11.01	NA	NA	NA	NA	NA	46.62
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**9 260.50**	**566.19**	**373.35**	**NA**	**NA**	**NA**	**NA**	**NA**	**10 200.04**
4.A. Forest land	9 260.50	566.19	373.35	**NA**	**NA**	**NA**	**NA**	**NA**	10 200.04
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**454.66**	**3 108.36**	**321.38**	**NA**	**NA**	**NA**	**NA**	**NA**	**3 884.40**
5.A. Solid waste disposal	NA	1 609.41	NA	NA	NA	NA	NA	NA	1 609.41
5.B. Biological treatment of solid waste	NA	22.14	15.84	NA	NA	NA	NA	NA	37.98
5.C. Incineration and open burning of waste	454.66	0.16	22.27	NA	NA	NA	NA	NA	477.09
5.D. Waste water treatment and discharge	NA	1 476.65	283.27	NA	NA	NA	NA	NA	1 759.93
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 702.21**	**2.63**	**13.59**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 718.44**
1.D.1.a. Aviation	596.65	0.10	4.97	NA	NA	NA	NA	NA	601.73
1.D.1.b. Navigation	1 105.56	2.53	8.62	NA	NA	NA	NA	NA	1 116.71
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.07**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.07**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**100 924.45**
Total CO_2 equivalent emissions with LULUCF	**111 124.49**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**100 924.45**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**111 124.49**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1995

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**62 850.74**	**30 942.03**	**5 376.79**	**1.22**	**NE**	**NE**	**0.31**	**NE**	**99 171.10**
1. Energy	**56 953.67**	**20 244.20**	**302.88**	**NA**	**NA**	**NA**	**NA**	NA	**77 500.76**
1.A. Fuel combustion	53 861.41	105.70	290.34	NA	NA	NA	NA	NA	54 257.45
1.A.1. Energy industries	27 865.01	14.56	16.97	NA	NA	NA	NA	NA	27 896.54
1.A.2. Manufacturing industries and construction	4 330.21	2.83	5.33	NA	NA	NA	NA	NA	4 338.37
1.A.3. Transport	10 869.63	56.11	255.80	NA	NA	NA	NA	NA	11 181.53
1.A.4. Other sectors	10 796.56	32.21	12.25	NA	NA	NA	NA	NA	10 841.01
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 092.26	20 138.51	12.54	NA	NA	NA	NA	NA	23 243.31
1.B.1. Solid fuels	NE	0.78	NA	NA	NA	NA	NA	NA	0.78
1.B.2. Oil and natural gas and other emissions from energy production	3 092.26	20 137.73	12.54	NA	NA	NA	NA	NA	23 242.53
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**10 829.04**	**17.02**	**433.86**	**1.22**	**NE**	**NE**	**0.31**	**NE**	**11 281.45**
2.A. Mineral industry	2 853.81	NO	NO	NA	NA	NA	NA	NA	2 853.81
2.B. Chemical industry	797.27	15.47	433.86	NO	NO	NO	NO	NO	1 246.60
2.C. Metal industry	7 177.96	1.55	NO	NA	NO	NO	NO	NO	7 179.51
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1.22	NE	NE	NO	NE	1.22
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.31	NE	0.31
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 375.67**	**4 251.49**	**NA**	**NA**	**NA**	**NA**	**NA**	**11 627.16**
3.A. Enteric fermentation	NA	6 514.52	NA	NA	NA	NA	NA	NA	6 514.52
3.B. Manure management	NA	789.54	2 897.95	NA	NA	NA	NA	NA	3 687.49
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 331.41	NA	NA	NA	NA	NA	1 331.41
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	71.61	22.13	NA	NA	NA	NA	NA	93.75
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-5 388.85**	**70.71**	**46.62**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5 271.52**
4.A. Forest land	-5 388.85	70.71	46.62	**NA**	**NA**	**NA**	**NA**	**NA**	-5 271.52
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**456.88**	**3 234.43**	**341.93**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 033.24**
5.A. Solid waste disposal	NA	1 718.18	NA	NA	NA	NA	NA	NA	1 718.18
5.B. Biological treatment of solid waste	NA	21.73	15.54	NA	NA	NA	NA	NA	37.27
5.C. Incineration and open burning of waste	456.88	0.16	22.67	NA	NA	NA	NA	NA	479.70
5.D. Waste water treatment and discharge	NA	1 494.37	303.73	NA	NA	NA	NA	NA	1 798.09
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 902.91**	**2.78**	**15.26**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 920.95**
1.D.1.a. Aviation	745.82	0.13	6.22	NA	NA	NA	NA	NA	752.16
1.D.1.b. Navigation	1 157.09	2.65	9.04	NA	NA	NA	NA	NA	1 168.79
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.07**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.07**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**104 442.61**
Total CO_2 equivalent emissions with LULUCF	**99 171.10**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**104 442.61**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**99 171.10**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1996

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**59 036.74**	**32 414.28**	**5 399.30**	**2.12**	**NE**	**NE**	**0.34**	**NE**	**96 852.79**
1. Energy	**56 688.45**	**21 547.13**	**295.32**	**NA**	**NA**	**NA**	**NA**	NA	**78 530.90**
1.A. Fuel combustion	53 457.27	105.58	282.26	NA	NA	NA	NA	NA	53 845.11
1.A.1. Energy industries	27 797.30	13.85	17.18	NA	NA	NA	NA	NA	27 828.33
1.A.2. Manufacturing industries and construction	4 357.68	2.86	5.39	NA	NA	NA	NA	NA	4 365.93
1.A.3. Transport	10 503.28	56.66	247.43	NA	NA	NA	NA	NA	10 807.38
1.A.4. Other sectors	10 799.01	32.21	12.25	NA	NA	NA	NA	NA	10 843.47
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 231.18	21 441.56	13.06	NA	NA	NA	NA	NA	24 685.79
1.B.1. Solid fuels	NE	0.32	NA	NA	NA	NA	NA	NA	0.32
1.B.2. Oil and natural gas and other emissions from energy production	3 231.18	21 441.23	13.06	NA	NA	NA	NA	NA	24 685.47
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**9 744.59**	**13.37**	**439.74**	**2.12**	**NE**	**NE**	**0.34**	**NE**	**10 200.17**
2.A. Mineral industry	3 136.17	NO	NO	NA	NA	NA	NA	NA	3 136.17
2.B. Chemical industry	792.29	12.01	439.74	NO	NO	NO	NO	NO	1 244.04
2.C. Metal industry	5 816.13	1.37	NO	NA	NO	NO	NO	NO	5 817.50
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	2.12	NE	NE	NO	NE	2.12
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.34	NE	0.34
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 484.43**	**4 292.62**	**NA**	**NA**	**NA**	**NA**	**NA**	**11 777.04**
3.A. Enteric fermentation	NA	6 595.88	NA	NA	NA	NA	NA	NA	6 595.88
3.B. Manure management	NA	786.89	2 911.48	NA	NA	NA	NA	NA	3 698.37
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 349.72	NA	NA	NA	NA	NA	1 349.72
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	101.66	31.42	NA	NA	NA	NA	NA	133.07
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 853.71**	**14.10**	**9.30**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 830.31**
4.A. Forest land	-7 853.71	14.10	9.30	**NA**	**NA**	**NA**	**NA**	**NA**	-7 830.31
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**457.41**	**3 355.24**	**362.32**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 174.98**
5.A. Solid waste disposal	NA	1 828.70	NA	NA	NA	NA	NA	NA	1 828.70
5.B. Biological treatment of solid waste	NA	21.27	15.21	NA	NA	NA	NA	NA	36.48
5.C. Incineration and open burning of waste	457.41	0.16	23.00	NA	NA	NA	NA	NA	480.57
5.D. Waste water treatment and discharge	NA	1 505.12	324.11	NA	NA	NA	NA	NA	1 829.23
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 806.53**	**2.50**	**14.51**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 823.55**
1.D.1.a. Aviation	775.65	0.14	6.47	NA	NA	NA	NA	NA	782.25
1.D.1.b. Navigation	1 030.88	2.36	8.05	NA	NA	NA	NA	NA	1 041.30
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.07**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.07**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**104 683.09**
Total CO_2 equivalent emissions with LULUCF	**96 852.79**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**104 683.09**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**96 852.79**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1997

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**60 856.37**	**34 300.00**	**5 487.41**	**3.09**	**NE**	**NE**	**0.39**	**NE**	**100 647.26**
1. Energy	**58 199.16**	**23 262.07**	**288.72**	**NA**	**NA**	**NA**	**NA**	NA	**81 749.95**
1.A. Fuel combustion	54 793.96	108.94	275.04	NA	NA	NA	NA	NA	55 177.93
1.A.1. Energy industries	28 561.99	14.50	17.35	NA	NA	NA	NA	NA	28 593.85
1.A.2. Manufacturing industries and construction	5 244.46	3.44	6.50	NA	NA	NA	NA	NA	5 254.39
1.A.3. Transport	10 225.27	57.27	238.71	NA	NA	NA	NA	NA	10 521.25
1.A.4. Other sectors	10 762.24	33.72	12.48	NA	NA	NA	NA	NA	10 808.45
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 405.21	23 153.14	13.68	NA	NA	NA	NA	NA	26 572.02
1.B.1. Solid fuels	NE	0.56	NA	NA	NA	NA	NA	NA	0.56
1.B.2. Oil and natural gas and other emissions from energy production	3 405.21	23 152.57	13.68	NA	NA	NA	NA	NA	26 571.45
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**9 332.27**	**11.12**	**445.62**	**3.09**	**NE**	**NE**	**0.39**	**NE**	**9 792.48**
2.A. Mineral industry	3 005.18	NO	NO	NA	NA	NA	NA	NA	3 005.18
2.B. Chemical industry	807.49	10.27	445.62	NO	NO	NO	NO	NO	1 263.38
2.C. Metal industry	5 519.60	0.85	NO	NA	NO	NO	NO	NO	5 520.45
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	3.09	NE	NE	NO	NE	3.09
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.39	NE	0.39
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 516.71**	**4 345.66**	**NA**	**NA**	**NA**	**NA**	**NA**	**11 862.36**
3.A. Enteric fermentation	NA	6 698.23	NA	NA	NA	NA	NA	NA	6 698.23
3.B. Manure management	NA	787.68	2 952.20	NA	NA	NA	NA	NA	3 739.87
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 383.94	NA	NA	NA	NA	NA	1 383.94
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	30.79	9.52	NA	NA	NA	NA	NA	40.31
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 131.83**	**37.24**	**24.56**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 070.03**
4.A. Forest land	-7 131.83	37.24	24.56	**NA**	**NA**	**NA**	**NA**	**NA**	-7 070.03
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**456.77**	**3 472.86**	**382.86**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 312.50**
5.A. Solid waste disposal	NA	1 940.62	NA	NA	NA	NA	NA	NA	1 940.62
5.B. Biological treatment of solid waste	NA	20.78	14.86	NA	NA	NA	NA	NA	35.65
5.C. Incineration and open burning of waste	456.77	0.16	23.30	NA	NA	NA	NA	NA	480.23
5.D. Waste water treatment and discharge	NA	1 511.30	344.70	NA	NA	NA	NA	NA	1 856.01
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

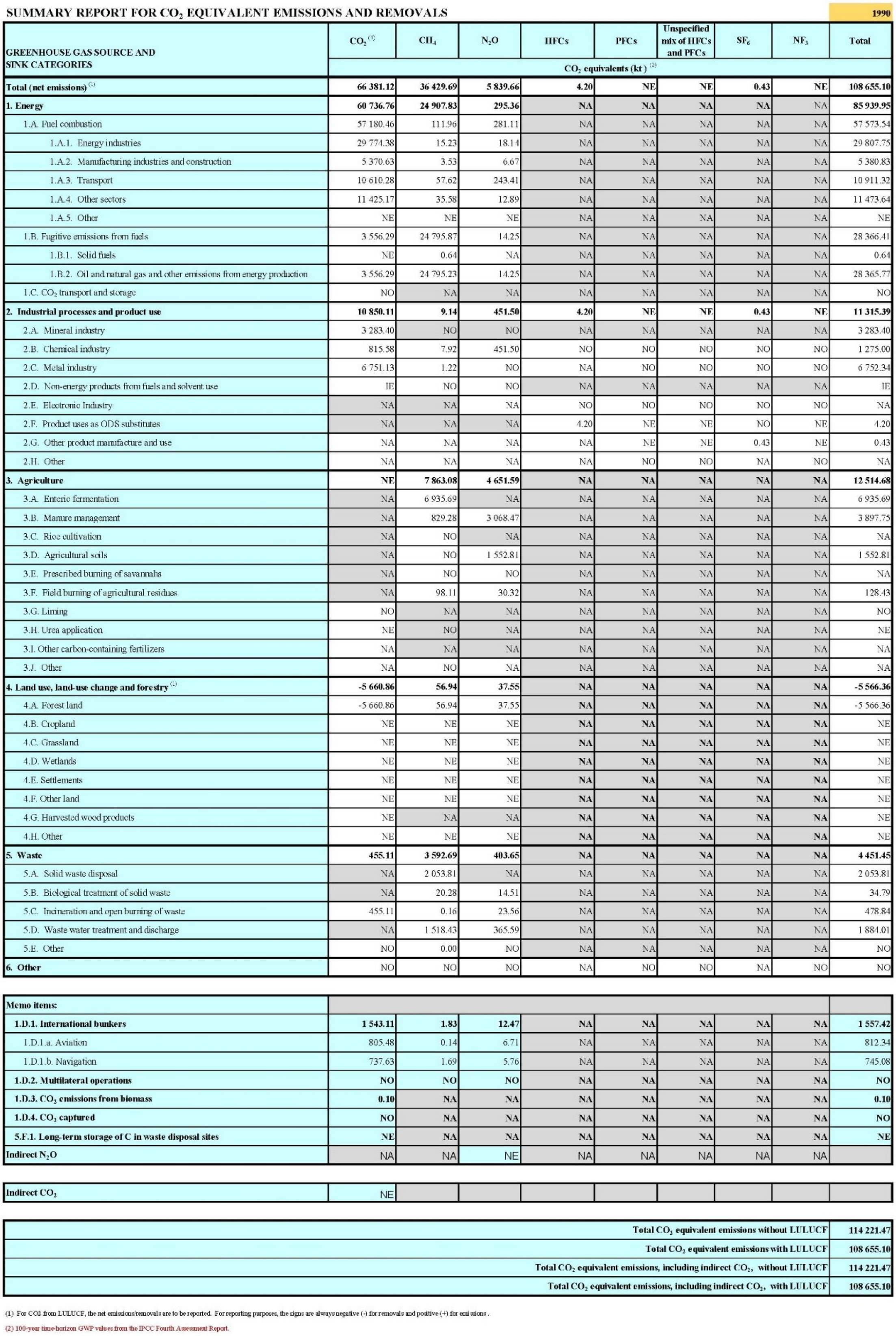
Memo items:									
1.D.1. International bunkers	**1 596.59**	**2.02**	**12.88**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 611.48**
1.D.1.a. Aviation	775.65	0.14	6.47	NA	NA	NA	NA	NA	782.25
1.D.1.b. Navigation	820.94	1.88	6.41	NA	NA	NA	NA	NA	829.23
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**107 717.29**
Total CO_2 equivalent emissions with LULUCF	**100 647.26**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**107 717.29**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**100 647.26**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

1990

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) [2]								
Total (net emissions) [1]	**66 381.12**	**36 429.69**	**5 839.66**	**4.20**	**NE**	**NE**	**0.43**	**NE**	**108 655.10**
1. Energy	**60 736.76**	**24 907.83**	**295.36**	**NA**	**NA**	**NA**	**NA**	NA	**85 939.95**
1.A. Fuel combustion	57 180.46	111.96	281.11	NA	NA	NA	NA	NA	57 573.54
1.A.1. Energy industries	29 774.38	15.23	18.14	NA	NA	NA	NA	NA	29 807.75
1.A.2. Manufacturing industries and construction	5 370.63	3.53	6.67	NA	NA	NA	NA	NA	5 380.83
1.A.3. Transport	10 610.28	57.62	243.41	NA	NA	NA	NA	NA	10 911.32
1.A.4. Other sectors	11 425.17	35.58	12.89	NA	NA	NA	NA	NA	11 473.64
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 556.29	24 795.87	14.25	NA	NA	NA	NA	NA	28 366.41
1.B.1. Solid fuels	NE	0.64	NA	NA	NA	NA	NA	NA	0.64
1.B.2. Oil and natural gas and other emissions from energy production	3 556.29	24 795.23	14.25	NA	NA	NA	NA	NA	28 365.77
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**10 850.11**	**9.14**	**451.50**	**4.20**	**NE**	**NE**	**0.43**	**NE**	**11 315.39**
2.A. Mineral industry	3 283.40	NO	NO	NA	NA	NA	NA	NA	3 283.40
2.B. Chemical industry	815.58	7.92	451.50	NO	NO	NO	NO	NO	1 275.00
2.C. Metal industry	6 751.13	1.22	NO	NA	NO	NO	NO	NO	6 752.34
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	4.20	NE	NE	NO	NE	4.20
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.43	NE	0.43
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 863.08**	**4 651.59**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 514.68**
3.A. Enteric fermentation	NA	6 935.69	NA	NA	NA	NA	NA	NA	6 935.69
3.B. Manure management	NA	829.28	3 068.47	NA	NA	NA	NA	NA	3 897.75
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 552.81	NA	NA	NA	NA	NA	1 552.81
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	98.11	30.32	NA	NA	NA	NA	NA	128.43
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry [1]	**-5 660.86**	**56.94**	**37.55**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5 566.36**
4.A. Forest land	-5 660.86	56.94	37.55	**NA**	**NA**	**NA**	**NA**	**NA**	-5 566.36
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**455.11**	**3 592.69**	**403.65**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 451.45**
5.A. Solid waste disposal	NA	2 053.81	NA	NA	NA	NA	NA	NA	2 053.81
5.B. Biological treatment of solid waste	NA	20.28	14.51	NA	NA	NA	NA	NA	34.79
5.C. Incineration and open burning of waste	455.11	0.16	23.56	NA	NA	NA	NA	NA	478.84
5.D. Waste water treatment and discharge	NA	1 518.43	365.59	NA	NA	NA	NA	NA	1 884.01
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

