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30 YEARS IN ALBANIA

Albania's National Greenhouse Gas Inventory Report

Under the First Biennial Update Report

July 2021

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Abbreviations

BUR1	First Biennial Update Report
NC4	Fourth National Communication
AFOLU	Agriculture, Forestry and other land use
BEF	Biomass Expansion Factor
BCEF	Biomass Conversion and Expansion Factor
DOC	Degradable Organic Carbon
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
MMS	Manure Management System
NCs	National Communications
NMVOC	Non-Methane Volatile Organic Compounds
NDC	National Determined Contribution
ODS	Ozone Depleting Substances
TNC	Third National Communication
TPP	Thermal Power Plant
HPP	Hydro Power Plant
RA	Republic of Albania
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization of UN
GPG	Good Practice Guidance
SWDS	Solid Waste Disposal Sites
FOD	First Order Decay
DOC	Degradable Organic Carbon
MTE	Ministry of Tourism and Environment;
MIE	Ministry of Infrastructure and Energy
LULUCF	Land Use, Land Use Change and Forestry
FNC	First National Communication
SNC	Second National Communication
INSTAT	Institute of Statistics
MSW	Municipal Solid Waste
NEA	National Environment Agency

Chemical Symbols

CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2 eq.	Carbon Dioxide Equivalent
CH_4	Methane
N	Nitrogen
N_2O	Nitrous Oxide
NO_x	Nitrogen Oxides
NMVOC	Non Methane Volatile Organic Compounds
SO_2	Sulfur dioxide
CFC	Chloro Fluoro Carbon
HFC	Hydrofluorocarbon
PFC	Perfuorocarbon

Measures

t	tone
kt	kilotone (10^3 t)
Mt	megatone (10^6 t)
ktoe	kilo ton oil equivalent
mm	millimeter
m	meter
km	kilometer
km^2	square kilometer
m^3	cubic meter
km^3	cubic kilometer
g	grams
Gg	gigagram (10^9 g) = kt = 1000 tones
ha	hectare
J	joule
TJ	Terajoule
thous.	thousand
mln.	million
ppm	parts per million
MWt	megawatt
Wh	watt - hour
KWh	kilowatt - hour
GWh.	gigawatt - hour
$	dollars USD

EXECUTIVE SUMMARY

Albania, as a non-Annex 1 country to the United Nations Framework Convention on Climate Change (UNFCCC), has been developing an inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) emitted to or removed from the atmosphere since 1990 as part of its National Communications on Climate Change and Biennial Update Reports. Up to now three National Communications (2002, 2009 and 2016) have been delivered to the UNFCCC.

Albania's First Biennial Update Report (BUR1) includes a national GHG inventory for the years 2010 – 2016, including a revision of the inventory results for the year 2009 to adjust to the use of the 2006 IPCC Guidelines. The inventory covers the GHG emissions and removals estimates as divided into the following main sectors: (i) Energy; (ii) Industrial Processes and Product Use (IPPU); (iii) Agriculture, Forestry and Other Land Use (AFOLU) and (iv) Waste. The Tier 1 method i.e. the “Default method” is applied for all subsectors in the absence of the country specific emission factors. To facilitate aggregate reporting of the GHG values, expressed as carbon dioxide equivalents (CO_2 eq.), as indicated in the Decision 17/CP.8, the global warming potentials (GWPs) values provided in the IPCC Second Assessment Report (temporal horizon 100 years) are used. The inventory covers the following Greenhouse Gases: CO_2, CH_4, N_2O, PFCs and HFCs and precursor and indirect emissions of CO, NO_x, NMVOC and SO_2.

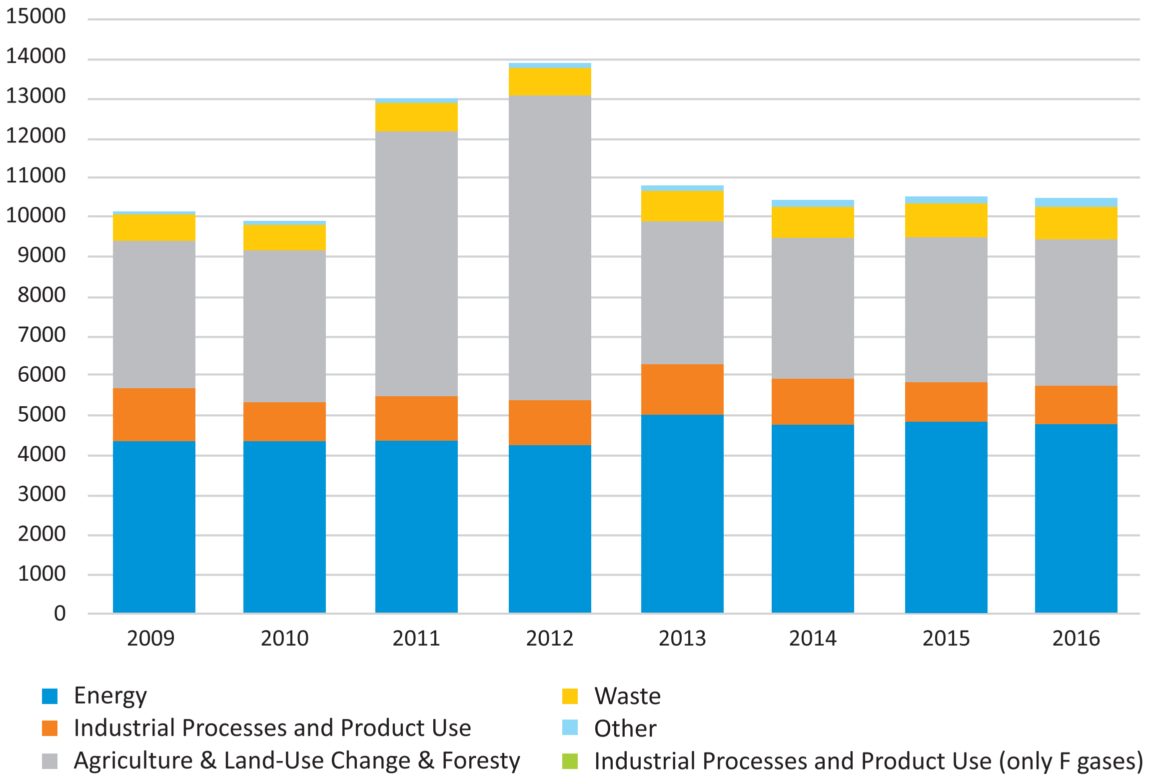
The GHG inventory under the First Biennial Update Report (BUR1) is coordinated by the Ministry of Tourism and Environment as the UNFCCC focal point and the central authority in Albania in charge for climate change policy. The preparation of the GHG Inventory is project based, supported by the Global Environment Facility (GEF) and the UNDP. Six professionals were engaged to form the GHG inventory team (each of them responsible for one or more sectors including data collection). The inventory was prepared using the latest IPCC Inventory software version available at the time of the preparing the inventory (IPCC 2006 software - version 2.691).

The table and figure below show net emissions, including removals from AFOLU, for the years 2009 to 2016 disaggregated by sector. Energy and AFOLU are the most significant contributors of GHG emissions in Albania.

Table 1: Anthropogenic greenhouse gas emissions by sector in Albania (Gg CO_2 eq.)

Sector	2009	2010	2011	2012	2013	2014	2015	2016
Energy	4,340	4,347	4,398	4,252	5,026	4,746	4,813	4,781
IPPU	1,358	967	1,125	1,154	1,245	1,194	1,106	1,020
AFOLU	3,748	3,870	6,647	7,641	3,641	3,560	3,620	3,688
Waste	621	660	705	747	784	801	821	839
Other	75	80	82	83	86	104	129	134
Total	**10,141**	**9,924**	**12,957**	**13,876**	**10,782**	**10,405**	**10,489**	**10,461**

Figure 1: CO_2 eq. emissions and removals from all economic sectors (Gg)

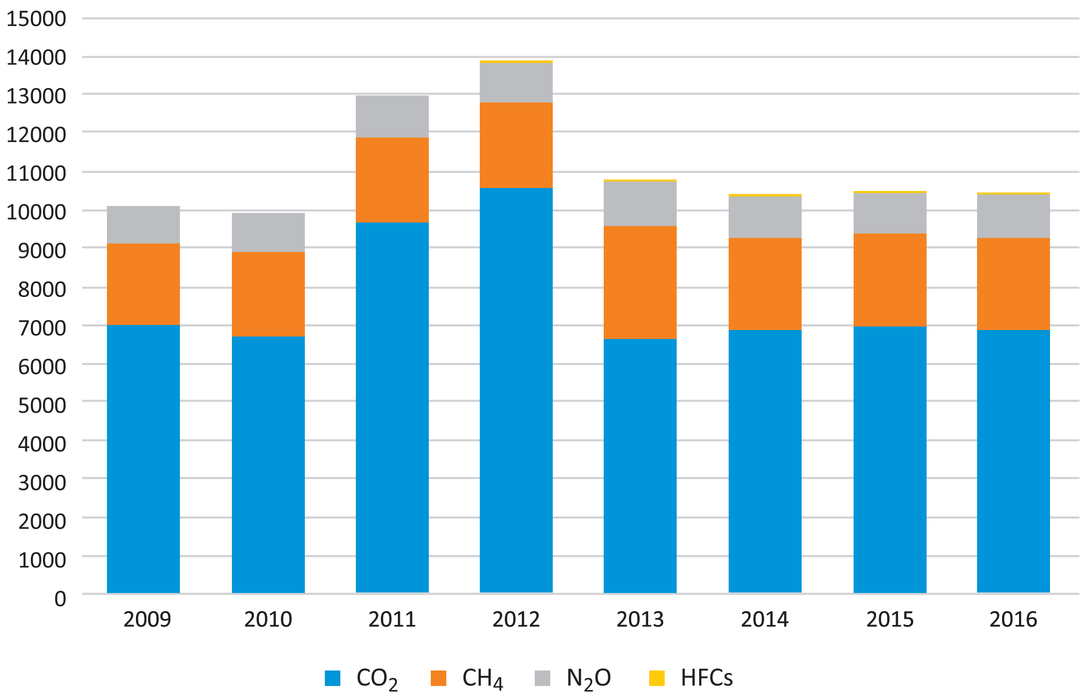


The table and figure below show net emissions, including removals from AFOLU, for the years 2009 to 2016 disaggregated by gas. CO_2 is the most significant GHG in Albania.

Table 2: Anthropogenic greenhouse gas emissions by gas in Albania (Gg CO_2 eq.)

Sector	2009	2010	2011	2012	2013	2014	2015	2016
CO_2	7,028	6,773	9,731	10,589	6,678	6,919	7,022	6,939
CH_4	2,103	2,151	2,190	2,253	2,925	2,381	2,361	2,370
N_2O	1,010	1,000	1,037	1,034	1,172	1,089	1,081	1,118
HFCs	NE	NE	NE	0.1	8	16	25	35
Total	**10,141**	**9,924**	**12,957**	**13,876**	**10,782**	**10,405**	**10,489**	**10,461**

Figure 2: Total GHG emissions by gas (Gg CO_2 eq.)



The GHG emissions from the Energy Sector accounts for the emissions released as a result of fuel combustion activities, as well as the fugitive emissions from the extraction of solid and transmission and distribution of liquid and gaseous fuels. The emissions are separated in the following categories: Energy Industries, Manufacturing Industries and Construction, Transport, Other sectors (Commercial/ Institutional, Residential and Agriculture/Forestry/ Fishing) and Non-Specified. In addition, the Fugitive emissions from extraction of lignite and oil refining related activities have been calculated. Analysis show that the Transport subsector has been playing a continuous bigger role followed by the Manufacturing Industry and Construction (related to fuel consumption).

The GHG emissions from the IPPU sector come mainly from two main subsectors: Mineral Industry and Metal Industry. In 2016, CO_2 emissions from Mineral Industry were approximately 86% of total CO_2 eq. emissions from industry sector. The other important subsector, the Metal Industry has experienced a big drop in emissions due to a technology change in the Kurum Elbasan Steel company. Since 2010, it has been operating Electric Arc Furnace (EAF) technology, which has a lower emission factor.

The GHG emissions and removals from the AFOLU sector represent a significant source of GHGs in Albania, but also a sector where mitigation of those emissions can be significantly implemented if sectoral policies are based on the principle of sustainable development. Within this sector, 'livestock' with 41% of the total and the 'land' with 38% of the total GHGs emissions remain the main emitters of GHGs. Although forests should serve as a sink of GHGs, in Albania, under the category 'Land' they represent one of the key sources of emissions. This is because their management in the last three decades has been neglected. Among others, negative impact in this direction has been from the uncontrolled deforestation, massive forest fires, lack of effective investment in forest improvement and afforestation, informality and lack of development reforms.

The GHG emissions from the Waste sector cover the following categories: Solid waste Disposal, Biological Treatment of Solid waste, Incineration and Open Burning of Waste and Wastewater Treatment and Discharge. Systems for the collection of urban solid waste are provided in most cities and towns. Very little recycling of waste is undertaken. There are no collection systems in rural areas and small towns. Most of the waste from these areas is disposed of by dumping in ditches, ravines, or at the side of roads where it is washed and blown onto other land and ultimately into water courses. Emissions from Waste sector have increased year by year with almost constant growth rate. In 2016, the highest contribution is that of solid waste disposal followed by wastewater treatment.

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment), is conducted using Approach 1 in the 2006 IPCC Guidelines. According to this approach, key categories are those that, when summed together in descending order of magnitude, add up to 95% of the total level/trend. On other words, a key source category is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs, in terms of the absolute emissions and the trend. The level assessment key categories for 2016 are:

1. Road Transportation, CO_2 (23.30%)
2. Forest land Remaining Forest land, CO_2 (12.03%)
3. Enteric Fermentation, CH_4 (11.80%)
4. Manufacturing Industries and Construction - Liquid Fuels, CO_2 (10.15%)
5. Cement production, CO_2 (7.40%)
6. Solid Waste Disposal, CH_4 (6.23%)
7. Direct N_2O Emissions from managed soils (5.26%)
8. Other Sectors - Liquid Fuels, CO_2 (4.24%)
9. Energy Industries - Liquid Fuels, CO_2 (2.99%)
10. Non-Specified - Liquid Fuels, CO_2 (2.00%)
11. Manure Management, CH_4 (1.96%)
12. Indirect N_2O Emissions from managed soils (1.76%)
13. Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH3 (1.27%)
14. Oil, CH_4 (0.96%)
15. Wastewater Treatment and Discharge, CH_4 (0.92%)
16. Land Converted to Settlements, CO_2 (0.89%)
17. Manure Management, N_2O (0.81%)
18. Cropland Remaining Cropland, CO_2 (0.69%)

The 2009-2016 trend assessment key categories are:

1. Iron and Steel Production, CO_2 (26%)
2. Manufacturing Industries and Construction - Liquid Fuels, CO_2 (18%)
3. Cement production, CO_2 (12%)
4. Solid Waste Disposal, CH_4 (9%)
5. Forest land Remaining Forest land, CO_2 (8%)
6. Manufacturing Industries and Construction - Solid Fuels, CO_2 (7%)
7. Road Transportation, CO_2 (5%)
8. Lime production, CO_2 (3%)
9. Other Sectors - Liquid Fuels, CO_2 (3%)
10. Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3, N_2O (2%)
11. Direct N_2O Emissions from managed soils, N_2O (1%)

An uncertainty analysis was carried out to help prioritize efforts to improve the accuracy of the inventory and quantify the uncertainty of the compiled estimates. Uncertainty values for activity data and emission factors were collected and included in the IPCC Inventory software, which calculates uncertainty using the Error Propagation methods (Approach 1). The overall uncertainty of the 2016 estimates is 5.8% and the overall uncertainty of the 2009-2016 trend is 5.1%.

With regards to the QA/QC activities undertaken in the national GHG inventory process, the recommendations given in the TNC (QA/QC plan) were taken into consideration together with the relevant international best practices. The following QA/QC activities have been carried out:

- Compare with information submitted to international agencies.
- Compare emissions calculations with use of default NCVs/EFs if not used.
- Cross-check against Reference approach (Energy sector).

Two approaches have been used for the estimation of the emissions of carbon dioxide, the most significant greenhouse gas. According to the first approach, CO_2 emissions are estimated for each fuel type, based on the total national consumption, and then the values are summarized (top-down approach). According to the second approach, emissions for separate sectors and source categories are estimated and then summarized (bottom-up approach). The use of these two approaches in the Albania's inventory firstly allows to judge on the fuel spectrum of the carbon dioxide emissions (top-down), and secondly on the sector distribution (bottom-up). In both approaches are used the default IPCC emission factors for each fuel type. Differences between two methods for the energy sector is 2.91% for the year 2009 and 1.67% for the year 2016.

In this regard, worth mentioning are the training materials on GHG inventory preparation developed by the GHG inventory team. These materials are rather country specific and based on personal experience gathered and lessons learnt during the GHG inventory preparation in Albanian conditions.

Good practices, improvements and recommendations for future inventories are outlined by sector, regarding activity data collection, level of disaggregation, consistency, and quality of the activity data collection, as well as application of higher tiers/other methods for emission estimates where appropriate.

1 INTRODUCTION

Albania is a signatory Party of the UN Framework Convention on Climate Change. The UNFCCC was ratified by the Albanian Parliament in 1994. Albania has also signed the Kyoto Protocol and ratified it, as stated in law no. 9334, dated 16.12.2004, and has actively participated in the Conferences of Parties organized under the UNFCCC.

The Albanian Government in general and Ministry of Tourism and Environment in particular has recently paid great attention to the climate change development at the global level and this has been reflected by a number of important related actions. In response to the invitation to the UNFCCC parties, the Republic of Albania adopted the INDC document by the Decision of the CoM no. 762, dated 16.09.2015 and submitted it to the UNFCCC Secretariat by 24 September, 2015. It commits to reduce CO_2 emissions compared to the baseline scenario in the period of 2016 to 2030 by 11.5%. Maintaining the low GHG emission content of the electricity generation and decoupling growth from increase of GHG emissions in other sectors are the primary drivers of the country regarding mitigation contribution as its INDC. The Albanian Parliament ratified the Paris Climate Agreement on 14th July 2016 through the law "On ratification of the Paris Agreement in the frame of the UNFCCC".

During the last 2 decades the Ministry in charge of Environment has been strongly supported by GEF and the UNDP Climate Change Programme for all climate change activities under the UNFCCC and the Kyoto Protocol, including the preparation of three National Communications (2002, 2009 and 2016) and participation in various negotiation forums.

The First National GHG Inventory was developed under the First National Communication (FNC) for the period 1990 – 1994 and under the Second National Communication (SNC), this period was revised and extended to cover the years 1995-2000. In the Third National Comunication (TNC), the GHG inventory considered the time-frame 2001-2009. In these reports the inventory was developed in accordance with the 1996 Revised IPCC Guidelines for national Greenhouse Gas Inventories.

The inventory activities under the First Biennial Update Report (BUR1) are built on the work done in the previous National Communications, with full consideration of knowledge generated during new studies, research, and complementary projects. For the first time, the inventory is compiled using the IPCC Inventory Software, in compliance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The time series are updated to consider the year 2009 and 2010-2016 (by using the IPCC Inventory Software-version 2.691).

The inventory covers the GHG emissions and removals estimates as divided into the following main sectors: (i) Energy; (ii) Industrial Processes and Product Use (IPPU); (iii) Agriculture, Forestry and Other Land Use (AFOLU) and (iv) Waste. Each sector comprises individual categories and subcategories, so the national inventory was developed at sub-category level. The Tier 1 method i.e., the "Default method" is applied for all subsectors in the absence of the country specific emission factors. To facilitate aggregate reporting of the GHG values, expressed as carbon dioxide equivalents (CO_2 eq.), as indicated in the Decision 17/CP.8, the global warming potentials (GWPs) values provided in the IPCC SAR (temporal horizon 100 years) are used (see table 2.1). The inventory covers the following Greenhouse Gases: CO_2, CH_4, N_2O, PFCs and HFCs and precursor and indirect emissions of: CO, NOx, NMVOC and SO_2.

Most of the activity data used for the preparation of national inventory are taken from official national documents such as: statistical yearbooks, energy balances, sectoral reports and INSTAT database, various strategies and reports from relevant institutions, such as Ministry of Tourism and Environment, National Environmental Agency, Ministry of Infrastructure and Energy, National Agency for Natural Resources, Ministry of Agriculture and Rural Development, Extractive Industries Transparent Initiative, although they did not provide activity data for GHG inventory purposes according to the IPCC nominations. Other data providers/sources are Bank of Albania, General Directory of Customs and different data bases, surveys and studies assisted by international organizations (like the UNDP, World Bank, FAO, EU, etc.), public/private universities and different NGOs. With regards to emission factors, they are represented by default factors provided by 2006 IPCC software.

An overview of the trends of the overall GHG emissions and removals by sinks is given in Chapter 2. The GHG emissions and removals for each sector are given in details in Chapters 3-6. The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emission and removals (trend assessment) is given in Chapter 7, while the uncertainty analysis performed for each sector are elaborated in the Chapter 8. Last, but not least, Chapters 9-10 are dedicated to the QA/QC Activities; Problems encountered and implemented solutions; and Good practices, improvements and recommendations for future inventories as outlined by sector, regarding activity data collection, level of disaggregation, and consistency and quality of the activity data collection. A legal framework is recommended as part of the BUR1 to address the basis for future updates to the GHG inventory. The IPCC Good Practice Guidelines is applied to all categories. Data for each activity, emission and conversion factors are documented directly in the sectorial and sub-sectorial MS Excel worksheets of the 2006 IPCC software. This documentation procedure assisted a lot to increase the long-term sustainability and transparency of the Inventory Process.

In terms of the process, the GHG inventory under the First Biennial Update Report (BUR1) is coordinated by the Ministry of Tourism and Environment as the UNFCCC focal point and the central authority in Albania in charge for climate change policy. As part of the process, the National Climate Change Steering Committee has been appointed and regularly updated with the BUR1 process, providing information and policy guidance, to furthermore ensure the streamlining of the results of the BUR1 to sectorial policies and/or strategies. The Steering Committee comprises representatives of Ministry of Tourism and Environment, Ministry of Infrastructure and Energy, Ministry of Agriculture and Rural Development, Ministry of Finance and Economy, Ministry of Defense, National Environment Agency, Institute of Geosciences, Water and Environment, INSTAT, Vlora Region, and environmental related NGOs.

The preparation of the national GHG inventory is project based, supported by the Global Environment Facility (GEF) and the United Nations Development Program (UNDP). Six professionals were engaged to form the GHG inventory team (each of them responsible for one or more sectors including data collection) and capacity building of the relevant structures within Ministry of Tourism and Environment and its relevant National Environment Agency, other line ministries/agencies, academia, universities and interested professionals in order to ensure the continuous and regular updating of the national GHG inventories and the possible establishment in the near future of a Monitoring, Reporting and Verification (MRV) system. Training materials were prepared for each sector, including a step-by-step process for completing inventory tables, explanation of good practices and sources of data and emission factors.

As above-mentioned, relevant recommendations are provided to ensure a legally binding national system for collecting/managing and processing the necessary data to developing the Greenhouse Gas Inventory on a regular basis.

Summing up, the national inventory process includes the following key players:

- Ministry of Tourism and Environment, responsible for supervising the national inventory process, reporting the emissions to the UNFCCC and for other international reporting.
- National Environment Agency, responsible for data monitoring and reporting.
- UNDP Climate Change Programme, responsible for the management of the Project "Development of Albania' Fourth National Communication to the UNFCCC and First Biennial Report.
- GHG Inventory Development team, composed of external sectoral experts responsible for preparing the GHG inventory in four sectors (Energy, IPPU, AFOLU and Waste).
- Data suppliers, with INSTAT being the most important data source.
- Verification which besides technical experts is also ensured by multilayer structure involving the Climate Change Programme, the UNDP/UNEP Global Support Programme, and international/national team in charge for the revision of the Albanian National Determined Contribution in response to Paris Agreement.

The Greenhouse gas inventory was prepared using the latest IPCC Inventory software version available at the time of the preparing the inventory (IPCC 2006 software - version 2.691).

Table 1.1: Global Warming potential values used in the preparation of the GHG Inventory (100-year time horizon).

Species	Chemical Formula	Lifetime	
		(years)	100 years
CO_2	CO_2	Variable[2]	1
Methane[3]	CH_4	12±3	21
Nitrous oxide	N_2O	120	310
HFC-23	CHF_3	264	11,700
HFC-32	CH_2F_2	5.6	650
HFC-41	CH_3F	3.7	150
HFC-43-10mee	$C_5H_2F_{10}$	17.1	1,300
HFC-125	C_2HF_5	32.6	2,800
HFC-134	$C_2H_2F_4$	10.6	1,000
HFC-134a	CH_2FCF_3	14.6	1,300
HFC-152a	$C_2H_4F_2$	1.5	140
HFC-143	$C_2H_3F_3$	3.8	300
HFC-143a	$C_2H_3F_3$	48.3	3,800
HFC-227ea	C_3HF_7	36.5	2,900
HFC-236fa	$C_3H_2F_6$	209	6,300
HFC-245ca	$C_3H_3F_5$	6.6	560
Sulphur hexafluoride	SF_6	3,200	23,900
Perfluoromethane	CF_4	50,000	6,500
Perfluoroethane	C_2F_6	10,000	9,200
Perfluoropropane	C_3F_8	2,600	7,000
Perfluorobutane	C_4F_{10}	2,600	7,000
Perfluorocyclobutane	$c\text{-}C_4F_8$	3,200	8,700
Perfluoropentane	C_5F_{12}	4,100	7,500
Perfluorohexane	C_6F_{14}	3,200	7,400
Ozone-depleting Substances[4]			

2 *Derived from the Bern carbon cycle model*

3 *The GWP for methane includes indirect effects of tropospheric ozone production and stratospheric water vapor production, as in IPCC (1994).*

4 *The Global Warming Potentials for ozone-depleting substances are a sum of a direct (positive) component and an indirect (negative) component which depends strongly upon the effectiveness of each substance for ozone destruction. Generally, the halons are likely to have negative net GWPs, while those of the CFCs are likely to be positive over 100-year time horizons.*

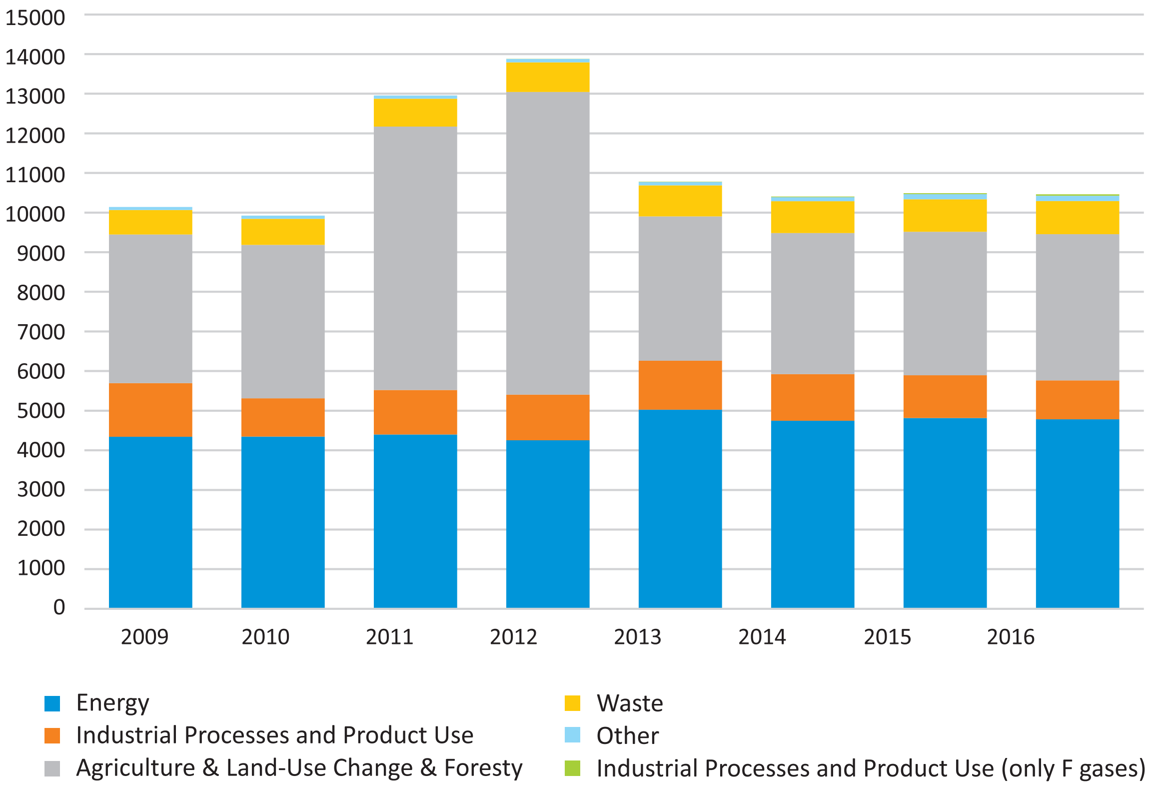
2 EMISSION TRENDS

This section gives an overview of the trends of the GHG emissions and removals by sinks in Albania. The GHG Inventory for the purpose of the BUR1 covers the time series 2010-2016. In addition, revision and update of the calculation provided under the TNC for the 2009 are provided. More detailed information on the GHG emissions and removals for each sector are provided in the subsequent sections (Chapter 3-6). The inventory covers the following Greenhouse Gases: CO_2, CH_4, N_2O, PFCs and HFCs and precursor and indirect emissions of: CO, NOx, NMVOC and SO_2.

2.1 GHG emissions by sector

The aggregate GHG emissions and removals (net emissions) are estimated to 10140.82 in 2009 and 10460.98 in 2016 respectively (in Gg CO_2 eq.), including the FOLU sector. The figure 2.1 shows the time series of emissions and removals, including the net emissions (in CO_2 eq.) from 2009- 2016.