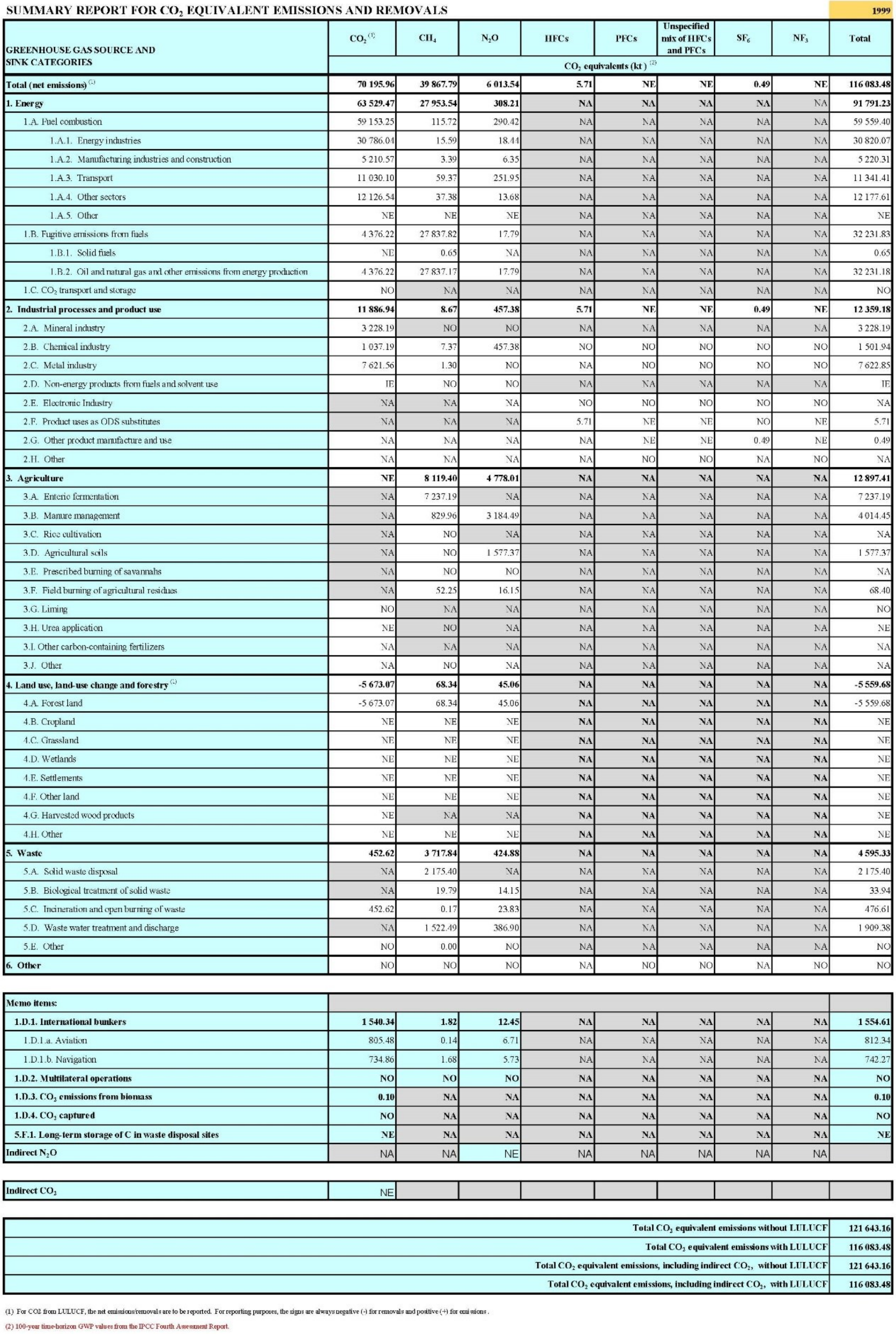
Memo items:									
1.D.1. International bunkers	**1 543.11**	**1.83**	**12.47**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 557.42**
1.D.1.a. Aviation	805.48	0.14	6.71	NA	NA	NA	NA	NA	812.34
1.D.1.b. Navigation	737.63	1.69	5.76	NA	NA	NA	NA	NA	745.08
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**114 221.47**
Total CO_2 equivalent emissions with LULUCF	**108 655.10**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**114 221.47**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**108 655.10**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS **1999**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**70 195.96**	**39 867.79**	**6 013.54**	**5.71**	**NE**	**NE**	**0.49**	**NE**	**116 083.48**
1. Energy	**63 529.47**	**27 953.54**	**308.21**	**NA**	**NA**	**NA**	**NA**	NA	**91 791.23**
1.A. Fuel combustion	59 153.25	115.72	290.42	NA	NA	NA	NA	NA	59 559.40
1.A.1. Energy industries	30 786.04	15.59	18.44	NA	NA	NA	NA	NA	30 820.07
1.A.2. Manufacturing industries and construction	5 210.57	3.39	6.35	NA	NA	NA	NA	NA	5 220.31
1.A.3. Transport	11 030.10	59.37	251.95	NA	NA	NA	NA	NA	11 341.41
1.A.4. Other sectors	12 126.54	37.38	13.68	NA	NA	NA	NA	NA	12 177.61
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 376.22	27 837.82	17.79	NA	NA	NA	NA	NA	32 231.83
1.B.1. Solid fuels	NE	0.65	NA	NA	NA	NA	NA	NA	0.65
1.B.2. Oil and natural gas and other emissions from energy production	4 376.22	27 837.17	17.79	NA	NA	NA	NA	NA	32 231.18
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**11 886.94**	**8.67**	**457.38**	**5.71**	**NE**	**NE**	**0.49**	**NE**	**12 359.18**
2.A. Mineral industry	3 228.19	NO	NO	NA	NA	NA	NA	NA	3 228.19
2.B. Chemical industry	1 037.19	7.37	457.38	NO	NO	NO	NO	NO	1 501.94
2.C. Metal industry	7 621.56	1.30	NO	NA	NO	NO	NO	NO	7 622.85
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	5.71	NE	NE	NO	NE	5.71
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.49	NE	0.49
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 119.40**	**4 778.01**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 897.41**
3.A. Enteric fermentation	NA	7 237.19	NA	NA	NA	NA	NA	NA	7 237.19
3.B. Manure management	NA	829.96	3 184.49	NA	NA	NA	NA	NA	4 014.45
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 577.37	NA	NA	NA	NA	NA	1 577.37
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	52.25	16.15	NA	NA	NA	NA	NA	68.40
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-5 673.07**	**68.34**	**45.06**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5 559.68**
4.A. Forest land	-5 673.07	68.34	45.06	**NA**	**NA**	**NA**	**NA**	**NA**	-5 559.68
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**452.62**	**3 717.84**	**424.88**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 595.33**
5.A. Solid waste disposal	NA	2 175.40	NA	NA	NA	NA	NA	NA	2 175.40
5.B. Biological treatment of solid waste	NA	19.79	14.15	NA	NA	NA	NA	NA	33.94
5.C. Incineration and open burning of waste	452.62	0.17	23.83	NA	NA	NA	NA	NA	476.61
5.D. Waste water treatment and discharge	NA	1 522.49	386.90	NA	NA	NA	NA	NA	1 909.38
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

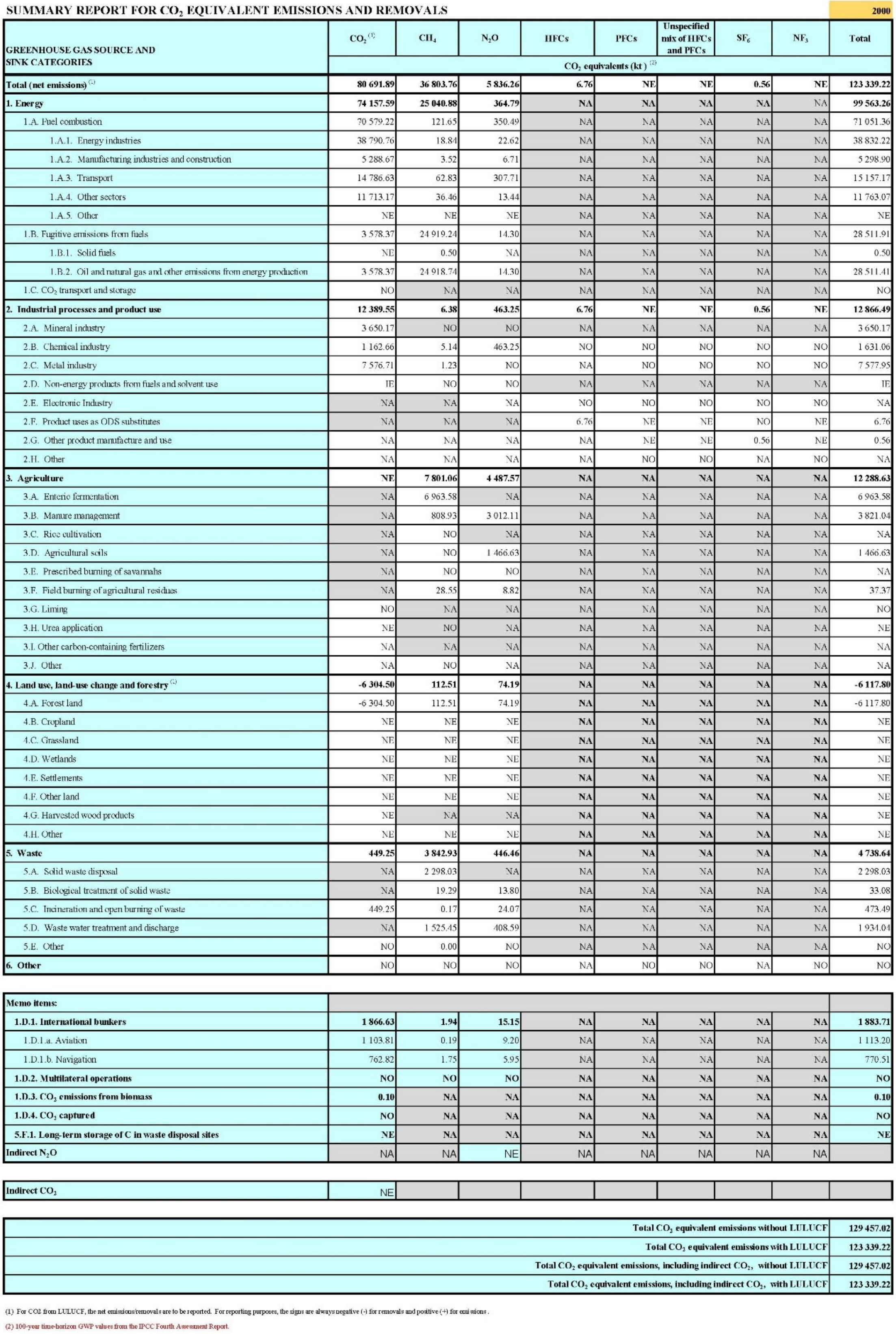
Memo items:									
1.D.1. International bunkers	**1 540.34**	**1.82**	**12.45**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 554.61**
1.D.1.a. Aviation	805.48	0.14	6.71	NA	NA	NA	NA	NA	812.34
1.D.1.b. Navigation	734.86	1.68	5.73	NA	NA	NA	NA	NA	742.27
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**121 643.16**
Total CO_2 equivalent emissions with LULUCF	**116 083.48**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**121 643.16**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**116 083.48**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2000

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**80 691.89**	**36 803.76**	**5 836.26**	**6.76**	**NE**	**NE**	**0.56**	**NE**	**123 339.22**
1. Energy	**74 157.59**	**25 040.88**	**364.79**	**NA**	**NA**	**NA**	**NA**	NA	**99 563.26**
1.A. Fuel combustion	70 579.22	121.65	350.49	NA	NA	NA	NA	NA	71 051.36
1.A.1. Energy industries	38 790.76	18.84	22.62	NA	NA	NA	NA	NA	38 832.22
1.A.2. Manufacturing industries and construction	5 288.67	3.52	6.71	NA	NA	NA	NA	NA	5 298.90
1.A.3. Transport	14 786.63	62.83	307.71	NA	NA	NA	NA	NA	15 157.17
1.A.4. Other sectors	11 713.17	36.46	13.44	NA	NA	NA	NA	NA	11 763.07
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 578.37	24 919.24	14.30	NA	NA	NA	NA	NA	28 511.91
1.B.1. Solid fuels	NE	0.50	NA	NA	NA	NA	NA	NA	0.50
1.B.2. Oil and natural gas and other emissions from energy production	3 578.37	24 918.74	14.30	NA	NA	NA	NA	NA	28 511.41
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**12 389.55**	**6.38**	**463.25**	**6.76**	**NE**	**NE**	**0.56**	**NE**	**12 866.49**
2.A. Mineral industry	3 650.17	NO	NO	NA	NA	NA	NA	NA	3 650.17
2.B. Chemical industry	1 162.66	5.14	463.25	NO	NO	NO	NO	NO	1 631.06
2.C. Metal industry	7 576.71	1.23	NO	NA	NO	NO	NO	NO	7 577.95
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	6.76	NE	NE	NO	NE	6.76
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.56	NE	0.56
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**7 801.06**	**4 487.57**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 288.63**
3.A. Enteric fermentation	NA	6 963.58	NA	NA	NA	NA	NA	NA	6 963.58
3.B. Manure management	NA	808.93	3 012.11	NA	NA	NA	NA	NA	3 821.04
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 466.63	NA	NA	NA	NA	NA	1 466.63
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	28.55	8.82	NA	NA	NA	NA	NA	37.37
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-6 304.50**	**112.51**	**74.19**	**NA**	**NA**	**NA**	**NA**	**NA**	**-6 117.80**
4.A. Forest land	-6 304.50	112.51	74.19	**NA**	**NA**	**NA**	**NA**	**NA**	-6 117.80
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**449.25**	**3 842.93**	**446.46**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 738.64**
5.A. Solid waste disposal	NA	2 298.03	NA	NA	NA	NA	NA	NA	2 298.03
5.B. Biological treatment of solid waste	NA	19.29	13.80	NA	NA	NA	NA	NA	33.08
5.C. Incineration and open burning of waste	449.25	0.17	24.07	NA	NA	NA	NA	NA	473.49
5.D. Waste water treatment and discharge	NA	1 525.45	408.59	NA	NA	NA	NA	NA	1 934.04
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

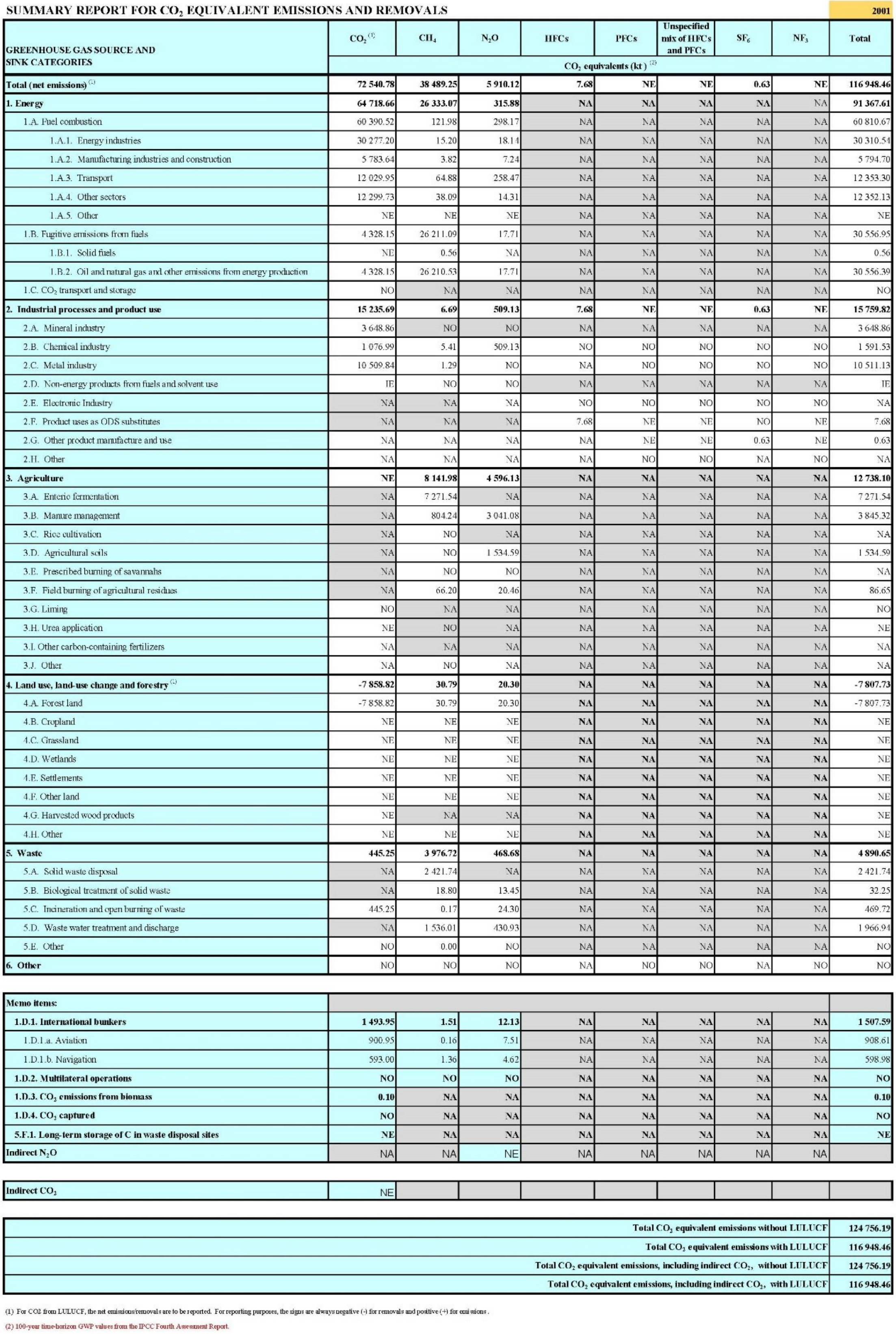
Memo items:									
1.D.1. International bunkers	**1 866.63**	**1.94**	**15.15**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 883.71**
1.D.1.a. Aviation	1 103.81	0.19	9.20	NA	NA	NA	NA	NA	1 113.20
1.D.1.b. Navigation	762.82	1.75	5.95	NA	NA	NA	NA	NA	770.51
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**129 457.02**
Total CO_2 equivalent emissions with LULUCF	**123 339.22**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**129 457.02**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**123 339.22**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2001

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**72 540.78**	**38 489.25**	**5 910.12**	**7.68**	**NE**	**NE**	**0.63**	**NE**	**116 948.46**
1. Energy	**64 718.66**	**26 333.07**	**315.88**	**NA**	**NA**	**NA**	**NA**	NA	**91 367.61**
1.A. Fuel combustion	60 390.52	121.98	298.17	NA	NA	NA	NA	NA	60 810.67
1.A.1. Energy industries	30 277.20	15.20	18.14	NA	NA	NA	NA	NA	30 310.54
1.A.2. Manufacturing industries and construction	5 783.64	3.82	7.24	NA	NA	NA	NA	NA	5 794.70
1.A.3. Transport	12 029.95	64.88	258.47	NA	NA	NA	NA	NA	12 353.30
1.A.4. Other sectors	12 299.73	38.09	14.31	NA	NA	NA	NA	NA	12 352.13
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 328.15	26 211.09	17.71	NA	NA	NA	NA	NA	30 556.95
1.B.1. Solid fuels	NE	0.56	NA	NA	NA	NA	NA	NA	0.56
1.B.2. Oil and natural gas and other emissions from energy production	4 328.15	26 210.53	17.71	NA	NA	NA	NA	NA	30 556.39
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**15 235.69**	**6.69**	**509.13**	**7.68**	**NE**	**NE**	**0.63**	**NE**	**15 759.82**
2.A. Mineral industry	3 648.86	NO	NO	NA	NA	NA	NA	NA	3 648.86
2.B. Chemical industry	1 076.99	5.41	509.13	NO	NO	NO	NO	NO	1 591.53
2.C. Metal industry	10 509.84	1.29	NO	NA	NO	NO	NO	NO	10 511.13
2.D. Non-energy products from fuels and solvent use	IE	NO	NO	NA	NA	NA	NA	NA	IE
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	7.68	NE	NE	NO	NE	7.68
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.63	NE	0.63
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 141.98**	**4 596.13**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 738.10**
3.A. Enteric fermentation	NA	7 271.54	NA	NA	NA	NA	NA	NA	7 271.54
3.B. Manure management	NA	804.24	3 041.08	NA	NA	NA	NA	NA	3 845.32
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 534.59	NA	NA	NA	NA	NA	1 534.59
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	66.20	20.46	NA	NA	NA	NA	NA	86.65
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 858.82**	**30.79**	**20.30**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 807.73**
4.A. Forest land	-7 858.82	30.79	20.30	**NA**	**NA**	**NA**	**NA**	**NA**	-7 807.73
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**445.25**	**3 976.72**	**468.68**	**NA**	**NA**	**NA**	**NA**	**NA**	**4 890.65**
5.A. Solid waste disposal	NA	2 421.74	NA	NA	NA	NA	NA	NA	2 421.74
5.B. Biological treatment of solid waste	NA	18.80	13.45	NA	NA	NA	NA	NA	32.25
5.C. Incineration and open burning of waste	445.25	0.17	24.30	NA	NA	NA	NA	NA	469.72
5.D. Waste water treatment and discharge	NA	1 536.01	430.93	NA	NA	NA	NA	NA	1 966.94
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

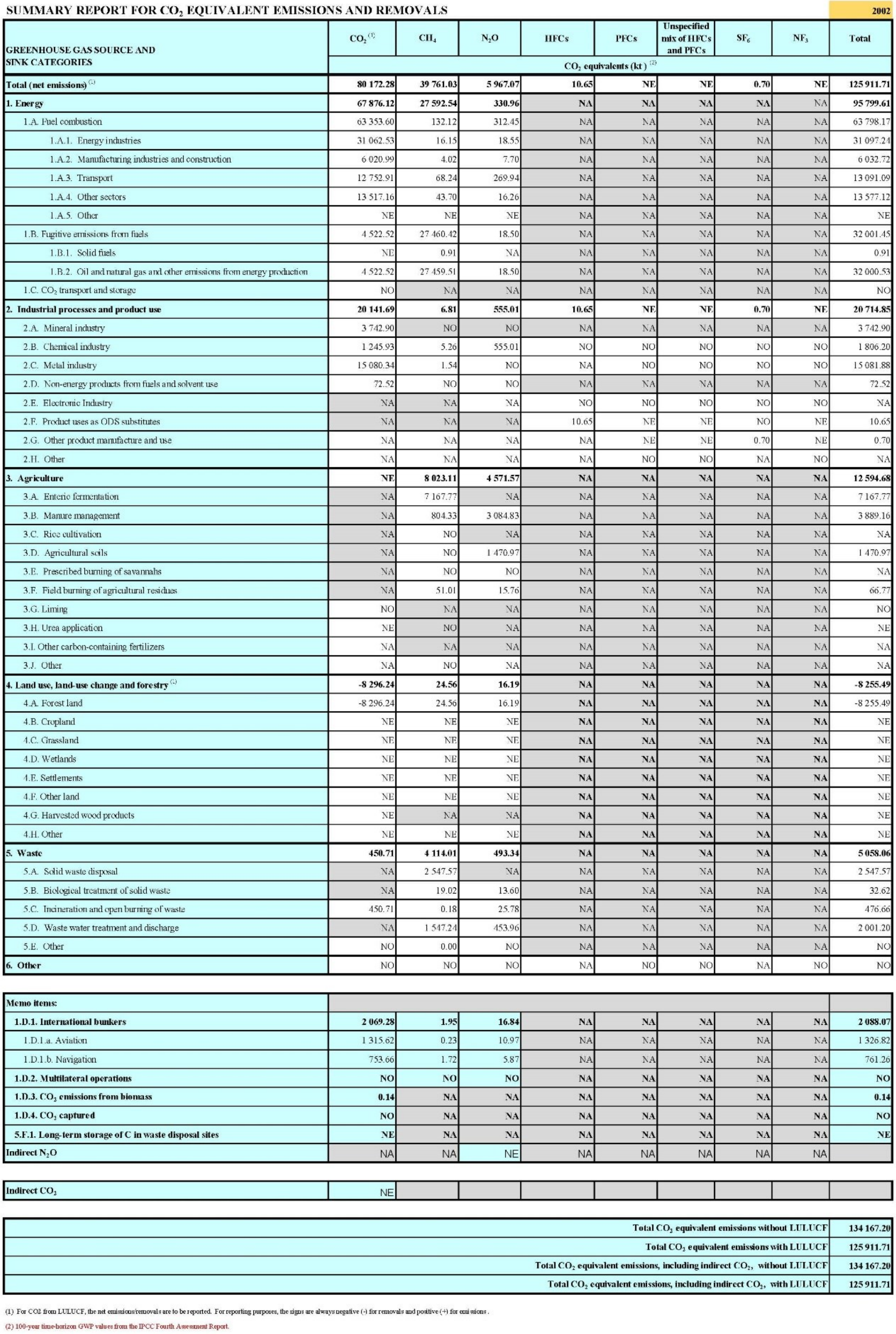
Memo items:									
1.D.1. International bunkers	**1 493.95**	**1.51**	**12.13**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 507.59**
1.D.1.a. Aviation	900.95	0.16	7.51	NA	NA	NA	NA	NA	908.61
1.D.1.b. Navigation	593.00	1.36	4.62	NA	NA	NA	NA	NA	598.98
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**124 756.19**
Total CO_2 equivalent emissions with LULUCF	**116 948.46**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**124 756.19**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**116 948.46**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**80 172.28**	**39 761.03**	**5 967.07**	**10.65**	**NE**	**NE**	**0.70**	**NE**	**125 911.71**
1. Energy	**67 876.12**	**27 592.54**	**330.96**	**NA**	**NA**	**NA**	**NA**	NA	**95 799.61**
1.A. Fuel combustion	63 353.60	132.12	312.45	NA	NA	NA	NA	NA	63 798.17
1.A.1. Energy industries	31 062.53	16.15	18.55	NA	NA	NA	NA	NA	31 097.24
1.A.2. Manufacturing industries and construction	6 020.99	4.02	7.70	NA	NA	NA	NA	NA	6 032.72
1.A.3. Transport	12 752.91	68.24	269.94	NA	NA	NA	NA	NA	13 091.09
1.A.4. Other sectors	13 517.16	43.70	16.26	NA	NA	NA	NA	NA	13 577.12
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 522.52	27 460.42	18.50	NA	NA	NA	NA	NA	32 001.45
1.B.1. Solid fuels	NE	0.91	NA	NA	NA	NA	NA	NA	0.91
1.B.2. Oil and natural gas and other emissions from energy production	4 522.52	27 459.51	18.50	NA	NA	NA	NA	NA	32 000.53
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**20 141.69**	**6.81**	**555.01**	**10.65**	**NE**	**NE**	**0.70**	**NE**	**20 714.85**
2.A. Mineral industry	3 742.90	NO	NO	NA	NA	NA	NA	NA	3 742.90
2.B. Chemical industry	1 245.93	5.26	555.01	NO	NO	NO	NO	NO	1 806.20
2.C. Metal industry	15 080.34	1.54	NO	NA	NO	NO	NO	NO	15 081.88
2.D. Non-energy products from fuels and solvent use	72.52	NO	NO	NA	NA	NA	NA	NA	72.52
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	10.65	NE	NE	NO	NE	10.65
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.70	NE	0.70
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 023.11**	**4 571.57**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 594.68**
3.A. Enteric fermentation	NA	7 167.77	NA	NA	NA	NA	NA	NA	7 167.77
3.B. Manure management	NA	804.33	3 084.83	NA	NA	NA	NA	NA	3 889.16
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 470.97	NA	NA	NA	NA	NA	1 470.97
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	51.01	15.76	NA	NA	NA	NA	NA	66.77
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-8 296.24**	**24.56**	**16.19**	**NA**	**NA**	**NA**	**NA**	**NA**	**-8 255.49**
4.A. Forest land	-8 296.24	24.56	16.19	**NA**	**NA**	**NA**	**NA**	**NA**	-8 255.49
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**450.71**	**4 114.01**	**493.34**	**NA**	**NA**	**NA**	**NA**	**NA**	**5 058.06**
5.A. Solid waste disposal	NA	2 547.57	NA	NA	NA	NA	NA	NA	2 547.57
5.B. Biological treatment of solid waste	NA	19.02	13.60	NA	NA	NA	NA	NA	32.62
5.C. Incineration and open burning of waste	450.71	0.18	25.78	NA	NA	NA	NA	NA	476.66
5.D. Waste water treatment and discharge	NA	1 547.24	453.96	NA	NA	NA	NA	NA	2 001.20
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

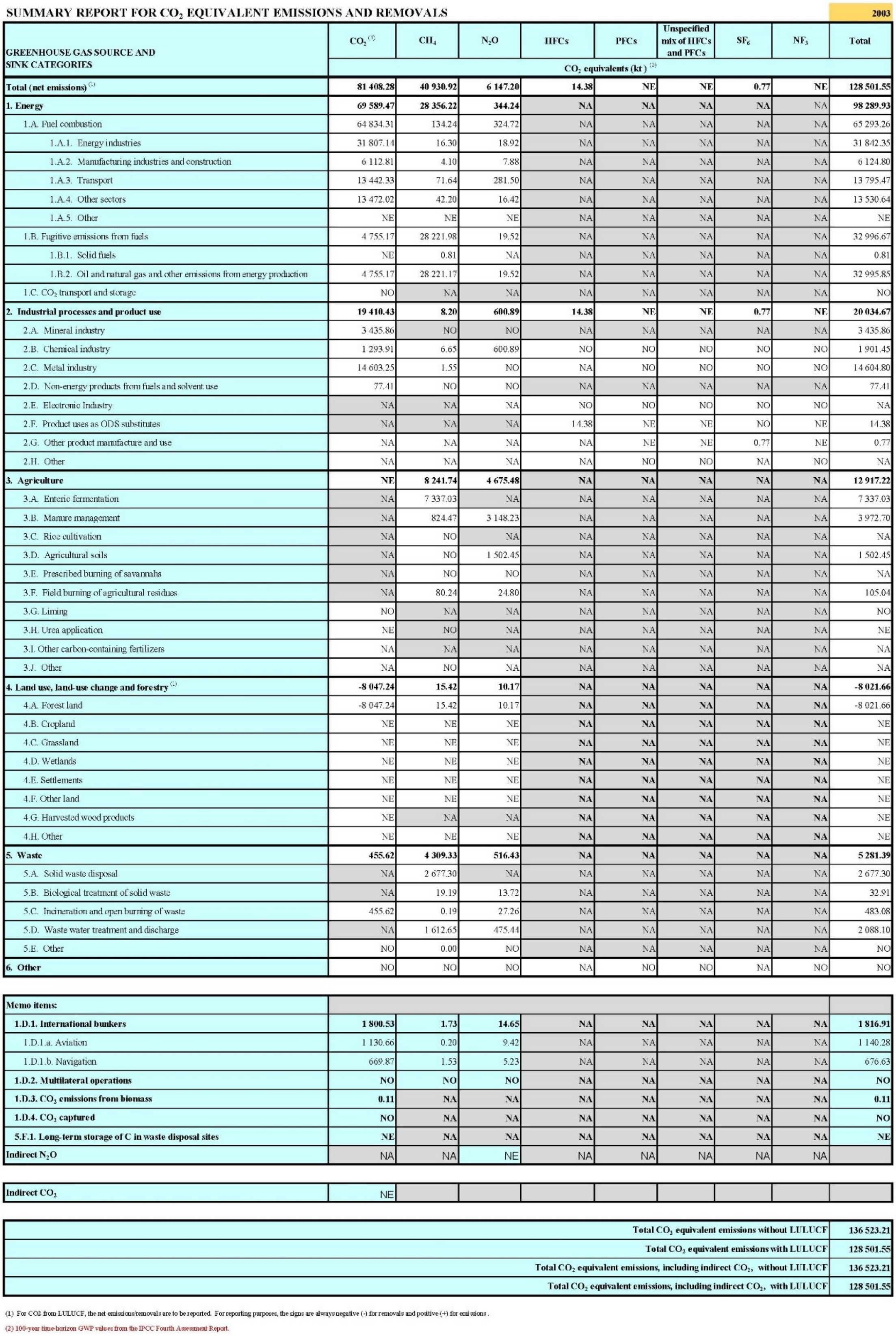
Memo items:									
1.D.1. International bunkers	**2 069.28**	**1.95**	**16.84**	**NA**	**NA**	**NA**	**NA**	**NA**	**2 088.07**
1.D.1.a. Aviation	1 315.62	0.23	10.97	NA	NA	NA	NA	NA	1 326.82
1.D.1.b. Navigation	753.66	1.72	5.87	NA	NA	NA	NA	NA	761.26
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.14**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.14**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**134 167.20**
Total CO_2 equivalent emissions with LULUCF	**125 911.71**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**134 167.20**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**125 911.71**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO₂ equivalents (kt) (2)								
Total (net emissions) (1)	**81 408.28**	**40 930.92**	**6 147.20**	**14.38**	**NE**	**NE**	**0.77**	**NE**	**128 501.55**
1. Energy	**69 589.47**	**28 356.22**	**344.24**	**NA**	**NA**	**NA**	**NA**	NA	**98 289.93**
1.A. Fuel combustion	64 834.31	134.24	324.72	NA	NA	NA	NA	NA	65 293.26
1.A.1. Energy industries	31 807.14	16.30	18.92	NA	NA	NA	NA	NA	31 842.35
1.A.2. Manufacturing industries and construction	6 112.81	4.10	7.88	NA	NA	NA	NA	NA	6 124.80
1.A.3. Transport	13 442.33	71.64	281.50	NA	NA	NA	NA	NA	13 795.47
1.A.4. Other sectors	13 472.02	42.20	16.42	NA	NA	NA	NA	NA	13 530.64
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 755.17	28 221.98	19.52	NA	NA	NA	NA	NA	32 996.67
1.B.1. Solid fuels	NE	0.81	NA	NA	NA	NA	NA	NA	0.81
1.B.2. Oil and natural gas and other emissions from energy production	4 755.17	28 221.17	19.52	NA	NA	NA	NA	NA	32 995.85
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**19 410.43**	**8.20**	**600.89**	**14.38**	**NE**	**NE**	**0.77**	**NE**	**20 034.67**
2.A. Mineral industry	3 435.86	NO	NO	NA	NA	NA	NA	NA	3 435.86
2.B. Chemical industry	1 293.91	6.65	600.89	NO	NO	NO	NO	NO	1 901.45
2.C. Metal industry	14 603.25	1.55	NO	NA	NO	NO	NO	NO	14 604.80
2.D. Non-energy products from fuels and solvent use	77.41	NO	NO	NA	NA	NA	NA	NA	77.41
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	14.38	NE	NE	NO	NE	14.38
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.77	NE	0.77
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 241.74**	**4 675.48**	**NA**	**NA**	**NA**	**NA**	**NA**	**12 917.22**
3.A. Enteric fermentation	NA	7 337.03	NA	NA	NA	NA	NA	NA	7 337.03
3.B. Manure management	NA	824.47	3 148.23	NA	NA	NA	NA	NA	3 972.70
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 502.45	NA	NA	NA	NA	NA	1 502.45
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	80.24	24.80	NA	NA	NA	NA	NA	105.04
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-8 047.24**	**15.42**	**10.17**	**NA**	**NA**	**NA**	**NA**	**NA**	**-8 021.66**
4.A. Forest land	-8 047.24	15.42	10.17	**NA**	**NA**	**NA**	**NA**	**NA**	-8 021.66
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**455.62**	**4 309.33**	**516.43**	**NA**	**NA**	**NA**	**NA**	**NA**	**5 281.39**
5.A. Solid waste disposal	NA	2 677.30	NA	NA	NA	NA	NA	NA	2 677.30
5.B. Biological treatment of solid waste	NA	19.19	13.72	NA	NA	NA	NA	NA	32.91
5.C. Incineration and open burning of waste	455.62	0.19	27.26	NA	NA	NA	NA	NA	483.08
5.D. Waste water treatment and discharge	NA	1 612.65	475.44	NA	NA	NA	NA	NA	2 088.10
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

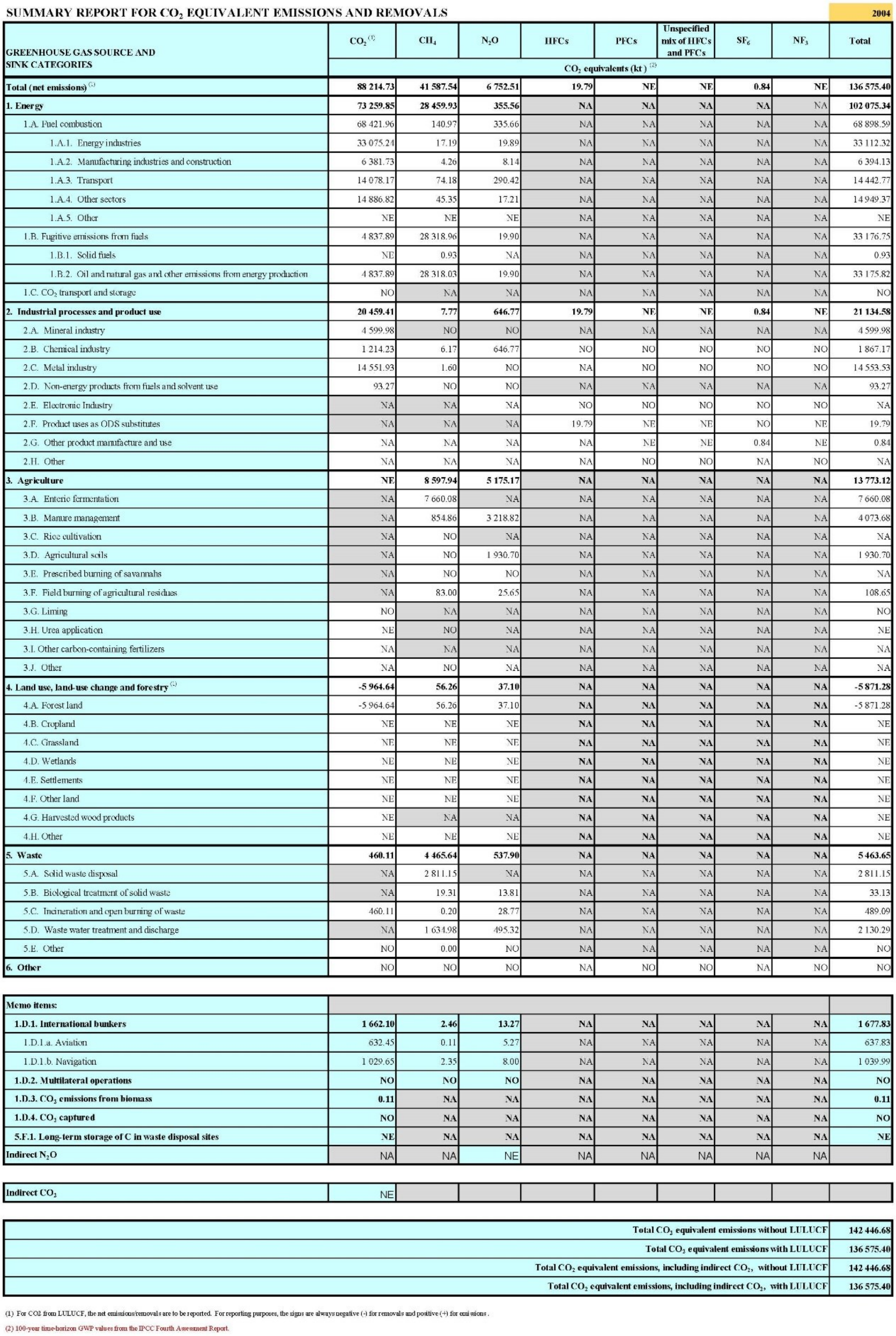
Memo items:									
1.D.1. International bunkers	**1 800.53**	**1.73**	**14.65**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 816.91**
1.D.1.a. Aviation	1 130.66	0.20	9.42	NA	NA	NA	NA	NA	1 140.28
1.D.1.b. Navigation	669.87	1.53	5.23	NA	NA	NA	NA	NA	676.63
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.11**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.11**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**136 523.21**
Total CO_2 equivalent emissions with LULUCF	**128 501.55**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**136 523.21**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**128 501.55**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**88 214.73**	**41 587.54**	**6 752.51**	**19.79**	**NE**	**NE**	**0.84**	**NE**	**136 575.40**
1. Energy	**73 259.85**	**28 459.93**	**355.56**	**NA**	**NA**	**NA**	**NA**	NA	**102 075.34**
1.A. Fuel combustion	68 421.96	140.97	335.66	NA	NA	NA	NA	NA	68 898.59
1.A.1. Energy industries	33 075.24	17.19	19.89	NA	NA	NA	NA	NA	33 112.32
1.A.2. Manufacturing industries and construction	6 381.73	4.26	8.14	NA	NA	NA	NA	NA	6 394.13
1.A.3. Transport	14 078.17	74.18	290.42	NA	NA	NA	NA	NA	14 442.77
1.A.4. Other sectors	14 886.82	45.35	17.21	NA	NA	NA	NA	NA	14 949.37
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 837.89	28 318.96	19.90	NA	NA	NA	NA	NA	33 176.75
1.B.1. Solid fuels	NE	0.93	NA	NA	NA	NA	NA	NA	0.93
1.B.2. Oil and natural gas and other emissions from energy production	4 837.89	28 318.03	19.90	NA	NA	NA	NA	NA	33 175.82
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**20 459.41**	**7.77**	**646.77**	**19.79**	**NE**	**NE**	**0.84**	**NE**	**21 134.58**
2.A. Mineral industry	4 599.98	NO	NO	NA	NA	NA	NA	NA	4 599.98
2.B. Chemical industry	1 214.23	6.17	646.77	NO	NO	NO	NO	NO	1 867.17
2.C. Metal industry	14 551.93	1.60	NO	NA	NO	NO	NO	NO	14 553.53
2.D. Non-energy products from fuels and solvent use	93.27	NO	NO	NA	NA	NA	NA	NA	93.27
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	19.79	NE	NE	NO	NE	19.79
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	0.84	NE	0.84
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 597.94**	**5 175.17**	**NA**	**NA**	**NA**	**NA**	**NA**	**13 773.12**
3.A. Enteric fermentation	NA	7 660.08	NA	NA	NA	NA	NA	NA	7 660.08
3.B. Manure management	NA	854.86	3 218.82	NA	NA	NA	NA	NA	4 073.68
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 930.70	NA	NA	NA	NA	NA	1 930.70
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	83.00	25.65	NA	NA	NA	NA	NA	108.65
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-5 964.64**	**56.26**	**37.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5 871.28**
4.A. Forest land	-5 964.64	56.26	37.10	**NA**	**NA**	**NA**	**NA**	**NA**	-5 871.28
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**460.11**	**4 465.64**	**537.90**	**NA**	**NA**	**NA**	**NA**	**NA**	**5 463.65**
5.A. Solid waste disposal	NA	2 811.15	NA	NA	NA	NA	NA	NA	2 811.15
5.B. Biological treatment of solid waste	NA	19.31	13.81	NA	NA	NA	NA	NA	33.13
5.C. Incineration and open burning of waste	460.11	0.20	28.77	NA	NA	NA	NA	NA	489.09
5.D. Waste water treatment and discharge	NA	1 634.98	495.32	NA	NA	NA	NA	NA	2 130.29
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