Figure 2.1: CO_2 eq. emissions and removals from all economic sectors (Gg)

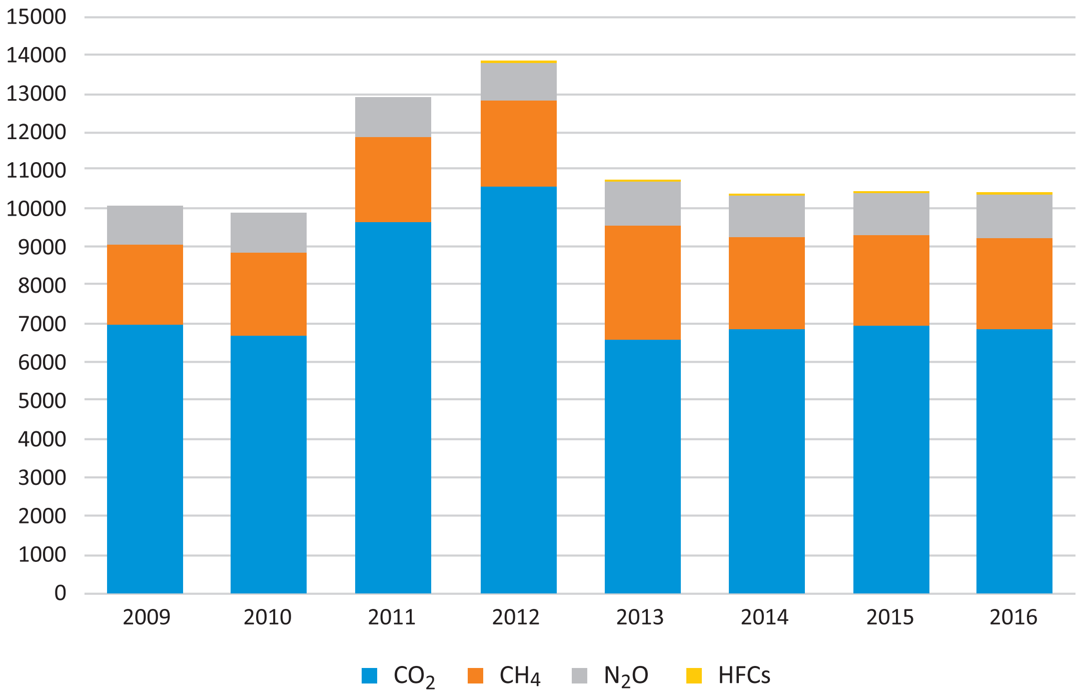


Analysis of figures 2.1 shows clearly that Energy sector has the highest contribution followed from Agriculture, Forestry and Other Land Use, the third sector is Industrial Processes and Product Use and the last one is Waste sector. GHGs (net emissions) from AFOLU sector have decreased from 3747.69 Gg CO_2 eq. in 2009 to 3687.74 Gg CO_2 eq. in 2016, because of some improvements to forest management.

GHG emissions by gas

The aggregate GHG emissions by gas are given in Figure 2.2 CO_2 emissions accounted for 6939.06 Gg in 2016, followed by CH_4 emissions with 2369.64 Gg (in CO_2 eq.), then N_2O emissions with 1117.86 Gg (in CO_2 eq.) and HFCs with only 34.54 Gg (in CO_2 eq.).

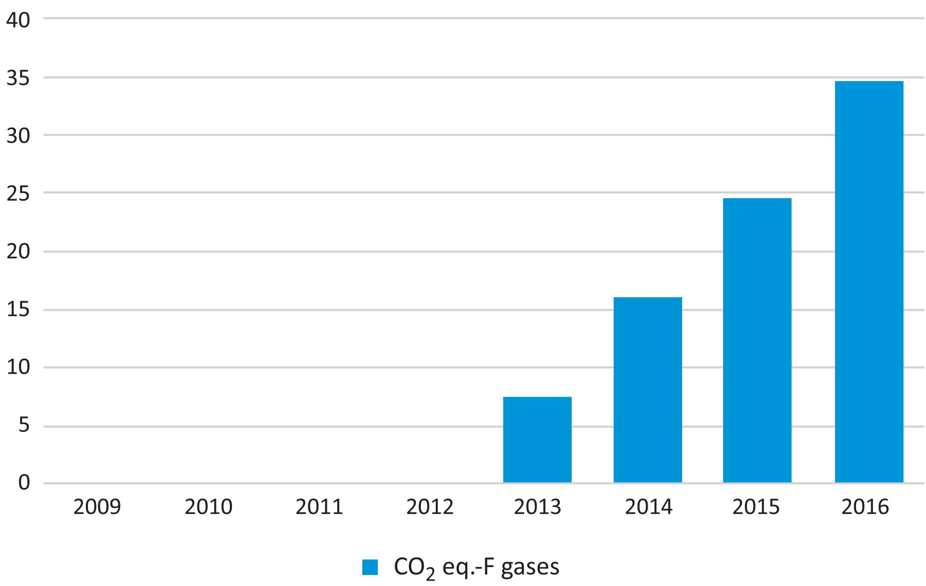
Figure 2.2: Total GHG emissions by gas (Gg CO_2 eq.)



Expressed in terms of weight, highest contribution to GHG emissions is coming from CO_2 with 66% (2016); the second one is CH_4 23% (2016); the third one N_2O with 11% (2016), CO_2 eq. and the fourth one HFCs with 0.3% (2016).

In spite of the small share of the F-gases in the total emissions, they are reported in the inventory as in the Figure 2.3. The emissions of F-gases are coming from Product Uses as substitutes of ODS in IPPU sector for i) Refrigeration and Air Conditioning; ii) Foam Blowing Agents and iii) Fire Protection.

Figure: 2.3: Emissions of F-gasses (in Gg CO_2 eq.)



The table below provides the GHG emission estimates in Albania for the years 2009-2016 by sector and by gas.

Table 2.1: Anthropogenic greenhouse gas emissions in Albania

Gases	Sectors	2009	2010	2011	2012	2013	2014	2015	2016
CO_2	1 Energy	4121.56	4125.98	4175.47	4032.26	4052.31	4465.48	4593.53	4560.50
	2 Industrial Processes and Product Use	1357.64	967.32	1124.81	1153.57	1237.24	1177.86	1080.84	985.35
	3 Agriculture, Forestry and Other Land Use	1545.21	1676.13	4426.56	5399.70	1384.61	1272.32	1344.90	1390.11
	4 Waste	3.82	3.82	3.76	3.43	3.42	3.23	3.12	3.10
	5 Other	-	-	-	-	-	-	-	-
	Total (Gg CO_2)	**7028.23**	**6773.25**	**9730.60**	**10588.96**	**6677.58**	**6918.89**	**7022.39**	**6939.06**
CH_4	1 Energy	7.76	7.92	7.90	7.86	37.85	10.19	7.71	7.69
	2 Industrial Processes and Product Use	-	-	-	-	-	-	-	-
	3 Agriculture, Forestry and Other Land Use	66.94	67.27	66.98	67.96	68.19	68.86	69.34	68.86
	4 Waste	25.44	27.25	29.41	31.45	33.22	34.33	35.40	36.29
	5 Other	-	-	-	-	-	-	-	-
	Total (Gg CH_4)	**100.13**	**102.44**	**104.29**	**107.27**	**139.27**	**113.38**	**112.45**	**112.84**
N_2O	1 Energy	0.18	0.18	0.18	0.18	0.58	0.22	0.19	0.19
	2 Industrial Processes and Product Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3 Agriculture, Forestry and Other Land Use	2.57	2.52	2.62	2.63	2.66	2.72	2.64	2.75
	4 Waste	0.27	0.27	0.27	0.27	0.27	0.25	0.24	0.24
	5 Other	0.24	0.26	0.26	0.27	0.28	0.33	0.41	0.43
	Total (Gg N_2O)	**3.26**	**3.23**	**3.34**	**3.34**	**3.78**	**3.51**	**3.49**	**3.61**
HFCs	1 Energy	-	-	-	-	-	-	-	-
	2 Industrial Processes and Product Use	-	-	-	0.15	7.59	15.95	24.66	34.54
	3 Agriculture, Forestry and Other Land Use	-	-	-	-	-	-	-	-
	4 Waste	-	-	-	-	-	-	-	-
	5 Other	-	-	-	-	-	-	-	-
	Total (Gg CO_2 eq.)	**-**	**-**	**-**	**0.15**	**7.59**	**15.95**	**24.66**	**34.54**
All gases	1 Energy	4339.96	4346.70	4397.87	4251.64	5026.37	4746.43	4813.45	4780.71
	2 Industrial Processes and Product Use	1357.64	967.32	1124.81	1153.72	1244.83	1193.81	1105.50	1019.89
	3 Agriculture, Forestry and Other Land Use	3747.69	3869.51	6646.99	7640.88	3641.16	3560.04	3620.45	3687.74
	4 Waste	620.90	660.25	705.45	747.13	783.78	801.40	821.05	838.98
	5 Other	74.63	80.42	82.12	83.03	86.07	103.53	128.54	133.65
All gases	**All sectors (Gg CO_2 eq.)**	10140.82	9924.20	12957.24	13876.39	10782.22	10405.21	10488.99	10460.98

(Source: Albania, years 2009-2016)

3 ENERGY SECTOR

3.1 Overview

The primary energy supply in Albania is dominated by oil by products, hydro and net import electricity, fuel wood and a small amount of coal and natural gas as shown in Figure 3.1 and 3.2. Oil by products have been reduced from 60.40% (2009) at 58.93% (2016), hydro & net import electricity have increased from 26.69% (2009) to 28.53% (2016) and fuel wood has been reduced from 10.04% (2009) to 7.96% (2016). Figure 3.2 and 3.3 show the Final Energy Consumption in Albania in 2009 and 2016 respectively, demonstrating that the transport sector consumes the most final energy, followed by households and industry.

Figure 3.1: Energy supply (kToe) for the period 2009-2016

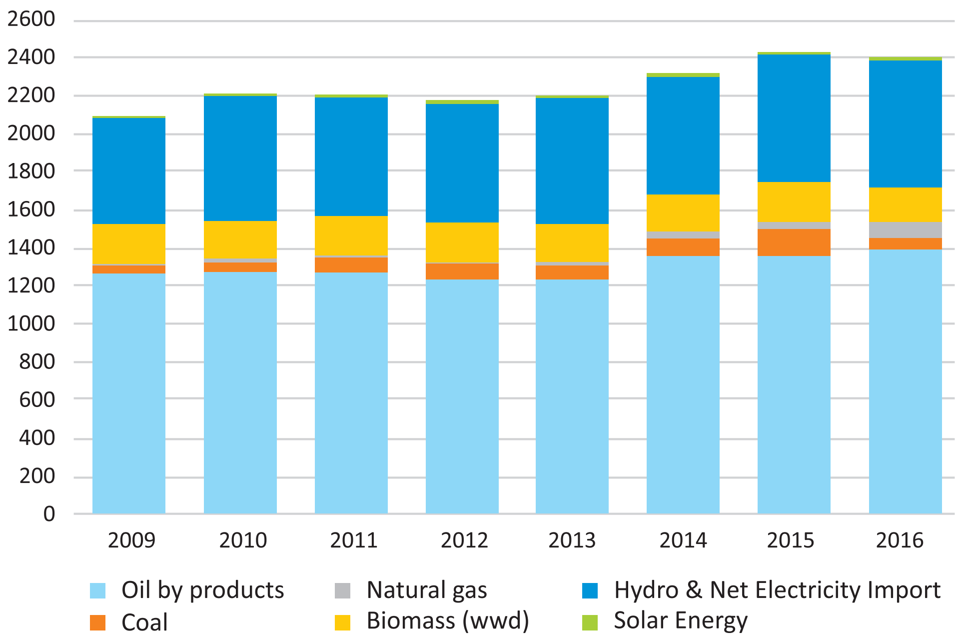


Figure 3.2: Primary Energy Supply for the year 2009 (%)

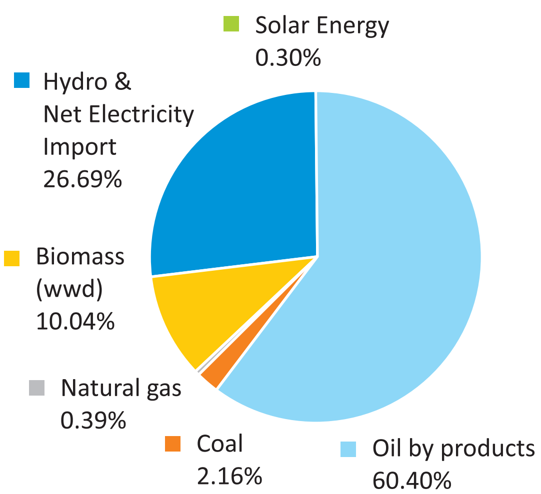


Figure 3.3: Primary Energy Supply for the year 2016 (%)

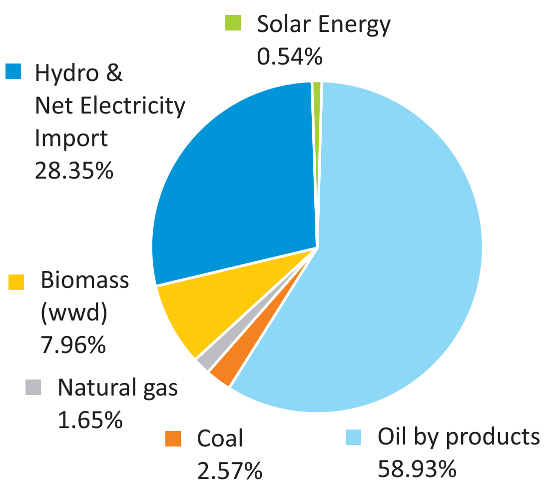


Figure 3.4: Final Energy Consumption for the year 2009 (%)

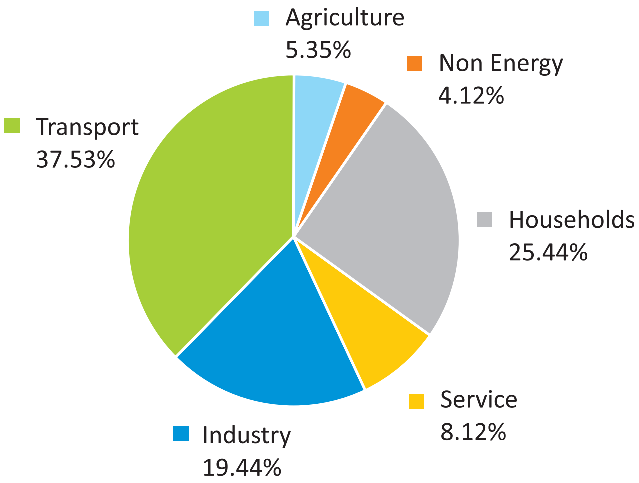
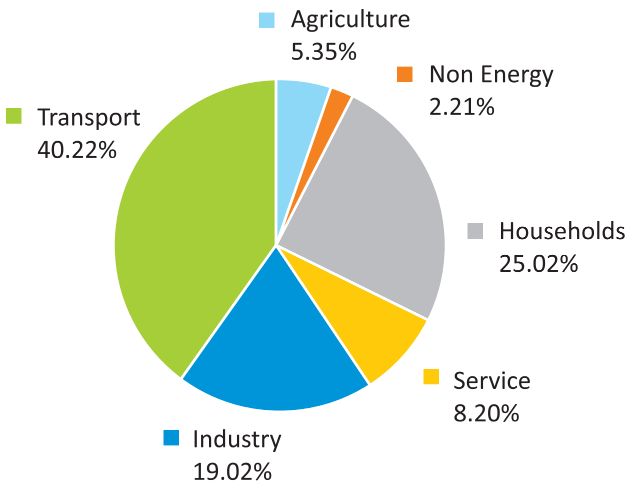


Figure 3.5: Final Energy Consumption for the year 2016 (%)



Electricity generation has been historically met almost exclusively by hydropower plants, with a total installed power capacity of 2,011 MW at the end of 2016. The country has exploited approximately 50% of its hydropower potential, and future expansion of hydropower capacity is possible mainly along the Drini, Mati, Devolli, and Bistrica rivers. Given that one of the most important natural renewable energy resources for electricity generation in our country is the hydro, it is very important that Water Secretariat Responsible for Water Resources Administration should be monitoring all new licenses issued for hydro power plants. Monitoring of water resources should guarantee the protection and preservation of water resources in the country, in accordance with the policies integrated in the field of water resource management.

The only thermal power plant, Vlora TPP, is not yet operational, and its conversion to natural gas is foreseen following construction of the Trans Adriatic Pipeline (TAP). Albania imports electricity from neighboring countries, although imports have progressively dropped in the last ten years following the increase in domestic power generation and the reduction of (technical and non-technical) electricity losses in the distribution system, which have been reduced from 45% in 2013 to 28% by the end of 2016[4] with a clear investment and management plan to reduce them further to 17% by the end of 2022. Albania's electricity market is under transition from a centrally planned to a market-based system. The wholesale power market is dominated by the state-owned, regulated generation company KESh, which supplies to OSHEE the electricity needed for captive customers under regulated "full supply" condition. The competitive wholesale environment consists of independent producers and a small number of large customers supplied through bilateral contracts.

4 Implementation of the project "Recovery of the Power Sector" and the recent revamping work carried out on the transmission-distribution networks during the years 2014-2020.

Table 3.1 presents the summary table of the GHG emissions from the energy sector (2016) and more details are presented in the following session.

Table 3.1: GHG main emissions of the energy sector (2016)

1 Energy Greenhouse Gas Source and Sink Categories	Gases Included	% Total Emissions*	Key Categories	Uncertainty %**	Tier/ NK	Method section	Notes
A. Fuel Combustion Activities							
1. Energy Industries							
a. Main Activity Electricity and Heat Production	CO_2, CH_4, N_2O	0.295%	NO	7.310	T1	IPCC 2006	
b. Petroleum Refining	CO_2, CH_4, N_2O	3.378%	Yes-2.988%	7.310	T1	IPCC 2006	
c. Manufacture of Solid Fuels and Other Energy Industries	CO_2, CH_4, N_2O	-	NO	-	NO	IPCC 2006	
2. Manufacturing Industries and Construction							
a. Iron and Steel	CO_2, CH_4, N_2O	2.418%	Yes-10.145%	51.036	T1	IPCC 2006	
b. Non-Ferrous Metals	CO_2, CH_4, N_2O	2.396%		7.310	T1	IPCC 2006	
c. Chemicals	CO_2, CH_4, N_2O	1.018%		7.310	T1	IPCC 2006	
d. Pulp, Paper and Print	CO_2, CH_4, N_2O	0.169%		7.310	T1	IPCC 2006	
e. Food Processing, Beverages and Tobacco	CO_2, CH_4, N_2O	0.892%		7.310	T1	IPCC 2006	
f. Non-Metallic Minerals	CO_2, CH_4, N_2O	0.176%		7.310	T1	IPCC 2006	
g. Transport Equipment	CO_2, CH_4, N_2O	0.074%		7.310	T1	IPCC 2006	
h. Machinery	CO_2, CH_4, N_2O	0.273%		7.310	T1	IPCC 2006	
i. Mining	CO_2, CH_4, N_2O	3.231%		7.310	T1	IPCC 2006	
j. Wood and wood products	CO_2, CH_4, N_2O	0.306%		7.310	T1	IPCC 2006	
k. Construction	CO_2, CH_4, N_2O	0.343%		7.310	T1	IPCC 2006	
l. Textile and Leather	CO_2, CH_4, N_2O	0.259%		7.310	T1	IPCC 2006	
m. Non-specified Industry	CO_2, CH_4, N_2O	0.146%		7.310	T1	IPCC 2006	
3. Transport							
a. Domestic Aviation	CO_2, CH_4, N_2O	0.125%	NO	7.7872	T1	IPCC 2006	
b. Road Transportation	CO_2, CH_4, N_2O		Yes-23.301%	0.7049	T1	IPCC 2006	
b.i. Cars	CO_2, CH_4, N_2O		NO	0.7049	T1	IPCC 2006	
b.ii. Light duty trucks	CO_2, CH_4, N_2O	7.556%	NO	7.0711	T1	IPCC 2006	
b.iii. Heavy duty trucks and buses	CO_2, CH_4, N_2O	2.730%	NO	7.0711	T1	IPCC 2006	
b.iv. Motorcycles	CO_2, CH_4, N_2O	0.515%	NO	6.4597	T1	IPCC 2006	
b.v. Other	CO_2, CH_4, N_2O	0.000%	NO	6.3254	T1	IPCC 2006	
c. Railways	CO_2, CH_4, N_2O	0.761%	NO	7.0852	T1	IPCC 2006	
d. Water-borne Navigation	CO_2, CH_4, N_2O	0.214%	NO	6.7469	T1	IPCC 2006	
e. Other Transportation	CO_2, CH_4, N_2O	0.000%	NO	7.0711	NO	IPCC 2006	

4. Other Sectors							
a. Commercial/Institutional	CO_2, CH_4, N_2O	1.690%	Yes-4.240%	7.3103	T1	IPCC 2006	
b. Residential	CO_2, CH_4, N_2O	3.010%		7.3103	T1	IPCC 2006	
c. Agriculture/Forestry/Fish-ing/Fish farms	CO_2, CH_4, N_2O	0.789%		13.426	T1	IPCC 2006	
5. Non-Specified							
a. Stationary	CO_2, CH_4, N_2O	0.000%	NO	13.426	T1	IPCC 2006	
b. Mobile	CO_2, CH_4, N_2O	2.337%	1.998%	13.426	T1	IPCC 2006	
c. Multilateral Operations	-	-			NA		
B. Fugitive emissions from fuels							
1. Solid Fuels							
a. Coal mining and handling	CH_4	0.038%	NO	5.000	T1	IPCC 2006	
b. Uncontrolled combustion and burning coal dumps	CH_4	0.000%	NO	5.000	T1	IPCC 2006	
c. Fuel transformation	CH_4	-		5.000	NO	IPCC 2006	
2. Oil and Natural Gas							
a. Oil	CH_4	1.127%	Yes-0.958%	5.000	T1	IPCC 2006	
b. Natural Gas Systems	CH_4	0.000%	NO	5.000	T1	IPCC 2006	
3. Other emissions from Energy Production							
Other emissions from Energy Production	-	-			NO		
C. Carbon dioxide Transport and Storage							
1. Transport of CO_2	-	-			NO	-	
2. Injection and Storage	-	-			NO	-	
3. Other	-	-			NO	-	
Memo items:							
International bunkers							
International aviation	CO_2, CH_4, N_2O	0.535%	NO	7.7872	T1	IPCC 2006	
Navigation	CO_2, CH_4, N_2O	0.185%	NO	6.7469	T1	IPCC 2006	
Multilateral operations		-			NO	IPCC 2006	
CO_2 emissions from biomass	CO_2, CH_4, N_2O	9.857%	NO	50.000	T1	IPCC 2006	
CO_2 captured	**-**	-			NO	-	

*Note: NK = notation key, MS = method statement, T = tier, * percentage of total emissions without LULUCF in the most recent inventory year, ** Square root of the sum of the contribution to variance by category in the latest year*

3.2 Emissions trends-Reference Approach

In this session, the GHG emissions have been calculated using the Reference approach, which is a top-down and straightforward approach. Figure 3.6 presents the fuel supply for the whole period and analysis shows clearly that crude oil and oil by products are having the highest contribution followed by coal and natural gas (both in very minor scale). The Reference Approach has been applied using the apparent fuel consumption figures to account for the fuel flows into and out of the country. The estimated CO_2 emissions and the apparent fuel consumption for the reporting years are presented in figure 3.6 and 3.7.

Figure 3.6: The apparent fuel consumption (in ktoe) - Reference Approach

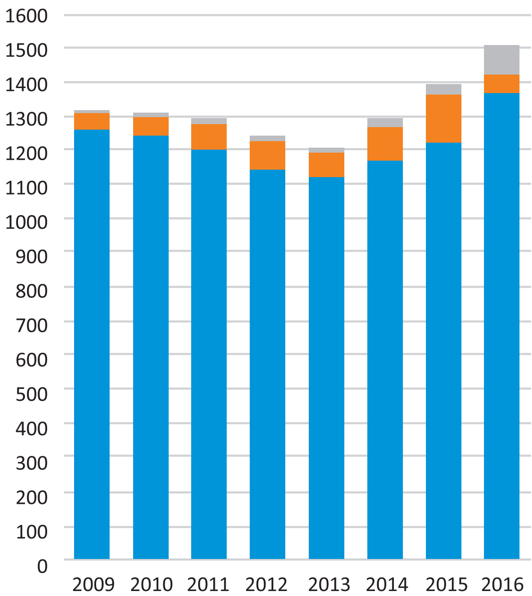
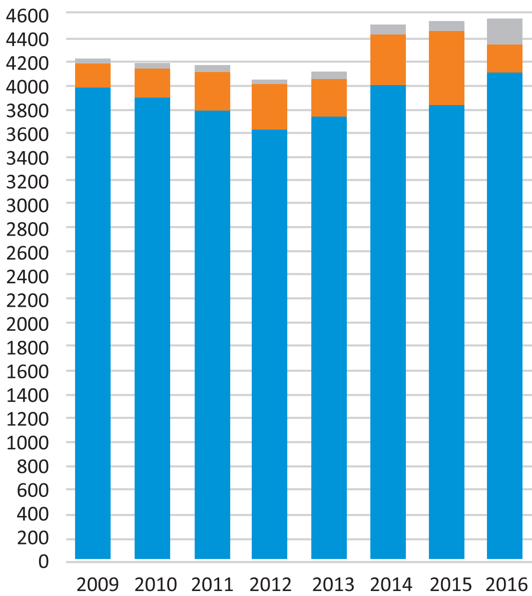


Figure 3.7: CO_2 emissions (in Gg) - Reference Approach



Analysis of figure 3.7 shows that crude oil and oil by products have the highest contribution regarding the CO_2 emissions from the Energy sector and this is related to increase of fuel consumption in the transport sector.

Table 3.2: CO_2 emissions (in Gg)-Reference Approach

Fuels	2009	2010	2011	2012	2013	2014	2015	2016
Crude oil and oil by products	3991.22	3908.52	3804.69	3637.71	3730.05	3993.26	3840.16	4103.00
Coal	198.86	242.20	321.06	366.05	334.21	434.27	617.82	250.22
Natural gas	21.937	34.371	40.014	39.083	35.442	78.371	81.325	197.427
1 – Energy Reference Approach	4212.02	4185.09	4165.76	4042.84	4099.70	4505.90	4539.31	4550.65

3.3 Emission Trends – Sectoral Approach

The sectoral approach of the inventory for the Energy sector accounts for the GHG emissions released because of fuel combustion activities in the energy and transport, as well as fugitive emissions from extraction of solid fuels and transmission and distribution of liquid and gaseous fuels. The emissions from Fuel Combustion activities are derived from several categories:

- Energy industries
- Manufacturing industries and construction
- Transport
- Other sectors (Commercial/Institutional, Residential and Agriculture / Forestry / Fishing)
- Non-Specified

The entire Energy sector emissions by category are given in Figures 3.8-3.11 and in Table 3.3 (More details provided in Attachments).

Figure 3.8: CO_2 emissions from Energy Sub-sectors, 2009-2016 (Gg)

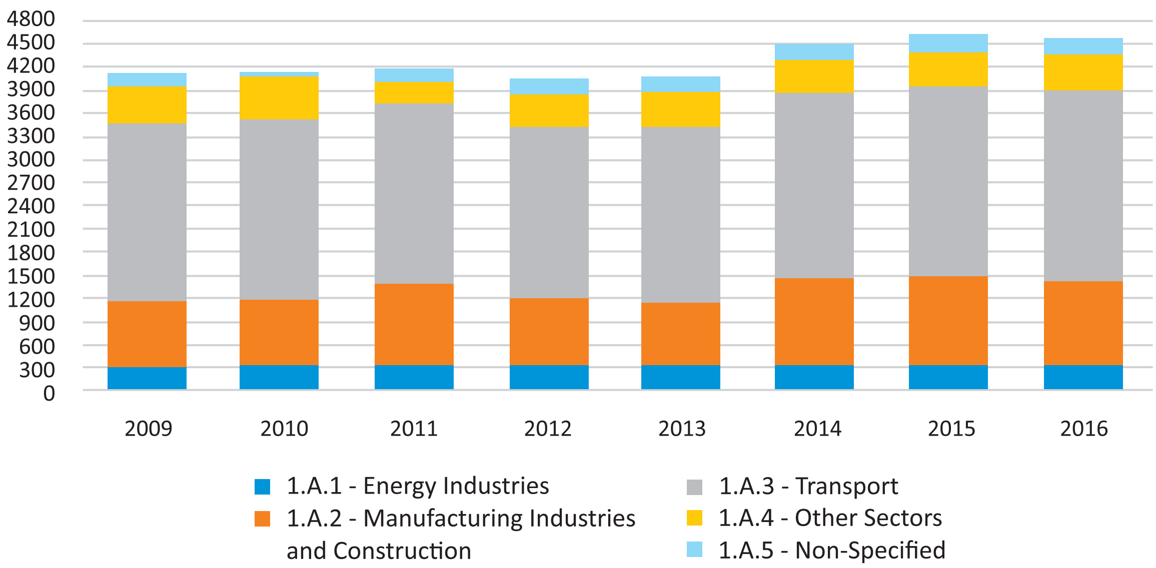


Figure 3.9: CH_4 emissions from Energy Sub-sectors, 2009-2016 (Gg)

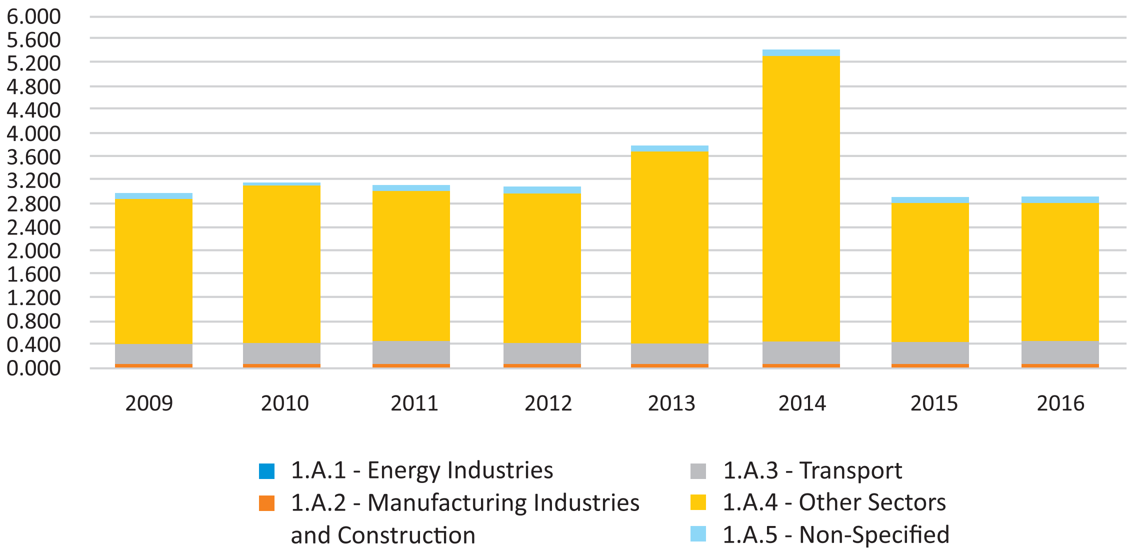


Figure 3.10: N_2O emissions from Energy Sub-sectors, 2009-2016 (Gg)

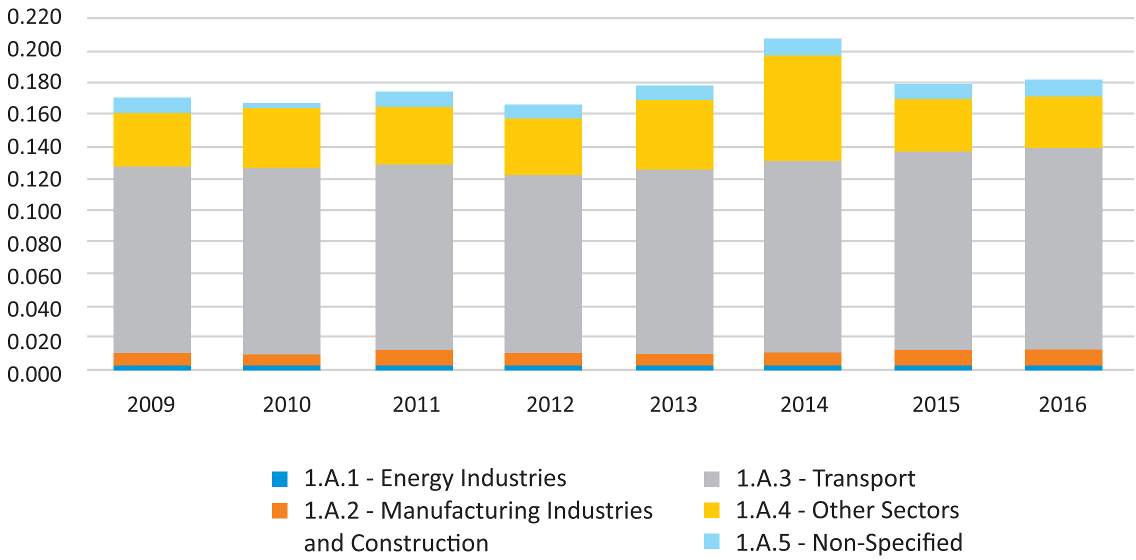
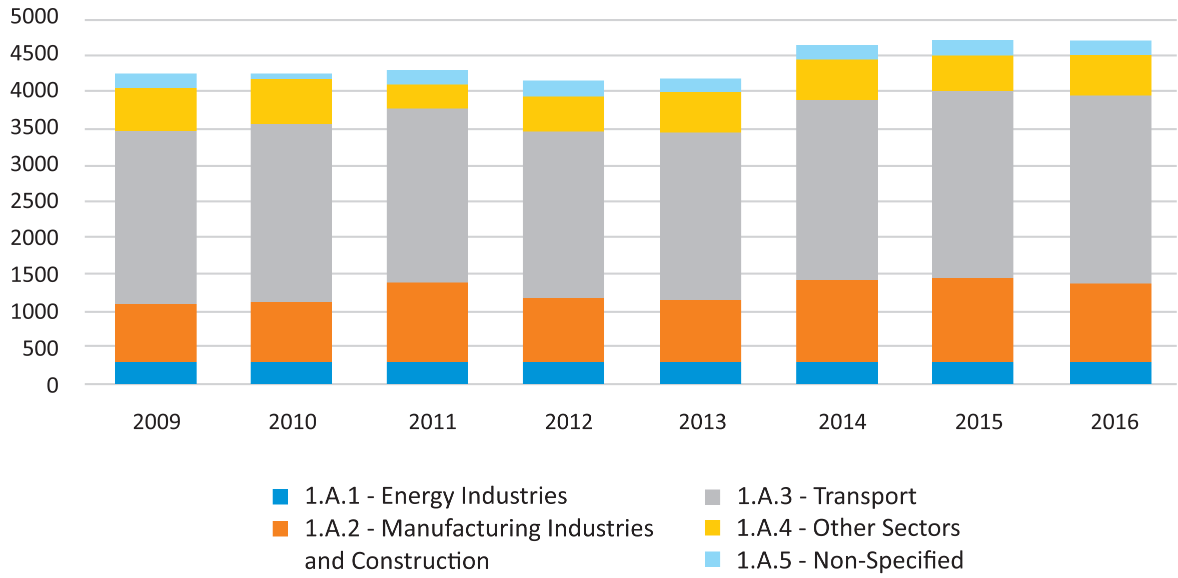


Figure 3.11: CO_2eq. emissions from Energy Sub-sectors, 2009-2016 (Gg)



Analysis show that the Transport subsector has been playing a continuous bigger role in (with 53.99% in 2009, slightly reduced to 53.05% in 2016). The second biggest subsector is the Manufacturing Industry and Construction (related to fuel consumption) with 18.56% in 2009 which increased to 22.56% in 2016. The third subsectors are residential and service ones (under the Other Sectors) with 12.94% in 2009, which is slightly reduced to 10.57% in 2016. In both approaches, the default IPCC emission factors are used for each fuel type. Differences between those two methods for the Energy sector is -2.15% for the year 2009 and 0.22% for the year 2016.