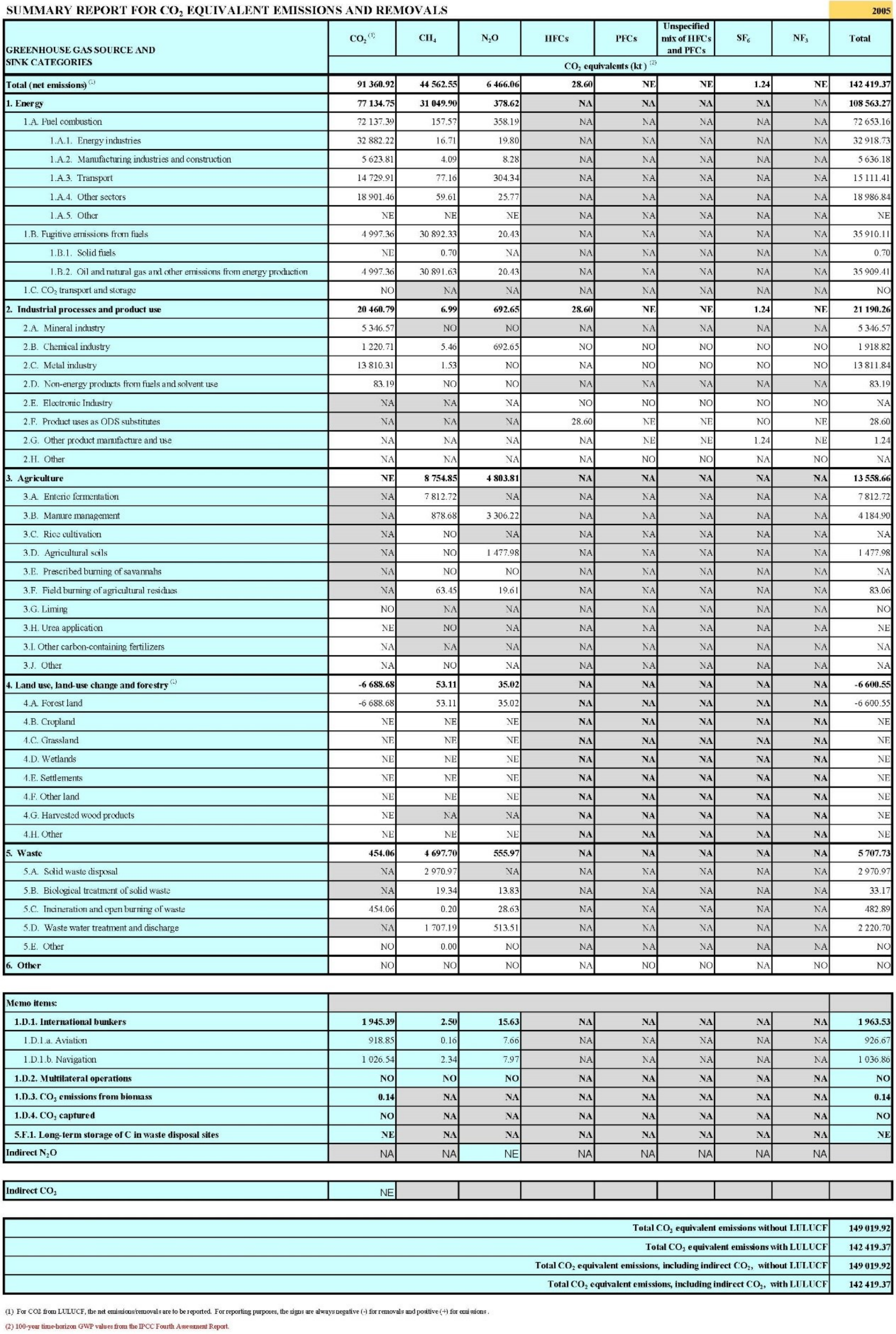
Memo items:									
1.D.1. International bunkers	**1 662.10**	**2.46**	**13.27**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 677.83**
1.D.1.a. Aviation	632.45	0.11	5.27	NA	NA	NA	NA	NA	637.83
1.D.1.b. Navigation	1 029.65	2.35	8.00	NA	NA	NA	NA	NA	1 039.99
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.11**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.11**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**142 446.68**
Total CO_2 equivalent emissions with LULUCF	**136 575.40**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**142 446.68**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**136 575.40**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**91 360.92**	**44 562.55**	**6 466.06**	**28.60**	**NE**	**NE**	**1.24**	**NE**	**142 419.37**
1. Energy	**77 134.75**	**31 049.90**	**378.62**	**NA**	**NA**	**NA**	**NA**	NA	**108 563.27**
1.A. Fuel combustion	72 137.39	157.57	358.19	NA	NA	NA	NA	NA	72 653.16
1.A.1. Energy industries	32 882.22	16.71	19.80	NA	NA	NA	NA	NA	32 918.73
1.A.2. Manufacturing industries and construction	5 623.81	4.09	8.28	NA	NA	NA	NA	NA	5 636.18
1.A.3. Transport	14 729.91	77.16	304.34	NA	NA	NA	NA	NA	15 111.41
1.A.4. Other sectors	18 901.46	59.61	25.77	NA	NA	NA	NA	NA	18 986.84
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 997.36	30 892.33	20.43	NA	NA	NA	NA	NA	35 910.11
1.B.1. Solid fuels	NE	0.70	NA	NA	NA	NA	NA	NA	0.70
1.B.2. Oil and natural gas and other emissions from energy production	4 997.36	30 891.63	20.43	NA	NA	NA	NA	NA	35 909.41
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**20 460.79**	**6.99**	**692.65**	**28.60**	**NE**	**NE**	**1.24**	**NE**	**21 190.26**
2.A. Mineral industry	5 346.57	NO	NO	NA	NA	NA	NA	NA	5 346.57
2.B. Chemical industry	1 220.71	5.46	692.65	NO	NO	NO	NO	NO	1 918.82
2.C. Metal industry	13 810.31	1.53	NO	NA	NO	NO	NO	NO	13 811.84
2.D. Non-energy products from fuels and solvent use	83.19	NO	NO	NA	NA	NA	NA	NA	83.19
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	28.60	NE	NE	NO	NE	28.60
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	1.24	NE	1.24
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**8 754.85**	**4 803.81**	**NA**	**NA**	**NA**	**NA**	**NA**	**13 558.66**
3.A. Enteric fermentation	NA	7 812.72	NA	NA	NA	NA	NA	NA	7 812.72
3.B. Manure management	NA	878.68	3 306.22	NA	NA	NA	NA	NA	4 184.90
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 477.98	NA	NA	NA	NA	NA	1 477.98
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	63.45	19.61	NA	NA	NA	NA	NA	83.06
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-6 688.68**	**53.11**	**35.02**	**NA**	**NA**	**NA**	**NA**	**NA**	**-6 600.55**
4.A. Forest land	-6 688.68	53.11	35.02	**NA**	**NA**	**NA**	**NA**	**NA**	-6 600.55
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**454.06**	**4 697.70**	**555.97**	**NA**	**NA**	**NA**	**NA**	**NA**	**5 707.73**
5.A. Solid waste disposal	NA	2 970.97	NA	NA	NA	NA	NA	NA	2 970.97
5.B. Biological treatment of solid waste	NA	19.34	13.83	NA	NA	NA	NA	NA	33.17
5.C. Incineration and open burning of waste	454.06	0.20	28.63	NA	NA	NA	NA	NA	482.89
5.D. Waste water treatment and discharge	NA	1 707.19	513.51	NA	NA	NA	NA	NA	2 220.70
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 945.39**	**2.50**	**15.63**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 963.53**
1.D.1.a. Aviation	918.85	0.16	7.66	NA	NA	NA	NA	NA	926.67
1.D.1.b. Navigation	1 026.54	2.34	7.97	NA	NA	NA	NA	NA	1 036.86
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.14**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.14**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**149 019.92**
Total CO_2 equivalent emissions with LULUCF	**142 419.37**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**149 019.92**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**142 419.37**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2006

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**89 263.29**	**41 905.28**	**7 017.07**	**38.72**	**NE**	**NE**	**1.70**	**NE**	**138 226.04**
1. Energy	**77 262.05**	**27 904.25**	**447.53**	**NA**	**NA**	**NA**	**NA**	NA	**105 613.83**
1.A. Fuel combustion	73 106.43	136.09	430.77	NA	NA	NA	NA	NA	73 673.29
1.A.1. Energy industries	33 003.24	16.78	19.36	NA	NA	NA	NA	NA	33 039.38
1.A.2. Manufacturing industries and construction	7 496.41	4.93	9.33	NA	NA	NA	NA	NA	7 510.67
1.A.3. Transport	21 160.25	81.03	394.78	NA	NA	NA	NA	NA	21 636.05
1.A.4. Other sectors	11 446.53	33.35	7.30	NA	NA	NA	NA	NA	11 487.19
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 155.61	27 768.16	16.76	NA	NA	NA	NA	NA	31 940.53
1.B.1. Solid fuels	NE	0.83	NA	NA	NA	NA	NA	NA	0.83
1.B.2. Oil and natural gas and other emissions from energy production	4 155.61	27 767.33	16.76	NA	NA	NA	NA	NA	31 939.70
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**19 340.88**	**7.70**	**738.53**	**38.72**	**NE**	**NE**	**1.70**	**NE**	**20 127.51**
2.A. Mineral industry	6 133.88	NO	NO	NA	NA	NA	NA	NA	6 133.88
2.B. Chemical industry	1 057.97	5.94	738.53	NO	NO	NO	NO	NO	1 802.44
2.C. Metal industry	12 061.18	1.76	NO	NA	NO	NO	NO	NO	12 062.93
2.D. Non-energy products from fuels and solvent use	87.85	NO	NO	NA	NA	NA	NA	NA	87.85
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	38.72	NE	NE	NO	NE	38.72
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	1.70	NE	1.70
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**9 073.40**	**5 246.36**	**NA**	**NA**	**NA**	**NA**	**NA**	**14 319.76**
3.A. Enteric fermentation	NA	8 089.87	NA	NA	NA	NA	NA	NA	8 089.87
3.B. Manure management	NA	911.40	3 482.76	NA	NA	NA	NA	NA	4 394.16
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 741.31	NA	NA	NA	NA	NA	1 741.31
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	72.13	22.29	NA	NA	NA	NA	NA	94.42
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 786.45**	**27.42**	**18.08**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 740.95**
4.A. Forest land	-7 786.45	27.42	18.08	**NA**	**NA**	**NA**	**NA**	**NA**	-7 740.95
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**446.82**	**4 892.51**	**566.57**	**NA**	**NA**	**NA**	**NA**	**NA**	**5 905.90**
5.A. Solid waste disposal	NA	3 140.55	NA	NA	NA	NA	NA	NA	3 140.55
5.B. Biological treatment of solid waste	NA	19.31	13.81	NA	NA	NA	NA	NA	33.12
5.C. Incineration and open burning of waste	446.82	0.20	28.38	NA	NA	NA	NA	NA	475.40
5.D. Waste water treatment and discharge	NA	1 732.45	524.37	NA	NA	NA	NA	NA	2 256.82
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**2 144.35**	**2.62**	**17.25**	**NA**	**NA**	**NA**	**NA**	**NA**	**2 164.22**
1.D.1.a. Aviation	1 076.96	0.19	8.98	NA	NA	NA	NA	NA	1 086.12
1.D.1.b. Navigation	1 067.39	2.43	8.28	NA	NA	NA	NA	NA	1 078.10
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.12**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.12**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**145 967.00**
Total CO_2 equivalent emissions with LULUCF	**138 226.04**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**145 967.00**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**138 226.04**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2007

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**95 383.37**	**42 305.84**	**7 245.97**	**50.63**	**NE**	**NE**	**2.23**	**NE**	**144 988.04**
1. Energy	**81 715.13**	**27 791.72**	**501.21**	**NA**	**NA**	**NA**	**NA**	NA	**110 008.05**
1.A. Fuel combustion	77 550.56	149.89	484.39	NA	NA	NA	NA	NA	78 184.85
1.A.1. Energy industries	32 854.07	16.53	19.42	NA	NA	NA	NA	NA	32 890.02
1.A.2. Manufacturing industries and construction	8 300.72	5.47	10.39	NA	NA	NA	NA	NA	8 316.58
1.A.3. Transport	23 503.49	90.49	446.39	NA	NA	NA	NA	NA	24 040.37
1.A.4. Other sectors	12 892.29	37.40	8.20	NA	NA	NA	NA	NA	12 937.88
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 164.56	27 641.83	16.81	NA	NA	NA	NA	NA	31 823.20
1.B.1. Solid fuels	NE	0.69	NA	NA	NA	NA	NA	NA	0.69
1.B.2. Oil and natural gas and other emissions from energy production	4 164.56	27 641.13	16.81	NA	NA	NA	NA	NA	31 822.51
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**19 151.00**	**7.27**	**784.40**	**50.63**	**NE**	**NE**	**2.23**	**NE**	**19 995.53**
2.A. Mineral industry	6 637.72	NO	NO	NA	NA	NA	NA	NA	6 637.72
2.B. Chemical industry	1 114.19	5.35	784.40	NO	NO	NO	NO	NO	1 903.94
2.C. Metal industry	11 314.79	1.92	NO	NA	NO	NO	NO	NO	11 316.71
2.D. Non-energy products from fuels and solvent use	84.31	NO	NO	NA	NA	NA	NA	NA	84.31
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	50.63	NE	NE	NO	NE	50.63
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	2.23	NE	2.23
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**9 269.88**	**5 330.55**	**NA**	**NA**	**NA**	**NA**	**NA**	**14 600.43**
3.A. Enteric fermentation	NA	8 258.17	NA	NA	NA	NA	NA	NA	8 258.17
3.B. Manure management	NA	934.13	3 575.77	NA	NA	NA	NA	NA	4 509.90
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 730.81	NA	NA	NA	NA	NA	1 730.81
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	77.58	23.98	NA	NA	NA	NA	NA	101.56
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-5 921.18**	**81.90**	**54.00**	**NA**	**NA**	**NA**	**NA**	**NA**	**-5 785.28**
4.A. Forest land	-5 921.18	81.90	54.00	**NA**	**NA**	**NA**	**NA**	**NA**	-5 785.28
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**438.43**	**5 155.07**	**575.81**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 169.31**
5.A. Solid waste disposal	NA	3 320.45	NA	NA	NA	NA	NA	NA	3 320.45
5.B. Biological treatment of solid waste	NA	19.24	13.76	NA	NA	NA	NA	NA	33.00
5.C. Incineration and open burning of waste	438.43	0.20	28.05	NA	NA	NA	NA	NA	466.67
5.D. Waste water treatment and discharge	NA	1 815.19	534.00	NA	NA	NA	NA	NA	2 349.20
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

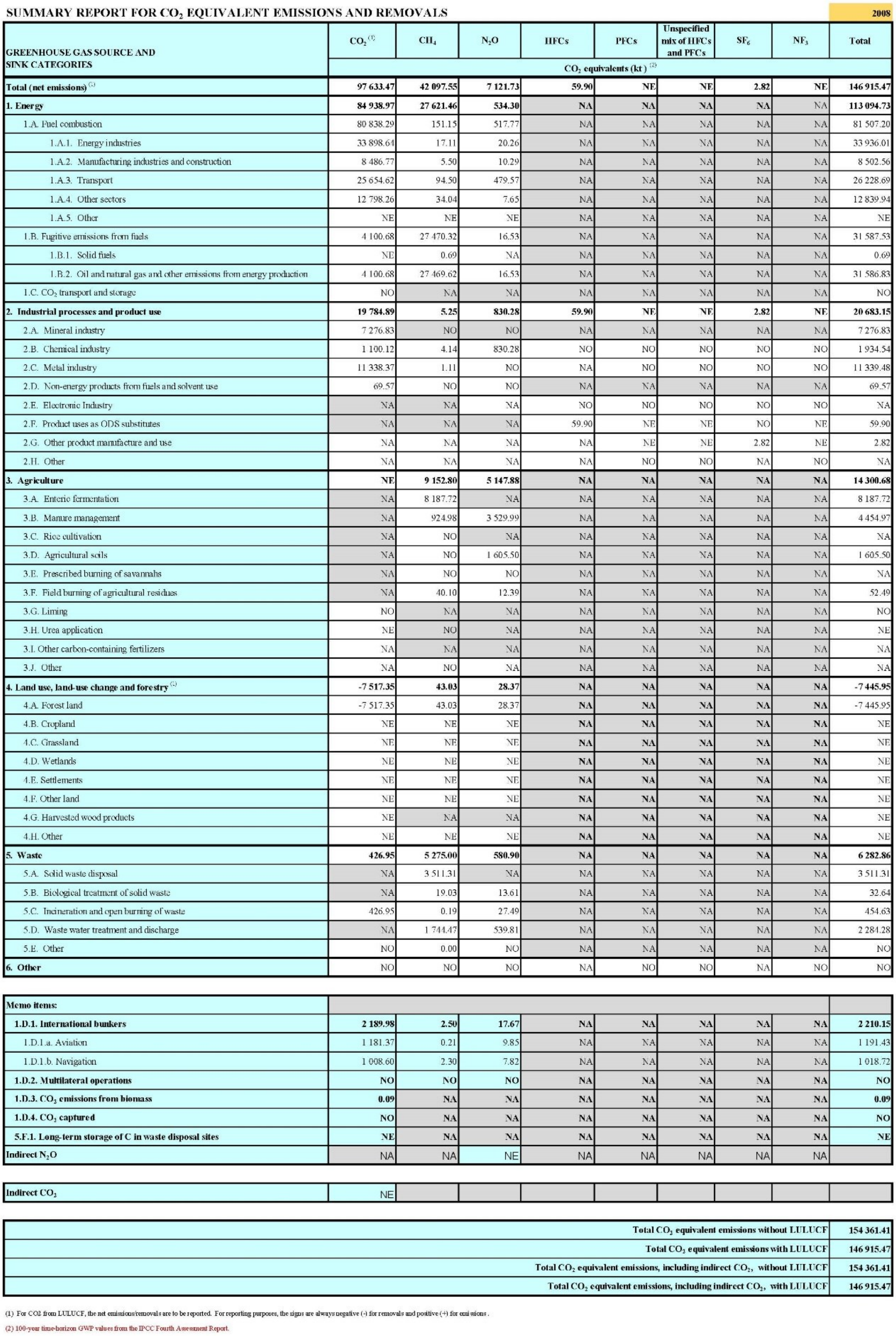
Memo items:									
1.D.1. International bunkers	**2 142.03**	**2.66**	**17.22**	**NA**	**NA**	**NA**	**NA**	**NA**	**2 161.91**
1.D.1.a. Aviation	1 056.08	0.18	8.80	NA	NA	NA	NA	NA	1 065.06
1.D.1.b. Navigation	1 085.95	2.47	8.42	NA	NA	NA	NA	NA	1 096.84
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.14**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.14**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**150 773.32**
Total CO_2 equivalent emissions with LULUCF	**144 988.04**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**150 773.32**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**144 988.04**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2008

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**97 633.47**	**42 097.55**	**7 121.73**	**59.90**	**NE**	**NE**	**2.82**	**NE**	**146 915.47**
1. Energy	**84 938.97**	**27 621.46**	**534.30**	**NA**	**NA**	**NA**	**NA**	NA	**113 094.73**
1.A. Fuel combustion	80 838.29	151.15	517.77	NA	NA	NA	NA	NA	81 507.20
1.A.1. Energy industries	33 898.64	17.11	20.26	NA	NA	NA	NA	NA	33 936.01
1.A.2. Manufacturing industries and construction	8 486.77	5.50	10.29	NA	NA	NA	NA	NA	8 502.56
1.A.3. Transport	25 654.62	94.50	479.57	NA	NA	NA	NA	NA	26 228.69
1.A.4. Other sectors	12 798.26	34.04	7.65	NA	NA	NA	NA	NA	12 839.94
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	4 100.68	27 470.32	16.53	NA	NA	NA	NA	NA	31 587.53
1.B.1. Solid fuels	NE	0.69	NA	NA	NA	NA	NA	NA	0.69
1.B.2. Oil and natural gas and other emissions from energy production	4 100.68	27 469.62	16.53	NA	NA	NA	NA	NA	31 586.83
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**19 784.89**	**5.25**	**830.28**	**59.90**	**NE**	**NE**	**2.82**	**NE**	**20 683.15**
2.A. Mineral industry	7 276.83	NO	NO	NA	NA	NA	NA	NA	7 276.83
2.B. Chemical industry	1 100.12	4.14	830.28	NO	NO	NO	NO	NO	1 934.54
2.C. Metal industry	11 338.37	1.11	NO	NA	NO	NO	NO	NO	11 339.48
2.D. Non-energy products from fuels and solvent use	69.57	NO	NO	NA	NA	NA	NA	NA	69.57
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	59.90	NE	NE	NO	NE	59.90
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	2.82	NE	2.82
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**9 152.80**	**5 147.88**	**NA**	**NA**	**NA**	**NA**	**NA**	**14 300.68**
3.A. Enteric fermentation	NA	8 187.72	NA	NA	NA	NA	NA	NA	8 187.72
3.B. Manure management	NA	924.98	3 529.99	NA	NA	NA	NA	NA	4 454.97
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 605.50	NA	NA	NA	NA	NA	1 605.50
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	40.10	12.39	NA	NA	NA	NA	NA	52.49
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-7 517.35**	**43.03**	**28.37**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 445.95**
4.A. Forest land	-7 517.35	43.03	28.37	**NA**	**NA**	**NA**	**NA**	**NA**	-7 445.95
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**426.95**	**5 275.00**	**580.90**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 282.86**
5.A. Solid waste disposal	NA	3 511.31	NA	NA	NA	NA	NA	NA	3 511.31
5.B. Biological treatment of solid waste	NA	19.03	13.61	NA	NA	NA	NA	NA	32.64
5.C. Incineration and open burning of waste	426.95	0.19	27.49	NA	NA	NA	NA	NA	454.63
5.D. Waste water treatment and discharge	NA	1 744.47	539.81	NA	NA	NA	NA	NA	2 284.28
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**2 189.98**	**2.50**	**17.67**	**NA**	**NA**	**NA**	**NA**	**NA**	**2 210.15**
1.D.1.a. Aviation	1 181.37	0.21	9.85	NA	NA	NA	NA	NA	1 191.43
1.D.1.b. Navigation	1 008.60	2.30	7.82	NA	NA	NA	NA	NA	1 018.72
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.09**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.09**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**154 361.41**
Total CO_2 equivalent emissions with LULUCF	**146 915.47**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**154 361.41**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**146 915.47**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2009

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) [2]								
Total (net emissions) [1]	**100 879.68**	**41 630.67**	**7 677.52**	**71.72**	**NE**	**NE**	**3.49**	**NE**	**150 263.08**
1. Energy	**86 202.86**	**26 396.68**	**565.94**	**NA**	**NA**	**NA**	**NA**	NA	**113 165.48**
1.A. Fuel combustion	82 342.62	154.55	550.42	NA	NA	NA	NA	NA	83 047.59
1.A.1. Energy industries	35 339.44	16.84	21.14	NA	NA	NA	NA	NA	35 377.42
1.A.2. Manufacturing industries and construction	7 172.50	3.77	5.82	NA	NA	NA	NA	NA	7 182.09
1.A.3. Transport	27 110.49	99.14	515.70	NA	NA	NA	NA	NA	27 725.33
1.A.4. Other sectors	12 720.20	34.79	7.75	NA	NA	NA	NA	NA	12 762.75
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 860.24	26 242.13	15.53	NA	NA	NA	NA	NA	30 117.90
1.B.1. Solid fuels	NE	0.14	NA	NA	NA	NA	NA	NA	0.14
1.B.2. Oil and natural gas and other emissions from energy production	3 860.24	26 241.99	15.53	NA	NA	NA	NA	NA	30 117.76
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**21 566.21**	**6.90**	**876.16**	**71.72**	**NE**	**NE**	**3.49**	**NE**	**22 524.48**
2.A. Mineral industry	7 832.98	NO	NO	NA	NA	NA	NA	NA	7 832.98
2.B. Chemical industry	1 119.55	5.81	876.16	NO	NO	NO	NO	NO	2 001.51
2.C. Metal industry	12 533.44	1.09	NO	NA	NO	NO	NO	NO	12 534.53
2.D. Non-energy products from fuels and solvent use	80.24	NO	NO	NA	NA	NA	NA	NA	80.24
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	71.72	NE	NE	NO	NE	71.72
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	3.49	NE	3.49
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**44.53**	**9 705.34**	**5 609.51**	**NA**	**NA**	**NA**	**NA**	**NA**	**15 359.38**
3.A. Enteric fermentation	NA	8 635.15	NA	NA	NA	NA	NA	NA	8 635.15
3.B. Manure management	NA	984.44	3 743.91	NA	NA	NA	NA	NA	4 728.35
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 839.10	NA	NA	NA	NA	NA	1 839.10
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	85.75	26.50	NA	NA	NA	NA	NA	112.25
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	44.53	NO	NA	NA	NA	NA	NA	NA	44.53
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry [1]	**-7 350.39**	**42.99**	**28.35**	**NA**	**NA**	**NA**	**NA**	**NA**	**-7 279.06**
4.A. Forest land	-7 350.39	42.99	28.35	**NA**	**NA**	**NA**	**NA**	**NA**	-7 279.06
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**416.47**	**5 478.76**	**597.56**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 492.79**
5.A. Solid waste disposal	NA	3 718.15	NA	NA	NA	NA	NA	NA	3 718.15
5.B. Biological treatment of solid waste	NA	18.90	13.51	NA	NA	NA	NA	NA	32.41
5.C. Incineration and open burning of waste	416.47	0.19	27.04	NA	NA	NA	NA	NA	443.70
5.D. Waste water treatment and discharge	NA	1 741.53	557.00	NA	NA	NA	NA	NA	2 298.53
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

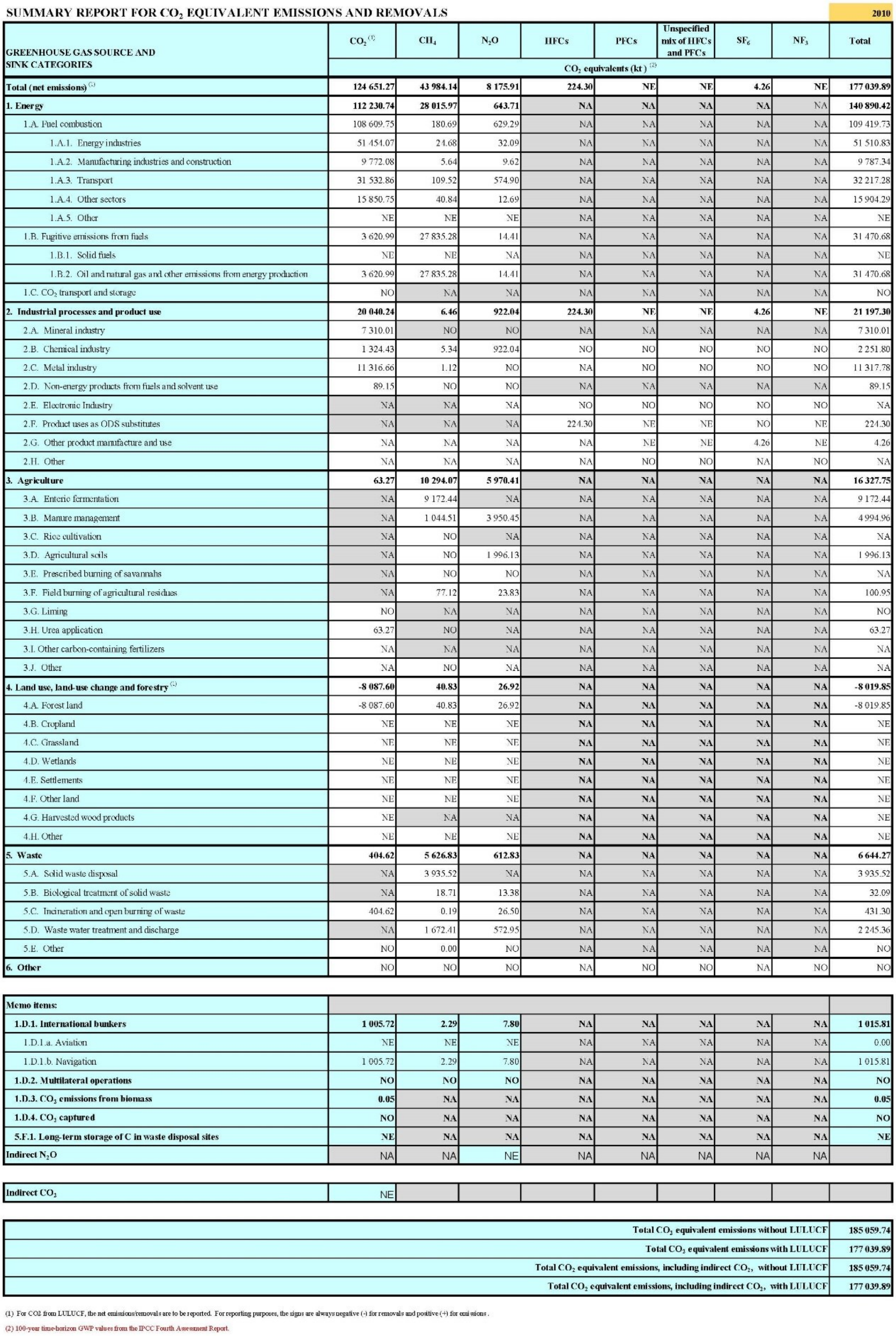
Memo items:									
1.D.1. International bunkers	**2 251.73**	**2.31**	**18.25**	**NA**	**NA**	**NA**	**NA**	**NA**	**2 272.29**
1.D.1.a. Aviation	1 342.47	0.23	11.19	NA	NA	NA	NA	NA	1 353.89
1.D.1.b. Navigation	909.26	2.07	7.06	NA	NA	NA	NA	NA	918.39
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.10**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.10**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**157 542.14**
Total CO_2 equivalent emissions with LULUCF	**150 263.08**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**157 542.14**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**150 263.08**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2010

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**124 651.27**	**43 984.14**	**8 175.91**	**224.30**	**NE**	**NE**	**4.26**	**NE**	**177 039.89**
1. Energy	**112 230.74**	**28 015.97**	**643.71**	**NA**	**NA**	**NA**	**NA**	NA	**140 890.42**
1.A. Fuel combustion	108 609.75	180.69	629.29	NA	NA	NA	NA	NA	109 419.73
1.A.1. Energy industries	51 454.07	24.68	32.09	NA	NA	NA	NA	NA	51 510.83
1.A.2. Manufacturing industries and construction	9 772.08	5.64	9.62	NA	NA	NA	NA	NA	9 787.34
1.A.3. Transport	31 532.86	109.52	574.90	NA	NA	NA	NA	NA	32 217.28
1.A.4. Other sectors	15 850.75	40.84	12.69	NA	NA	NA	NA	NA	15 904.29
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 620.99	27 835.28	14.41	NA	NA	NA	NA	NA	31 470.68
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 620.99	27 835.28	14.41	NA	NA	NA	NA	NA	31 470.68
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**20 040.24**	**6.46**	**922.04**	**224.30**	**NE**	**NE**	**4.26**	**NE**	**21 197.30**
2.A. Mineral industry	7 310.01	NO	NO	NA	NA	NA	NA	NA	7 310.01
2.B. Chemical industry	1 324.43	5.34	922.04	NO	NO	NO	NO	NO	2 251.80
2.C. Metal industry	11 316.66	1.12	NO	NA	NO	NO	NO	NO	11 317.78
2.D. Non-energy products from fuels and solvent use	89.15	NO	NO	NA	NA	NA	NA	NA	89.15
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	224.30	NE	NE	NO	NE	224.30
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	4.26	NE	4.26
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**63.27**	**10 294.07**	**5 970.41**	**NA**	**NA**	**NA**	**NA**	**NA**	**16 327.75**
3.A. Enteric fermentation	NA	9 172.44	NA	NA	NA	NA	NA	NA	9 172.44
3.B. Manure management	NA	1 044.51	3 950.45	NA	NA	NA	NA	NA	4 994.96
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	1 996.13	NA	NA	NA	NA	NA	1 996.13
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	77.12	23.83	NA	NA	NA	NA	NA	100.95
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	63.27	NO	NA	NA	NA	NA	NA	NA	63.27
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-8 087.60**	**40.83**	**26.92**	**NA**	**NA**	**NA**	**NA**	**NA**	**-8 019.85**
4.A. Forest land	-8 087.60	40.83	26.92	**NA**	**NA**	**NA**	**NA**	**NA**	-8 019.85
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**404.62**	**5 626.83**	**612.83**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 644.27**
5.A. Solid waste disposal	NA	3 935.52	NA	NA	NA	NA	NA	NA	3 935.52
5.B. Biological treatment of solid waste	NA	18.71	13.38	NA	NA	NA	NA	NA	32.09
5.C. Incineration and open burning of waste	404.62	0.19	26.50	NA	NA	NA	NA	NA	431.30
5.D. Waste water treatment and discharge	NA	1 672.41	572.95	NA	NA	NA	NA	NA	2 245.36
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 005.72**	**2.29**	**7.80**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 015.81**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	1 005.72	2.29	7.80	NA	NA	NA	NA	NA	1 015.81
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.05**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.05**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**185 059.74**
Total CO_2 equivalent emissions with LULUCF	**177 039.89**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**185 059.74**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**177 039.89**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**123 908.12**	**43 591.93**	**8 478.27**	**291.73**	**NE**	**NE**	**5.17**	**NE**	**176 275.22**
1. Energy	**115 775.04**	**27 094.61**	**694.12**	**NA**	**NA**	**NA**	**NA**	NA	**143 563.78**
1.A. Fuel combustion	112 273.79	192.84	680.19	NA	NA	NA	NA	NA	113 146.82
1.A.1. Energy industries	49 835.17	23.79	30.79	NA	NA	NA	NA	NA	49 889.75
1.A.2. Manufacturing industries and construction	10 027.41	5.89	10.20	NA	NA	NA	NA	NA	10 043.50
1.A.3. Transport	34 794.78	121.09	625.20	NA	NA	NA	NA	NA	35 541.07
1.A.4. Other sectors	17 616.42	42.08	14.00	NA	NA	NA	NA	NA	17 672.49
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 501.25	26 901.77	13.94	NA	NA	NA	NA	NA	30 416.96
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 501.25	26 901.77	13.94	NA	NA	NA	NA	NA	30 416.96
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**17 438.86**	**7.34**	**967.92**	**291.73**	**NE**	**NE**	**5.17**	**NE**	**18 711.01**
2.A. Mineral industry	7 884.16	NO	NO	NA	NA	NA	NA	NA	7 884.16
2.B. Chemical industry	1 326.32	6.76	967.92	NO	NO	NO	NO	NO	2 301.00
2.C. Metal industry	8 159.23	0.58	NO	NA	NO	NO	NO	NO	8 159.81
2.D. Non-energy products from fuels and solvent use	69.16	NO	NO	NA	NA	NA	NA	NA	69.16
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	291.73	NE	NE	NO	NE	291.73
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	5.17	NE	5.17
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**59.50**	**10 692.33**	**6 155.52**	**NA**	**NA**	**NA**	**NA**	**NA**	**16 907.35**
3.A. Enteric fermentation	NA	9 532.42	NA	NA	NA	NA	NA	NA	9 532.42
3.B. Manure management	NA	1 090.13	4 099.89	NA	NA	NA	NA	NA	5 190.02
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 034.07	NA	NA	NA	NA	NA	2 034.07
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	69.78	21.56	NA	NA	NA	NA	NA	91.34
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	59.50	NO	NA	NA	NA	NA	NA	NA	59.50
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-9 756.11**	**31.93**	**21.06**	**NA**	**NA**	**NA**	**NA**	**NA**	**-9 703.12**
4.A. Forest land	-9 756.11	31.93	21.06	**NA**	**NA**	**NA**	**NA**	**NA**	-9 703.12
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**390.83**	**5 765.72**	**639.65**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 796.20**
5.A. Solid waste disposal	NA	4 165.79	NA	NA	NA	NA	NA	NA	4 165.79
5.B. Biological treatment of solid waste	NA	18.46	13.20	NA	NA	NA	NA	NA	31.67
5.C. Incineration and open burning of waste	390.83	0.18	25.85	NA	NA	NA	NA	NA	416.86
5.D. Waste water treatment and discharge	NA	1 581.29	600.60	NA	NA	NA	NA	NA	2 181.88
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**796.51**	**1.81**	**6.18**	**NA**	**NA**	**NA**	**NA**	**NA**	**804.50**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	796.51	1.81	6.18	NA	NA	NA	NA	NA	804.50
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.05**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.05**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**185 978.34**
Total CO_2 equivalent emissions with LULUCF	**176 275.22**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**185 978.34**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**176 275.22**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2012

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**132 985.02**	**44 492.20**	**9 071.80**	**413.40**	**NE**	**NE**	**6.29**	**NE**	**186 968.71**
1. Energy	**122 596.71**	**27 213.63**	**781.47**	**NA**	**NA**	**NA**	**NA**	NA	**150 591.82**
1.A. Fuel combustion	119 290.13	209.13	768.46	NA	NA	NA	NA	NA	120 267.72
1.A.1. Energy industries	51 352.46	23.94	30.37	NA	NA	NA	NA	NA	51 406.77
1.A.2. Manufacturing industries and construction	9 374.30	5.09	8.19	NA	NA	NA	NA	NA	9 387.58
1.A.3. Transport	39 222.48	135.24	716.31	NA	NA	NA	NA	NA	40 074.03
1.A.4. Other sectors	19 340.88	44.85	13.59	NA	NA	NA	NA	NA	19 399.33
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 306.59	27 004.50	13.01	NA	NA	NA	NA	NA	30 324.10
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 306.59	27 004.50	13.01	NA	NA	NA	NA	NA	30 324.10
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**14 346.52**	**6.95**	**1 013.80**	**413.40**	**NE**	**NE**	**6.29**	**NE**	**15 786.95**
2.A. Mineral industry	7 796.00	NO	NO	NA	NA	NA	NA	NA	7 796.00
2.B. Chemical industry	1 574.34	6.38	1 013.80	NO	NO	NO	NO	NO	2 594.52
2.C. Metal industry	4 917.22	0.56	NO	NA	NO	NO	NO	NO	4 917.78
2.D. Non-energy products from fuels and solvent use	58.96	NO	NO	NA	NA	NA	NA	NA	58.96
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	413.40	NE	NE	NO	NE	413.40
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	6.29	NE	6.29
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**45.47**	**11 155.00**	**6 495.68**	**NA**	**NA**	**NA**	**NA**	**NA**	**17 696.15**
3.A. Enteric fermentation	NA	9 931.82	NA	NA	NA	NA	NA	NA	9 931.82
3.B. Manure management	NA	1 140.52	4 274.11	NA	NA	NA	NA	NA	5 414.63
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 196.03	NA	NA	NA	NA	NA	2 196.03
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	82.66	25.55	NA	NA	NA	NA	NA	108.21
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	45.47	NO	NA	NA	NA	NA	NA	NA	45.47
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-4 379.32**	**181.57**	**119.73**	**NA**	**NA**	**NA**	**NA**	**NA**	**-4 078.02**
4.A. Forest land	-4 379.32	181.57	119.73	**NA**	**NA**	**NA**	**NA**	**NA**	-4 078.02
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**375.63**	**5 935.06**	**661.13**	**NA**	**NA**	**NA**	**NA**	**NA**	**6 971.82**
5.A. Solid waste disposal	NA	4 402.00	NA	NA	NA	NA	NA	NA	4 402.00
5.B. Biological treatment of solid waste	NA	17.94	12.83	NA	NA	NA	NA	NA	30.78
5.C. Incineration and open burning of waste	375.63	0.18	25.10	NA	NA	NA	NA	NA	400.91
5.D. Waste water treatment and discharge	NA	1 514.94	623.19	NA	NA	NA	NA	NA	2 138.13
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