Table 3.3: The GHG emissions from Energy, by subsectors and gases (in Gg CO_2 eq.)

Sub sector	Gases	2009	2010	2011	2012	2013	2014	2015	2016
1 - Energy	CO_2	4121.56	4125.98	4175.47	4032.26	4052.31	4465.48	4593.53	4560.50
	CH_4	7.755	7.922	7.898	7.860	7.854	10.191	7.706	7.691
	N_2O	0.179	0.175	0.182	0.175	0.578	0.216	0.187	0.189
	CO_2 eq.	**4339.96**	**4346.70**	**4397.87**	**4251.64**	**5026.37**	**4746.43**	**4813.45**	**4780.71**
1.A - Fuel Combustion Activities	CO_2	4117.98	4122.41	4171.90	4028.68	4048.74	4461.90	4589.96	4556.92
	CH_4	2.964	3.130	3.106	3.067	3.061	5.398	2.912	2.898
	N_2O	0.170	0.166	0.173	0.166	0.568	0.206	0.178	0.180
	CO_2 eq.	**4232.79**	**4239.52**	**4290.69**	**4144.44**	**4919.17**	**4639.23**	**4706.24**	**4673.50**
1.A.1 - Energy Industries	CO_2	330.73	335.20	332.25	332.39	335.93	336.39	336.70	337.05
	CH_4	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
	N_2O	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	CO_2 eq.	**331.78**	**336.26**	**333.31**	**333.44**	**337.00**	**337.46**	**337.77**	**338.13**
1.A.2 Manufacturing and Construction	CO_2	801.97	835.45	1061.31	874.10	811.63	1119.28	1134.60	1074.74
	CH_4	0.046	0.035	0.049	0.041	0.039	0.049	0.051	0.051
	N_2O	0.008	0.007	0.009	0.007	0.007	0.009	0.009	0.009
	CO_2 eq.	**805.38**	**838.23**	**1065.14**	**877.19**	**814.56**	**1122.99**	**1138.45**	**1078.74**
1.A.3 Transport	CO_2	2299.64	2325.48	2327.04	2217.25	2278.29	2383.35	2462.94	2489.42
	CH_4	0.366	0.398	0.379	0.353	0.368	0.380	0.389	0.379
	N_2O	0.116	0.117	0.117	0.111	0.114	0.120	0.124	0.125
	CO_2 eq.	**2343.34**	**2369.95**	**2371.23**	**2259.21**	**2321.49**	**2428.47**	**2509.53**	**2536.27**
1.A.4 - Other Sectors (Residential & Service)	CO_2	499.67	569.96	257.24	407.01	421.00	421.00	445.66	445.66
	CH_4	2.451	2.657	2.573	2.566	3.254	4.860	2.360	2.355
	N_2O	0.034	0.037	0.035	0.035	0.044	0.066	0.033	0.033
	CO_2 eq.	**561.80**	**637.38**	**322.24**	**471.85**	**502.83**	**543.51**	**505.34**	**505.21**

1.A.5 - Non-Specified (Agriculture)	CO_2	185.97	56.33	194.05	197.93	201.89	201.89	210.05	210.05
	CH_4	0.089	0.027	0.092	0.094	0.096	0.096	0.100	0.100
	N_2O	0.009	0.003	0.009	0.009	0.009	0.009	0.010	0.010
	CO_2 eq.	**190.49**	**57.69**	**198.77**	**202.75**	**206.80**	**206.80**	**215.16**	**215.16**
1.B - Fugitive emissions from fuels	CO_2	3.5760	3.5761	3.5761	3.5762	3.5764	3.5764	3.5765	3.5765
	CH_4	4.791	4.792	4.792	4.793	4.793	4.793	4.793	4.793
	N_2O	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	CO_2 eq.	**107.17**	**107.18**	**107.18**	**107.20**	**107.20**	**107.20**	**107.21**	**107.21**
International Marine Bunkers	CO_2	15.8826	16.0412	16.2020	16.5273	16.6925	16.6925	16.8600	16.85997
	CH_4	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016
	N_2O	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	0.0005
	CO2 eq.	**16.047**	**16.207**	**16.370**	**16.698**	**16.865**	**16.865**	**17.034**	**17.034**
International Aviation Bunkers	CO_2	46.381	46.524	47.313	48.265	48.747	48.747	49.235	49.235
	CH_4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
	N_2O	0.0013	0.0013	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014
	CO2 eq..	**46.38**	**46.53**	**47.31**	**48.27**	**48.75**	**48.75**	**49.24**	**49.24**
International Bunkers	CO_2	61.8585	62.1587	63.1017	64.3701	65.0136	65.0136	65.6644	65.6644
	CH_4	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019
	N_2O	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	CO_2 eq.	**62.428**	**62.731**	**63.683**	**64.963**	**65.613**	**65.613**	**66.269**	**66.269**

3.3.1 Energy industries

This category is comprised of the following subsectors:

- Electricity Generation
- Combined Heat and Power Generation
- Heat Plants
- Other Energy Industries

In Albania, there is only ARMO Ballsh refinery, classified under this category, as there were no other thermal, cogeneration or heat plans into operation during the inventory period. On the other side, the Ballsh refinery' operation has been almost in constant condition during 2009-2016.

Figure 3.12 and Table 3.4 give the GHG emissions from the Energy Industries (in Gg CO_2 eq.).

Figure 3.12: The GHG Emissions from the Energy Industries (in Gg CO_2 eq.)

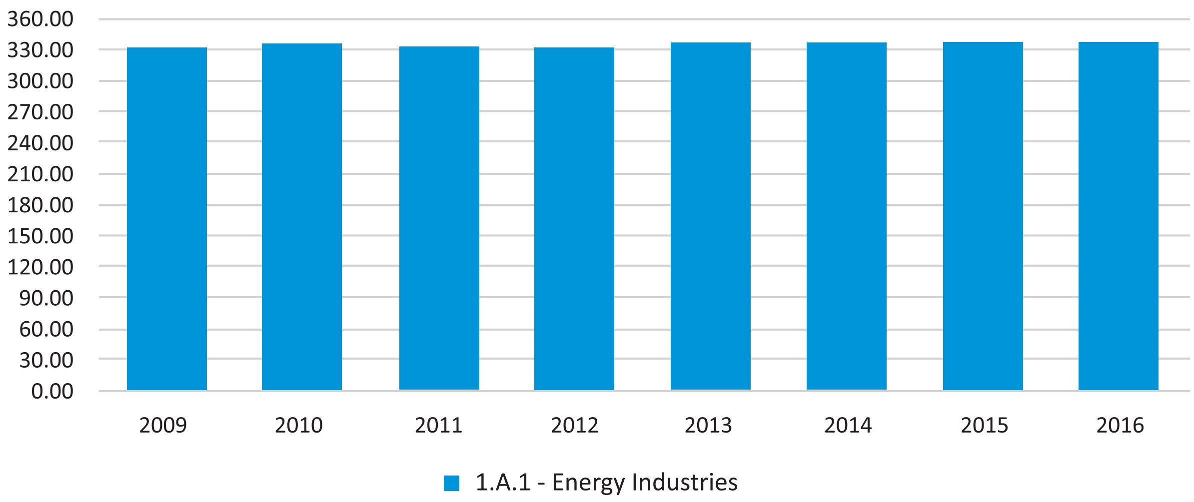


Table 3.4: GHG Emissions in the Energy Industries (in Gg CO_2 eq.)

Sub sector	Gases	2009	2010	2011	2012	2013	2014	2015	2016
1.A.1 - Energy Industries	CO_2	330.73	335.20	332.25	332.39	335.93	336.39	336.70	337.05
	CH_4	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
	N_2O	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	CO_2 eq.	331.78	336.26	333.31	333.44	337.00	337.46	337.77	338.13

3.3.1 Manufacturing Industries and Construction

The Industry Sector in the energy balance is divided in the following sub sectors: Metallurgy, Chemical, Building Materials, Mining, Food/Beverage/Tobacco, Textile/Leather/Shows, Wood/Paper/Printing, Mechanical and others. The analysis of the economic development during the period 2009-2016 show a decline of the contribution of the Industry Sector in the national development. In other words, the contribution of the general industrial production in absolute values of GDP is much lower than used to be before '90. Meantime, after the political and social transformations, the property changes and industrial enterprise management, there is a tendency towards a new stabilized situation, due to the establishing of the market economy.

The statistics of last 15-20 years show a considerable decline of the heavy industry productions considering before 90's (minerals over 20 times, coal 50 times, oil and natural gas respectively 3 and 50 times, non-ferrous metallurgy over 100 times, chemicals over 70 times); mechanical industry over 50 times; light industry over 10 times; food industry over 10 times, etc. But meanwhile, it should be underlined that many industrial and energy products such as steel and ferrochromium, electricity, bricks, tiles and lime production, meat, and milk by-products, refreshing drinks, cloths, and leather production, despite many difficulties have occupied a large part of the market, playing an important role in the economy with a contribution of approximately 15% (or 360 Million USD) in the real GDP. During the last 10 years, the stabilizing developments and increasing tendencies in the processing industry are mainly based on the existing technology, with some positive developments. From energy consumption standpoint, the industry continues to have very high energy intensity for each production unit in nature it consumes: 0.074 toe/ton and for each produced monetary unit it consumes: 0.65 toe/thousand USD (which means that to produce a value of 1000 USD from industrial products the energy cost is 150-165 USD).

Figure 3.13 and Table 3.5 give the GHG emissions in the Energy Industries (in Gg CO_2 eq.). Analysis show that four largest sub-industrial sectors with highest emissions are Non-Ferrous Metals, Mining, Iron and Steel and Food& Beverage for the whole period 2009-2016.

Figure 3.13: The GHG Emissions from the Manufacturing Industries and Construction (in Gg CO_2 eq.)

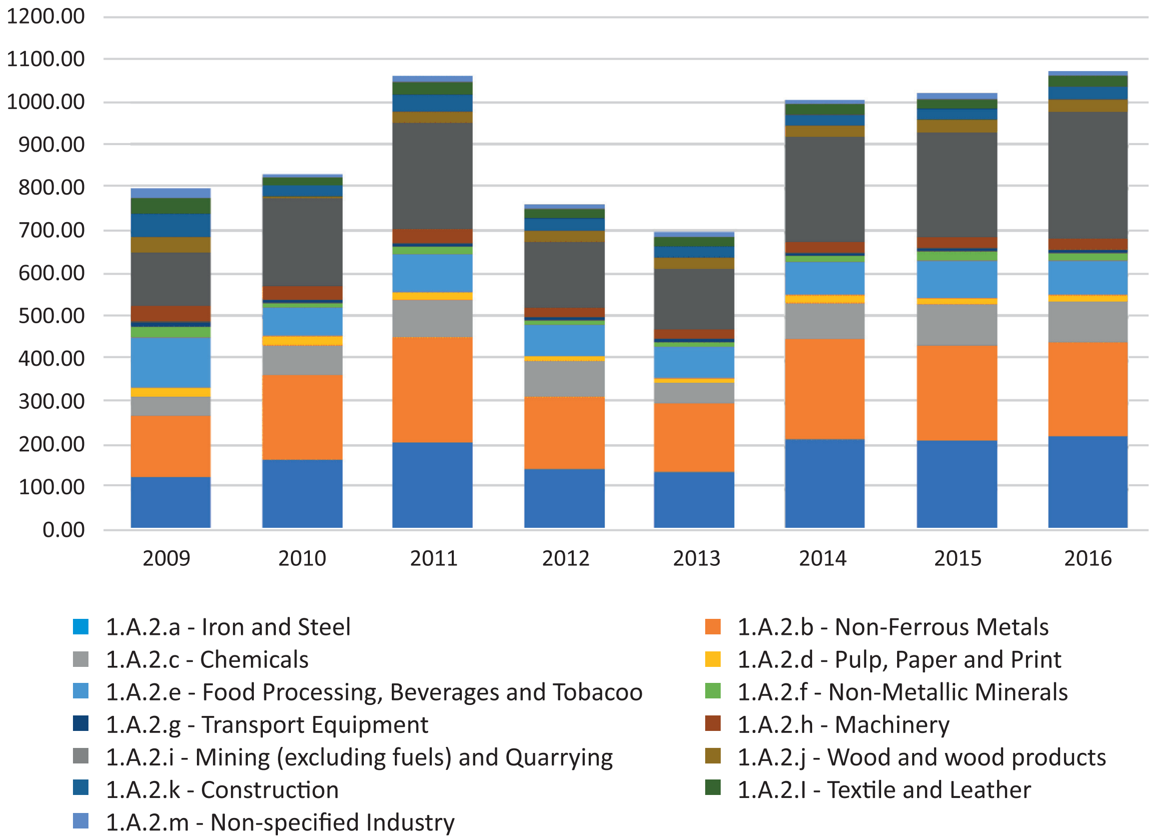


Table 3.5: GHG Emissions in the Manufacturing Industries and Construction (in Gg CO_2 eq.)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016
1.A.2.a - Iron and Steel	128.49	168.68	209.94	146.96	138.81	216.88	212.39	222.56
1.A.2.b - Non-Ferrous Metals	144.02	197.43	245.00	168.38	160.36	234.18	223.34	220.50
1.A.2.c - Chemicals	41.80	70.87	86.76	84.15	48.77	85.20	95.61	93.72
1.A.2.d - Pulp, Paper and Print	24.33	20.56	17.31	12.22	12.89	15.24	15.76	15.60
1.A.2.e - Food Processing, Beverages and Tobacco	117.10	64.32	89.08	71.44	71.59	77.65	85.01	82.12
1.A.2.f - Non-Metallic Minerals	24.33	12.46	17.31	12.22	12.38	15.32	22.40	16.19
1.A.2.g - Transport Equipment	12.16	6.23	8.66	6.27	6.38	6.67	6.83	6.82
1.A.2.h - Machinery	34.48	35.98	30.30	22.19	22.41	24.65	25.00	25.13
1.A.2.i - Mining (excluding fuels) and Quarrying	125.46	203.47	250.55	152.20	142.34	245.64	247.56	297.41
1.A.2.j - Wood and wood products	36.49	4.35	26.03	26.01	23.90	24.05	27.07	28.15
1.A.2.k - Construction	54.74	24.99	38.95	27.98	27.44	28.72	25.92	31.54
1.A.2.l - Textile and Leather	36.71	16.43	27.96	21.84	21.84	23.33	23.41	23.83
1.A.2.m - Non-specified Industry	24.33	12.46	17.30	12.52	12.61	12.61	12.74	13.40
TOTAL	804.44	838.23	1065.14	764.40	701.73	1010.15	1023.03	1076.96

3.3.2 Transport

The transport sector in Albania started to develop with fast growth rate after 2000, when, in addition to the quantitative increase of road transport means, the infrastructure and transporting capacities of the road and sea modes where developed, establishing the transport structure. The Transport Sector plays an important role in the consumption of energy resources. The evident increase of the number of the transport modes after 2010, especially in the road transport, was accompanied with increase of transport activity and an evident increase of the fuel consumption, mainly diesel and gasoline. In order to calculate the future energy demand, the sector was divided in two sub sectors: transport of freight and passenger.

The transport of freight had a very strong increase during the period 2005-2016, where it consumed an average of 15-17% of the total energy consumed per year. The increase in 2016 was in average only 2.5% per year compared with the year 2000. The main part of the decline could be attributed to the decline of the activity in the rail transport.

The Transport category participate with 53.30% in the overall Energy sector emissions in 2016. There are four subcategories actively contributing to the GHG emissions: Road transportation, Domestic Marine, Domestic Aviation and Railways.

Figure 3.14 and Table 3.6 give the GHG emissions in the Transport Sector (in Gg CO_2 eq.). Analysis shows that the highest emissions are coming from road transport for the whole period 2009-2016.

Figure 3.14: The GHG Emissions from the Transport Sector (in Gg CO_2 eq.)

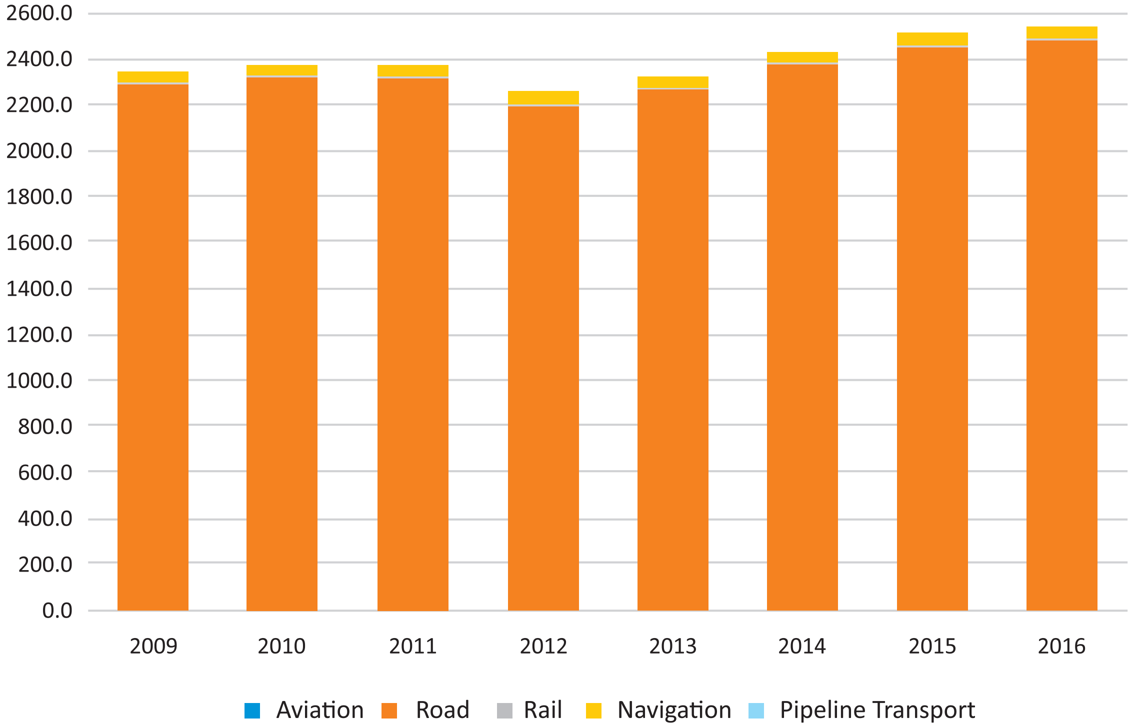


Table 3.6: GHG Emissions from the Transport Sector (in Gg CO_2 eq.)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016
Aviation	11.0	11.3	11.6	12.3	12.1	12.2	12.2	12.1
Road	2276.7	2302.9	2303.9	2188.7	2253.3	2360.5	2442.6	2470.9
Rail	9.5	9.1	8.8	8.8	8.1	7.7	7.2	6.7
Navigation	45.9	46.6	47.0	49.4	48.0	48.0	47.5	46.5
Pipeline Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**2343.34**	**2369.95**	**2371.23**	**2259.21**	**2321.49**	**2428.47**	**2509.53**	**2536.27**

3.3.3 Other sectors

Other sector participates with 10.37% in the overall Energy sector emissions in 2016.
There are three subcategories actively contributing to the emissions and they are:

- Commercial/Institutional
- Residential
- Agriculture/Forestry/Fishing.

Figure 3.15 and Table 3.7 give the GHG emissions in the Other Sectors (in Gg CO_2 eq.). Analysis shows that the residential sector has highest emissions, since it is consuming high amounts of fuel (for heating and cooking) for the whole period 2009-2016.

Figure 3.15: The GHG Emissions from Other Sectors (in Gg CO_2 eq.)

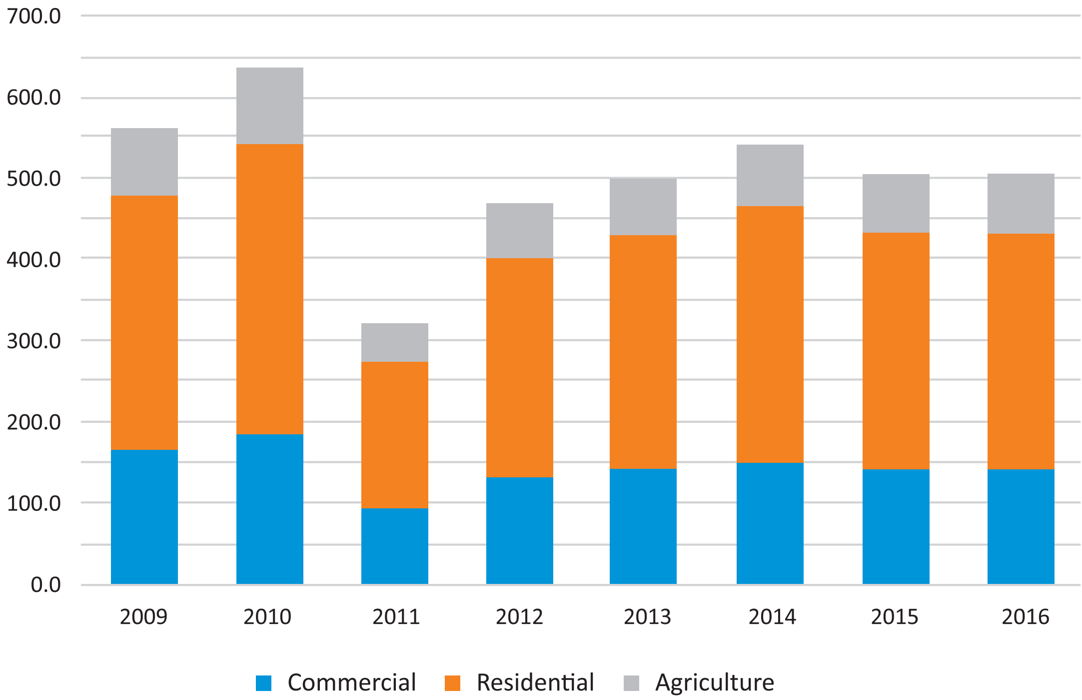


Table 3.7: GHG Emissions for Other Sectors (in Gg CO_2 eq.)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016
Commercial	164.8	188.2	94.7	134.8	143.4	152.7	144.2	141.9
Residential	315.3	356.1	180.7	270.3	288.1	314.9	289.6	292.8
Agriculture	81.6	93.1	46.9	66.9	71.3	75.9	71.6	70.6
Total	**561.8**	**637.38**	**322.24**	**471.85**	**502.83**	**543.51**	**505.34**	**505.21**

3.3.4 Non-specified

There are no gases reported under the non-specified category.

3.3.5. Fugitive emissions from fuels

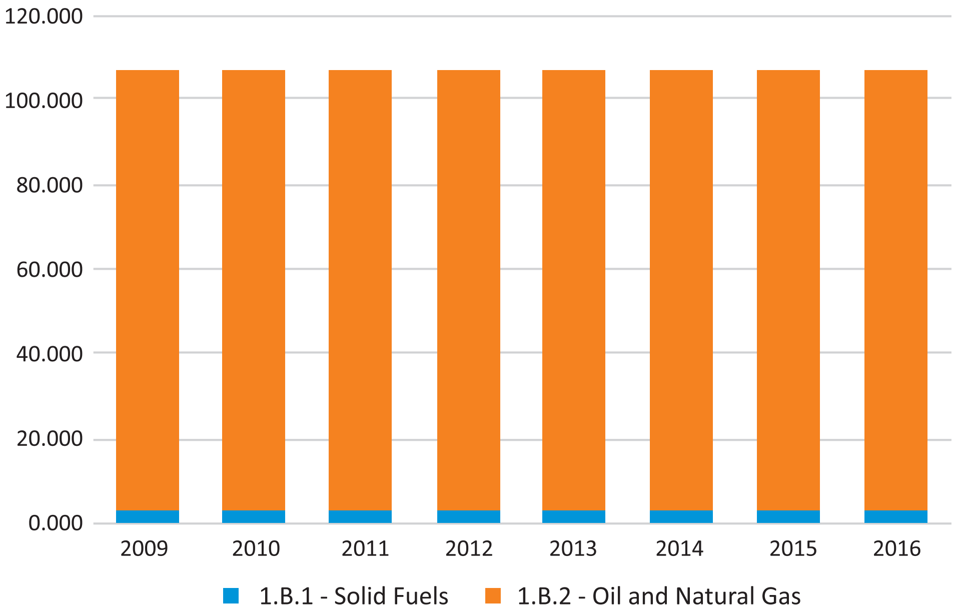
According to the IPCC methodology, emissions coming from energy activities like fugitive emissions from fuels are calculated considering the intentional and accidental releases of gases from anthropogenic activities. In this group are included: Solid Fuels (activities concerning coal underground mining and post mining activities, as well as solid fuel transformation activities); Oil & Natural Gas (exploitation, production/processing, transmission/distribution, refining, other leakage) and Oil & Natural Gas Venting & Flaring.

Figure 3.16 and the Table 3.8 give the fugitive emissions from solid fuels, & oil and natural gas sector (in Gg CO_2 eq.)

Table 3.8: Fugitive emissions from solid fuels, & oil and natural gas sector (in Gg CO_2 eq.)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016
1.B - Fugitive emissions from fuels	107.168	107.182	107.184	107.202	107.205	107.205	107.210	107.210
1.B.1 - Solid Fuels	3.488	3.488	3.488	3.488	3.488	3.488	3.488	3.488
1.B.2 - Oil and Natural Gas	103.681	103.694	103.696	103.714	103.717	103.717	103.721	103.720

Figure 3.16: Fugitive emissions from Fuels (in CO_2 eq.)



3.3.6 Memo Items: International Bunkers

International Bunkers category is comprised of the following subsectors:

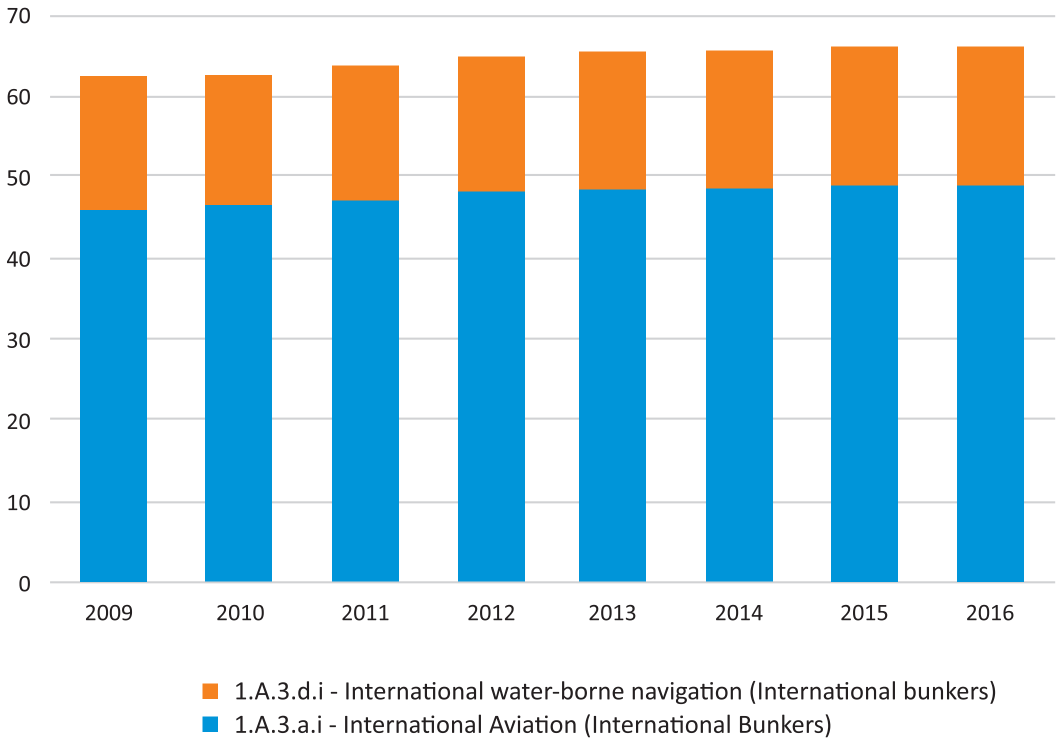
- 1.A.3.a.i - International Aviation (International Bunkers)
- 1.A.3.d.i - International water-borne navigation (International bunkers)

Figure 3.17 and the Table 3.9 gives the GHG emissions in the International Bunkers (in Gg CO_2 eq.)

Table 3.9: GHG Emissions/International Bunkers (in Gg CO_2 eq.)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016
International Bunkers	62.428	62.731	63.683	64.963	65.613	65.613	66.269	66.269
1.A.3.a.i - International Aviation (International Bunkers)	46.38	46.53	47.31	48.27	48.75	48.75	49.24	49.24
1.A.3.d.i - International water-borne navigation (International bunkers)	16.047	16.207	16.370	16.698	16.865	16.865	17.034	17.034

Figure 3.17: GHG emissions from International Bunkers (in CO_2 eq.)



3.4 Comparison of Reference and Sectoral Approach

Two approaches have been used for the estimation of the emissions of carbon dioxide, the most significant greenhouse gas. According to the first approach, CO_2 emissions is estimated for each fuel type, based on the total national consumption, and then the values were summarized (top-down approach). According to the second approach, emissions for separate sectors and source categories are estimated and then summarized (bottom-up approach). The use of these two approaches in the Albania's inventory firstly is allowing to judge on the fuel spectrum of the carbon dioxide emissions (top-down), and secondly on the sector distribution (bottom-up). In both approaches is used the default IPCC emission factors for each fuel type. Differences between two methods for energy sector is -2.19% for the year 2009 and 0.22% for the year 2016.

Table 3.10: Comparison of Sectoral and Reference Approach – total consumption and CO_2 emissions for all reported years

Year	Reference Approach		Sectoral Approach		Difference	
	Apparent Consumption (TJ)	CO_2 emissions (Gg)	Energy Consumption (TJ)	CO_2 emissions (Gg)	Energy Consumption (%)	CO_2 emissions (%)
2009	1316.25	4121.56	1316.64	4212.02	-0.03%	-2.19%
2010	1307.83	4125.98	1308.06	4185.09	-0.02%	-1.43%
2011	1293.47	4175.47	1293.40	4165.76	0.01%	0.23%
2012	1241.52	4032.26	1241.59	4042.84	-0.01%	-0.26%
2013	1208.41	4052.31	1208.67	4099.70	-0.02%	-1.17%
2014	1292.73	4465.48	1293.13	4505.90	-0.03%	-0.91%
2015	1393.18	4593.53	1392.78	4539.30	0.03%	1.18%
2016	1505.18	4560.50	1505.41	4550.65	-0.02%	0.22%

3.5 Methodology and emission factors

The Tier 1 method is used for calculation of each GHG emissions from the Energy sector, determined by the accessibility of the corresponding national data:

- Tier 1: data on the amount of fuel combusted in the source category; default emissions factors.

The emission factors used, according to the Tier 1 approach, to estimate the GHG emissions from the Energy Sector are given in the table 3.11 below.

Table 3.11: The emission factors used for the Energy Sector

Energy commodities	Default CO_2 EF, kg/TJ	Default CH_4 EF, kg/TJ	Default N_2O EF, kg/TJ
Lignite	101 000	10	1.5
Anthracite	98 300	10	1.5
Coking Coal	94 600	3	0.6
Residual Fuel Oil	77 400	3	0.6
Diesel Oil	74 100	3	0.6
Motor Gasoline	69 300	3	0.6
Natural Gas	56 100	3	0.6
Crude oil	73 300	3	0.6
Orimulsion	77 000	3	0.6
Natural gas liquid	64 200	3	0.6
Jet gasoline	70 000	3	0.6
Jet Kerosene	71 500	3	0.6
Other kerosene	71 900	3	0.6

3.6 Data Sources

Based in IPCC Methodology, activity data for Energy Sector are related with two big subcategories: fuel combustion and fugitive fuel emissions. All activity data are gathered mainly from National Balances of Energy prepared by the National Agency of Natural Resources, the Ministry of Infrastructure and Energy and INSTAT. The main categories are included and are summarized at the following Table 3.12:

Table 3.12: Data sources for the Energy Sector

Code	Main Category	Main Institutions of Activity Data Source
A.	Fuel combustion	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications
A.I	Energy and	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications
A.II	Industry: GHG from final consumption of fuels in industry	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications

A.III	Transport	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Green Transport Action Plan v) Other publications
A.IV	Small Combustion	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by INSTAT, ERE and other International Donors
A.V	Other	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by INSTAT, ERE and other International Donors
A.VI	Traditional biomass burned for energy purposes	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by INSTAT, ERE, Ministry of Tourism and Environment and other International Donors.
B	Fugitive emissions from fuels	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, Ministry of Tourism and Environment and other International Donors v) Mining Rescue Institute.
B.I	Solid Fuels	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) Mining Rescue Institute.
B.II	Oil & Natural Gas	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, Ministry of Tourism and Environment and other International Donors.
B.III	Venting & Flaring	i) Yearly Energy Balances (2009-2016) prepared from the National Agency of the National Resources and final approval from the Ministry responsible for Energy ii) 1st and 2nd & 3rd National Energy Efficiency Action Plans iii) 1st and 2nd National Renewable Energy Sources Action Plans iv) Other publications especially prepared by ALBPETROL, ARMO, Other Oil and Refinery Companies, Ministry of Tourism and Environment and other International Donors.

4 Industrial Processes and Product Use (IPPU)

4.1 Overview

Albania's economy is based on the service (54.1%), agriculture (21.7%), and industrial (24.2%) sectors. The economic activity in some branches of Industry have steadily increased in last decade. This was reflected in the growth in industrial exports and sales at home. Industrial sector sales accelerated their annual growth rate in a stable manner, registering a peak during 2012-2014 period, when considering the metal and ferroalloys production and the cement industry.

Emission Factors and Conversion Factors were taken from the IPCC Guidelines for National Greenhouse Gas Inventories and applied to Albania's condition for each industrial sub- sector, while the activity data for each were gathered either from the ministry in charge of the industry sector or INSTAT. Table 4.1 presents the summary table for IPPU sector and more details are presented in the following session.

Table 4.1: GHG main emissions of the IPPU sector (2016)

2 Industrial Processes and Product Use Greenhouse Gas Source and Sink Categories	Gases Included	% Total Emissions*	Key Categories	Uncertainty %	Tier/ NK	Method section	Notes
A. Mineral Industry							
1. Cement production	CO_2	9,566%	YES	11.180	T1	IPCC 2006	
2. Lime production	CO_2	0,150%	NO	6.325	T1	IPCC 2006	
3. Glass Production	CO_2	N/O	NO	5.000	T1	IPCC 2006	
4. Other Process Uses of Carbonates	CO_2	N/O	NO	0.000	T1	IPCC 2006	
5. Other	CO_2	N/O	NO	0.000	T1	IPCC 2006	
B. Chemical Industry							
1. Ammonia Production	CO_2	N/O	NO	5	T1	IPCC 2006	
2. Nitric Acid Production	N_2O	N/O	NO	2	T1	IPCC 2006	
3. Adipic Acid Production	N_2O	N/O	NO	5	T1	IPCC 2006	
4. Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	N/O	NO	10	T1	IPCC 2006	
5. Carbide Production	CO_2, CH_4	N/O	NO	0	T1	IPCC 2006	
6. Titanium Dioxide Production	CO_2	N/O	NO	5	T1	IPCC 2006	
7. Soda Ash Production	CO_2	N/O	NO	5	T1	IPCC 2006	
8. Petrochemical and Carbon Black Production	CO_2, CH_4	N/O	NO	10	T1	IPCC 2006	
9. Fluorochemical Production	HFC, PFC, SF_6, HCC	N/O	NO	1	T1	IPCC 2006	
10. Other		N/O	NO	n/a	T1	IPCC 2006	

C. Metal Industry							
1. Iron and Steel Production	CO_2, CH_4	0,202%	NO	10	T1	IPCC 2006	
2. Ferroalloys Production	CO_2, CH_4	0,629%	NO	4	T1	IPCC 2006	
3. Aluminium Production	CO_2, CH_4	N/O	NO	9,055	T1	IPCC 2006	
4. Magnesium Production	CO_2, SF_6	N/O	NO	5	T1	IPCC 2006	
5. Lead Production	CO_2	0,004%	NO	50,99	T1	IPCC 2006	
6. Zinc Production	CO_2	N/O	NO	10	T1	IPCC 2006	
7. Other		N/O	NO	n/a	T1	IPCC 2006	
D. Non-Energy Products from Fuels and Solvent Use							
1. Lubricant Use	CO_2	0,155%	NO	10	T1	IPCC 2006	
2. Paraffin Wax Use	CO_2	N/O	NO	10	T1	IPCC 2006	
3. Solvent Use	NMVOC	N/E	NO	n/a	T1	IPCC 2006	
4. Other		N/O	NO	n/a	T1	IPCC 2006	
E. Electronics Industry							
1. Integrated Circuit or Semiconductor	C_2F_6, CF_4, CHF_3, C_3F_8	N/O	NO	10	T1	IPCC 2006	
2. TFT Flat Panel Display	CF_4, SF_6	N/O	NO	10	T1	IPCC 2006	
3. Photovoltaics	CF_4, C_2F_6	N/O	NO	10	T1	IPCC 2006	
4. Heat Transfer Fluid	C_6F_{14}	N/O	NO	10	T1	IPCC 2006	
5. Other					T1	IPCC 2006	
F. Product Uses as Substitutes for Ozone Depleting Substances							
1. Refrigeration and Air Conditioning	HFC	0,375%	NO	n/a	T1	IPCC 2006	
2. Foam Blowing Agents	HFC	N/E	NO	n/a	T1	IPCC 2006	
3. Fire Protection	HFC	N/E	NO	n/a	T1	IPCC 2006	
4. Aerosols	HFC	N/E	NO	n/a	T1	IPCC 2006	
5. Solvents	HFC, PFC	N/E	NO	n/a	T1	IPCC 2006	
6. Other Applications	HFC, PFC, SF_6, HCC	N/O	NO	n/a	T1	IPCC 2006	
G. Other Product Manufacture and Use							
1. Electrical Equipment	HFC, PFC, SF_6, HCC	N/O	NO	n/a	T1	IPCC 2006	
2. SF_6 and PFCs from Other Product Uses	HFC, PFC, SF_6, HCC	N/O	NO	n/a	T1	IPCC 2006	
3. N_2O from Product Uses	N_2O	N/O	NO	n/a	T1	IPCC 2006	
4. Other		N/O	NO	n/a	T1	IPCC 2006	
H. Other							
1. Pulp and Paper Industry	CO_2	N/A	NO	0	T1	IPCC 2006	
2. Food and Beverages Industry	NMVOC	N/A	NO	0	T1	IPCC 2006	
3. Other		N/O	NO	n/a	T1	IPCC 2006	

*Note: NK = notation key, MS = method statement, T = tier, * percentage of total emissions without LULUCF in the most recent inventory year*

4.2 IPPU Categories and sub-categories

Following the 2006 IPCC guidelines and the IPCC Good Practice Guidance, the Greenhouse Gas Inventory for the IPPU sector was carried out, covering the period 2010-2016, but also adjusting for the differences coming due to new IPCC Guidelines used for the year 2009, produced under the TNC considering (i) Industrial Processes; and (ii) Product Use.

Industrial Processes and Product Use (IPPU) subcategories covered are:

- Processes that chemically or physically transform materials (e.g., blast furnace)
- Product uses of GHGs, for example in refrigerators and aerosol cans
- Non-energy uses of fossil fuels, for example, the use of lubricants in engines and paraffin wax used in candles or corrugated boxes

Gases included in the inventory for the IPPU sector are:

- CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3
- Additional gases for which the GWPs are not available in the IPCC Third Assessment Report covered in the 2006 Guideline

Emissions from IPPU sector include non-energy related CO_2 emissions from the production of cement, non-cement clinker and glass production, SO_2 emissions from metal production, NMVOC emissions from solvent use, asphalt production and food and beverage industry as well as emissions of F-gases from refrigeration, air conditioning and other product use. In IPPU Sector the emission estimation considers only process-related emissions and does not consider energy-related emissions. Energy-related emissions from these industries are accounted for in the Energy Sector and there is no double-counting of emissions between the Energy and IPPU Sectors.

F-gases are serving as alternatives to ozone depleting substances (ODS) which are being phased out under the Montreal Protocol. They are used in refrigeration and cooling devices, in air conditioning devices and as aerosols, as foam blowing agents and in fire protection. IPPU Sector greenhouse gas source categories include the following emission source sub-categories:

- 2.A - Mineral Industry (CO_2 emissions)
- 2.B - Chemical Industry
- 2.C - Metal Industry (SO_2 emissions)
- 2.D - Non-Energy Products from Fuels and Solvent Use (NMVOC)
- 2.E - Electronics Industry
- 2.F - Product Uses as Substitutes for Ozone Depleting Substances (HFCs)
- 2.G - Other Product Manufacture and Use
- 2.H - Other

4.3 Emission trends in IPPU sector

Table 4.2 and Figure 4.1 and 4.2 give the GHG emissions from the IPPU sector, by category (in Gg CO_2 eq.).

Table 4.2: CO_2 eq. emissions from Industrial sub-sectors, 2009-2016 (Gg)

Years	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO_2 eq. (Gg)							
2 - Industrial Processes and Product Use	1357.642	967.320	1124.811	1153.718	1244.833	1193.813	1105.501	1019.892
2.A - Mineral Industry	671.446	872.404	1011.379	1056.891	1145.924	1065.005	974.293	894.250
2.B - Chemical Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C - Metal Industry	671.351	80.034	98.444	82.099	77.507	102.389	95.068	76.823
2.D - Non-Energy Products from Fuels and Solvent Use	14.844	14.882	14.988	14.579	13.807	10.469	11.477	14.277
2.E - Electronics Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F - Product Uses as Substitutes for ODS	0.000	0.000	0.000	0.148	7.594	15.950	24.663	34.543
2.G - Other Product Manufacture and Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H - Other	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 4.1: CO_2 eq. emission from Industrial sub-sector, 2009-2016 (Gg)

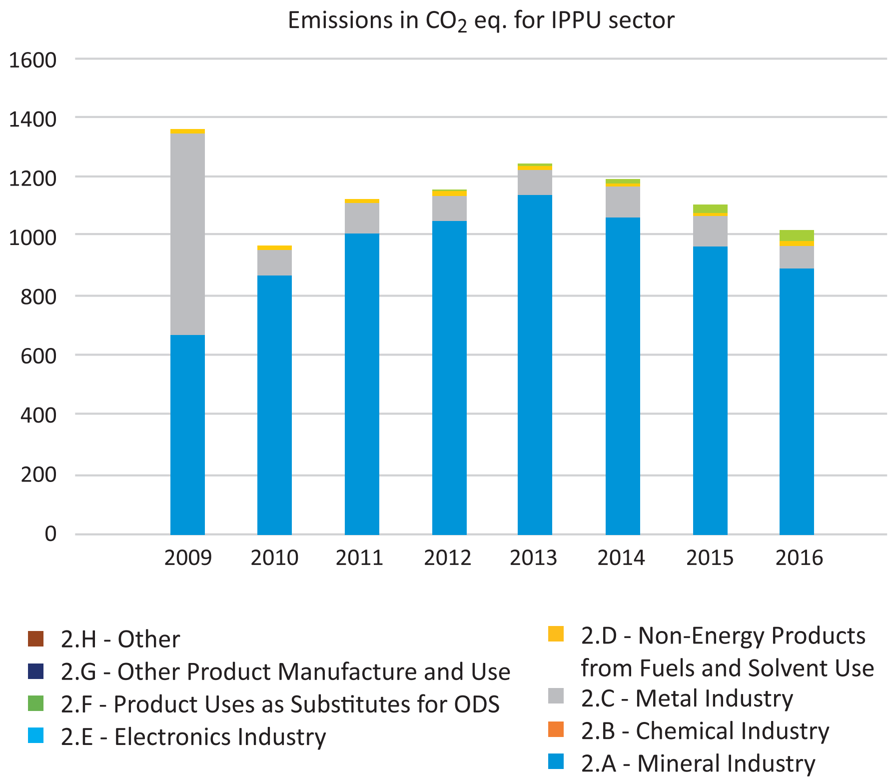
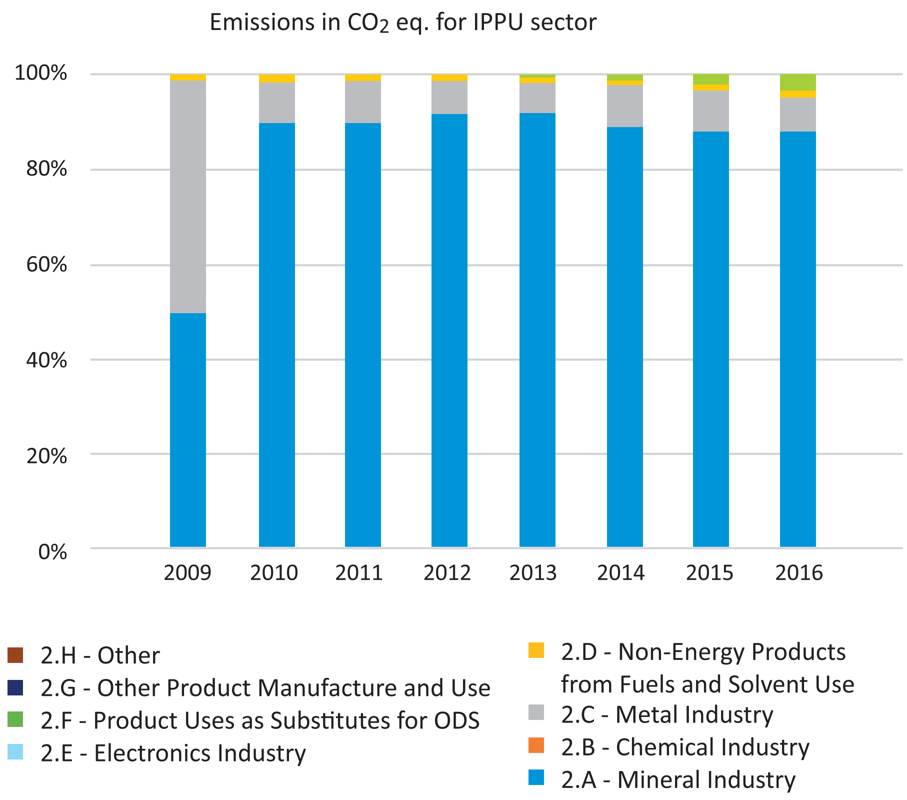


Figure 4.2: CO_2, eq. emission from Industrial sub-sector, 2009-2016 (%)



In 2010 - CO_2 emissions from Mineral Industry were 872 Gg or about 86.6% of total CO_2 eq emissions from industry sector, meanwhile, in 2016, this figure was increased up to 894 Gg or about 86.3% of total. The other important subsector, the Metal Industry has experienced a big change in the CO_2eq. emissions, due to a technology change in the Kurum Elbasan Steel company, which is operating since 2010 with Electric Arc Furnace (EAF) technology. This fact explains the drop-in emissions coming from this subsector, due to a lower Emission Factor applied for this technology. In 2010 - CO_2 emissions from Metal Industry were 80 Gg or about 8.3% of total CO_2 eq. emissions from industry sector, meanwhile, in 2016, this figure was decreased to 76.8 Gg or about 7.5% of total. (figures 4.1 and 4.2).

4.3.1 Emission trends in Mineral Industry subcategory

The Activity Data under the Mineral Industry subcategory are:

- 2.A.1 - Cement production
- 2.A.2 - Lime production
- 2.A.3 - Glass Production
- 2.A.4 - Other Process Uses of Carbonates
- 2.A.5 - Other

For the case of Albania, Cement production and Lime production is contributing to the CO_2eq. emissions, as shown in the Table 4.3, while Figure 4.3 and 4.4 give the GHG emissions from the Mineral Industry subcategory of the IPPU sector (in Gg CO_2 eq.).

Table 4.3: CO_2 eq. emission from the Mineral Industry subcategory, 2009-2016 (Gg)

Years	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO_2 eq. (Gg)							
2.A - Mineral Industry	671.446	872.404	1011.379	1056.891	1145.924	1065.005	974.293	894.250
2.A.1 - Cement production	585.000	837.737	976.500	1039.500	1128.600	1044.900	954.113	880.470
2.A.2 - Lime production	86.446	34.667	34.879	17.391	17.324	20.105	20.180	13.780
2.A.3 - Glass Production	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4 - Other Process Uses of Carbonates	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.5 - Other (please specify)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 4.3: CO_2 eq. emission from Mineral Industry, IPPU sector, 2009-2016 (Gg)

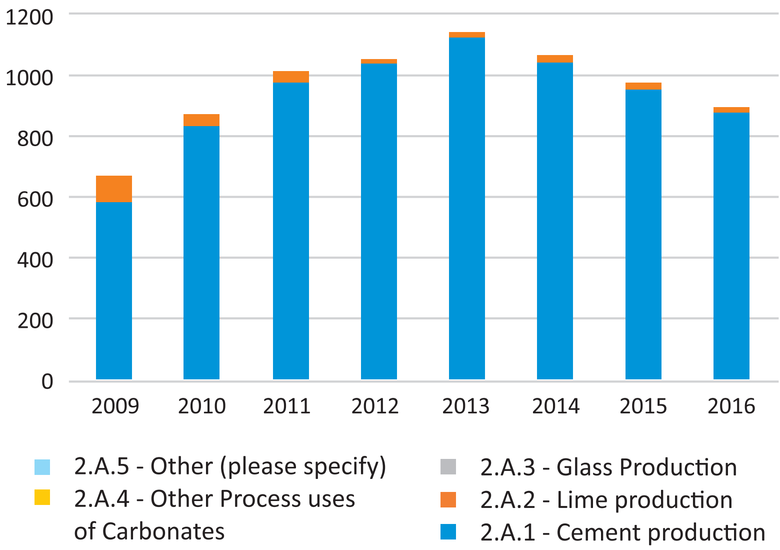
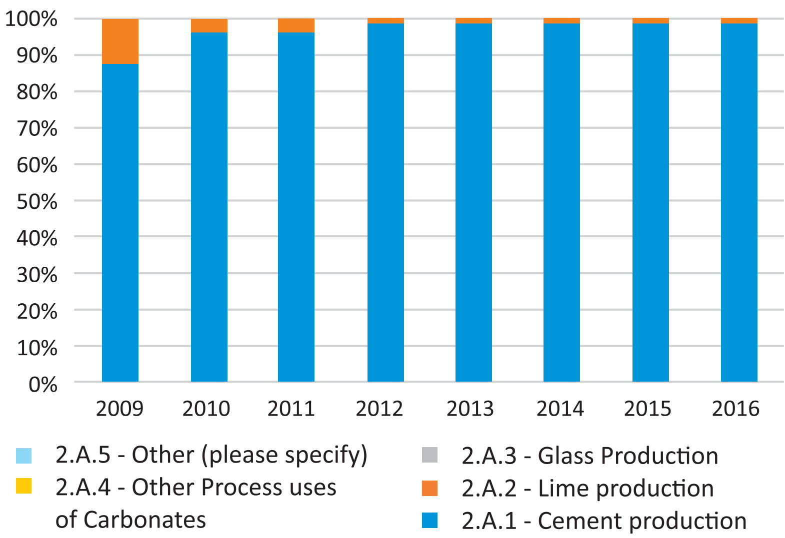


Figure 4.4: CO_2 eq. emission from Mineral Industry, IPPU sector, 2009-2016 (%)



Breakdown of the Mineral Industry is composed from two main sub-sectors: cement and lime. In 2010 - CO_2 emissions from cement industry were 837 Gg or about 86% of total CO_2 equivalent emissions from IPPU sector, meanwhile, in 2016, this figure was increased up to 880 Gg or 87% of total (figures 4.3 and 4.4).

4.3.1.1 Cement Production

The category Cement production is a key category for CO_2 emissions in terms of emissions level. In Albania cement is produced in four plants: 1) Antea Cement Factory; 2) Fushe-Kruja Cement Factory; 3) Elbasani Cement Factory; and 4) Colacem Factory. In cement manufacture, CO_2 is produced during the production of clinker. The method used for estimating CO_2 emissions from cement production is based on national circumstances, where the cement production goes to the internal market and to export. Carbon dioxide emissions in cement production sub-category were estimated on clinker quantities used in the reporting year for cement production.

Carbon dioxide emissions from cement production were calculated by applying Tier 1 approach, as the only data available from all companies are regarding the yearly production and export. Tier 1 approach is based on Emission Factors for CO_2 emitted per unit mass of raw material or product manufactured. In the Tier 1 method, emissions are based on clinker production estimates inferred from cement production data, correcting for imports and exports of clinker. The emissions from clinker that is ultimately exported should be factored into national estimates of the country where the clinker is produced.

Albanian Cement Factories produces five CE-certified cements, packed in 10 different combinations, and distributed either in bulk or in 1.95t or 1.75t pallet configuration. Considering the variety of the cement products from all the factories and not having data regarding the amount of each product, the Clinker Fraction in the calculations of the emissions is considered 0.75. Table 4.4 presents the cement production and exports from Albanian cement factories.

Table 4.4: Cement production for the period 2009-2016 in Albania

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016
Antea Cement (Titan)									
Production	[ton/year]	na	761,638	1,040,000	1,062,000	1,098,000	710,000	675,250	652,600
Export	[ton/year]	na	334,600	435,000	548,000	477,000	419,034	218,650	146,155
Fushe – Kruje Cement									
Production	[ton/year]	na	900,000	910,000	1,018,000	980,000	1,087,000	955,000	850,000
Export	[ton/year]	na	275,000	275,935	545,000	485,000	585,000	453,878	460,800
Elbasani Cement									
Production	[ton/year]	na	200,000	220,000	230,000	215,000	290,000	235,000	202,000
Export	[ton/year]	na	145,000	154,000	125,000	130,000	100,000	161,054	86,955
Colachem, Balldren, Lezhe									
Production	[ton/year]	0	0	0	0	215,000	235,000	255,000	252,000
Export	[ton/year]	0	0	0	0	55,000	53,000	62,000	58,000
Total production	**[ton/year]**	**1,300,000**	**1,861,638**	**2,170,000**	**2,310,000**	**2,508,000**	**2,322,000**	**2,120,250**	**1,956,600**

4.3.1.2 Lime production

Calcium oxide (CaO or 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 stabilization), primarily high calcium limestone (calcite) is utilized.

The Tier 1 method is based on applying a default emission factor to national level lime production data. While country-specific information on lime production by type (e.g., high calcium lime, dolomitic lime, or hydraulic lime) is not necessary for good practice in Tier 1, where data are available to identify the specific types of lime produced in the country, this may be used. It is not necessary for good practice to account for LKD in Tier 1. Table 4.5 presents the lime production from Albanian factories.

Table 4.5: Lime production for the period 2009-2016 in Albania

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016
Lime Production	[ton/year]	114,802	46,039	46,320	23,096	23,007	26,700	26,800	18,300

4.3.2 Emission trends in Metal Industry subcategory

The Activity Data under the Metal Industry subcategory are:

- 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

The contribution to the CO_2eq. emissions, are shown in the Table 4.6 and Figure 4.5 and 4.6 for the Metal Industry subcategory of the IPPU sector (in Gg CO_2 eq.).

Table 4.6: CO_2 eq. emission from the Metal Industry subcategory, 2009-2016 (Gg)

Years	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO_2 eq. (Gg)							
2.A - Metal Industry	671.351	80.034	98.444	82.099	77.507	102.389	95.068	76.823
2.C.1 - Iron and Steel Production	635.104	50.139	60.721	50.402	44.981	56.502	37.880	18.579
2.C.2 - Ferroalloys Production	35.447	29.273	37.053	31.223	32.110	45.366	56.770	57.916
2.C.3 - Aluminium production	0.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.4 - Magnesium production	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.5 - Lead Production	0.000	0.622	0.670	0.474	0.416	0.521	0.418	0.328
2.C.6 - Zinc Production	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.7 - Other (please specify)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure 4.5: CO_2 eq. emission from Metal Industry, IPPU sector, 2009-2016 (Gg)

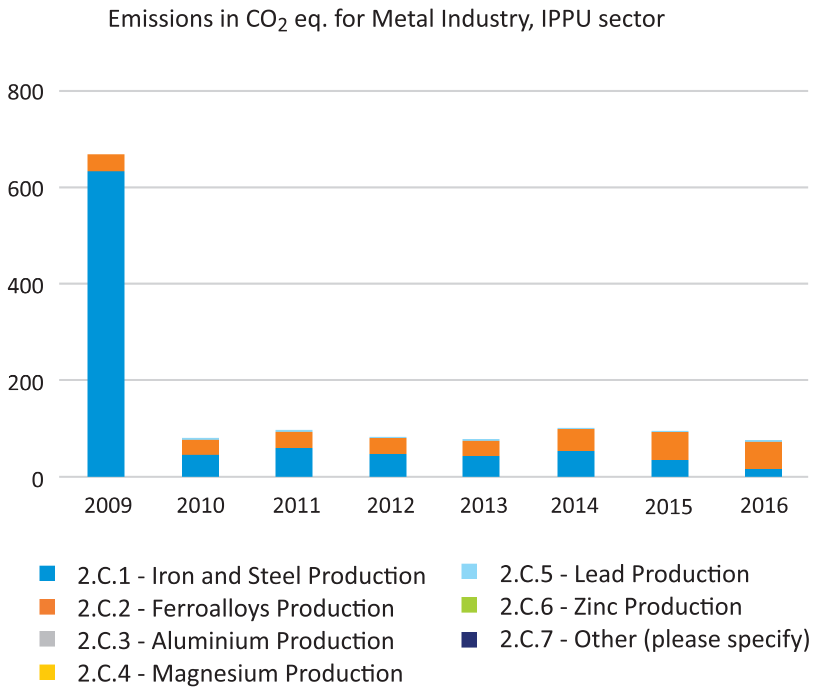
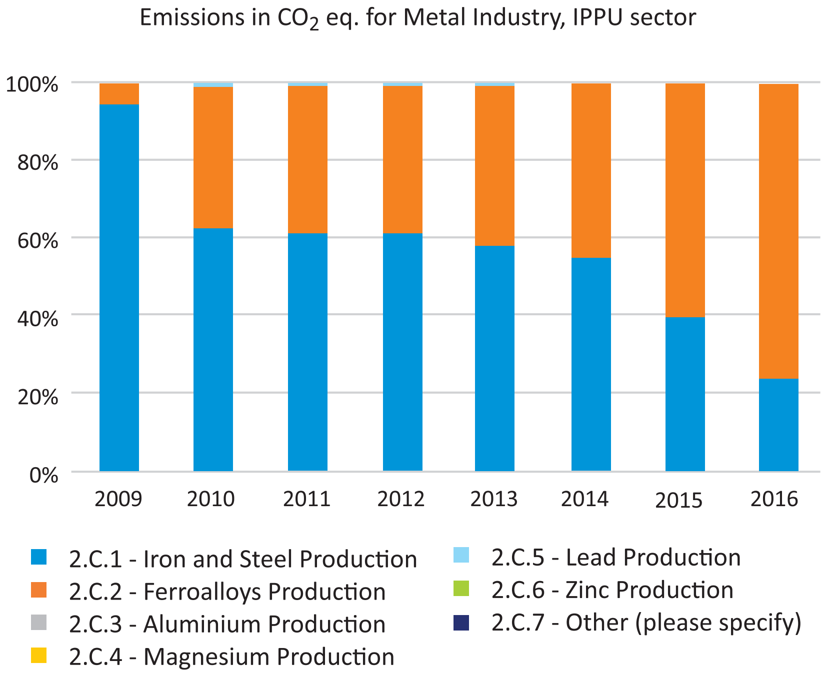


Figure 4.6: CO_2 eq. emission from Metal Industry, IPPU sector, 2009-2016 (%)



Breakdown of the Metal Industry is composed from two main sub-sectors: Iron & Steel production and Ferroalloy production. In 2010 - CO_2 emissions from Iron & Steel production were 50 Gg or about 5.2% of total CO_2 equivalent emissions from IPPU sector, meanwhile, in 2016, this figure was decreased up to 19 Gg or about 1.8% of total (figures 4.5 and 4.6). On the other side, the emissions from the Ferroalloy production are increased in this time period. In 2010 - CO_2 emissions from Ferroalloy production were 29 Gg or about 3.0% of total CO_2 equivalent emissions from IPPU sector, meanwhile, in 2016, this figure was increased up to 58 Gg or about 5.7% of total.