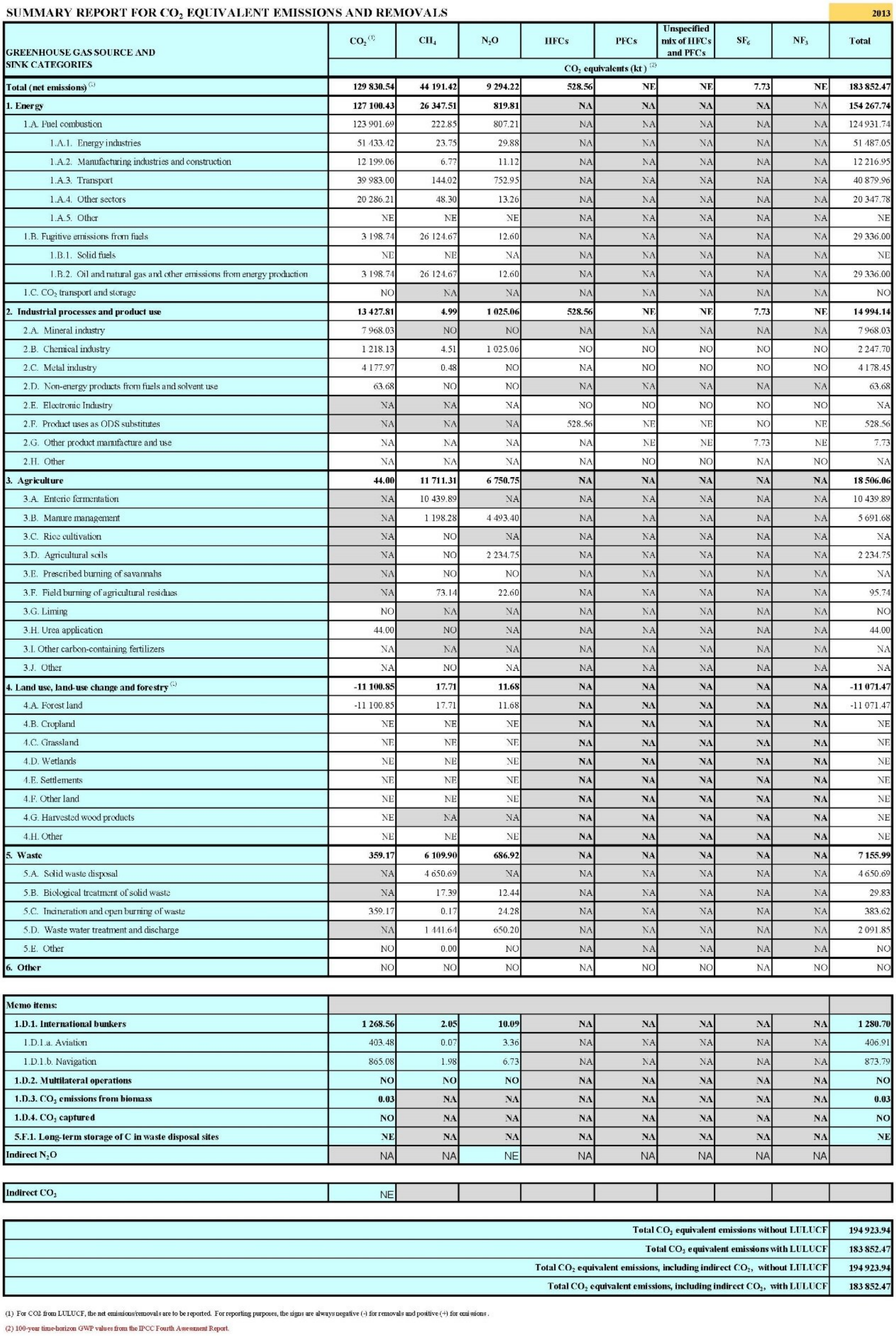
Memo items:									
1.D.1. International bunkers	**817.39**	**1.86**	**6.35**	**NA**	**NA**	**NA**	**NA**	**NA**	**825.60**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	817.39	1.86	6.35	NA	NA	NA	NA	NA	825.60
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.03**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.03**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**191 046.73**
Total CO_2 equivalent emissions with LULUCF	**186 968.71**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**191 046.73**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**186 968.71**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2013

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**129 830.54**	**44 191.42**	**9 294.22**	**528.56**	**NE**	**NE**	**7.73**	**NE**	**183 852.47**
1. Energy	**127 100.43**	**26 347.51**	**819.81**	**NA**	**NA**	**NA**	**NA**	NA	**154 267.74**
1.A. Fuel combustion	123 901.69	222.85	807.21	NA	NA	NA	NA	NA	124 931.74
1.A.1. Energy industries	51 433.42	23.75	29.88	NA	NA	NA	NA	NA	51 487.05
1.A.2. Manufacturing industries and construction	12 199.06	6.77	11.12	NA	NA	NA	NA	NA	12 216.95
1.A.3. Transport	39 983.00	144.02	752.95	NA	NA	NA	NA	NA	40 879.96
1.A.4. Other sectors	20 286.21	48.30	13.26	NA	NA	NA	NA	NA	20 347.78
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 198.74	26 124.67	12.60	NA	NA	NA	NA	NA	29 336.00
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 198.74	26 124.67	12.60	NA	NA	NA	NA	NA	29 336.00
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**13 427.81**	**4.99**	**1 025.06**	**528.56**	**NE**	**NE**	**7.73**	**NE**	**14 994.14**
2.A. Mineral industry	7 968.03	NO	NO	NA	NA	NA	NA	NA	7 968.03
2.B. Chemical industry	1 218.13	4.51	1 025.06	NO	NO	NO	NO	NO	2 247.70
2.C. Metal industry	4 177.97	0.48	NO	NA	NO	NO	NO	NO	4 178.45
2.D. Non-energy products from fuels and solvent use	63.68	NO	NO	NA	NA	NA	NA	NA	63.68
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	528.56	NE	NE	NO	NE	528.56
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	7.73	NE	7.73
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**44.00**	**11 711.31**	**6 750.75**	**NA**	**NA**	**NA**	**NA**	**NA**	**18 506.06**
3.A. Enteric fermentation	NA	10 439.89	NA	NA	NA	NA	NA	NA	10 439.89
3.B. Manure management	NA	1 198.28	4 493.40	NA	NA	NA	NA	NA	5 691.68
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 234.75	NA	NA	NA	NA	NA	2 234.75
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	73.14	22.60	NA	NA	NA	NA	NA	95.74
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	44.00	NO	NA	NA	NA	NA	NA	NA	44.00
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-11 100.85**	**17.71**	**11.68**	**NA**	**NA**	**NA**	**NA**	**NA**	**-11 071.47**
4.A. Forest land	-11 100.85	17.71	11.68	**NA**	**NA**	**NA**	**NA**	**NA**	-11 071.47
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**359.17**	**6 109.90**	**686.92**	**NA**	**NA**	**NA**	**NA**	**NA**	**7 155.99**
5.A. Solid waste disposal	NA	4 650.69	NA	NA	NA	NA	NA	NA	4 650.69
5.B. Biological treatment of solid waste	NA	17.39	12.44	NA	NA	NA	NA	NA	29.83
5.C. Incineration and open burning of waste	359.17	0.17	24.28	NA	NA	NA	NA	NA	383.62
5.D. Waste water treatment and discharge	NA	1 441.64	650.20	NA	NA	NA	NA	NA	2 091.85
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**1 268.56**	**2.05**	**10.09**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 280.70**
1.D.1.a. Aviation	403.48	0.07	3.36	NA	NA	NA	NA	NA	406.91
1.D.1.b. Navigation	865.08	1.98	6.73	NA	NA	NA	NA	NA	873.79
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.03**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.03**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**194 923.94**
Total CO_2 equivalent emissions with LULUCF	**183 852.47**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**194 923.94**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**183 852.47**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2014

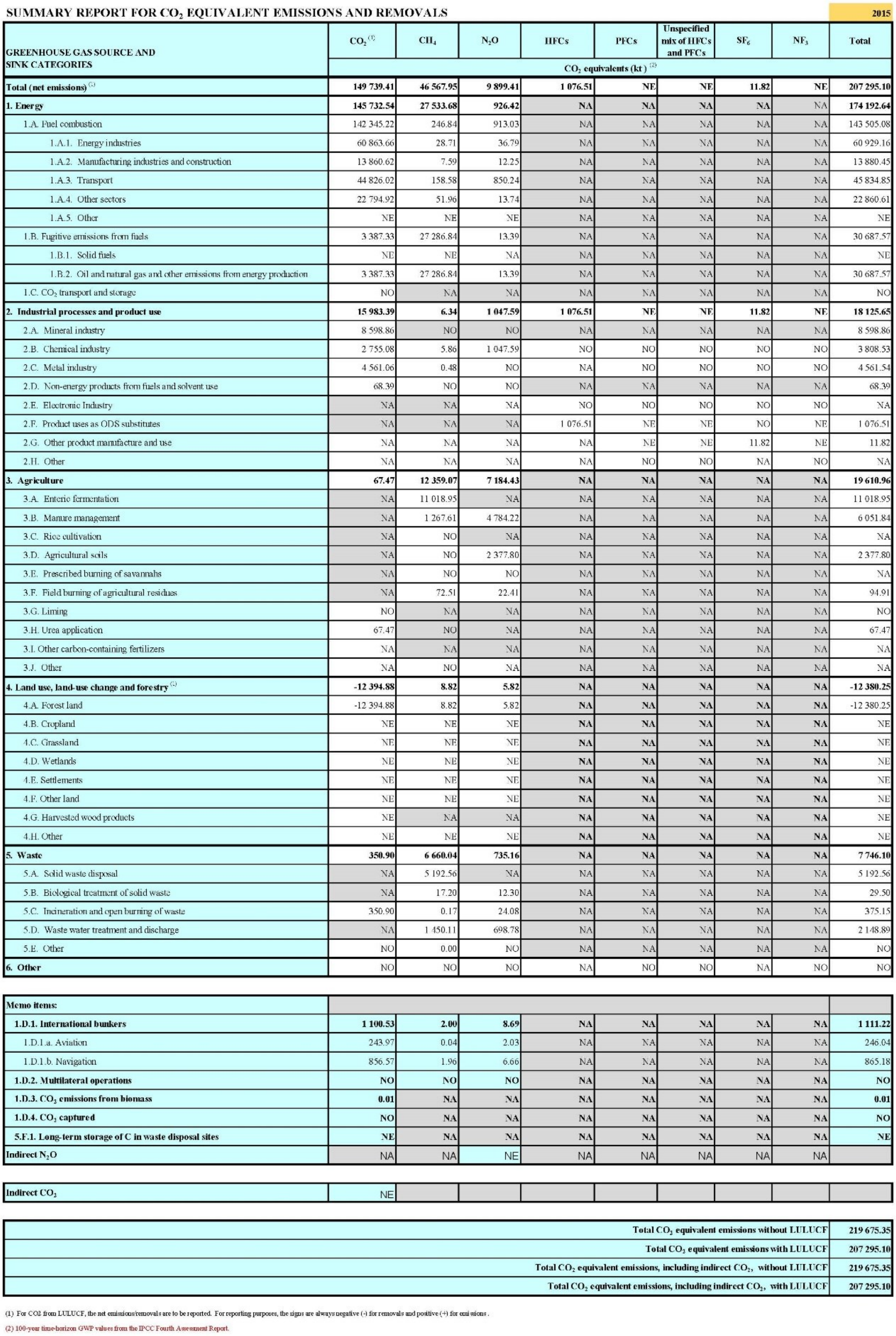
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**137 972.30**	**46 151.40**	**9 738.83**	**654.74**	**NE**	**NE**	**9.53**	**NE**	**194 526.80**
1. Energy	**132 435.19**	**27 412.71**	**865.39**	**NA**	**NA**	**NA**	**NA**	NA	**160 713.29**
1.A. Fuel combustion	128 988.15	230.20	851.71	NA	NA	NA	NA	NA	130 070.06
1.A.1. Energy industries	53 622.40	24.88	31.38	NA	NA	NA	NA	NA	53 678.67
1.A.2. Manufacturing industries and construction	12 374.46	6.73	10.79	NA	NA	NA	NA	NA	12 391.98
1.A.3. Transport	42 079.35	150.73	796.75	NA	NA	NA	NA	NA	43 026.83
1.A.4. Other sectors	20 911.94	47.85	12.79	NA	NA	NA	NA	NA	20 972.58
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 447.04	27 182.51	13.68	NA	NA	NA	NA	NA	30 643.23
1.B.1. Solid fuels	NE	0.02	NA	NA	NA	NA	NA	NA	0.02
1.B.2. Oil and natural gas and other emissions from energy production	3 447.04	27 182.49	13.68	NA	NA	NA	NA	NA	30 643.22
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**14 848.84**	**6.66**	**1 036.32**	**654.74**	**NE**	**NE**	**9.53**	**NE**	**16 556.10**
2.A. Mineral industry	8 288.39	NO	NO	NA	NA	NA	NA	NA	8 288.39
2.B. Chemical industry	2 360.14	6.18	1 036.32	NO	NO	NO	NO	NO	3 402.65
2.C. Metal industry	4 135.46	0.48	NO	NA	NO	NO	NO	NO	4 135.94
2.D. Non-energy products from fuels and solvent use	64.86	NO	NO	NA	NA	NA	NA	NA	64.86
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	654.74	NE	NE	NO	NE	654.74
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	9.53	NE	9.53
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**67.47**	**12 287.95**	**7 087.50**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 442.91**
3.A. Enteric fermentation	NA	10 968.58	NA	NA	NA	NA	NA	NA	10 968.58
3.B. Manure management	NA	1 251.65	4 718.09	NA	NA	NA	NA	NA	5 969.75
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 348.47	NA	NA	NA	NA	NA	2 348.47
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	67.72	20.93	NA	NA	NA	NA	NA	88.64
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	67.47	NO	NA	NA	NA	NA	NA	NA	67.47
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-9 718.10**	**60.52**	**39.91**	**NA**	**NA**	**NA**	**NA**	**NA**	**-9 617.67**
4.A. Forest land	-9 718.10	60.52	39.91	**NA**	**NA**	**NA**	**NA**	**NA**	-9 617.67
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**338.90**	**6 383.56**	**709.71**	**NA**	**NA**	**NA**	**NA**	**NA**	**7 432.16**
5.A. Solid waste disposal	NA	4 916.36	NA	NA	NA	NA	NA	NA	4 916.36
5.B. Biological treatment of solid waste	NA	16.79	12.01	NA	NA	NA	NA	NA	28.79
5.C. Incineration and open burning of waste	338.90	0.16	23.34	NA	NA	NA	NA	NA	362.39
5.D. Waste water treatment and discharge	NA	1 450.25	674.37	NA	NA	NA	NA	NA	2 124.62
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
Memo items:									
1.D.1. International bunkers	**1 195.38**	**1.94**	**9.50**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 206.82**
1.D.1.a. Aviation	373.18	0.07	3.11	NA	NA	NA	NA	NA	376.36
1.D.1.b. Navigation	822.20	1.88	6.39	NA	NA	NA	NA	NA	830.47
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.01**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.01**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	
Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**204 144.47**
Total CO_2 equivalent emissions with LULUCF	**194 526.80**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**204 144.47**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**194 526.80**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS **2015**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**149 739.41**	**46 567.95**	**9 899.41**	**1 076.51**	**NE**	**NE**	**11.82**	**NE**	**207 295.10**
1. Energy	**145 732.54**	**27 533.68**	**926.42**	**NA**	**NA**	**NA**	**NA**	NA	**174 192.64**
1.A. Fuel combustion	142 345.22	246.84	913.03	NA	NA	NA	NA	NA	143 505.08
1.A.1. Energy industries	60 863.66	28.71	36.79	NA	NA	NA	NA	NA	60 929.16
1.A.2. Manufacturing industries and construction	13 860.62	7.59	12.25	NA	NA	NA	NA	NA	13 880.45
1.A.3. Transport	44 826.02	158.58	850.24	NA	NA	NA	NA	NA	45 834.85
1.A.4. Other sectors	22 794.92	51.96	13.74	NA	NA	NA	NA	NA	22 860.61
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 387.33	27 286.84	13.39	NA	NA	NA	NA	NA	30 687.57
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 387.33	27 286.84	13.39	NA	NA	NA	NA	NA	30 687.57
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**15 983.39**	**6.34**	**1 047.59**	**1 076.51**	**NE**	**NE**	**11.82**	**NE**	**18 125.65**
2.A. Mineral industry	8 598.86	NO	NO	NA	NA	NA	NA	NA	8 598.86
2.B. Chemical industry	2 755.08	5.86	1 047.59	NO	NO	NO	NO	NO	3 808.53
2.C. Metal industry	4 561.06	0.48	NO	NA	NO	NO	NO	NO	4 561.54
2.D. Non-energy products from fuels and solvent use	68.39	NO	NO	NA	NA	NA	NA	NA	68.39
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 076.51	NE	NE	NO	NE	1 076.51
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	11.82	NE	11.82
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**67.47**	**12 359.07**	**7 184.43**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 610.96**
3.A. Enteric fermentation	NA	11 018.95	NA	NA	NA	NA	NA	NA	11 018.95
3.B. Manure management	NA	1 267.61	4 784.22	NA	NA	NA	NA	NA	6 051.84
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 377.80	NA	NA	NA	NA	NA	2 377.80
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	72.51	22.41	NA	NA	NA	NA	NA	94.91
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	67.47	NO	NA	NA	NA	NA	NA	NA	67.47
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-12 394.88**	**8.82**	**5.82**	**NA**	**NA**	**NA**	**NA**	**NA**	**-12 380.25**
4.A. Forest land	-12 394.88	8.82	5.82	**NA**	**NA**	**NA**	**NA**	**NA**	-12 380.25
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**350.90**	**6 660.04**	**735.16**	**NA**	**NA**	**NA**	**NA**	**NA**	**7 746.10**
5.A. Solid waste disposal	NA	5 192.56	NA	NA	NA	NA	NA	NA	5 192.56
5.B. Biological treatment of solid waste	NA	17.20	12.30	NA	NA	NA	NA	NA	29.50
5.C. Incineration and open burning of waste	350.90	0.17	24.08	NA	NA	NA	NA	NA	375.15
5.D. Waste water treatment and discharge	NA	1 450.11	698.78	NA	NA	NA	NA	NA	2 148.89
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