4.3.2.1 Iron and Steel Production

The category Iron and steel production is a key category for CO_2 emissions in terms of emissions level. In Albania there is only one factory which produces iron and steel, Kurum factory in Elbasan, which produces i) Billets; ii) Reinforcing bars (Rebars); iii) Ribbed wire rods; iv) Smooth wire rods; and v) Spooler. The Tier 1 approach for emissions from iron and steel production is to multiply default emission factors by national production data. Because emissions per unit of steel production vary widely depending on the method of steel production, it is good practice to determine the share of steel produced in different types of steelmaking processes, calculate emissions for each process, and then sum the estimates. The IPCC 2006 guidelines offer Emission Factors according to the Process or Steelmaking method, as presented below. Table 4.7 presents steel production from Albanian factories.

Table 4.7: Steel production for the period 2009-2016 in Albania

Description	Unit	209	2010	2011	2012	2013	2014	2015	2016
Steel ingots	[ton/year]	na	390,850	463,620	381,692	312,789	433,735	239,300	111,072
Katanke steel	[ton/year]	na	235,882	395,393	248,327	249,476	272,541	234,200	121,161
Iron & Steel Production	**[ton/year]**	**435,003**	**626,732**	**759,013**	**630,019**	**562,256**	**706,276**	**473,500**	**232,233**

4.3.2.2 Ferroalloys Production

Ferroalloy is the term used to describe concentrated alloys of iron and one or more metals such as silicon, manganese, chromium, molybdenum, vanadium and tungsten. In Albania there is only Ferro-Chromium production. Ferroalloy production involves a metallurgical reduction process that results in significant carbon dioxide emissions. The IPCC Guidelines outline several approaches for calculating CO_2 emissions from ferroalloy production. The Tier 1 method calculates emissions from general emission factors applied to a country's total ferroalloy production. Table 4.8 presents steel production from Albanian factories.

Table 4.8: Ferro-Chromium production for the period 2009-2016 in Albania

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016
Ferro-Chromium Production	[ton/year]	27,267	22,518	28,502	24,018	24,700	34,897	43,669	44,551

4.3.2.3 Aluminum production

Worldwide, primary aluminum is produced exclusively by the Hall-Heroult electrolytic process. In this process, electrolytic reduction cells differ in the form and configuration of the carbon anode and alumina feed system and belong to one of four technology types: Centre-Worked Prebake (CWPB)3, Side-Worked Prebake (SWPB), Horizontal Stud Søderberg (HSS) and Vertical Stud Søderberg (VSS). The most significant process emissions are: (i) Carbon dioxide (CO_2) emissions from the consumption of carbon anodes in the reaction to convert aluminum oxide to aluminum metal; (ii) Perfluorocarbons (PFCs) emissions of CF_4 and C_2F_6 during anode effects. Also emitted are smaller amounts of process emissions, CO, SO_2, and NMVOC. SF_6 is not emitted during the electrolytic process and is only rarely used in the aluminum manufacturing process, where small quantities are emitted when fluxing specialized high magnesium aluminum alloys. Table 4.9 presents the aluminium production from Albanian factories.

Table 4.9: Aluminium production in Albania

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016
Aluminium production	[ton/year]	na	20,332	20,550	19,842	21,530	16,516	17,110	21,840
Aluminium production from recycling	[ton/year]	500	2,605	3,309	1,940	4,124	1,345	9,152	10,747
Total Aluminium Production	**[ton/year]**	**500**	**22,937**	**23,859**	**21,782**	**25,654**	**17,861**	**26,262**	**32,587**

4.3.2.4 *Lead Production*

There are two primary processes to produce rough lead bullion from lead concentrates. The first type is sintering/smelting, which consists of sequential sintering and smelting steps and constitutes roughly 78 percent of the primary lead production. The second type is direct smelting, which eliminates the sintering step and constitutes the remaining 22 percent of primary lead production in the developed world. Table 4.9 presents the lead production from recycling in Albania.

Table 4.10: Lead production from recycling in Albania

Description	Unit	2009	2010	2011	2012	2013	2014	2015	2016
Lead Production (recycling)	[ton/year]	na	3109	3,351	2,372	2,078	2,603	2,091	1,638

4.3.3 Emission trends in "Product Uses as Substitutes for Ozone Depleting Substances" subcategory

The Activity Data under the Product Uses as Substitutes for Ozone Depleting Substances" subcategory are:

- 2.F.1 - Refrigeration and Air Conditioning
- 2.F.2 - Foam Blowing Agents
- 2.F.3 - Fire Protection
- 2.F.4 - Aerosols
- 2.F.5 - Solvents
- 2.F.6 - Other Applications

AS the data for this sector are provided only as the sum of all subcategories, the emissions are shown for the total subcategory only.

Table 4.11: CO_2 eq. emission from "Product Uses as Substitutes for Ozone Depleting Substances" subcategory, 2009-2016 (Gg)

Years	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO_2 eq. (Gg)							
2.F - Product Uses as Substitutes for ODS	0.000	0.000	0.000	0.148	7.594	15.950	24.663	34.543

In 2010 - CO_2 emissions from "Product Uses as Substitutes for Ozone Depleting Substances" are not estimated due to the lack of data, meanwhile, in 2016, this figure resulted to be 35 Gg or about 3.4% of total.

4.3.3.1 *F-Gases*

Hydrofluorocarbons (HFCs) and, to a very limited extent, perfluorocarbons (PFCs), are serving as alternatives to ozone depleting substances (ODS) being phased out under the Montreal Protocol. The use of HFCs and PFCs in some applications, specifically rigid foam (typically closed-cell foam), refrigeration and fire suppression, can lead to the development of ***long-lived banks of material***. The emission patterns from these uses can be particularly complex and methods employing disaggregated data sets are essential to generate accurate emissions estimates. Other applications, such as aerosols and solvent cleaning may have short-term inventories of stock but, in the context of emission estimation, can still be considered as sources of prompt emission.

As CFCs, halons, carbon tetrachloride, methyl chloroform, and, ultimately, HCFCs are being finally phased out, HFCs are being selectively used as replacements. PFCs are also being used, but only to a limited extent. Even though up to 75 percent of previous applications of CFC may now be covered by non-fluorocarbon technologies, HFC use is expected to continue to grow at least in the short term.

4.3.3.2 Refrigeration and Air Conditioning

Refrigeration and air-conditioning (RAC) systems may be classified in up to six sub-application domains or categories, although less sub-applications are typically used at a single country level.

These categories correspond to sub-applications that may differ by location and purpose, and are listed below:

(i) Domestic (i.e., household) refrigeration,
(ii) Commercial refrigeration including different types of equipment, from vending machines to centralized refrigeration systems in supermarkets,
(iii) Industrial processes including chillers, cold storage, and industrial heat pumps used in the food, petrochemical and other industries,
(iv) Transport refrigeration including equipment and systems used in refrigerated trucks, containers, reefers, and wagons,
(v) Stationary air conditioning including air-to-air systems, heat pumps, and chillers19 for building and residential applications,
(vi) Mobile air-conditioning systems used in passenger cars, truck cabins, buses, and trains.

For all these sub-applications, different HFCs are progressively replacing CFCs and HCFCs. For example, in developed and several developing countries, HFC-134a has replaced CFC-12 in domestic refrigeration, high-pressure chillers and mobile air conditioning systems, and blends of HFCs such as R-407C (HFC-32/HFC-125/HFC-134a) and R-410A (HFC-32/HFC-125) are replacing HCFC-22 mainly in stationary air conditioning. HFC blends R-404A (HFC-125/HFC-143a/HFC-134a) and R-507A (HFC-125/HFC-143a) have replaced R-502 (CFC-22/CFC-115) and HCFC-22 in commercial refrigeration. Other, non-HFC substances are also used to replace CFCs and HCFCs such as iso-butane (HC-600a) in domestic refrigeration or ammonia in industrial refrigeration. According to the information presented in the Ozone Secretariat webpage, the HCFs consumption are given at table 4.12.

Table 4.12: Consumption of HFCs in Albania[5]

COUNTRY CONSUMPTION OF HFCs [ton] (Source: UNIDO)					
F-GASES	2012	2013	2014	2015	2016
HFC-134a	15.152	17.450	22.978	27.215	*31.129
HFC-227ea	3.610	4.481	5.385	6.894	*7.782
R-404A	8.519	10.065	11.410	13.587	*15.033
R-407C	2.348	1.981	1.885	1.574	*1.343
R-410A	6.110	7.867	9.841	11.825	*13.691
R-507A	0.662	2.207	0.356	0.300	*0.250
TOTAL	**36.401**	**44.051**	**51.855**	**61.395**	***69.226**

* Estimated values

4.4 Methodology and emission factors

The estimation of the greenhouse gases from all categories in the IPPU sector was done in accordance with the 2006 IPPC Guidelines (Tier 1) and with the usage of IPCC software, version (version 2.691).

Emission factors and other parameters with background documentation or technical references were derived from the IPCC Emission Factor Database (EFDB), which contains the IPCC default data and the 2006 IPCC Guidelines. The emission factors are presented in Table 4.13.

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Table 4.13: Emission factors used in IPPU sector

No.	Category	Technology / Specification	Emission Factor - EF	Unit
1	2.A.1 - Cement production	n/a	0.52	[ton CO_2/ton clinker]
2	2.A.2 - Lime production	n/a	0.753	[ton CO_2/ton lime]
3	2.C.1 - Iron and Steel Production	Electric Arc Furnace (EAF)	0.08	[ton CO_2/ton produced]
4	2.C.1 - Iron and Steel Production	Open Hearth Furnace (OHF)	1.72	[ton CO_2/ton produced]
5	2.C.1 - Iron and Steel Production	Iron Production	1.35	[ton CO_2/ton produced]
6	2.C.2 - Ferroalloy production	Ferro-cromium	1.3	[ton CO_2/ton produced]
7	2.C.3 - Aluminium production	Prebake	1.6	[ton CO_2/ton produced]
8	2.C.3 - Aluminium production	Sodeberg	1.7	[ton CO_2/ton produced]
9	2.C.5 - Lead Production	From Treatment of Secondary Raw Materials	0.2	[ton CO_2/ton produced]

4.5 Data Sources for IPPU sector

The data for preparation of the greenhouse gases inventory for the IPPU sector are collected from the main sources as in table 4.14.

Table 4.14: Data Sources for the IPPU sector

Main sources of the collected data

No.	Description
1	The State statistics - INSTAT
2	Ministry of Industry and Energy - MIE
3	National Agency for Natural Resources - NANR
4	National Environment Agency - NEA
5	Ministry of Tourism and Environment - MTE
6	[https://www.globalcement.com/magazine/articles/1107-fushe-kruje-cement-factory-a-hybrid-plant]
7	[http://www.anteacement.com/_home/product/]
8	[https://www.colacem.com/al/en]
9	[https://www.see-industry.com/en/energy-efficiency-improvement-in-steel-factory-in-elbasan-albania/2/590/]
10	[https://ozone.unep.org/countries/data-table]
11	National Ozone Unit

5 Agriculture, Forestry, and Other Land Use

5.1 Overview

The AFOLU sector includes emissions and removals of greenhouse gases (GHGs) from four main categories: (i) agriculture/livestock, (ii) land (forest land, cropland, grassland, wetlands, settlements, and other land), (iii) aggregate sources and non-CO_2 emissions on land and (iv) other. Each land-use category is further subdivided into land remaining in that category (e.g., forest land remaining forest land) and land converted from one category to another (e.g., forest land converted to cropland).
The main problems of AFOLU sector are the lack of accurate data regarding land use categories and data on forest fund. There isn't yet any cadastral data for the whole land use in the country, in which is evidenced/reflected relevant changes by the land use of the territory.
AFOLU sector represents a significant source of GHG emissions in Albania, but also a sector where mitigation of those emissions can be significantly implemented, and removals can be increased if sectoral policies are based on the principle of sustainable development.
Trends in the emissions or sequestration of GHGs by the forest sector show that forests will continue to be a source of greenhouse gas emissions even in the near future, if their management continues as it has been up to now. This is because there is a huge gap between the natural growth of forests and their cutting. Table 5.1 presents the summary table for AFOLU sector and more details will be presented in the following session.

Table 5.1: GHG main emissions of the AFOLU sector (2016)

3 Agriculture Greenhouse Gas Source and Sink Categories	Gases Included	% Total Emissions*	Key Categories	Uncertainty %	Tier/ NK	MS reference	Notes
A. Livestock							
1. Enteric Fermentation							
a.i. Dairy cattle	CH_4	8.018	Yes	30.414	T1	IPCC 2006	
a.ii. Other cattle	CH_4	1.813	Yes	30.414			
b. Buffalo	CH_4	0.002	No	30.414			
c. Sheep	CH_4	2.250	Yes	30.414			
d. Goats	CH_4	1.073	No	30.414			
e. Camels	CH_4	-	-	-			
f. Horses	CH_4	0.131	No	30.414			
g. Mules and Asses	CH_4	0.141	No	30.414			
h. Swine breeding	CH_4	-	-	-			
h. Market swine	CH_4	0.041	No	30.414			
Poultry	CH_4	-		-			
j. Other	-	-		0.000			

2. Manure Management							
a.i. Dairy cattle	CH_4	2.306	Yes	30.414	T1	IPCC 2006	
a.ii. Other cattle	CH_4	0.405	Yes	50.249			
b. Buffalo	CH_4	0.000	No	5.000			
c. Sheep	CH_4	0.115	No	5.000			
d. Goats	CH_4	0.071		5.000			
e. Camels	CH_4	-	-	-			
f. Horses	CH_4	0.013	No	5.000			
g. Mules and Asses	CH_4	0.014	No	5.000			
h. Swine breeding	CH_4	0.193	No	30.414			
i. Poultry	CH_4	0.045	No	5.000			
j. Other							
B. Land							
1. Forest Land							
a. Forest land Remaining Forest land	CO_2	13.732	Yes	42.426	T1	IPCC 2006	
b. Land Converted to Forest land	CO_2	0.000	No	0.000			
2. Cropland							
a. Cropland Remaining Cropland land	CO_2	0.792	Yes	31.623	T1	IPCC 2006	
b. Land Converted to Cropland	CO_2	0.000	No	0.000			
3. Grassland							
a. Grassland Remaining Grassland	CO_2	0.000	No	50.359	T1	IPCC 2006	
b. Land Converted to Grassland	CO_2	0.000	No	0.000			
4. Wetlands							
a. Wetlands Remaining Wetlands	CO_2	0.000	No	90.139	T1	IPCC 2006	
b. Land Converted to Wetlands	CO_2	0.000	No	0.000			
5. Settlements							
a. Settlements Remaining Settlements	CO_2	0.000	No	0.000	T1	IPCC 2006	
b. Land Converted to Settlements	CO_2	1.016	Yes	0.000			
6. Other land							
a. Other land Remaining Other land	CO_2	0.000	No	0.000	T1	IPCC 2006	
b. Land Converted to Other land	CO_2	0.000	No	0.000			
D. Harvested Wood Products							
1. Harvested Wood Products	CO_2	0.000	No	0.000	T1	IPCC 2006	
C. Aggregate sources and non-CO_2 emissions sources on land							
1. GHG emissions from biomass burning	CH_4	0.016	No		T1	IPCC 2006	
2. Liming	CO_2	0.000	No				
3. Urea application	CO_2	0.355	No				
4. Direct N_2O emissions from managed soils	N_2O	6.001	Yes				
5. Indirect N_2O emissions from managed soils	N_2O	2.008	Yes				
6. Indirect N_2O emissions from manure management	N_2O	0.441	Yes				
7. Rice Cultivations	CH_4	0.000	No				
8. Other	-	-					

D. Other								
1. Harvested Wood Products	CO_2	-						
2. Other	-	-						

*Note: NK = notation key, MS = method statement, T = tier, * percentage of total emissions without LULUCF in the most recent inventory year*

Under AFOLU, livestock with about 1531.03 Gg CO_2 eq. (year 2016) remains the first emitter of GHGs with about 41% of total GHGs emissions through two main activities; enteric fermentation and manure management. Inside the livestock category, enteric fermentation has the largest share in terms of GHG emissions with over 80.98% of total emissions from livestock. Among livestock categories, cattle are the main contributors to GHGs with about 75% of total GHGs from livestock sector. There is no noticeable upward trend in GHGs from livestock during the inventory period. This is because the number of livestock heads has not increased significantly during this period. The amount of GHGs emissions depends mainly on the number of livestock, categories of livestock, their diet, and the manure management practice.
Within AFOLU sector, under sub-category "land" forests remain the second emitters of GHGs with 38% of the total. Although forests should serve as GHG sink, in Albania they represent one of the key sources of those gases with an average of 2198.86 Gg CO_2 per year, during 2010-2016. Together with '*Cropland converted to Settlements'* and '*Cropland Remaining Cropland*' they count about 38% of the total GHGs from AFOLU sector. This is because their management in the last three decades has been relatively neglected. Among others, negative impact in this direction has come from the uncontrolled deforestation, massive forest fires, lack of effective investment in forest improvement and afforestation, informality, and lack of development reforms. Here, the sub-category 'Cropland converted to Settlements' is a GHGs emitter with about 93.5 Gg CO_2 eq. or 2.53% of the total emissions for 2016. Other categories of land use such croplands have 1.93% (or 72.93 CO_2 eq.) of the contribution to the GHGs emissions under AFOLU sector.
Third important GHGs emitter under AFOLU sector are the aggregate sources and non-CO_2 emissions sources on land. Most important sources of GHG emissions here are Urea application, Direct N_2O Emissions from managed soils, Indirect N_2O Emissions from managed soils, Indirect N_2O Emissions from manure management. Altogether, they contribute about 21% of total GHGs under AFOLU sector with 811.98 Gg CO_2 eq. (year 2016).

5.1 Emission trends

The trend of GHGs emissions/removals depends on the land management practices and how sustainable they are. Emission and removal processes in the AFOLU Sector are described for the major ecosystem stocks and processes, organized by ecosystem components, i.e., 1) biomass, 2) dead organic matter, 3) soils and 4) livestock.

In the table 5.2 is shown the GHGs from AFOLU sector by years and different GHGs.

Table 5.2 GHGs (emissions and removals) from AFOLU sector (Gg)

GHGs	GHGs by years, in Gg							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
CO_2	1,536.14	1,665.90	4,403.19	5,382.42	1,372.85	1,257.06	1,304.45	1,377.62
CH_4	66.94	67.27	67.07	67.97	68.19	68.86	69.34	68.86
N_2O	2.60	2.55	2.69	2.68	2.70	2.76	2.77	2.79
Total CO_2 eq.	**3747.88**	**3869.07**	**6645.56**	**7640.59**	**3641.84**	**3558.72**	**3619.29**	**3688.58**

In the AFOLU sector, the two sectors with the highest impact on GHG emissions are livestock and forests. Regarding forests, the current situation has shown that their management has been done in an unstable manner, allowing their annual degradation year by year. As per the livestock sector, the amount of GHGs emitted depends on the number and structure of livestock, system of feeding (diets) and the manure management systems. Regarding livestock, situation of GHGs' emissions has had a uniform trend, without fluctuations during the years 2010-2016. The level of GHGs emitted is about 1540 Gg CO_2 eq. per year.

Inside the AFOLU sector, forests have the biggest contribution in both the cases of GHG removals and GHG emissions, as shown in the table 5.3.

Table 5.3: GHGs emissions and removals from AFOLU sector (Gg CO_2 eq.)

Total GHGs emissions in Gg CO_2 eq.					Total GHGs removals in Gg CO_2 eq.			Total GHGs emissions (net)
Year	**Livestock**	**Land**	**Agr.sorces and non CO_2 emiss.**	**Total**	**Forests**	**Crop-lands**	**Total re-movals**	**in Gg CO_2 eq.**
2009	1489.21	3673.74	748.73	5911.68	-2163.80	-0.0011	-2163.80	**3747.88**
2010	1496.36	3806.67	730.75	6033.78	-2164.71	-0.0013	-2164.71	**3869.07**
2011	1485.88	6535.82	788.14	8809.84	-2164.28	-0.0013	-2164.28	**6645.56**
2012	1509.89	7515.48	777.12	9802.49	-2161.90	-0.0013	-2161.90	**7640.59**
2013	1517.23	3504.77	779.68	5801.68	-2159.84	-0.0013	-2159.84	**3641.84**
2014	1532.20	3384.45	801.91	5718.56	-2159.84	-0.0013	-2159.84	**3558.72**
2015	1542.36	3428.88	805.08	5776.32	-2157.03	-0.0013	-2157.03	**3619.29**
2016	1531.03	3507.15	811.98	5850.16	-2161.58	-0.0013	-2161.58	**3688.58**

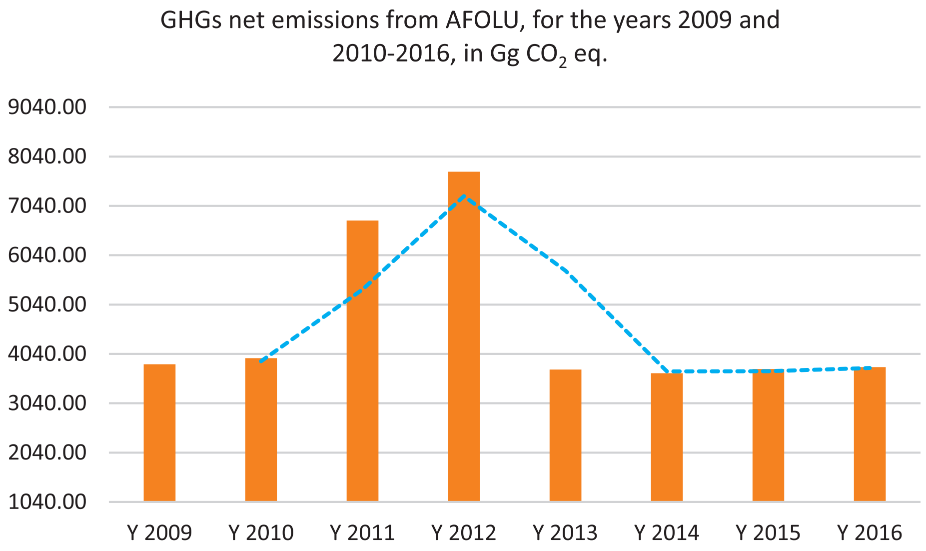
The largest increase in GHGs emissions from AFOLU has been during the period 2010-2016, which also coincides with the difficult situation of the forest sector (illegal logging, forest fires, lack of forest management, etc.). GHGs emissions from livestock has an almost uniform trend, with a slight increase in GHGs emissions of 3% in 2016 compared to 2010.
If we look in the table 5.4 the ratio between GHGs emissions and their removals, we see that only a portion of those gases are absorbed by forests as part of AFOLU, which varies from 36.1% in 2009 to 36.4% in 2016. During the years 2011 and 2012, due to massive forest fires, this rate is respectively 24.3 and 21.9%.

Table 5.4 GHGs ratio in AFOLU sector

Year	Total GHGs emissions in Gg CO_2 eq.	Total GHGs removals in Gg CO_2 eq.	Total GHGs removals *vs* total GHGs emissions, in %
Y 2009	5911.68	-2163.80	36.60%
Y 2010	6033.78	-2164.71	35.88%
Y 2011	8809.84	-2164.28	24.57%
Y 2012	9802.49	-2161.90	22.05%
Y 2013	5801.68	-2159.84	37.23%
Y 2014	5718.56	-2159.84	37.77%
Y 2015	5776.32	-2157.03	37.34%
Y 2016	5850.16	-2161.58	36.95%

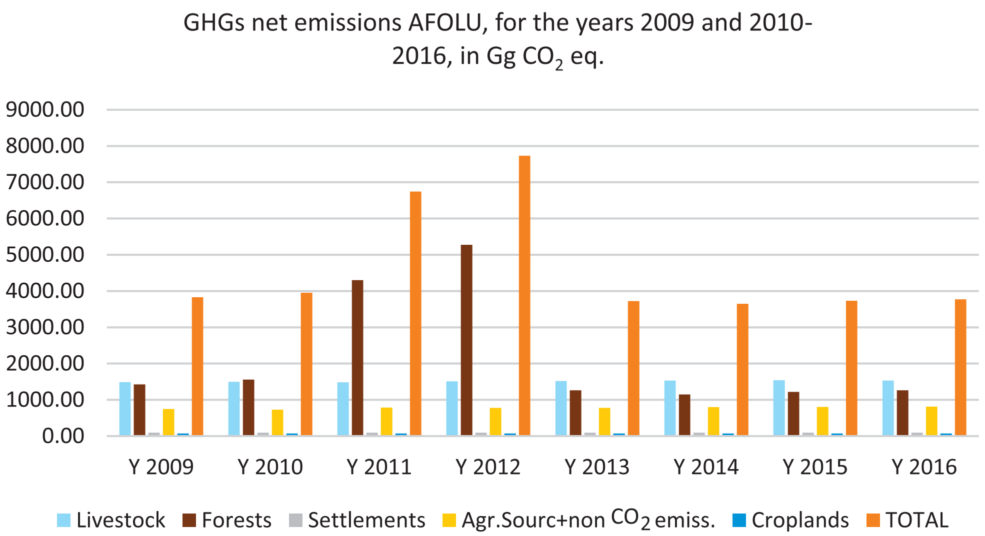
The figures below provide data on the amount of GHGs emissions during, 2009 and 2010-2016 in Gg CO_2 eq.

Figure 5.1: The annual amount of GHGs emissions from AFOLU sector



The annual amount of GHGs net emissions varies from 3748 Gg CO_2 eq. (2009) to 3688 Gg CO_2 eq. (2016), with an annual average of 4667 Gg CO_2 eq. during the inventory period. As seen in the figure 5.1, there are two peaks for the years 2011 and 2012 which coincides with the massive forest area burned during those two years.

Figure 5.2: GHG emissions from AFOLU in CO_2 eq. by sub-sectors



As Figures 5.2 – 5.4 show, during year 2016 the contribution of GHGs emitted from the land counted in about 38% of total GHGs emitted by the AFOLU sector, while Livestock contribution in GHGs emissions under AFOLU counts about 41% of that total and Aggregate sources and non-CO_2 emissions counts 21% of the total.

Figure 5.3: CO_2eq. emissions for two main categories of Land and Livestock (Gg)

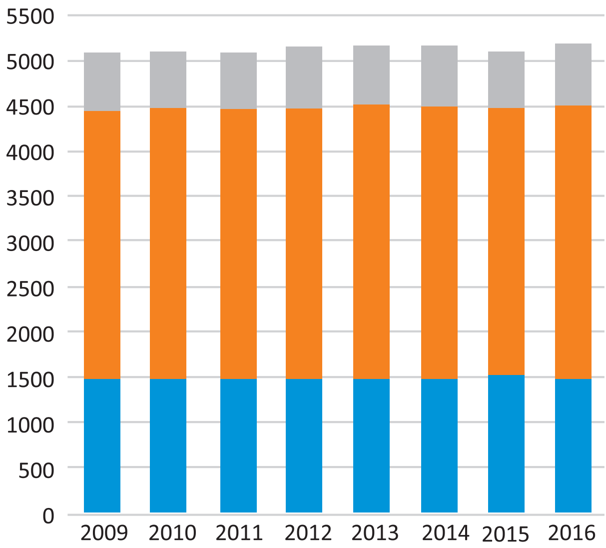
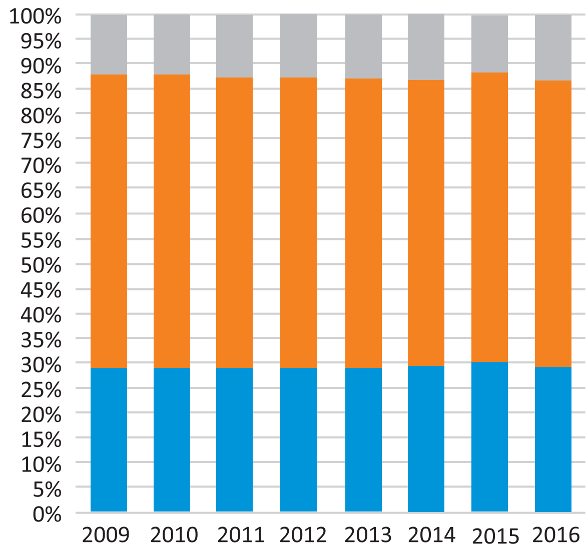


Figure 5.4: CO_2 eq. emissions for two main categories of Land and Livestock (%)



Two other emitters, "Croplands" and "Cropland converted to Settlements" contribute respectively with 1.95% and 2.5 % against total GHGs emissions from AFOLU sector.