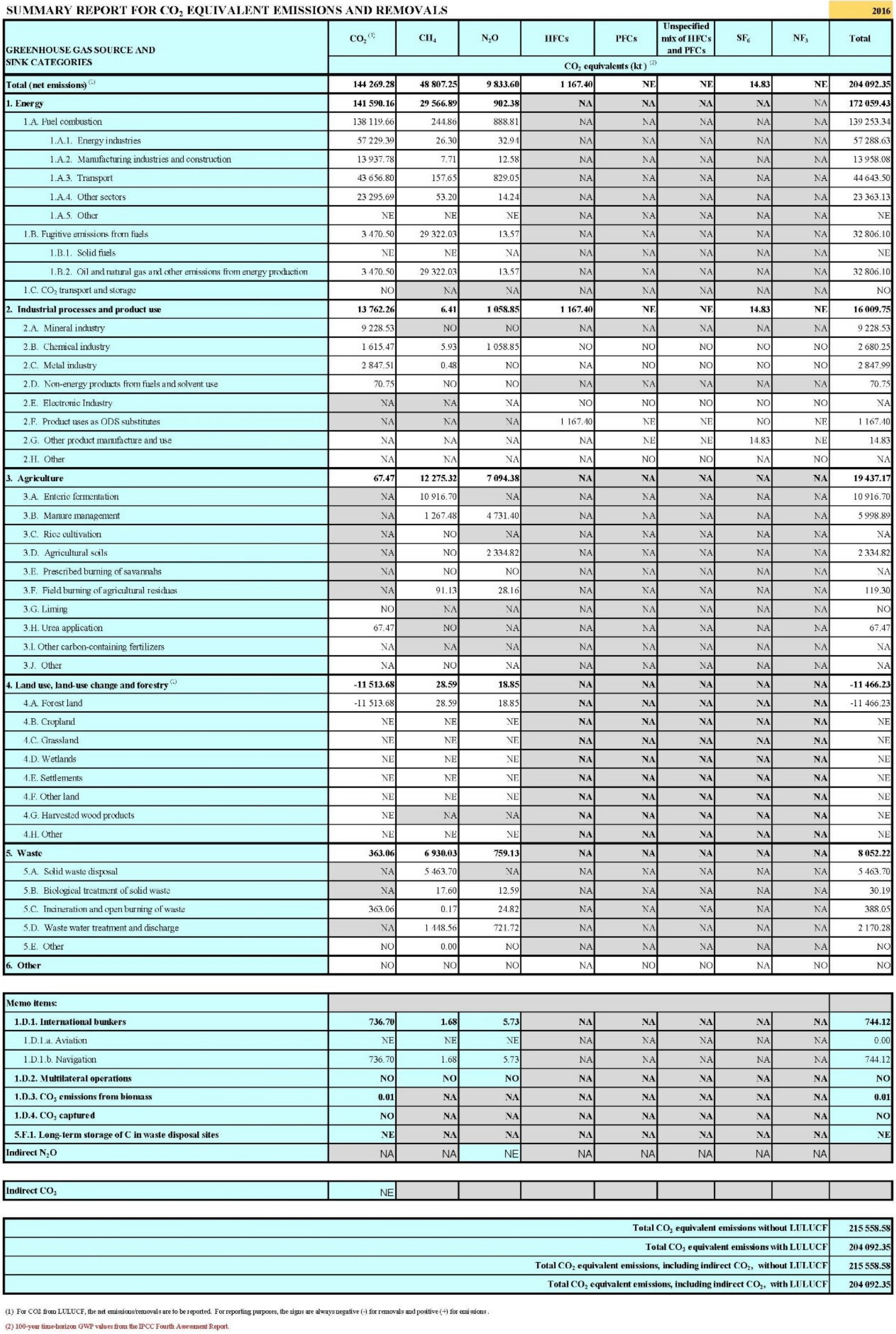
Memo items:									
1.D.1. International bunkers	**1 100.53**	**2.00**	**8.69**	**NA**	**NA**	**NA**	**NA**	**NA**	**1 111.22**
1.D.1.a. Aviation	243.97	0.04	2.03	NA	NA	NA	NA	NA	246.04
1.D.1.b. Navigation	856.57	1.96	6.66	NA	NA	NA	NA	NA	865.18
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.01**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.01**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**219 675.35**
Total CO_2 equivalent emissions with LULUCF	**207 295.10**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**219 675.35**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**207 295.10**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS 2016

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**144 269.28**	**48 807.25**	**9 833.60**	**1 167.40**	**NE**	**NE**	**14.83**	**NE**	**204 092.35**
1. Energy	**141 590.16**	**29 566.89**	**902.38**	**NA**	**NA**	**NA**	**NA**	NA	**172 059.43**
1.A. Fuel combustion	138 119.66	244.86	888.81	NA	NA	NA	NA	NA	139 253.34
1.A.1. Energy industries	57 229.39	26.30	32.94	NA	NA	NA	NA	NA	57 288.63
1.A.2. Manufacturing industries and construction	13 937.78	7.71	12.58	NA	NA	NA	NA	NA	13 958.08
1.A.3. Transport	43 656.80	157.65	829.05	NA	NA	NA	NA	NA	44 643.50
1.A.4. Other sectors	23 295.69	53.20	14.24	NA	NA	NA	NA	NA	23 363.13
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 470.50	29 322.03	13.57	NA	NA	NA	NA	NA	32 806.10
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 470.50	29 322.03	13.57	NA	NA	NA	NA	NA	32 806.10
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**13 762.26**	**6.41**	**1 058.85**	**1 167.40**	**NE**	**NE**	**14.83**	**NE**	**16 009.75**
2.A. Mineral industry	9 228.53	NO	NO	NA	NA	NA	NA	NA	9 228.53
2.B. Chemical industry	1 615.47	5.93	1 058.85	NO	NO	NO	NO	NO	2 680.25
2.C. Metal industry	2 847.51	0.48	NO	NA	NO	NO	NO	NO	2 847.99
2.D. Non-energy products from fuels and solvent use	70.75	NO	NO	NA	NA	NA	NA	NA	70.75
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 167.40	NE	NE	NO	NE	1 167.40
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	14.83	NE	14.83
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**67.47**	**12 275.32**	**7 094.38**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 437.17**
3.A. Enteric fermentation	NA	10 916.70	NA	NA	NA	NA	NA	NA	10 916.70
3.B. Manure management	NA	1 267.48	4 731.40	NA	NA	NA	NA	NA	5 998.89
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 334.82	NA	NA	NA	NA	NA	2 334.82
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	91.13	28.16	NA	NA	NA	NA	NA	119.30
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	67.47	NO	NA	NA	NA	NA	NA	NA	67.47
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-11 513.68**	**28.59**	**18.85**	**NA**	**NA**	**NA**	**NA**	**NA**	**-11 466.23**
4.A. Forest land	-11 513.68	28.59	18.85	**NA**	**NA**	**NA**	**NA**	**NA**	-11 466.23
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**363.06**	**6 930.03**	**759.13**	**NA**	**NA**	**NA**	**NA**	**NA**	**8 052.22**
5.A. Solid waste disposal	NA	5 463.70	NA	NA	NA	NA	NA	NA	5 463.70
5.B. Biological treatment of solid waste	NA	17.60	12.59	NA	NA	NA	NA	NA	30.19
5.C. Incineration and open burning of waste	363.06	0.17	24.82	NA	NA	NA	NA	NA	388.05
5.D. Waste water treatment and discharge	NA	1 448.56	721.72	NA	NA	NA	NA	NA	2 170.28
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**736.70**	**1.68**	**5.73**	**NA**	**NA**	**NA**	**NA**	**NA**	**744.12**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	736.70	1.68	5.73	NA	NA	NA	NA	NA	744.12
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.01**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.01**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**215 558.58**
Total CO_2 equivalent emissions with LULUCF	**204 092.35**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**215 558.58**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**204 092.35**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2017

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**147 424.91**	**49 298.57**	**9 676.75**	**1 040.16**	**NE**	**NE**	**18.70**	**NE**	**207 459.08**
1. Energy	**144 056.06**	**29 856.09**	**875.69**	**NA**	**NA**	**NA**	**NA**	NA	**174 787.84**
1.A. Fuel combustion	140 650.76	253.72	862.44	NA	NA	NA	NA	NA	141 766.92
1.A.1. Energy industries	58 975.39	27.21	34.20	NA	NA	NA	NA	NA	59 036.79
1.A.2. Manufacturing industries and construction	13 363.44	7.01	10.79	NA	NA	NA	NA	NA	13 381.24
1.A.3. Transport	43 245.99	161.26	801.24	NA	NA	NA	NA	NA	44 208.48
1.A.4. Other sectors	25 065.94	58.25	16.22	NA	NA	NA	NA	NA	25 140.41
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 405.30	29 602.38	13.24	NA	NA	NA	NA	NA	33 020.92
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	3 405.30	29 602.38	13.24	NA	NA	NA	NA	NA	33 020.92
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**12 988.62**	**5.72**	**1 070.12**	**1 040.16**	**NE**	**NE**	**18.70**	**NE**	**15 123.31**
2.A. Mineral industry	9 888.20	NO	NO	NA	NA	NA	NA	NA	9 888.20
2.B. Chemical industry	1 267.49	5.23	1 070.12	NO	NO	NO	NO	NO	2 342.84
2.C. Metal industry	1 775.74	0.48	NO	NA	NO	NO	NO	NO	1 776.22
2.D. Non-energy products from fuels and solvent use	57.19	NO	NO	NA	NA	NA	NA	NA	57.19
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 040.16	NE	NE	NO	NE	1 040.16
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	18.70	NE	18.70
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**12 113.80**	**6 900.48**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 014.28**
3.A. Enteric fermentation	NA	10 751.56	NA	NA	NA	NA	NA	NA	10 751.56
3.B. Manure management	NA	1 267.47	4 598.74	NA	NA	NA	NA	NA	5 866.21
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 272.45	NA	NA	NA	NA	NA	2 272.45
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	94.76	29.29	NA	NA	NA	NA	NA	124.05
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-9 995.05**	**91.27**	**60.18**	**NA**	**NA**	**NA**	**NA**	**NA**	**-9 843.60**
4.A. Forest land	-9 995.05	91.27	60.18	**NA**	**NA**	**NA**	**NA**	**NA**	-9 843.60
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**375.28**	**7 231.69**	**770.28**	**NA**	**NA**	**NA**	**NA**	**NA**	**8 377.25**
5.A. Solid waste disposal	NA	5 726.83	NA	NA	NA	NA	NA	NA	5 726.83
5.B. Biological treatment of solid waste	NA	18.00	12.87	NA	NA	NA	NA	NA	30.87
5.C. Incineration and open burning of waste	375.28	0.18	25.54	NA	NA	NA	NA	NA	401.00
5.D. Waste water treatment and discharge	NA	1 486.69	731.87	NA	NA	NA	NA	NA	2 218.55
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

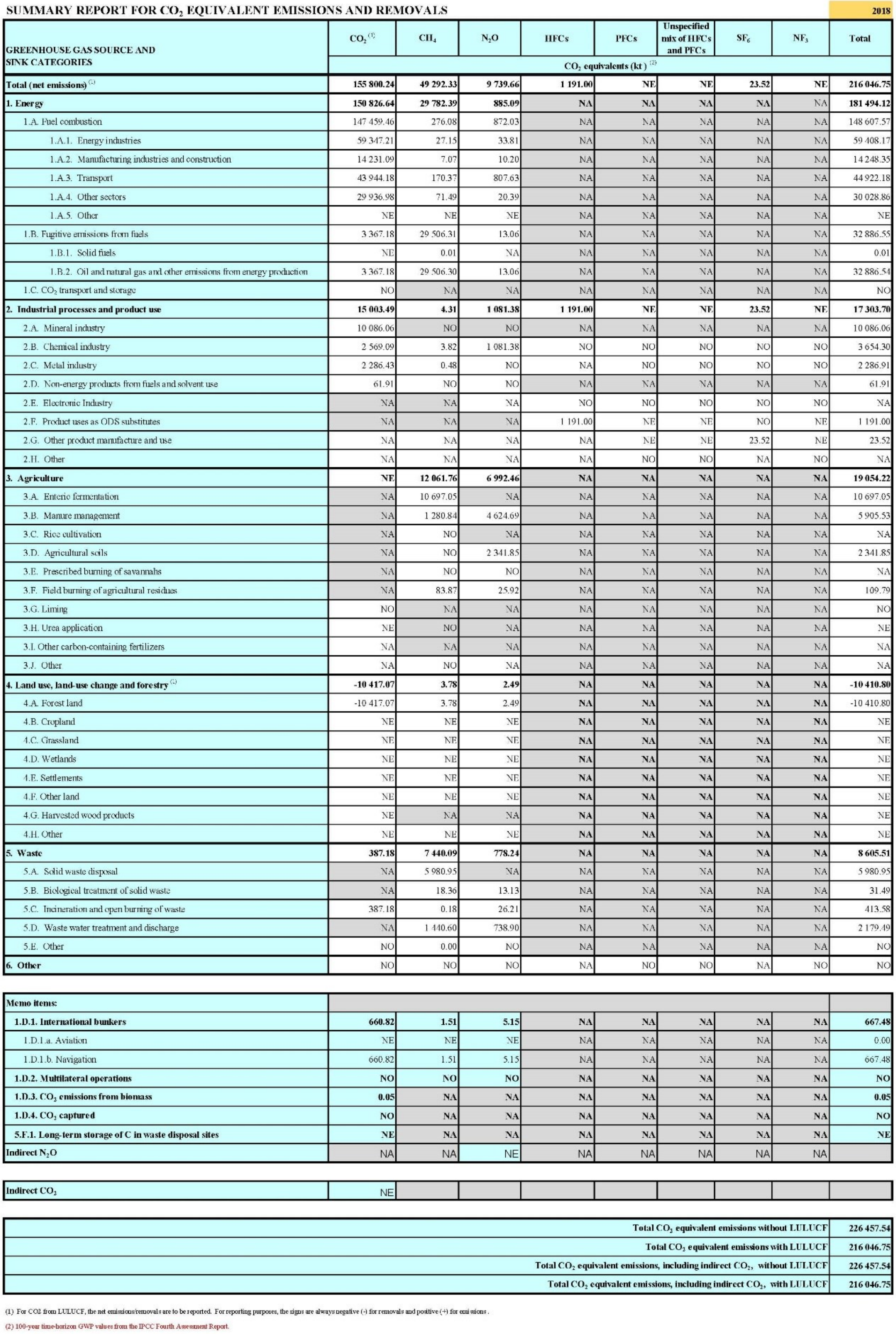
Memo items:									
1.D.1. International bunkers	**729.07**	**1.67**	**5.68**	**NA**	**NA**	**NA**	**NA**	**NA**	**736.42**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	729.07	1.67	5.68	NA	NA	NA	NA	NA	736.42
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.02**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.02**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**217 302.68**
Total CO_2 equivalent emissions with LULUCF	**207 459.08**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**217 302.68**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**207 459.08**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2018

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**155 800.24**	**49 292.33**	**9 739.66**	**1 191.00**	**NE**	**NE**	**23.52**	**NE**	**216 046.75**
1. Energy	**150 826.64**	**29 782.39**	**885.09**	**NA**	**NA**	**NA**	**NA**	NA	**181 494.12**
1.A. Fuel combustion	147 459.46	276.08	872.03	NA	NA	NA	NA	NA	148 607.57
1.A.1. Energy industries	59 347.21	27.15	33.81	NA	NA	NA	NA	NA	59 408.17
1.A.2. Manufacturing industries and construction	14 231.09	7.07	10.20	NA	NA	NA	NA	NA	14 248.35
1.A.3. Transport	43 944.18	170.37	807.63	NA	NA	NA	NA	NA	44 922.18
1.A.4. Other sectors	29 936.98	71.49	20.39	NA	NA	NA	NA	NA	30 028.86
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 367.18	29 506.31	13.06	NA	NA	NA	NA	NA	32 886.55
1.B.1. Solid fuels	NE	0.01	NA	NA	NA	NA	NA	NA	0.01
1.B.2. Oil and natural gas and other emissions from energy production	3 367.18	29 506.30	13.06	NA	NA	NA	NA	NA	32 886.54
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**15 003.49**	**4.31**	**1 081.38**	**1 191.00**	**NE**	**NE**	**23.52**	**NE**	**17 303.70**
2.A. Mineral industry	10 086.06	NO	NO	NA	NA	NA	NA	NA	10 086.06
2.B. Chemical industry	2 569.09	3.82	1 081.38	NO	NO	NO	NO	NO	3 654.30
2.C. Metal industry	2 286.43	0.48	NO	NA	NO	NO	NO	NO	2 286.91
2.D. Non-energy products from fuels and solvent use	61.91	NO	NO	NA	NA	NA	NA	NA	61.91
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 191.00	NE	NE	NO	NE	1 191.00
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	23.52	NE	23.52
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**12 061.76**	**6 992.46**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 054.22**
3.A. Enteric fermentation	NA	10 697.05	NA	NA	NA	NA	NA	NA	10 697.05
3.B. Manure management	NA	1 280.84	4 624.69	NA	NA	NA	NA	NA	5 905.53
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 341.85	NA	NA	NA	NA	NA	2 341.85
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	83.87	25.92	NA	NA	NA	NA	NA	109.79
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-10 417.07**	**3.78**	**2.49**	**NA**	**NA**	**NA**	**NA**	**NA**	**-10 410.80**
4.A. Forest land	-10 417.07	3.78	2.49	**NA**	**NA**	**NA**	**NA**	**NA**	-10 410.80
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**387.18**	**7 440.09**	**778.24**	**NA**	**NA**	**NA**	**NA**	**NA**	**8 605.51**
5.A. Solid waste disposal	NA	5 980.95	NA	NA	NA	NA	NA	NA	5 980.95
5.B. Biological treatment of solid waste	NA	18.36	13.13	NA	NA	NA	NA	NA	31.49
5.C. Incineration and open burning of waste	387.18	0.18	26.21	NA	NA	NA	NA	NA	413.58
5.D. Waste water treatment and discharge	NA	1 440.60	738.90	NA	NA	NA	NA	NA	2 179.49
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

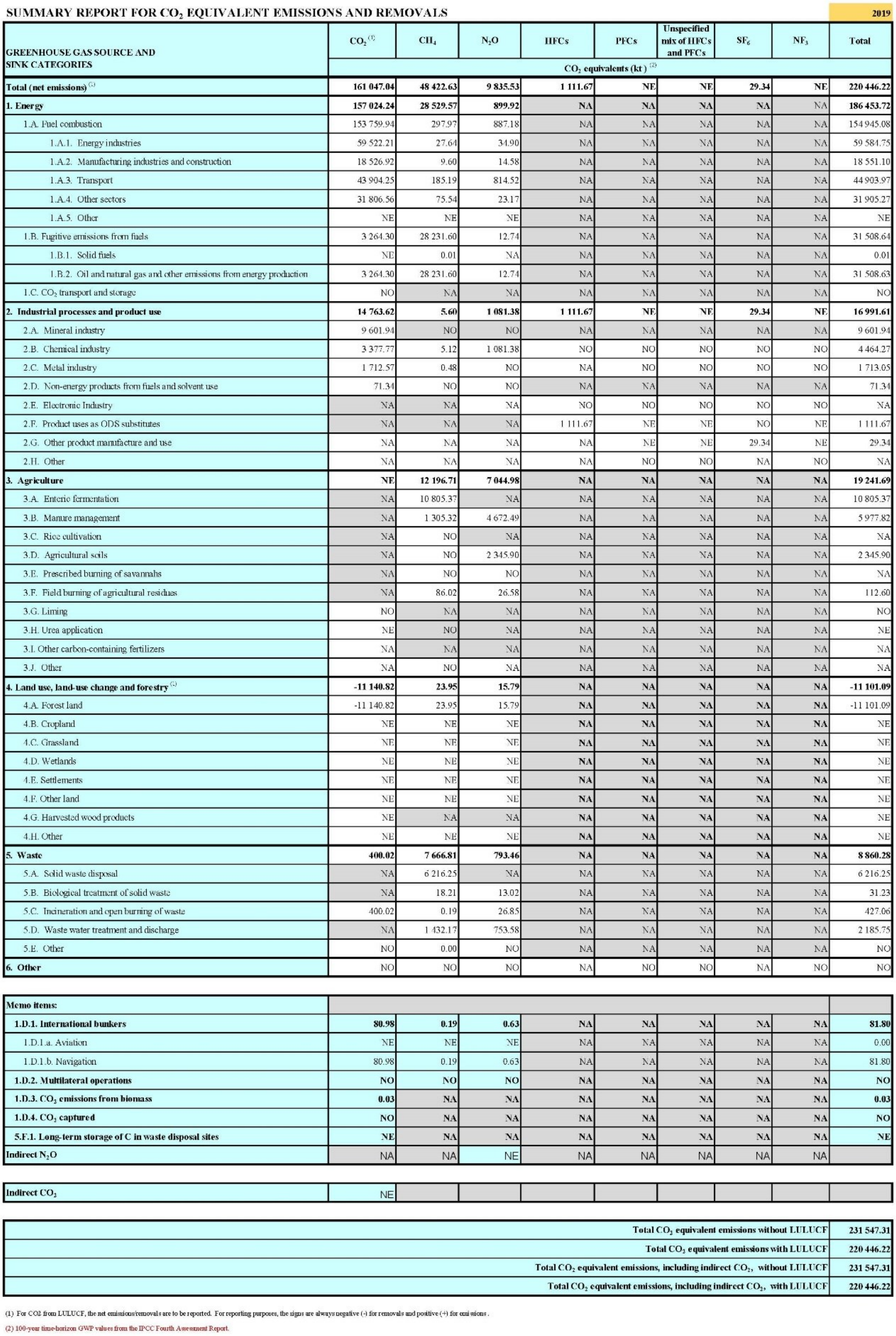
Memo items:									
1.D.1. International bunkers	**660.82**	**1.51**	**5.15**	**NA**	**NA**	**NA**	**NA**	**NA**	**667.48**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	660.82	1.51	5.15	NA	NA	NA	NA	NA	667.48
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.05**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.05**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**226 457.54**
Total CO_2 equivalent emissions with LULUCF	**216 046.75**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**226 457.54**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**216 046.75**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2019