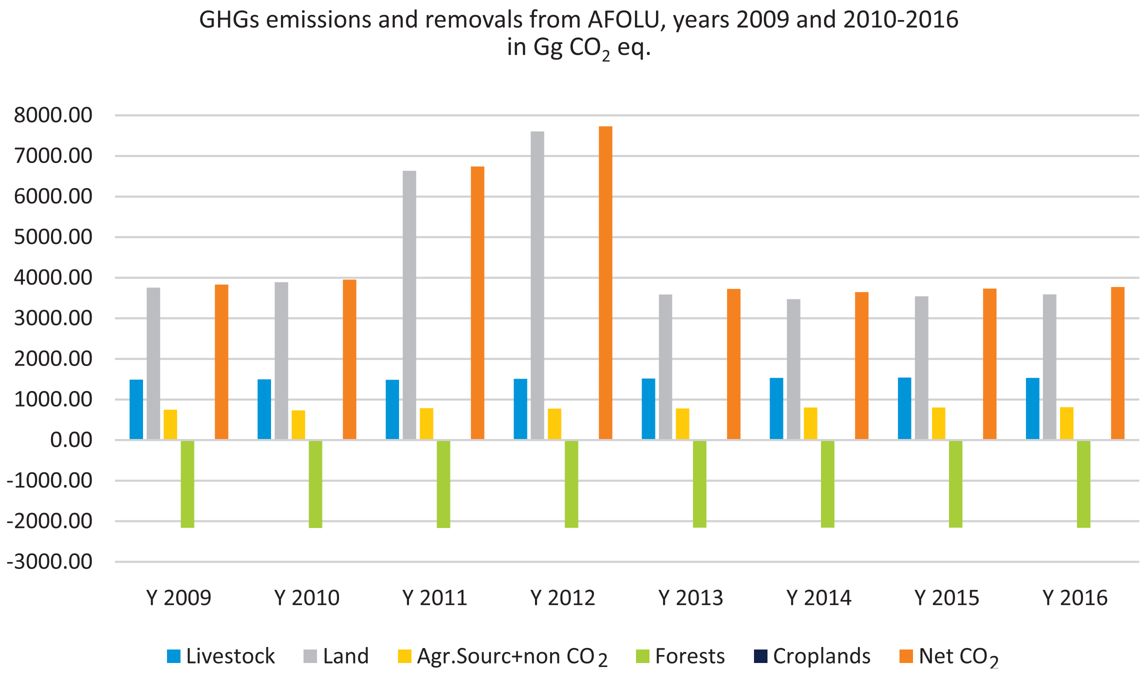
5.2 GHGs emissions and removals from AFOLU

The category AFOLU contents Livestock, Forest land, Cropland, Grassland, Settlements and Other land.

5.2.1 GHG from AFOLU

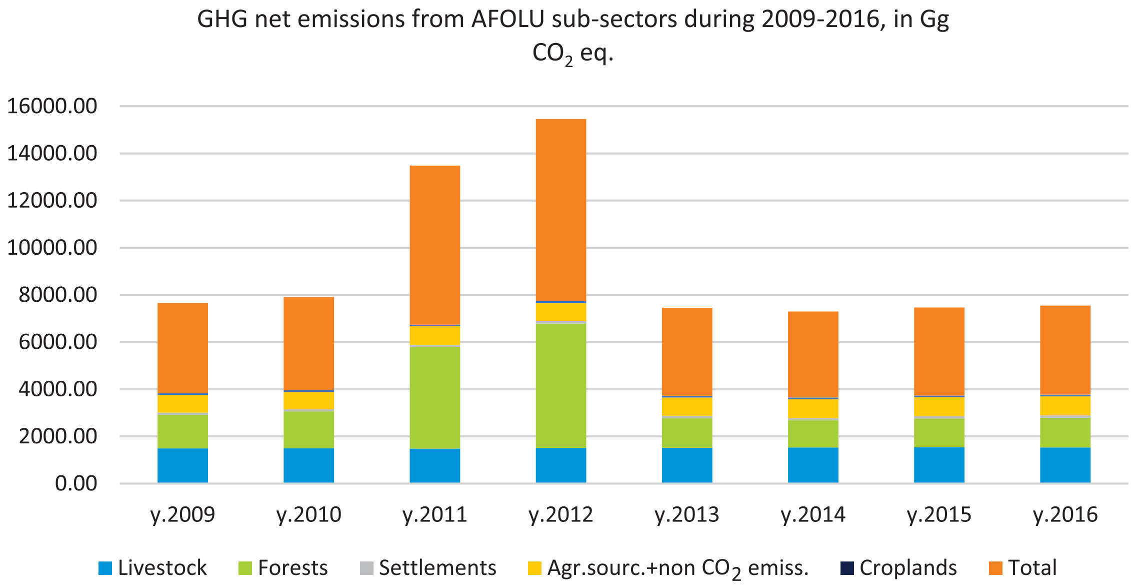
The category AFOLU contents Livestock, Forest land, Cropland, Grassland, Settlements and Other land. AFOLU represents an important sector in the Albanian economy from the economic and social point of view. But, due to the current circumstances, this sector remains an important emitter of GHGs in the country, with approximately with net 3688 Gg CO_2 eq. for 2016.
Contributions to GHGS emissions from AFOLU are given in the following figure 5.5.

Figure 5.5: GHGs emissions and removals from AFOLU



Despite the role of forests as GHS absorbers, they not only fail to reduce those gases in a significant way under the AFOLU subsector, but still worse, forests fail to be a net absorber of those gases as a separate sector - 'forests'.

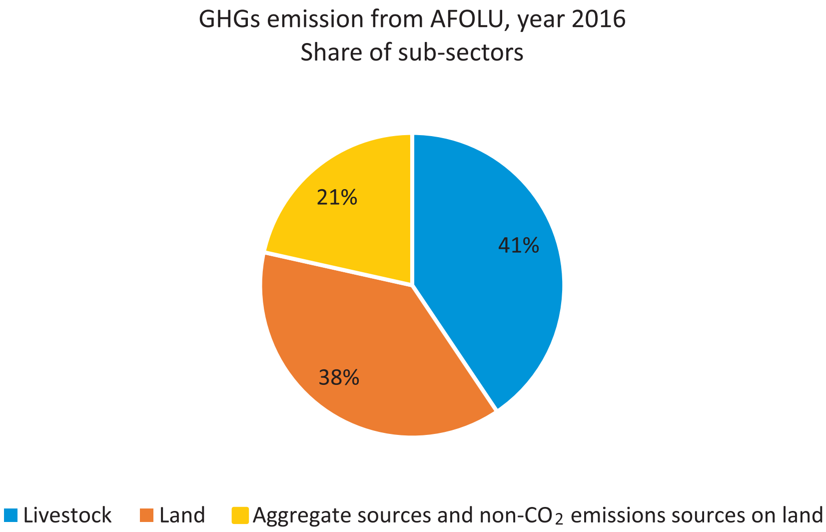
Figure 5.6: GHGs emissions from AFOLU sector (net).



From the categories above, most important remains forestry sector because its role in both GHGs emissions and removals is significant.

In the figure 5.7 is given the respective contribution in net emissions of GHGs.

Figure 5.7: GHGs share of net emissions from AFOLU in 2016



Under AFOLU, livestock with 41% of the total GHGs net emissions is the biggest contributor and source. The second one is forestry with 38% of that total and aggregate sources and non-CO_2 emissions sources on land have 21% of that share.

5.2.2 Livestock

Livestock production is seen as a backbone of Albania's agriculture. Livestock products constitute a main source of food, thus being the most important sector of agriculture. Yet the intensity of production is low compared to the European standards. The dairy industry, along with it the milk collection system, are still in the course of modernizing structures and technologies. The number of livestock has remained almost constant since the year 2001. However, the poultry is experiencing development in terms of the numbers.

Main GHGs emitted from livestock is methane (CH_4) through enteric fermentation and manure management. Non-CO_2 emissions are largely a product of microbiological processes (i.e., within soils, animal digestive tracts and manure) and combustion of organic materials.

The amount of GHGs emissions depends mainly on the number of livestock, categories of livestock, their diet, and the way of manure management.

Under agriculture, livestock with about 1531.03 Gg CO_2 in 2016 remains the main emitter of GHGs through two main activities: enteric fermentation and manure management.

The table 5.4 shows the GHG emissions from livestock by its main activities, enteric fermentation, and manure management from 2005-2016. The Figure 5.8 and Table 5.5 below illustrate the GHG emissions from this category.

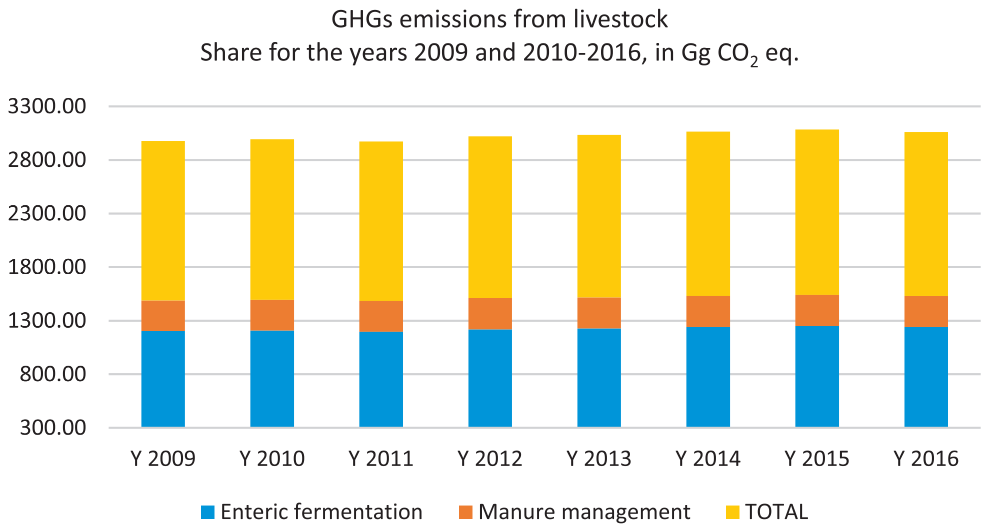
Table 5.5: GHGs from livestock in CO_2 eq.

Year	Enteric fermentation (EF)	Manure management (MM)	Total	% share of EF	% share of MM
Y 2009	1202.36	286.86	**1489.21**	80.74	19.26
Y 2010	1208.31	288.05	**1496.36**	80.75	19.25
Y 2011	1198.57	287.31	**1485.88**	80.66	19.34
Y 2012	1219.36	290.53	**1509.89**	80.76	19.24
Y 2013	1227.74	289.50	**1517.23**	80.92	19.08

Y 2014	1238.99	293.21	**1532.20**	80.86	19.14
Y 2015	1248.55	293.81	**1542.36**	80.95	19.05
Y 2016	1239.84	291.20	**1531.03**	80.98	19.02

In a more understandable way, the contribution of GHGs from livestock is presented in the figure below:

Figure 5.8: GHG emissions (CH_4 and N_2O) in Gg CO_2 eq. from Enteric Fermentation and Manure Management



As seen from the Figure 5.8, the livestock contribution to GHGs emissions has been significant during the inventory period, but there have been no significant changes during the inventory period.
Within the livestock sector, cattle remain the main source of GHGs emissions with 75% of the total emissions coming from this sector (for the year 2016), respectively contributing with 73% of the total GHGs from enteric fermentation and 86% of the total GHGs emitted from manure management systems in Albania.

5.2.2.1 Enteric fermentation

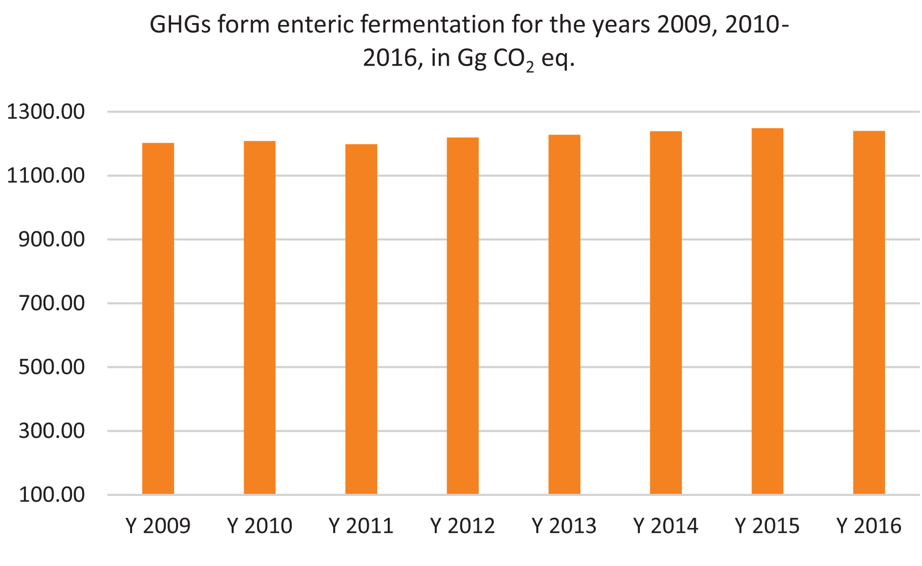
Enteric fermentation refers to the fermentation of feed as part of the normal digestive processes of livestock. In ruminant animals (principally cattle, sheep, and goats), a significant amount of fermentation takes place in the rumen, resulting in relatively large methane emissions per unit of feed energy consumed. Pseudo-ruminant animals (e.g., horses) and monogastric animals (e.g., pigs) do not support the same level of feed fermentation, and consequently emissions from these animals are relatively low. Therefore, indicators of methane emissions from enteric fermentation focus primarily on ruminant animals. Methane is produced as a by-product of the fermentation and is expelled. In other cases, methane is generated by anaerobic fermentation, where bacteria break down organic matter producing hydrogen (H_2), carbon dioxide (CO_2) and methane (CH_4).
About 81% of GHGs emitted by livestock under AFOLU sector belong to enteric fermentation.
In the table 5.6 is given the contribution in GHGs emissions by livestock categories from enteric fermentation processes.

Table 5.6: GHGs emissions from enteric fermentation (in Gg CO_2 eq.)

Livestock category	GHGs emissions by enteric fermentation in Gg CO_2 eq. by years;							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Cattle	905.63	906.13	904.05	914.80	913.08	916.75	921.25	904.91
Dairy Cows	733.89	738.05	735.97	744.28	740.12	744.28	742.20	738.05
Other Cattle	171.74	168.08	168.08	170.52	172.96	172.47	179.05	166.87
Buffalo	0.00	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Sheep	185.64	189.63	184.59	189.95	194.88	199.08	201.39	207.06
Goats	81.06	81.38	79.70	85.05	91.04	94.92	97.86	98.81
Horses	13.23	14.36	13.23	12.85	13.23	12.10	11.72	12.10
Mules and Asses	13.44	13.23	13.44	13.23	12.18	12.39	12.60	13.02
Swine	3.36	3.44	3.42	3.34	3.19	3.61	3.59	3.80
TOTAL	**1202.36**	**1208.31**	**1198.57**	**1219.36**	**1227.74**	**1238.99**	**1248.55**	**1239.84**

As can be seen from the table 5.6 and Figure 5.9, the largest contributors in GHGs emissions in this category are cattle (dairy caws and other cattle). Together they contribute about 73% of the total emissions of enteric fermentation. Other contributors are sheep with about 16.7% and goats with 8%. While less contributions have horses, mules and asses and swine.
The amount of methane emitted is driven primarily by the number of animals, the type of digestive system, and the type and amount of feed consumed.

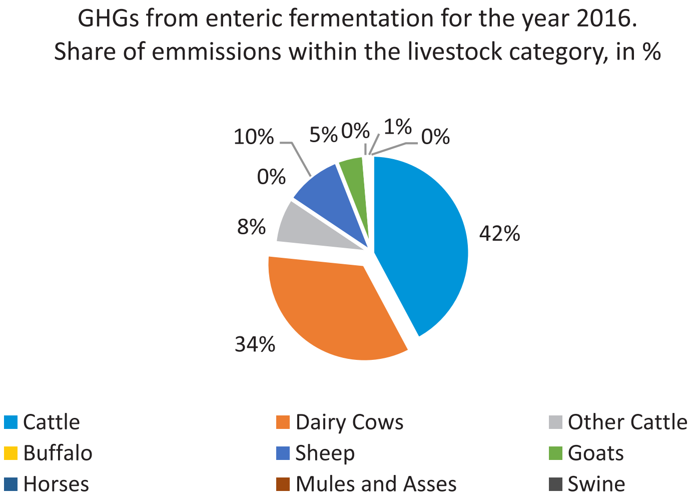
Figure 5.9: GHG emissions from enteric fermentation (in Gg CO_2 eq.)



Enteric fermentation remains a key category of GHGs emissions in the AFOLU sector. The main contributor here from the list of livestock remain dairy cattle (dairy cows and other cattle) with the 76% of the total GHGs emissions under this sub-category. Inside the cattle category of livestock – 42% of the total GHGs from enteric fermentation is from dairy cattle and 34% from other cattle.

The following figure 5.10 gives the GHGs emissions from livestock categories for 2016.

Figure 5.10: Share of GHGs from enteric fermentation for the year 2016



The contribution of buffalo here is minimal due to their very limited number.
Enteric methane production is related to the level of intake, the type and quality of feed, the amount of energy consumed, animal size, growth rate, level of production, and environmental temperature.

5.2.2.2 Manure management

Manure management refers to the capture, storage, treatment, and utilization of animal manures in an environmentally sustainable manner. It can be retained in various holding facilities. Animal manure (also referred to as animal waste) can occur in a liquid, slurry, or solid form. It is utilized by distribution on fields in amounts that enrich soils without causing water pollution or unacceptably high levels of nutrient enrichment. Manure management is a component of nutrient management. Livestock manure emits methane (CH_4) emissions from enteric fermentation and both CH_4 and nitrous oxide (N_2O) under anaerobic (oxygen-less) conditions. This is because the organic material within the manure begins to be decomposed by anaerobic bacteria; the results of this decomposition include methane, carbon dioxide, and stabilized organic material. Factors that influence these two considerations are the type of manure management system and the climate. Cattle are an important source of CH_4 because of their large population and high CH_4 emission rate due to their ruminant digestive system. Nitrous oxide emissions from manure management vary significantly between the types of management system used and can also result in indirect emissions due to other forms of nitrogen loss from the system. Manure management systems can be broadly classified as either liquid or dry. Dry systems included activities such as spreading the manure daily, dry feedlots, solid storage, and unmanaged manure from pasture livestock. Liquid systems are often found in intensive livestock management systems; it occurs through manure practices using tanks or lagoons to store. These systems create ideal anaerobic conditions. The most substantial manure emissions are associated with confined animal management operations, where manure is handled in liquid-based systems.

Production of N_2O during storage and treatment of animal wastes can occur via combined nitrification – de-nitrification of nitrogen contained in the wastes. The amount of N_2O released depends on the system and duration of waste management. Because N_2O production requires an initial aerobic reaction and then an anaerobic process, it is theorized that dry, aerobic management systems may provide an environment more conducive for N_2O production.
Emissions from manure management are in about 291.20 Gg CO_2 eq. in 2016 and they are presented in Figure 5.11 for every year of inventory period.

Figure 5.11: GHG emissions from Manure Management (in Gg CO_2 eq.)

GHGs form manure management for the years 2009, 2010-2016, in Gg CO_2 eq.

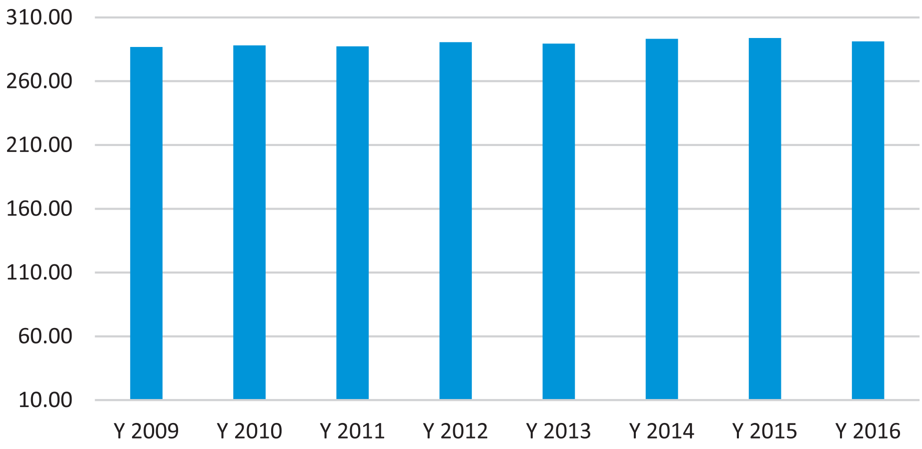
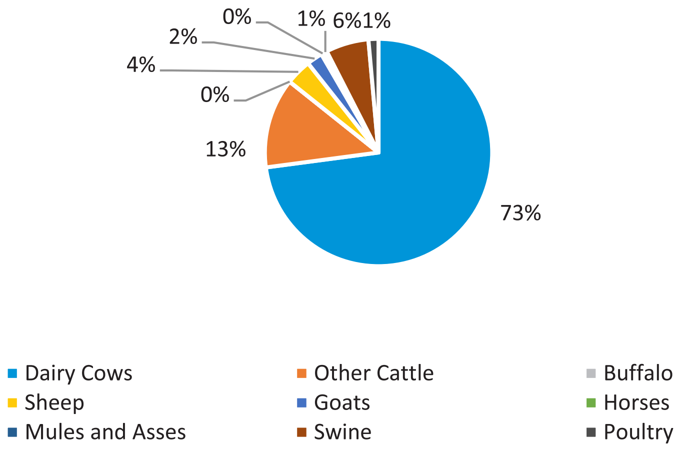


Figure 5.12 Share of GHGs from manure management for the year 2016

GHGs from manure management for the year 2016. Share of emmissions within the livestock category, in %



As per enteric fermentation, the main GHGs emitter under 'manure management' the dairy caws result as main emitters with 73%. Together with other cattle, they contribute with 86% of GHGs from manure management.

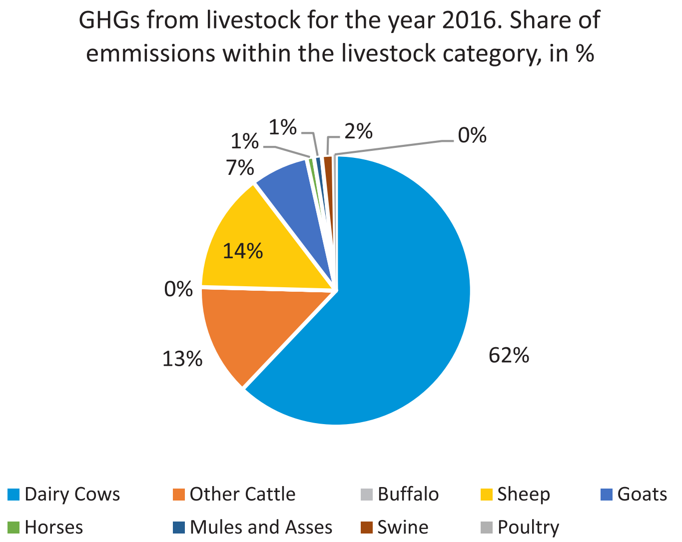
In the table 5.7 is given the contribution in GHGs emissions by livestock categories from the manure management processes.

Table 5.7 GHGs emissions from manure management

Livestock category	GHGs emissions by manure management in Gg CO_2 eq. by years;							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Cattle	249.44	249.82	249.23	252.16	251.51	252.60	253.47	249.55
Dairy Cows	211.09	212.28	211.69	214.08	212.88	214.08	213.48	212.28
Other Cattle	38.35	37.54	37.54	38.08	38.63	38.52	39.99	37.27
Buffalo	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04

Sheep	9.53	9.74	9.48	9.75	10.00	10.22	10.34	10.63
Goats	5.39	5.41	5.30	5.66	6.06	6.31	6.51	6.57
Horses	1.32	1.43	1.32	1.28	1.32	1.20	1.17	1.20
Mules and Asses	1.32	1.30	1.32	1.30	1.20	1.22	1.24	1.28
Swine	15.71	16.10	16.00	15.61	14.92	16.89	16.79	17.77
Poultry	4.15	4.21	4.63	4.73	4.45	4.73	4.27	4.15
TOTAL	**286.86**	**288.05**	**287.31**	**290.53**	**289.50**	**293.21**	**293.81**	**291.20**

Figure 5.13– Share of GHGs from manure management for the year 2016



Regarding GHGs emissions from manure management systems, the main livestock category that have the largest contribution in emissions (for the year 2016) are cattle with about 75% of the total GHGs. As in the enteric fermentation case, the cattle are main emitters of GHGs from manure management in Albania.

Among other livestock, swine have contribution in GHGs emission with about 6%, sheep with 4%, goats 2% and poultry with 1% of the total GHGs from manure management in Albania.

5.2.3 Land

The category Land contents Forest land, Cropland, Grassland, Settlements and Other land.

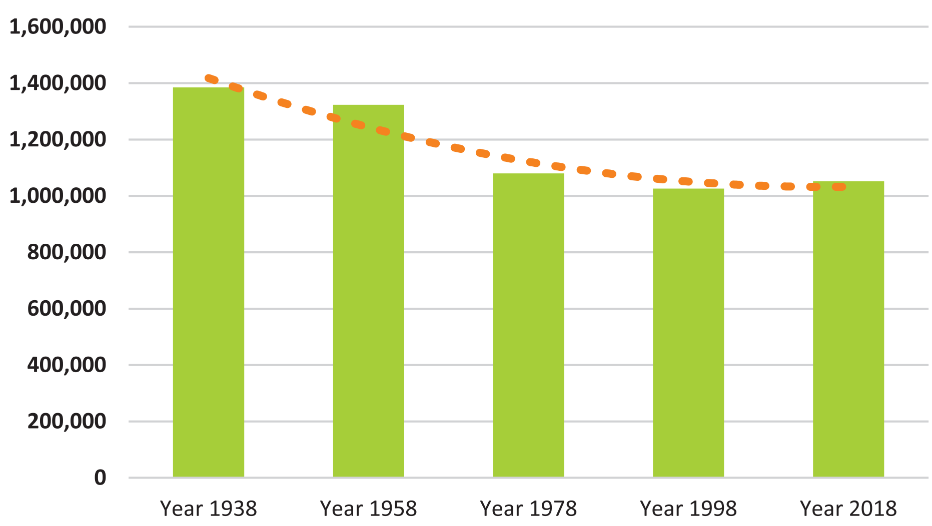
5.2.3.1 Forest land

Forest cover around 36% of the Albanian land area. Law 9385, Dated 4.5.2005, "On Forests and Forest Service", amended, on which the definition and classification of the national forest fund is based, defines the forest as; "Forest" is the surface of the land with a dense group of forest trees, in stable form or with other rare forest vegetation, with an area more than 0.1 hectare and with a coverage rate of not less than 30 percent, which produces wood biomass, exerts an impact on the surrounding environment and ensures the functions of the forest. The same law defines the forest fund as; "Forest fund" are all forest and non-forest areas, accompanying forest and non-forest resources, relevant infrastructure, including bare areas, which create a harmonious environment with forests and forest land (sands, rocks, dunes, and sand dunes), protective forest belts, isolated groups of trees and shrubs. Also, in the law there is a definition for forest lands, such as "Forest land" are land areas with trees, shrubs, and other non-forest vegetation, with a coverage rate of 5 to 30 percent, bare areas, ridges, rocky places, eroded and unproductive lands, sandstones, forest roads, unadjusted in other agricultural land funds and ecologically and functionally related to the national forest fund that, all together, provide the functions of the forest. The law defines the "Shrub" as a woody vegetation, branching from the base and not very high, which is distinguished from the herbaceous vegetation by the woody structure, while from the forest by the short trunk and the lack of the main trunk. In the law there is not any definition about high forests and coppice forests.

Some areas of other wooded land are included in the calculations of forest cover, half of them is classified as coppice and coppice with standards, the other half being high forest. Nearly four-fifths of the growing stock consists of broad-leaved species, predominantly species of deciduous and evergreen oak and of beech. Forest resource policies in Albania have changed significantly in recent years. In 2016, the Government of Albania transferred forest management (except for protected areas) to 61 Local Governmental Units (Municipalities – LGUs) and implemented a moratorium on harvesting with the goal of reducing the unsustainable harvesting of wood in the country. Exceptions to the 2016 moratorium permit are only Local Governmental Units, which can harvest fuel wood to meet local needs of households and large public building users.

Over the last 60 years, Albanian forestry has suffered significant changes, as a result of which, the forest area has been reduced by more than 300,000 ha mostly due to clearance for agriculture[6]. Except the deforestation for agriculture, the reduction of the forest fund is due to degradation from cutting, forest fires and overgrazing, which has changed the forest age structure and species composition, and the volume stock. For many years and decades, the forest exploitation has exceeded the annual increment, which has resulted in a decrease in the forest growing stock. Currently 96% of the forest is owned by the state (municipalities and National Agency of Protected Areas), and about 4% is under private ownership. There are efforts to increase the area of protected forest to preserve the biodiversity and the landscape. From 2004 until 2018, the area of Albanian protected forests areas is increased close to four times. All over Albania, especially in the mountainous zones, forests serve as a source of livelihood, goods, and income. Figure 5.14 presents the forest fund during the last decades (1938-2018) and clearly shows that a reduction of 400,000 ha occurred in forest area.

Figure 5.14: Forest fund during decades (ha)

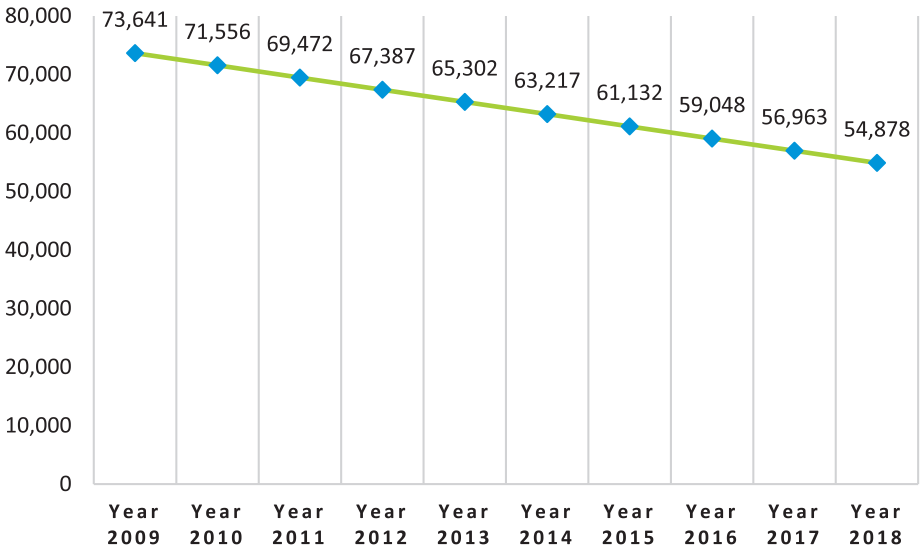


Firewood is an important commodity for Albania because it is used for heating by most households, and in rural areas it is also used for cooking and in some poor families also for water heating. This means that firewood is still the main energy source and it will continue to be important. The largest groups of consumers for firewood are households, but public institutions (schools, public administration,

6 UNECE, 2012

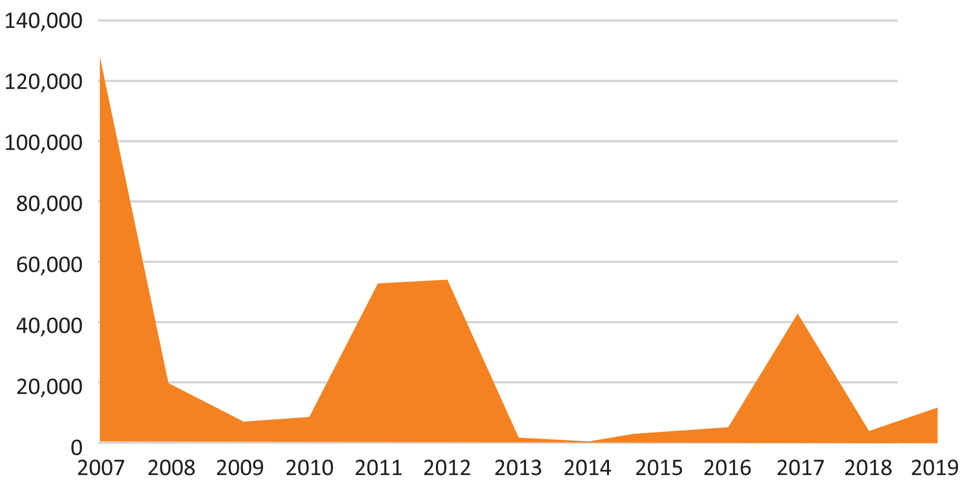
kindergartens etc.), charcoal and lime producers also consume significant volumes of it. One of the main problems of the forest sector is the lack of accurate data regarding forest fund (increase, decrease of its area and volume etc.). Forest cadaster continues to not reflect the real situation of the national forest. On the other hand, there isn't any cadaster for the whole country, in which relevant changes by the land use of the territory are evidenced/reflected. In figure 5.15 are given data on forest volume during 2009-20198.