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) (2)								
Total (net emissions) (1)	**161 047.04**	**48 422.63**	**9 835.53**	**1 111.67**	**NE**	**NE**	**29.34**	**NE**	**220 446.22**
1. Energy	**157 024.24**	**28 529.57**	**899.92**	**NA**	**NA**	**NA**	**NA**	NA	**186 453.72**
1.A. Fuel combustion	153 759.94	297.97	887.18	NA	NA	NA	NA	NA	154 945.08
1.A.1. Energy industries	59 522.21	27.64	34.90	NA	NA	NA	NA	NA	59 584.75
1.A.2. Manufacturing industries and construction	18 526.92	9.60	14.58	NA	NA	NA	NA	NA	18 551.10
1.A.3. Transport	43 904.25	185.19	814.52	NA	NA	NA	NA	NA	44 903.97
1.A.4. Other sectors	31 806.56	75.54	23.17	NA	NA	NA	NA	NA	31 905.27
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	3 264.30	28 231.60	12.74	NA	NA	NA	NA	NA	31 508.64
1.B.1. Solid fuels	NE	0.01	NA	NA	NA	NA	NA	NA	0.01
1.B.2. Oil and natural gas and other emissions from energy production	3 264.30	28 231.60	12.74	NA	NA	NA	NA	NA	31 508.63
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**14 763.62**	**5.60**	**1 081.38**	**1 111.67**	**NE**	**NE**	**29.34**	**NE**	**16 991.61**
2.A. Mineral industry	9 601.94	NO	NO	NA	NA	NA	NA	NA	9 601.94
2.B. Chemical industry	3 377.77	5.12	1 081.38	NO	NO	NO	NO	NO	4 464.27
2.C. Metal industry	1 712.57	0.48	NO	NA	NO	NO	NO	NO	1 713.05
2.D. Non-energy products from fuels and solvent use	71.34	NO	NO	NA	NA	NA	NA	NA	71.34
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 111.67	NE	NE	NO	NE	1 111.67
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	29.34	NE	29.34
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**12 196.71**	**7 044.98**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 241.69**
3.A. Enteric fermentation	NA	10 805.37	NA	NA	NA	NA	NA	NA	10 805.37
3.B. Manure management	NA	1 305.32	4 672.49	NA	NA	NA	NA	NA	5 977.82
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 345.90	NA	NA	NA	NA	NA	2 345.90
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	86.02	26.58	NA	NA	NA	NA	NA	112.60
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry (1)	**-11 140.82**	**23.95**	**15.79**	**NA**	**NA**	**NA**	**NA**	**NA**	**-11 101.09**
4.A. Forest land	-11 140.82	23.95	15.79	**NA**	**NA**	**NA**	**NA**	**NA**	-11 101.09
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**400.02**	**7 666.81**	**793.46**	**NA**	**NA**	**NA**	**NA**	**NA**	**8 860.28**
5.A. Solid waste disposal	NA	6 216.25	NA	NA	NA	NA	NA	NA	6 216.25
5.B. Biological treatment of solid waste	NA	18.21	13.02	NA	NA	NA	NA	NA	31.23
5.C. Incineration and open burning of waste	400.02	0.19	26.85	NA	NA	NA	NA	NA	427.06
5.D. Waste water treatment and discharge	NA	1 432.17	753.58	NA	NA	NA	NA	NA	2 185.75
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

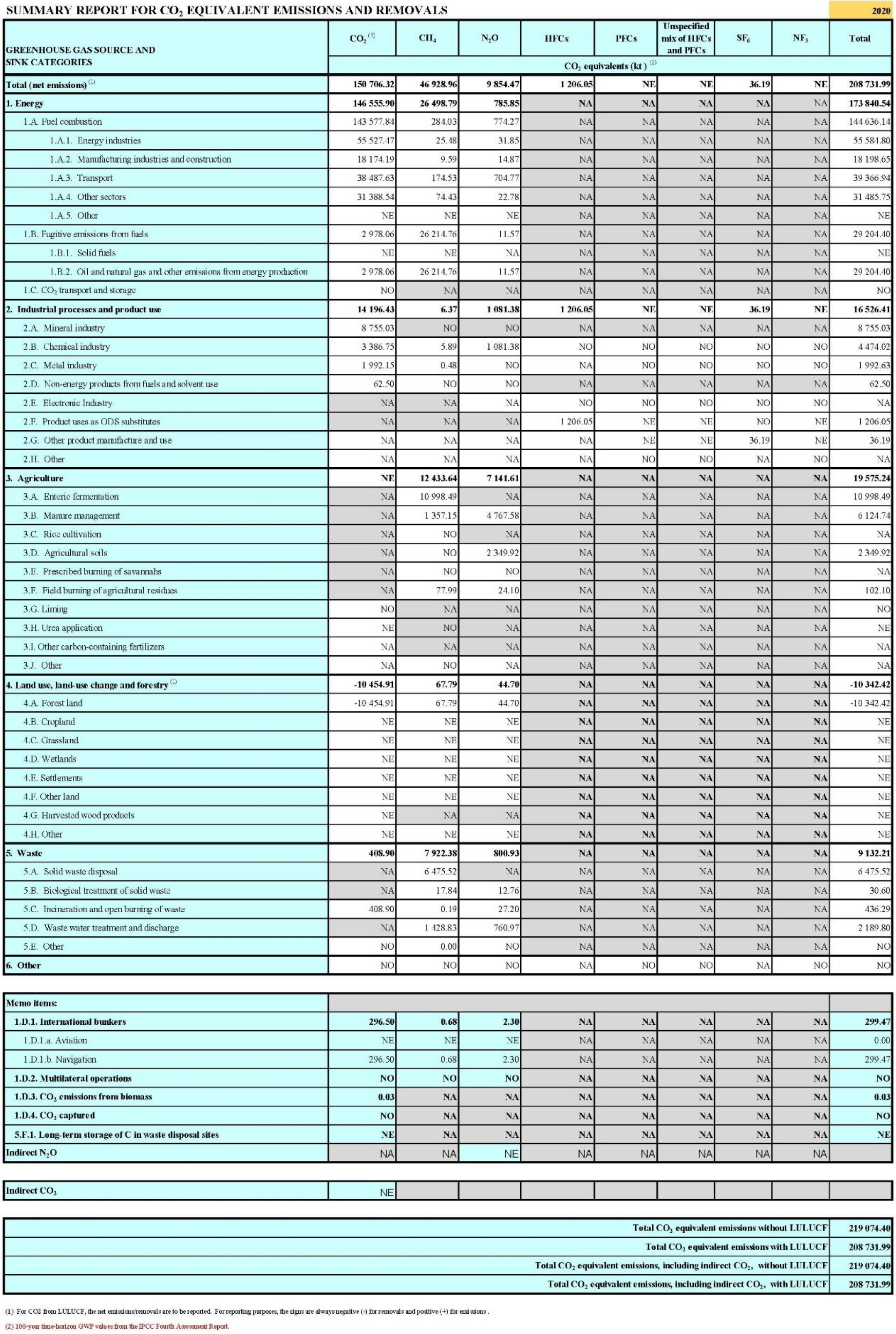
Memo items:									
1.D.1. International bunkers	**80.98**	**0.19**	**0.63**	**NA**	**NA**	**NA**	**NA**	**NA**	**81.80**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	80.98	0.19	0.63	NA	NA	NA	NA	NA	81.80
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.03**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.03**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**231 547.31**
Total CO_2 equivalent emissions with LULUCF	**220 446.22**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**231 547.31**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**220 446.22**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.



SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS AND REMOVALS

2020

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	Total
	CO_2 equivalents (kt) [2]								
Total (net emissions) [1]	**150 706.32**	**46 928.96**	**9 854.47**	**1 206.05**	**NE**	**NE**	**36.19**	**NE**	**208 731.99**
1. Energy	**146 555.90**	**26 498.79**	**785.85**	**NA**	**NA**	**NA**	**NA**	NA	**173 840.54**
1.A. Fuel combustion	143 577.84	284.03	774.27	NA	NA	NA	NA	NA	144 636.14
1.A.1. Energy industries	55 527.47	25.48	31.85	NA	NA	NA	NA	NA	55 584.80
1.A.2. Manufacturing industries and construction	18 174.19	9.59	14.87	NA	NA	NA	NA	NA	18 198.65
1.A.3. Transport	38 487.63	174.53	704.77	NA	NA	NA	NA	NA	39 366.94
1.A.4. Other sectors	31 388.54	74.43	22.78	NA	NA	NA	NA	NA	31 485.75
1.A.5. Other	NE	NE	NE	NA	NA	NA	NA	NA	NE
1.B. Fugitive emissions from fuels	2 978.06	26 214.76	11.57	NA	NA	NA	NA	NA	29 204.40
1.B.1. Solid fuels	NE	NE	NA	NA	NA	NA	NA	NA	NE
1.B.2. Oil and natural gas and other emissions from energy production	2 978.06	26 214.76	11.57	NA	NA	NA	NA	NA	29 204.40
1.C. CO_2 transport and storage	NO	NA	NA	NA	NA	NA	NA	NA	NO
2. Industrial processes and product use	**14 196.43**	**6.37**	**1 081.38**	**1 206.05**	**NE**	**NE**	**36.19**	**NE**	**16 526.41**
2.A. Mineral industry	8 755.03	NO	NO	NA	NA	NA	NA	NA	8 755.03
2.B. Chemical industry	3 386.75	5.89	1 081.38	NO	NO	NO	NO	NO	4 474.02
2.C. Metal industry	1 992.15	0.48	NO	NA	NO	NO	NO	NO	1 992.63
2.D. Non-energy products from fuels and solvent use	62.50	NO	NO	NA	NA	NA	NA	NA	62.50
2.E. Electronic Industry	NA	NA	NA	NO	NO	NO	NO	NO	NA
2.F. Product uses as ODS substitutes	NA	NA	NA	1 206.05	NE	NE	NO	NE	1 206.05
2.G. Other product manufacture and use	NA	NA	NA	NA	NE	NE	36.19	NE	36.19
2.H. Other	NA	NA	NA	NA	NO	NO	NA	NO	NA
3. Agriculture	**NE**	**12 433.64**	**7 141.61**	**NA**	**NA**	**NA**	**NA**	**NA**	**19 575.24**
3.A. Enteric fermentation	NA	10 998.49	NA	NA	NA	NA	NA	NA	10 998.49
3.B. Manure management	NA	1 357.15	4 767.58	NA	NA	NA	NA	NA	6 124.74
3.C. Rice cultivation	NA	NO	NA	NA	NA	NA	NA	NA	NA
3.D. Agricultural soils	NA	NO	2 349.92	NA	NA	NA	NA	NA	2 349.92
3.E. Prescribed burning of savannahs	NA	NO	NO	NA	NA	NA	NA	NA	NA
3.F. Field burning of agricultural residues	NA	77.99	24.10	NA	NA	NA	NA	NA	102.10
3.G. Liming	NO	NA	NA	NA	NA	NA	NA	NA	NO
3.H. Urea application	NE	NO	NA	NA	NA	NA	NA	NA	NE
3.I. Other carbon-containing fertilizers	NA	NA	NA	NA	NA	NA	NA	NA	NA
3.J. Other	NA	NO	NA	NA	NA	NA	NA	NA	NA
4. Land use, land-use change and forestry [1]	**-10 454.91**	**67.79**	**44.70**	**NA**	**NA**	**NA**	**NA**	**NA**	**-10 342.42**
4.A. Forest land	-10 454.91	67.79	44.70	**NA**	**NA**	**NA**	**NA**	**NA**	-10 342.42
4.B. Cropland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.C. Grassland	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.D. Wetlands	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.E. Settlements	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.F. Other land	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.G. Harvested wood products	NE	NA	NA	**NA**	**NA**	**NA**	**NA**	**NA**	NE
4.H. Other	NE	NE	NE	**NA**	**NA**	**NA**	**NA**	**NA**	NE
5. Waste	**408.90**	**7 922.38**	**800.93**	**NA**	**NA**	**NA**	**NA**	**NA**	**9 132.21**
5.A. Solid waste disposal	NA	6 475.52	NA	NA	NA	NA	NA	NA	6 475.52
5.B. Biological treatment of solid waste	NA	17.84	12.76	NA	NA	NA	NA	NA	30.60
5.C. Incineration and open burning of waste	408.90	0.19	27.20	NA	NA	NA	NA	NA	436.29
5.D. Waste water treatment and discharge	NA	1 428.83	760.97	NA	NA	NA	NA	NA	2 189.80
5.E. Other	NO	0.00	NO	NA	NA	NA	NA	NA	NO
6. Other	NO	NO	NO	NA	NO	NO	NA	NO	NO

Memo items:									
1.D.1. International bunkers	**296.50**	**0.68**	**2.30**	**NA**	**NA**	**NA**	**NA**	**NA**	**299.47**
1.D.1.a. Aviation	NE	NE	NE	NA	NA	NA	NA	NA	0.00
1.D.1.b. Navigation	296.50	0.68	2.30	NA	NA	NA	NA	NA	299.47
1.D.2. Multilateral operations	**NO**	**NO**	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
1.D.3. CO_2 emissions from biomass	**0.03**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.03**
1.D.4. CO_2 captured	**NO**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NO**
5.F.1. Long-term storage of C in waste disposal sites	**NE**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NE**
Indirect N_2O	NA	NA	NE	NA	NA	NA	NA	NA	

Indirect CO_2	NE								

Total CO_2 equivalent emissions without LULUCF	**219 074.40**
Total CO_2 equivalent emissions with LULUCF	**208 731.99**
Total CO_2 equivalent emissions, including indirect CO_2, without LULUCF	**219 074.40**
Total CO_2 equivalent emissions, including indirect CO_2, with LULUCF	**208 731.99**

(1) For CO2 from LULUCF, the net emissions/removals are to be reported. For reporting purposes, the signs are always negative (-) for removals and positive (+) for emissions .

(2) 100-year time-horizon GWP values from the IPCC Fourth Assessment Report.

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13 Units and abbreviations

13.1 Units and abbreviations, and standard equivalents

Unit	Abbreviation	Equivalents	Equivalents
1 tonne of oil equivalent (toe)	1 toe	1 x 10^{10} calories	1 x 10^{10} cal
1 ktoe		41.868 terajoules	41.868 TJ
1 short ton	1 sh t	0.9072 tonne	0.9072 t
1 tonne	1 t	1.1023 short tons	1.1023 sh t
1 kilogram	1 kg	2.2046 pounds	2.2046 lb
1 hectare	1 ha	10^4 square meters	10^4 m^2
1 calorie$_{IT}$	1 cal$_{IT}$	4.1868 Joules	4.1868 J
1 atmosphere	1 atm	101.325 kilopascal	101.325 kPa
1 gram	1 g	0.002205 pounds	0.00205 lb
1 pound	1 lb	453.6 gram	453.6 g
1 terajoule	1 TJ	2.78 x 10^5 kiloWatt hour	2.78 x 10^5 kWh
1 kilowatt hour	1 kWh	3.6 x 10^6 Joules	3.6 x 10^6 J

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

Abbreviation	Description (english)	Description (French)
GWh	Gigawatt-hour	Gigawatt-heure
TWh	Terawatt-hour	Térawatt-heure
kW	Kilowatt	kilowatt
kWh	Kilowatt-hour	Kilowatt-heure
MW	Megawatt	Mégawatt
MWh	Megawatt-hour	Mégawatt-heure

13.2 Derived units

Tons			**Grams**			**Equivalents***				
Multiple	**Name**	**Symbol**	**Multiple**	**Name**	**Symbol**	**Tonnes (t)**	**Kilograms (kg)**	**Grams (g)**	**US/short tons (ST)[†]**	**Imperial/long tons (LT)[†]**
10^0	tonne	t	10^6	megagram	Mg	1 t	1 000 kg	1 million g	1.1023 ST	0.98421 LT
10^3	kilotonne	kt	10^9	gigagram	Gg	1 000 t	1 million kg	1 billion g	1 102.3 ST	984.21 LT
10^6	megatonne	Mt	10^{12}	teragram	Tg	1 million t	1 billion kg	1 trillion g	1.1023 million ST	984,210 LT
10^9	gigatonne	Gt	10^{15}	petagram	Pg	1 billion t	1 trillion kg	1 quadrillion g	1.1023 billion ST	984.21 million LT
10^{12}	teratonne	Tt	10^{18}	exagram	Eg	1 trillion t	1 quadrillion kg	1 quintillion g	1.1023 trillion ST	984.21 billion LT
10^{15}	petatonne	Pt	10^{21}	zettagram	Zg	1 quadrillion t	1 quintillion kg	1 sextillion g	1.1023 quadrillion ST	984.21 trillion LT
10^{18}	exatonne	Et	10^{24}	yottagram	Yg	1 quintillion t	1 sextillion kg	1 septillion g	1.1023 quintillion ST	984.21 quadrillion LT

(*The equivalent units columns use the short scale large-number naming system currently used in most English-language countries, e.g., 1 billion = 1 000 million = 1 000 000 000)

Source: https://en.wikipedia.org/wiki/Tonne

13.3 Prefixes and multiplication factors

Multiplication Factor	Abbreviation	Prefix	Symbol
1 000 000 000 000 000	10^{15}	peta	P
1 000 000 000 000	10^{12}	tera	T
1 000 000 000	10^{9}	giga	G
1 000 000	10^{6}	mega	M
1 000	10^{3}	kilo	k
100	10^{2}	hecto	h
10	10^{1}	deca	da
0.1	10^{-1}	deci	d
0.01	10^{-2}	centi	c
0.001	10^{-3}	milli	m
0.000 001	10^{-6}	micro	µ

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents

13.4 Chemical formulae

Chemical formula	Gas	
C	Carbon	Méthane
CH_4	Methane	
CO	Carbon monoxide	Monoxyde de carbone
CO_2	Carbon dioxide	Dioxyde de carbone
H_2	Hydrogen	
H_2S	Hydrogen sulphide	
N		Nitrogen
N_2O	Nitrous oxide	oxyde nitreux
NO_X	Nitrogen oxides	Oxydes d'azote
SO_x	Sulphur oxides	Oxydes de soufre
SO_2	Sulphur dioxide	Dioxyde de soufre
NMVOC	Non-methane volatile organic compound	
COVNM		Composés organiques volatils non méthaniques
F-gases	Flourinated gases	Gaz fluorés
HFC	Hydrofluorocarbon	Hydrofluorocarbone
NF_3	Nitrogen trifluoride	Trifluorure d'azote
SF_6		Hexafluorure de soufre
CO_2 eq		CO_2 equivalent
GHG	Greenhouse gas	
GES		Gaz à effet de serre
KCA	Key category analysis	
UA	Uncertainty analysis	

Source: 2006 IPCC Guidelines, Volume 1: General Guidance and Reporting, Annex 8A.1: Prefixes, units and abbreviations, standard equivalents