Figure 5.15: Forest volume stock during years (000 m³)



The study "Wood fuel consumption in Albania" (FAO, 2017) evidenced that the level of fuel wood use in Albania is about 2.4 million m^3, or about two times more than annual increment of forest stock is. Another study, "Albania fuel wood demand assessment and analysis report" (the World Bank, 2018) evidenced that the annual total gross demand for fuel wood supply from the forests in 2016 was 3.035 million m^3 wood consisting of 2.176 million m^3 wood of household demand, 100,295m^3 wood of large user demand), and 758,765m^3 wood of harvesting loss. Another issue related to forest degradation in Albania have been forest fires. Based on the data provided by European Forest Fire Information System (EFFIS)[7], we can conclude that during the period 2007-2019 about 337,800 ha are burned, which constitute around 32% of the national forest fund.

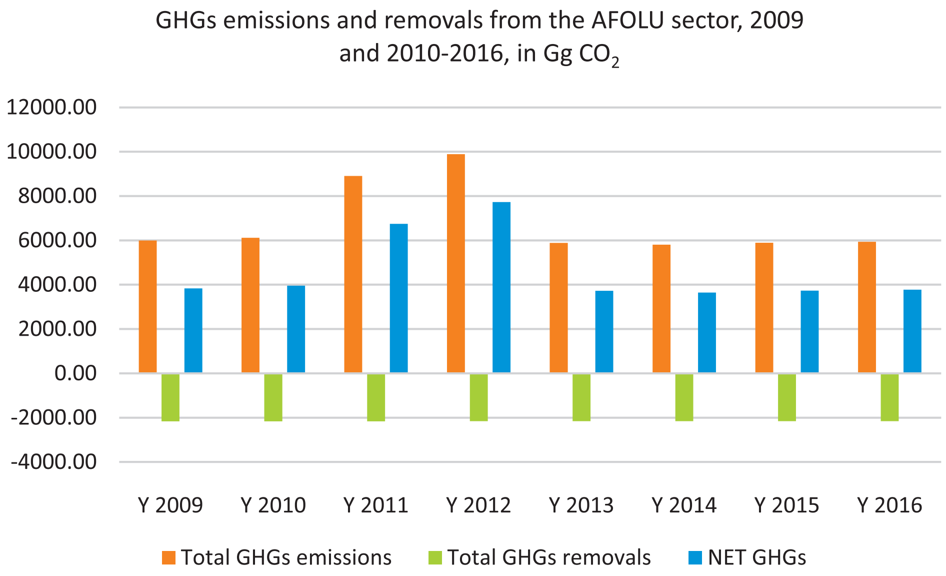
Figure 5.16: Forest fires in Albania during 2007-2019



7 https://effis.jrc.ec.europa.eu/reports-and-publications/annual-fire-reports/

The figure 5.17 shows the presents the situation of GHGs removals and emissions from the forest sector during the inventory years.

Figure 5.17: GHGs emissions and removals from forestry (Gg CO_2)

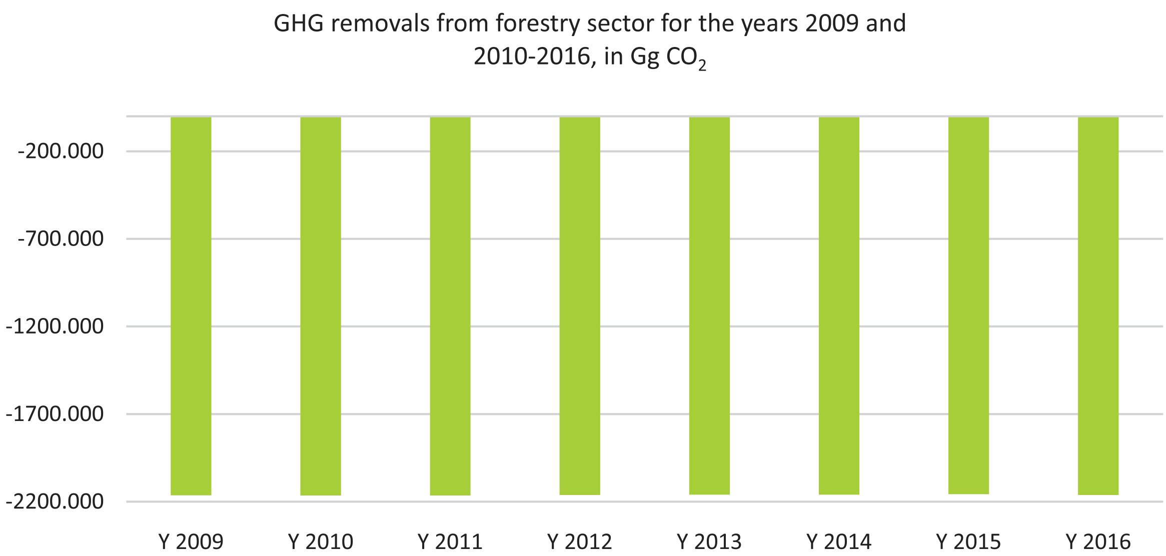


Throughout the inventory period, forests simultaneously absorb and emit GHGs into the atmosphere. In both cases, CO_2 remains the key gas not only for the forest sector but for all AFOLU.

GHG removals from forestry. Forests are absorbers of GHGs due to the growth of their biomass. Throughout the inventory period, forests have absorbed CO_2 from the atmosphere. The average annual growth of forests in Albania is only 1.4 m^3/ha/year. This causes the amount of CO_2 that accumulates to be limited as well.

The following figure 5.18 provides data on the total amount of GHGs absorbed by forests during the inventory period;

Figure 5.18: GHGs removals from forestry (Gg CO_2)

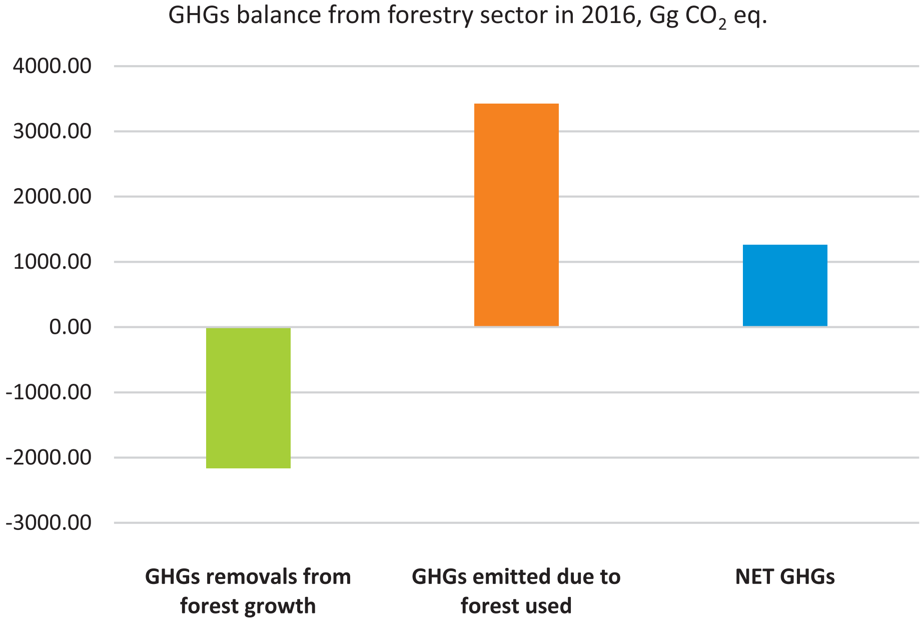


In 2016, the forests sequestered -2161.58 Gg CO_2 due to their annual natural growth.

Regarding this fact, it should be said that in terms of GHGs removals, CO_2 remains the main gas absorbed by natural ecosystems in Albania and forests have the main role in this regard, due to the natural growth of their biomass.

If we look in detail at the situation in the forestry sector, it is noticed that there is a large disproportion between the natural growth of forests and the volume of forest biomass that is removed from forests, as showed in the figure 5.19 below.

Figure 5.19: Forest growth and their use in 2016

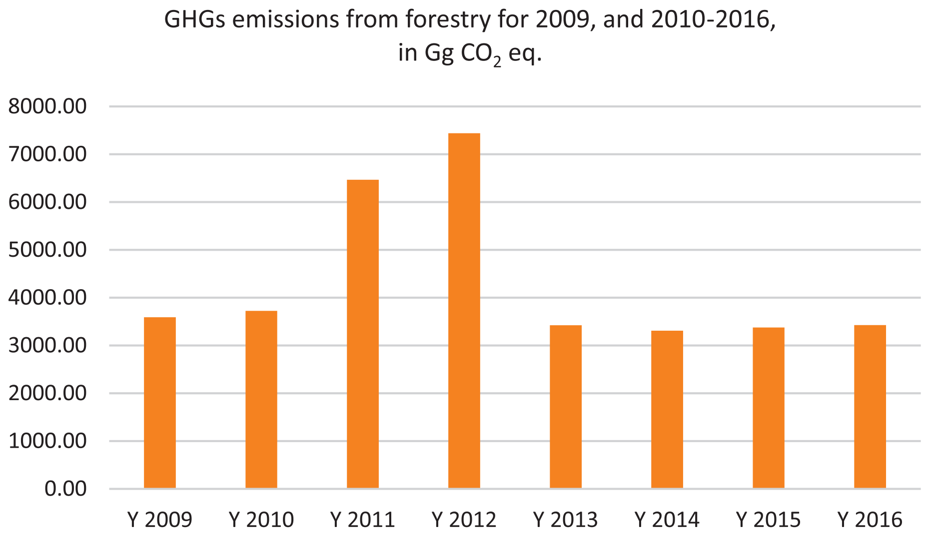


The figure 5.19 shows that the only 63% of the GHGs emitted by forestry are sequestered in 2016 by the natural forest growth. Due to the high level of forest damage (logging and forest fires), 37% of total GHGs remain as net emissions from forestry sector.

GHG emitted from forestry. Although it is not logical for forest ecosystems to be considered as GHG emitters, in Albania this is a bad reality. Due to illegal logging, forest fires and lack of management, forests result in GHG emitters. Furthermore the rate of forests removals (forest logging and forest fires) significantly exceeds their natural growth.

The following figure 5.20 provides data on the total amount of GHGs emitted by forests during the inventory period.

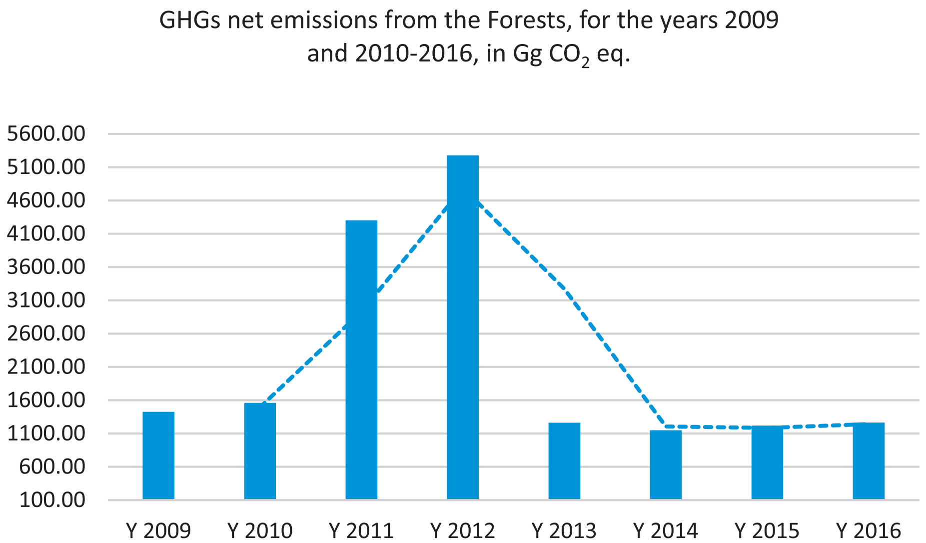
Figure 5.20: GHGs emitted by forests



Calculation of annual forest growth/reduction is done indirectly using the data from the INSTAT for the years of inventory period. The data for forest exploitation and cuttings is obtained as well from INSTAT. Calculating the amount of forest area is done taking into consideration the annual change in forest fund and forest biomass volume before and after conversion.

GHGs (net) emissions from forestry are presented in Figure 5.21.

Figure 5.21: GHG emissions (net) from Forest land (in Gg of CO_2 eq.)



Considering the ratio between the increase of forest biomass and its removal from deforestation and forest fires, in total it turns out that forests have been GHGs emitters during the inventory period. In 2011 and 2012 due to massive forest fires, the amount of GHG net emissions is 3-3.5 times more than other years of the inventory period.

Even in the case of GHGs emissions, due to mismanagement of forests and their degradation from cuttings and fires, CO_2 remains the main gas emitted by this sector, and forests remain the main source of GHGs emissions.

Thus, forests under AFOLU sector are the second main emitter of GHGs with 33.5% of their total for the year 2016.

5.2.3.2 Crop land

Cropland is mostly land cultivated by different crops or orchards. In Albania main institution dealing with this category of land is Ministry of Agriculture and Rural Development. Agriculture is one of the key sectors of Albanian economy, playing a significant role by contributing about 20-25 % of GDP (2010-2016). Agriculture provides the income basis for most of the population and serves as an employment safety net. The rural population is estimated to comprise about 50 percent of the total population while about 60 percent of the labor force works in agriculture and related fields. It seems obvious that any significant change in climate on a global scale will impact local agriculture. However, due to growth in other sectors of the Albanian economy the contribution of agriculture in GDP has been decreasing. The sector is still the main source of employment for more than a half of population.

During the last decade, the sector has experienced moderate growth, starting from 2006. However, the development of the sector is highly affected by several structural problems. The relatively underdeveloped infrastructure in rural areas holds back the emergence of agricultural products on the market. Agricultural land fragmentation hinders the effective organization of production, reduces productivity, and increases the cost of using agricultural mechanics. Meanwhile, agricultural land is not utilized at full capacity, because of the phenomenon of external and internal migration of population. This phenomenon, together with ownership problems, has limited the continuation of investment in the agricultural sector. In addition, the increase of agricultural prices on world markets conveys proper incentives for long-term production growth of this branch of the Albanian economy. On the other hand, developments, and structural reforms (aimed at increasing efficiency in agricultural production, facilitating access of local agricultural products in domestic and foreign markets, as well as financially supporting businesses and farms of this sector) has been a priority of future economic policies.

Cropland includes arable and tillable land, all annual and perennial crops as well as temporary fallow land. 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) orchards, vineyards and plantations with nuts. 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.

The amount of carbon stored in and emitted or removed from permanent cropland depends on crop type, management practices, and soil and climate variables.

During the inventory period, orchards are evidenced as GHGs absorbers, in a minimum rate. The Figure 5.22 and Table 5.8 below illustrate the GHGs from croplands.

Figure 5.22: GHG removals from the cropland for the years 2005, 2009 and 2010-2016 (in CO_2 eq.)

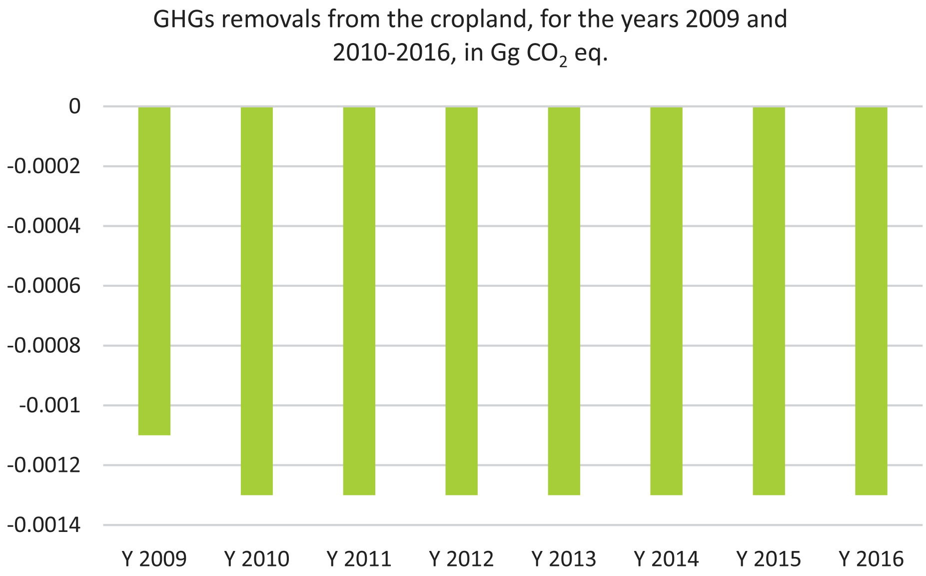


Table 5.8: GHGs removals from agriculture

Year	GHGs removals from Croplands, in Gg CO_2 eq.
Y 2009	-0.0011
Y 2010	-0.0013
Y 2011	-0.0013
Y 2012	-0.0013
Y 2013	-0.0013
Y 2014	-0.0013
Y 2015	-0.0013
Y 2016	-0.0013

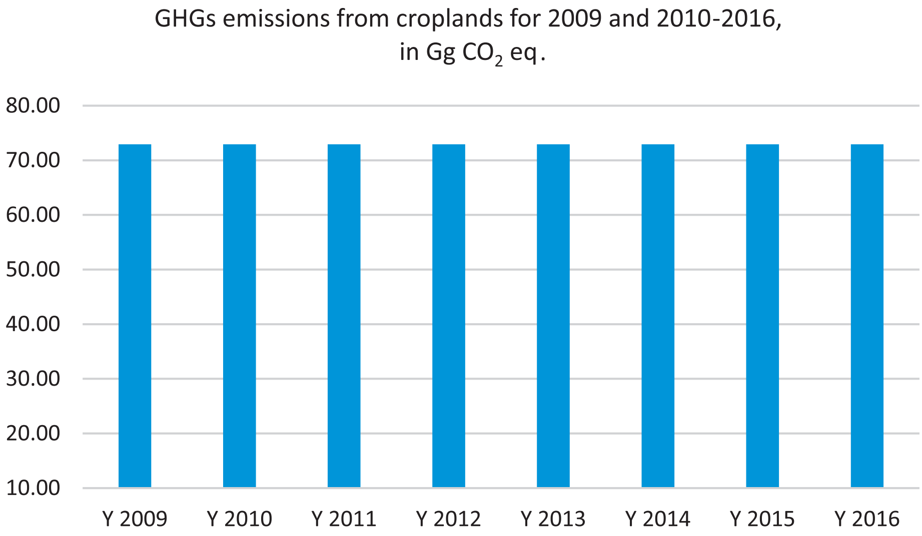
A small amount (0.0013 Gg CO_2) of GHGs is removed by orchards. The trend in GHGs absorption is slightly increasing, due to the increase of biomass from orchards, as well as the increase of orchard surfaces in the country.

There are also emissions from agricultural activities for the cultivation of organic lands, which are estimated to be 3978 ha.

Given that these lands are cultivated on an annual basis their total area, emissions are constant for the entire inventory period.

GHGs from croplands are presented in the figure 5.23 below:

Figure 5.23: GHGs emissions from croplands for 2009 and 2010-2016



During the inventory period there are reported changes in croplands (decrease) due to construction activities.

5.2.3.3 Grassland

In Albania grasslands occur mostly in mountainous areas of the country, above 800-1000 m elevation, from north to south, excluding as such the western part of the country where pastures occurred in the hilly areas and less in the plain areas of the country. The largest pastures are located above the forest belt (over 1600 m above sea level). But in some cases, the pastures are also found inside the forests. Many agricultural lands are also used as pastures, as they have not been cultivated for years.

Around 68% of the grassland area is used as supper pastureland while 32% of it is considered as winter pasture lands and mostly located in hilly and western part of the country. Based on data provided by INSTAT the area of pasture lands is given in Table 5.9 below.

Table 5.9. Pastures in Albania (in ha)

Year	Area, in hectare
2009	505,290
2010	509,529
2011	513,768
2012	518,008
2013	522,247
2014	526,486
2015	530,725
2016	534,964

Carbon stocks in permanent grassland are influenced by human activities and natural disturbances, including: harvesting of woody biomass, rangeland degradation, grazing, fires, pasture rehabilitation, pasture management, etc. Annual production of biomass in grassland can be large, but due to rapid turnover and losses through grazing and fire, and annual senescence of herbaceous vegetation, standing stock of above-ground biomass rarely exceeds a few tonnes per hectare. Larger amounts can accumulate in the woody component of vegetation, in root biomass and in soils. The extent to which carbon stocks increase or decrease in each of these pools is affected by management practices such as those described above. The amount of carbon stored in and emitted or removed from permanent cropland depends on crop type, management practices, and soil and climate variables.

In addition to the area of pastures is provided by INSTAT and draft final report for Albania National Forest and Pasture Inventory (December 2020), there is no other data yet on the use of pastures, the increase or decrease of biomass in them, new fires, changes in the destination of the pasture land, etc.

During the inventory period is evidenced the biomass burning during the years. GHGs emissions from this fact are reported under the category 'Aggregate sources and non-CO_2 emissions sources on land'.

5.2.3.4 Wetlands

Wetlands include any land that is covered or saturated by water for all or part of the year, and that does not fall into the Forest Land, Cropland, or Grassland categories. Managed wetlands will be restricted to wetlands where the water table is artificially changed (e.g., drained or raised) or those created through human activity.

Methodologies are provided for:

- Peatlands cleared and drained for production of peat for energy, horticultural and other uses. The estimation methodology includes emissions from the use of horticultural peat.

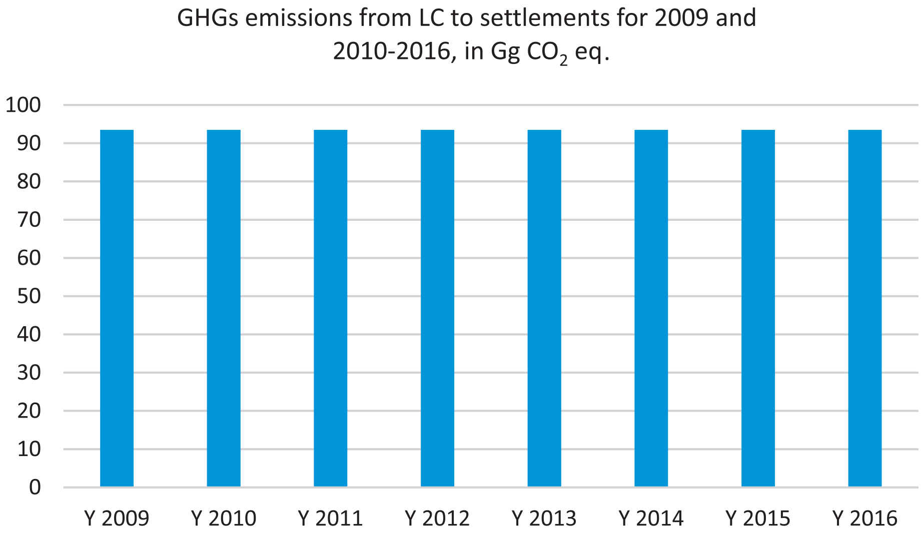
- Reservoirs or impoundments, for energy production, irrigation, navigation, or recreation. The scope of the assessment includes CO_2 emissions from all lands converted to permanently Flooded Lands. Flooded Lands exclude regulated lakes and rivers unless a substantial increase in water area has occurred.

Emissions from unmanaged wetlands are not estimated.
There is no data on the surface of wetlands in Albania, or how this surface has changed during the inventory period. In previous national communications it was said that the area of wetlands is 135 thousand hectares. During the last inventory period, under this category is added an area of 1,511 ha which comes from construction of Banja and Moglica HPPs.
Currently there are no data from national cadaster where the categories of land use are identified and how they change over the years.

5.2.3.5 Settlements

Settlements are defined as including all developed land i.e., residential, transportation, commercial, and production (commercial, manufacturing) infrastructure of any size, unless it is already included under other land-use categories. 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.
One of the main problems related to agriculture in Albania is the lack of documentation in land use change in agriculture lands. Although it has been about 30 years since agricultural land was reduced from construction (settlements, businesses, etc.), the surface of agricultural land in the cadaster has remained the same. During the inventory period, based on expert judgment, a progressive reduction of agricultural land by about 1500 ha/year was reported.
The following is the amount of GHG emissions from changes in agricultural land use.

Figure 5.24: GHGs emissions from the land converted to settlements, for 2009 and 2010-2016



As explained above, the emissions here represent the category '*Land Converted to Settlements*'. Since the amount of the land converted during the years is the same, the emissions are the same as well.

Since there are no data from national cadaster where the categories of land use are identified and how they change over the years, the area of land use change from croplands to settlements is based on expert judgment.

5.2.3.6 Other land

The category "Other Land" includes bare soil, rock, ice, and all land areas that do not fall into any of the other five land-use categories treated in the 2006 IPCC guidelines for National GHGs inventories.
Other unmanaged Land, and in that case changes in carbon stocks and non-CO_2 emissions and removals are not estimated.
Guidance is provided for the case of Land Converted to Other Land. This is because the conversion is associated with changes in carbon stocks or non-CO_2 emissions, most importantly those associated with conversions from Forest Land.
Inclusion also enables checking the overall consistency of land area and tracking conversions to and from Other Land.
The methododology requires estimates of carbon in biomass stocks prior to conversion, based on estimates of the areas of land converted during the period between land-use surveys. As a result of conversion to Other Land, it is assumed that the dominant vegetation is removed entirely, resulting in no carbon remaining in biomass after conversion.
The difference between initial and final biomass carbon pools is used to calculate change in carbon stocks due to land-use conversion. In subsequent years, accumulations and losses in living biomass in Other Land is considered to be zero.
Currently there are no data from national cadaster where the categories of land use are identified and how they change over the years.

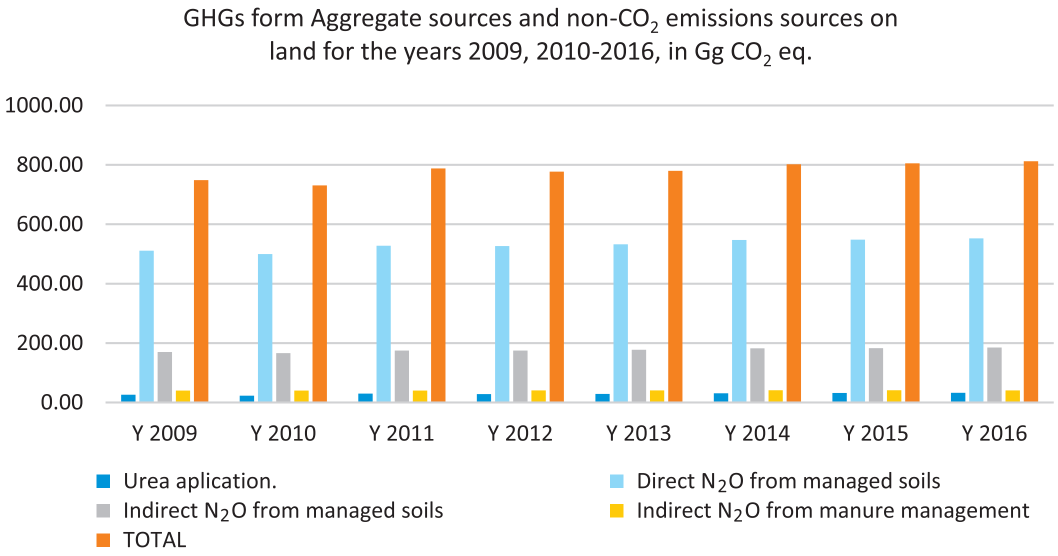
5.2.3.7 Aggregate sources and Non-CO_2 emissions sources on land

Nitrous oxide is a gaseous intermediate in the reaction sequence of denitrification and a by-product of nitrification that leaks from microbial cells into the soil and ultimately into the atmosphere.
The emissions of N_2O that result from anthropogenic N inputs or N mineralization occur through:

- Directly from the soils to which the N is added/released.
- Following volatilization of NH_3 and NO_x from managed soils and from fossil fuel combustion and biomass burning, and the subsequent re-deposition of these gases and their products NH_4 and NO_3 to soils and waters (indirect).
- After leaching and runoff of N, mainly as NO_3 from managed soils (indirect).

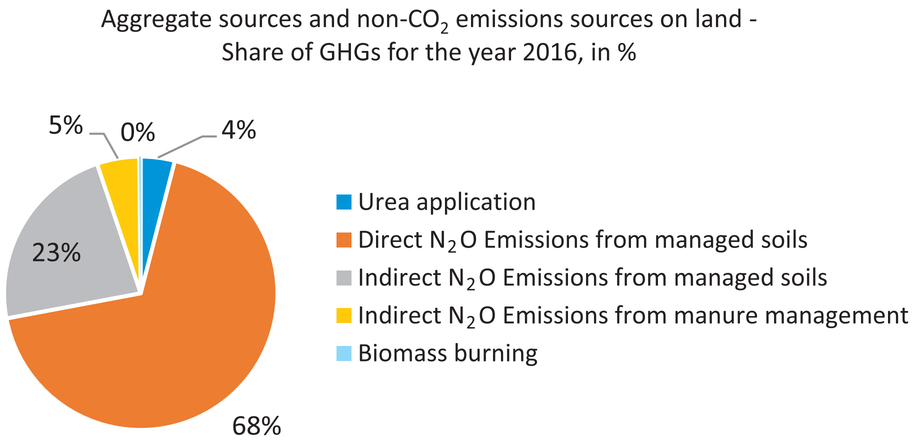
The following figure provides an overview of non-CO_2 emission sources (direct and indirect N_2O).

Figure 5.25 GHGs form aggregate sources and non-CO_2 emissions sources on land



As can be seen from the figure 5.25 above, the contribution of various GHGs sources is evident throughout the inventory period. Among others, two most important sources of GHG emissions here remain; Direct N_2O from managed soils and indirect N_2O from managed soils.
In the figure below is showed the contribution of the different source emissions for the year 2016, in %. Figure 5.26 gives the share of GHGs from Aggregate sources and non-CO_2 emissions sources on land.

Figure 5.26: Aggregate sources and non-CO_2 emissions sources on land



As seen from the figure 5.26, 68% of the contribution from this category are "Direct N_2O emissions from managed soils". Here, most of important sources are: N excretion from MMs which depends on number and the livestock categories, organic N applied to managed soils, direct N_2O emissions from managed soils (N in synthetic fertilizers, N in animal manure, N in mineral soils). Other important source here with 23% are indirect N_2O emissions from managed soils (this is related to the amount of synthetic fertilizers used and N_2O from N leaching/runoff from managed soils). Indirect N_2O Emissions from manure management count 5% and urea application 4%.

Direct N_2O emissions

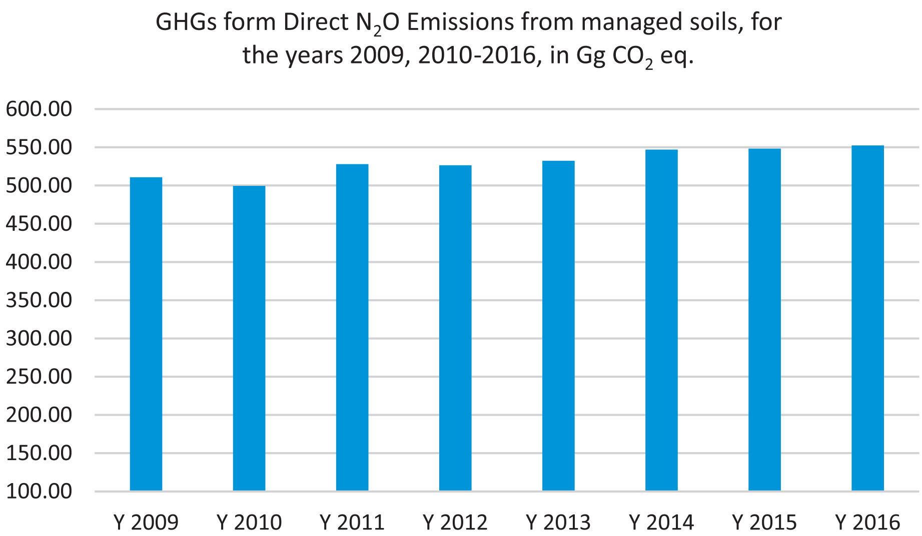
In most of the soils, an increase in available N enhances nitrification and denitrification rates which then increase the production of N_2O. Increases in available N can occur through human-induced N additions or change of land-use and/or management practices that mineralize soil organic N.

The following N sources which are estimated under this inventory as direct N_2O emissions from managed soils are:

- Synthetic N fertilizers
- Organic N applied as fertilizer
- Urine and dung N deposited on pasture, range, and paddock by grazing animals
- N in crop residues (above-ground and below-ground), including from N-fixing crops and from forages during pasture renewal
- N mineralization associated with loss of soil organic matter resulting from change of land use or management of mineral soils; and
- Drainage/management of organic soils

In the figure 5.27 is given GHGs form Direct N_2O Emissions from managed soils

Figure 5.27: GHGs form Direct N_2O Emissions from managed soils



Regarding Direct N_2O emissions, most of important sources are: N excretion from MMs which depends on number and the livestock categories, manure management systems, organic N applied to managed soils, direct N_2O emissions from managed soils (N in synthetic fertilizers, N in animal manure, N in mineral soils). The trend of GHGs emissions is slightly increasing by 7% (or 0.92% per year) from the year 2009 compare with 2016.

Indirect N_2O emissions

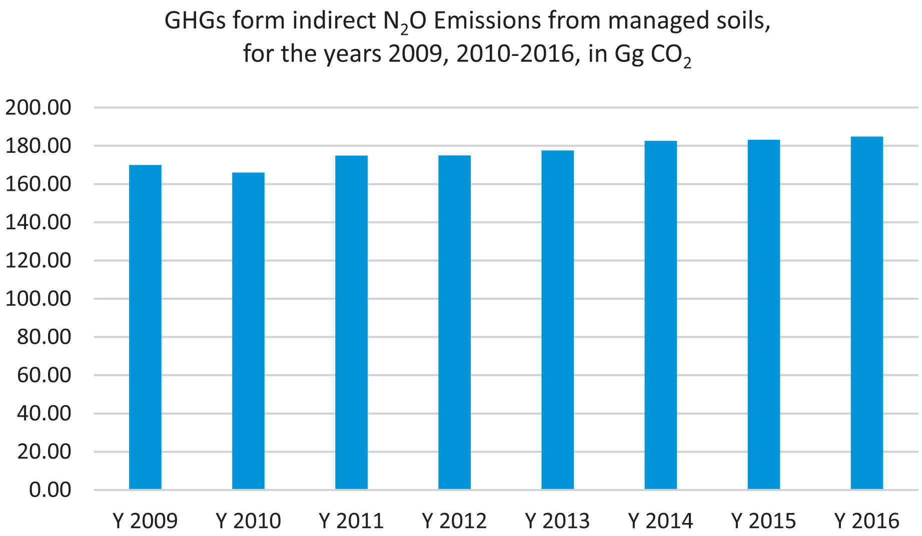
Despite the direct emissions of N_2O from managed soils that occur through a direct pathway, emissions of N_2O also take place through indirect pathways;

- Volatilisation of N as NH_3 and oxides of N (NOx), deposition of these gases and their products NH_4 and NO_3 into soils and the surface of water resources.

- Leaching and runoff from land of N from synthetic and organic fertiliser additions, crop residues, mineralisation 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. 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.

Figure 5.28 shows the GHGs form indirect N_2O Emissions from managed soils:

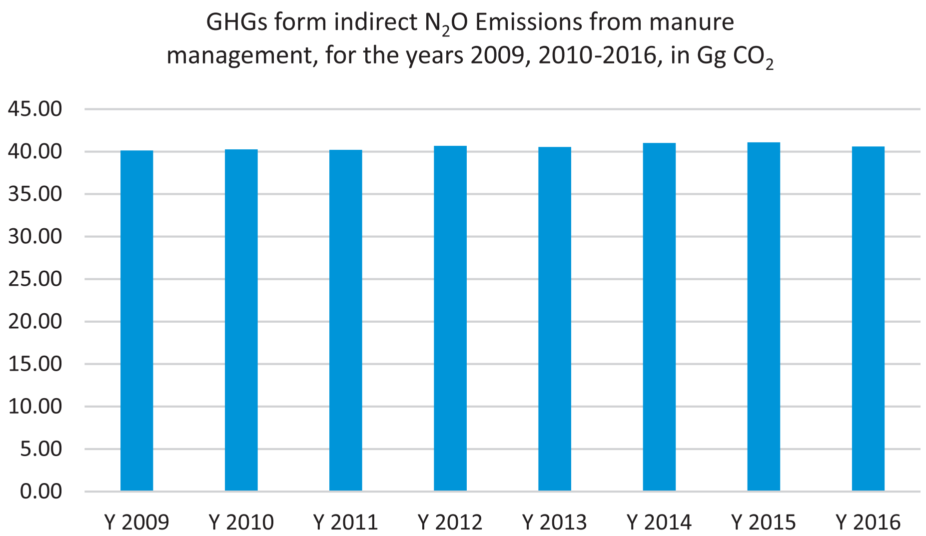
Figure 5.28: GHGs form indirect N_2O Emissions from managed soils



Here, N sources of indirect N_2O emissions from managed soils are:

- synthetic N fertilisers used during inventory period;
- organic N applied as fertiliser (applied animal manure, compost, sewage sludge and other organic amendments);
- urine and dung N deposited on pasture, range and paddock by grazing animals;
- N in crop residues (above- and below-ground), including N-fixing crops and forage/pasture renewal returned to soils etc.

Figure 5.29: GHGs form indirect N_2O Emissions from manure management

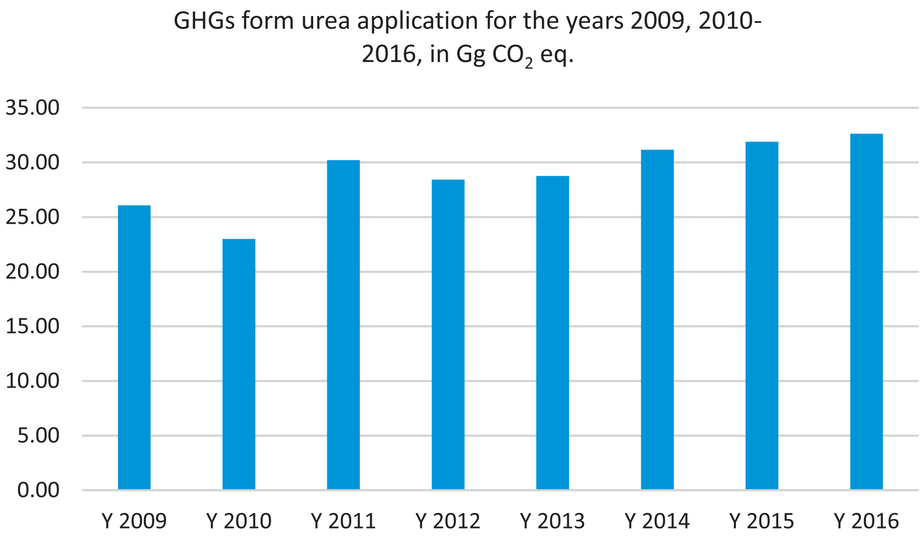


Most important N emissions here are from manure nitrogen that volatilized from manure management systems, amount/fraction of manure nitrogen which is loss due to leaching/runoff and indirect N_2O emissions due to leaching and runoff from manure management.
There is no obvious trend in the GHGs emissions from this category.

Urea application

Since the application of Urea affects the direct or indirect in N_2O emissions, the following is a summary of the contribution of this fertilizer to GHGs emissions in Albania during the inventory period:

Figure 5.30: GHGs form indirect N_2O Emissions from manure management



The amount of Urea application over the years varies, but there is a growing trend in the use of this fertilizer in the country since 2009 by 20% compared to 2016. As with other agricultural situations, farmers continue to buy nutrients without proper information/advice for plant requirements or soil analysis. This remains an ongoing challenge, where the agricultural extension service and research and scientific institutions must be at the forefront of sustainable agriculture in the country.

Biomass burning

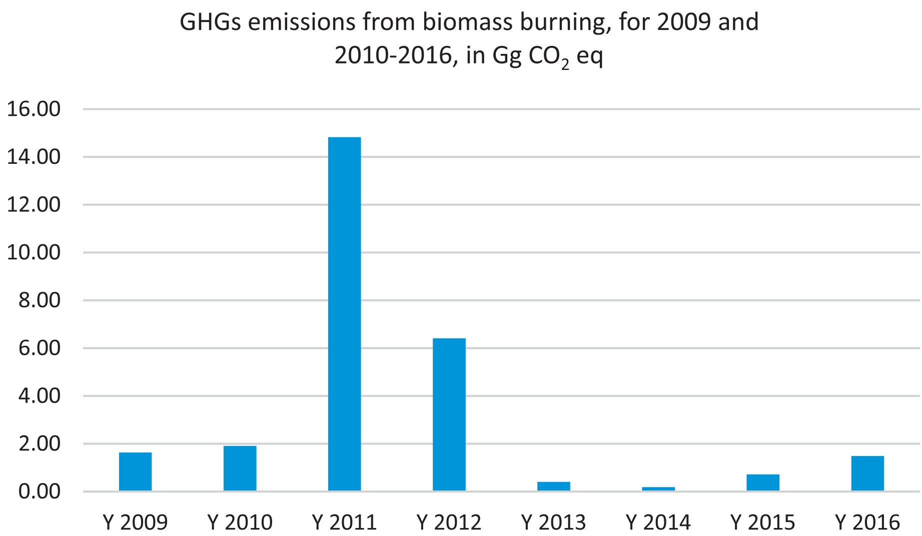
During the inventory period there were biomass burns. Burned biomass has been of two categories: biomass from crop residues (wheat residues) and that from pastures. In the table below is given the biomass burning during the years from croplands and grassland.

Table 5.9: Area of biomass burned in 2009 and 2010-2016, in ha

Year	Grasslands, ha	Croplands, ha	Total area, in ha
Y 2009	2309.7	352.02	2661.72
Y 2010	2501.28	740.24	3241.52
Y 2011	19742.86	4986.21	24729.07
Y 2012	9305.31	984.61	10289.92
Y 2013	570.52	76.29	646.81
Y 2014	260.32	32.29	292.61
Y 2015	1075.46	63.37	1138.83
Y 2016	2182.5	204.99	2387.49
Total	**37947.95**	**7440.02**	**45387.97**

As seen, during this inventory period a total area of grasslands and crop residues are burned. For both, croplands and grasslands, the peak of biomass burned is in 2011 and 2012 where the country suffered the massive forest fires. Around 54% of the total area burned during the inventory period, is burned only in 2011. The main source of agriculture residues burned comes from burning of wheat residues during the summertime. The data on area burned during the years are provided by the annual reports 'Forest Fires in Europe'[8], a technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service.
The emissions from the biomass burning are presented in the figure 5.31:

Figure 5.31: GHGs emissions from biomass burning



Most of the GHGs from biomass burning are during the year 2011, which presents 54% of the total GHGs emissions from the biomass burning for all the inventory periods.

5.3 Methodology and emission factors

The GHGs calculations from AFOLU sector are done by using the IPCC 2006 software (version 2.691), which software integrates the previously separate guidance in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories for Agriculture and Land Use, Land-Use Change and Forestry. This integration recognizes that the processes underlying greenhouse gas emissions and removals, as well as the different forms of terrestrial carbon stocks, can occur across all types of land. It recognizes that land-use changes can involve all types of land. This approach is intended to improve consistency and completeness in the estimation and reporting of greenhouse gas emissions and removals. The IPCC 2006 software integrates both, agriculture and FOLU in one sector.

Guidance and methods for estimating greenhouse gas emissions and removals for the AFOLU Sector now include:

- CO_2 emissions and removals resulting from C (carbon) stock changes in biomass, dead organic matter and mineral soils, for all managed lands
- CO_2 and non-CO_2 emissions from fire on all managed land
- N_2O emissions from all managed soils
- CO_2 emissions associated with urea application to managed soils
- CO_2 and N_2O emissions from cultivated organic soils

8 https://effis.jrc.ec.europa.eu/reports-and-publications/annual-fire-reports/

- CO_2 and N_2O emissions from managed wetlands
- CH_4 emission from livestock (enteric fermentation)
- CH_4 and N_2O emissions from manure management systems; and
- C (carbon) stock change associated with harvested wood products

In all sub-sectors Tier 1 is applied. The followed methodology for calculating GHG emissions/removals for each subcategory was:

Forests: The methodology for calculating GHGs was Gain-Loss Method based on estimates of annual change in biomass from estimates of biomass gain and loss on; *(i)* Forest Land Remaining Forest Land into forest types of different climatic or ecological zones, as adopted by the country. (ii) Estimation the annual biomass gain in Forest Land Remaining Forest Land. (iii) Estimation the annual carbon loss due to wood removals (iv) Estimate annual carbon loss due to wood fuel removal. (v) Estimate annual carbon loss due to disturbance (vi) Estimate the annual decrease in carbon stocks due to biomass losses (vii) Estimate the annual change in carbon stocks in biomass. Carbon fraction is considered =0.5 based on the document 'Assisted Natural Regeneration of Degraded Lands in Albania', a CDM project registered to UNFCCC.

Wood fuel consumption is considered based on the report; Wood Fuel Consumption in Albania, FAO 2017.

Livestock (Enteric fermentation): Identification livestock species applicable to each emission source category. In this regard, a complete list of all livestock populations that have default emission factor values have been developed. There are used data for annual population from INSTAT for each livestock category. For the source categories of Enteric Fermentation and Manure Management, is identified the emission and estimated for each species for that source category. The dairy cow population is estimated separately from other cattle. Dairy cows are defined as mature cows that are producing milk. Emission factors are used from the software approaching national circumstances and geographic location of the country.

***Crop lands*:** Multiply the area of perennial woody cropland by a net estimate of biomass accumulation from growth and subtract losses associated with harvest or gathering or disturbance. Losses are estimated by multiplying a carbon stock value by the area of cropland on which perennial woody crops are harvested.

Grasland: Tier 1 is chosen because there are no significant emissions or removals in Grassland Remaining Grassland.

***Wetlands*:** Calculation of both the rates of C uptake and decay losses based on local factors; climate, nutrient availability, water saturation or oxygen availability.

Settlements: Emissions and removals of CO_2 in this category are estimated by the subcategories of changes in carbon stocks in biomass (both woody and perennial non-woody components), in DOM, and in soils.

***Other lands*:** Estimation of carbon in biomass stocks prior to conversion, based on estimates of the areas of land converted during the period between land-use surveys. The difference between initial and final biomass carbon pools is used to calculate change in carbon stocks due to land-use conversion.

Aggregate sources and Non-CO_2 emissions sources on land: The methodology estimates N_2O emissions using human-induced net N additions to soils (e.g., synthetic, or organic fertilizers, deposited manure, crop residues, sewage sludge), or of mineralization of N in soil organic matter following drainage/ management of organic soils, or cultivation/land-use change on mineral soils.

The emission factors used for GHG emissions inventory in AFOLU are all default ones and given in Table 5.10 below.

Table 5.10: Emission factors used for AFOLU sector

Description	EF used	Unit	AFOLU Sub-category	Activity data
Dairy cows	99	Kg CH_4 / head year	Livestock	Enteric fermentation
Other cattle	58	Kg CH_4 / head year	Livestock	Enteric fermentation
Buffalo	55	Kg CH_4 / head year	Livestock	Enteric fermentation
Sheep	5	Kg CH_4 / head year	Livestock	Enteric fermentation
Goats	5	Kg CH_4 / head year	Livestock	Enteric fermentation
Horses	18	Kg CH_4 / head year	Livestock	Enteric fermentation
Mules and asses	10	Kg CH_4 / head year	Livestock	Enteric fermentation
Swine	1	Kg CH_4 / head year	Livestock	Enteric fermentation
Dairy cows	20	Kg CH_4 / head year	Livestock	Manure management
Other cattle	9	Kg CH_4 / head year	Livestock	Manure management
Buffalo	7	Kg CH_4 / head year	Livestock	Manure management
Sheep	0.15	Kg CH_4 / head year	Livestock	Manure management
Goats	0.17	Kg CH_4 / head year	Livestock	Manure management
Horses	1.64	Kg CH_4 / head year	Livestock	Manure management
Mules and asses	0.9	Kg CH_4 / head year	Livestock	Manure management
Swine	4	Kg CH_4 / head year	Livestock	Manure management
Poultry	0.02	Kg CH_4 / head year	Livestock	Manure management
BEF	1	Ratio	Forestry	Forest management
BCEF for coppice forest	0.61	t/m^3 volume	Forestry	Forest management
BCEF for high forest	0.8	t/m^3 volume	Forestry	Forest management
BCEF for shrubs	0.25	t/m^3 volume	Forestry	Forest management
Growing stock level	41-100	m^3/ha	Forestry	Forest management
Age classes	Years	>20 years	Forestry	Forest management
Wood density	Number	0.58	Forestry	Forest management
Carbon fraction	Number	0.5	Forestry	Forest management
Combustion factor for croplands	0.9	Default value	A.S& non-CO_2 emissions	Biomass burning
Combustion factor for croplands	1	Default value	A.S& non-CO_2 emissions	Biomass burning
Urea content in synthetic fertilizer	%	46	A.S& non-CO_2 emissions	
CH_4	21	GWP	CO_2	CO_2 eq.
N_2O	310	GWP	CO_2	CO_2 eq.

5.4 Data sources

There are limited data on forestry sector formatted as per the needs for the calculation of GHGs emissions/removals, therefore there is a need for more and better accurate data especially for those reflecting for any change occurring in the forestry sector, like forestation/afforestation, forest improvement, forest species composition, forest fires and damages affected by them, etc. There is also a need for a detailed study to assess the state of abandoned land across the country. There is lack of national cadastre to reflect all types of land use (agricultural land, forest, pastures, abandoned lands, water areas, urban area, etc.) and annual changes.

Data used under this inventory are provided from the following sources:

Table 5.11: The data sources for AFOLU sector

Data	Source of data
Forest area	INSTAT & Draft report on Albania National Forest and Pastures Inventory (December 2020)
Forest volume	INSTAT
Carbon fraction	Assisted Natural Regeneration of Degraded Lands in Albania
BEF for coppice forest	Assisted Natural Regeneration of Degraded Lands in Albania
Wood fuel consumption	report; Wood Fuel Consumption in Albania, FAO 2017
Other parameters	IPCC software 2006 (default factors/parameters)
Livestock number	INSTAT
Livestock categories	INSTAT
Emission factors	IPCC software 2006 (default factors/parameters)
Fires forest and other LU	https://effis.jrc.ec.europa.eu/reports-and-publications/annual-fire-reports/

6 GHG Emissions from Waste Sector

6.1 Overview

Waste management in Albania is still at a modest level. Systems for the collection of urban solid waste are provided in most cities and towns. Little recycling of waste is undertaken. The main method of disposal is dumping. There are no collection systems in rural areas and small towns. Most of the waste from these areas is disposed of by dumping in ditches, ravines, or at the side of roads where it is washed and blown onto other land and ultimately into water courses.

The problems of waste generation and management are many and various. The greatest amounts of waste generated (by weight) tend to be inert substances/construction waste, but the greatest risks are associated with smaller volumes of (mainly industrial) hazardous wastes. The latest State of the Environment Report summarizes these issues:

- Systems for collection and removal of waste are inadequate and inefficient
- Informed decisions about collection and disposal choices cannot be made in the absence of reliable information
- There is no tradition of proper waste treatment and disposal
- Financial and technical resources are insufficient; and
- Public awareness of the damage caused by poor waste management is lacking

Wastewater remains an issue in the whole country. Except for Kavaja and Pogradec wastewater treatment plants there are no other wastewater treatment facilities in the country. These two are relatively small to make a difference and almost the entirety of used water is discharged untreated to water bodies.

The Albanian legal waste framework has almost entirely approximated the EU directives. Plans for the solid waste management were in force for the time period under the BUR1 (2010-2016) but they were not fully implemented. Dumpsites remain the main treatment practice of urban solid waste. There are some landfills already functioning in 2010 (Tirana and Shkoder Region), while the others remained at the project level (new landfills of Korce, Pogradec, Sarande, Vlore, and Durres). Albania started the construction of an incinerator of urban waste in Elbasan. At the peak of its working regime, it will incinerate almost all of the urban waste of the country. There is no segregated collection system in place yet, which is required by law since several years now. In the country, there are established waste recycling industries mainly for plastics and metals.

In May 2020 the government approved a new Strategic Policy Document on Waste/Management Plan, covering the period of 2020-2035, exposing the policy of the government in the field of municipal, non-municipal and hazardous waste. This new document like its forerunner is drafted in accordance with the guidelines of the Framework Directive2008/98/EC. Its vision is to create a strategic and regulatory framework to minimize the waste and to set up a management system in line with the objectives of the EU framework directive. Its objective is to improve the quality of the environment so also enhance economic and social development of the country. The new Management Plan defines clearer (i) objectives in respect to respective timelines and (ii) roles and responsibilities of public institutions, central and local governments on the whole scheme of action.

Table 6.1 presents the summary table for waste sector and more details will be presented in the following session.

Table 6.1: GHG main emissions of the waste sector

4 Waste Greenhouse Gas Source and Sink Categories	Gases Included	% Total Emissions*	Key Categories	Uncertainty %	Tier/ NK	MS reference	Notes
A. Solid Waste Disposal							
Managed Waste Disposal Sites Unmanaged Waste Disposal Sites Uncategorised Waste Disposal Sites	CH_4	7,,11	Yes	30.414%	T1	IPCC 2006	
B. Biological Treatment of Solid Waste							
Biological Treatment of Solid Waste	CH_4, N_2O	0.07%	No	30.414% 30.414%	T1	IPCC 2006	
C. Incineration and Open Burning of Waste							
1. Waste Incineration	CH_4, N_2O, CO_2	0.0002%	No	11.180% 11.180% 40.311%	T1	IPCC 2006	
2. Open Burning of Waste	CH_4, N_2O, CO_2	0.13%	No	11.180% 11.180% 40.311%	T1	IPCC 2006	
D. Wastewater Treatment and Discharge							
Domestic Wastewater Treatment and Discharge Industrial Wastewater Treatment and Discharge	CH_4,	1.1%	Yes	30.414%	T1	IPCC 2006	
E. Other							
Other							

Note: NK = notation key, MS = method statement, T = tier, * percentage of total emissions without LULUCF in the most recent inventory year

6.2 Emission trends

Disposal and treatment of municipal and industrial wastes can produce the following GHG emissions:

- CO_2 emissions from all waste subcategories are presented in figure 6.1. It is very important to point out that CO_2 emissions happen only from the waste incineration.

Figure 6.1: Contribution of CO_2 gases (Gg) from different sub-categories and their total CO_2eq. in the waste sector

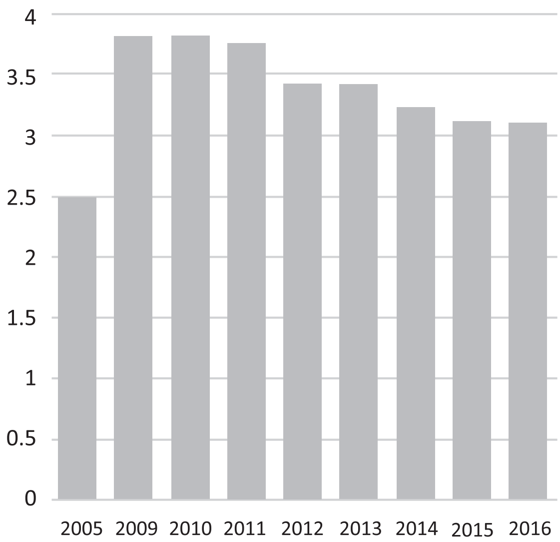
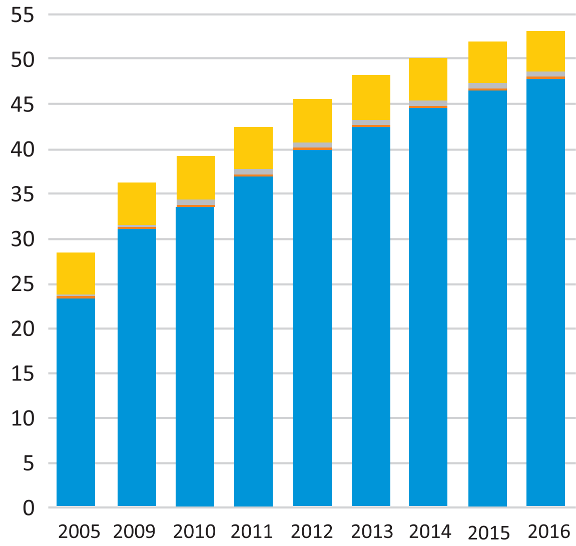


Figure 6.2: Contribution of CH_4 gases (Gg) from different sub-categories and their total CO_2eq. in the waste sector



- CH_4 emissions from solid waste disposal: in Albania the solid wastes are disposed of through open dumping (landfill) without including the methane recovery systems, therefore methane is the biggest emitter from the waste sector. CH_4 emissions from all waste subcategories are presented in figure 6.2.

- N_2O emissions from human sewage and domestic/industrial wastewaters handling: in Albania the wastewater is managed without priory handling and/or treatment systems. so only the part of population living in urban areas are considered to contribute to the N_2O emissions. On the other hand, industrial wastewaters have their contribution while calculating the N_2O emissions for the period 2005 – 2016. A small share of domestic wastewater is collected in sewer systems, with the remainder ending up in river discharge. Some industrial wastewaters may be discharged into municipal sewer lines where it combines with domestic wastewater. For the time being, series sewer systems are existent in the main cities. Their primary purpose is to convey wastewater out of the cities' boundaries. By the end of the time series, two small wastewater treatment systems are becoming functional, but the fraction of domestic wastewater treated is irrelevant to influence the outcome of the default river discharge method emissions calculation outcome. N_2O emissions from all waste subcategories are presented in figure 6.3.

Figure 6.3: Contribution of N_2O gases (Gg) from different sub-categories and their total CO_2eq. in the waste sector

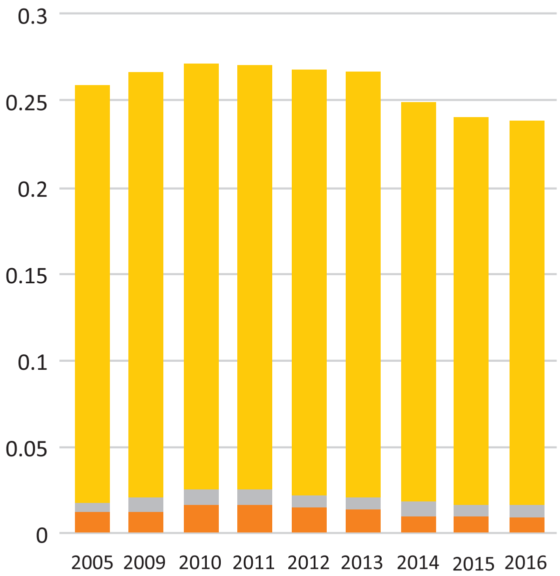
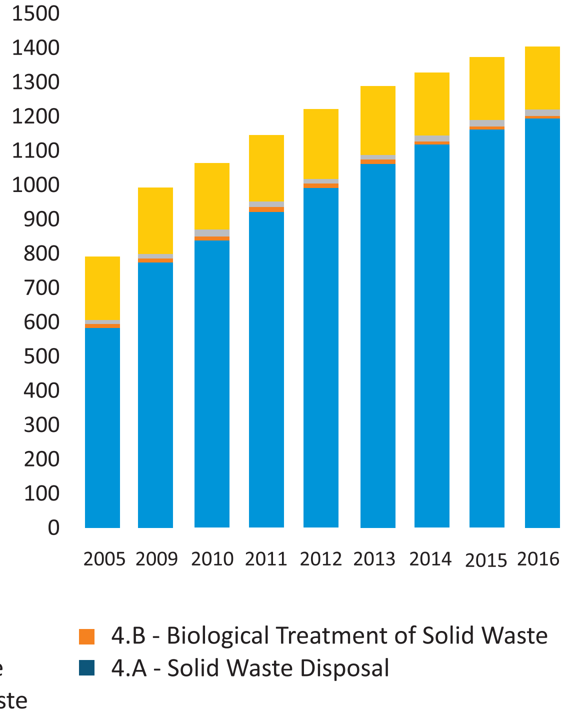


Figure 6.4: Contribution of CO_2eq. gases (Gg) from different sub-categories and their total CO_2eq. in the waste sector



- CO_2eq emissions from all waste subcategories are presented in figure 6.4. Analysis shows clearly that the emissions from the Solid Waste Disposal are the highest one, the wastewater treatment and discharge are the second one.

Figure 6.5: GHG emission from Waste Sub-Sectors in percentage (2016)

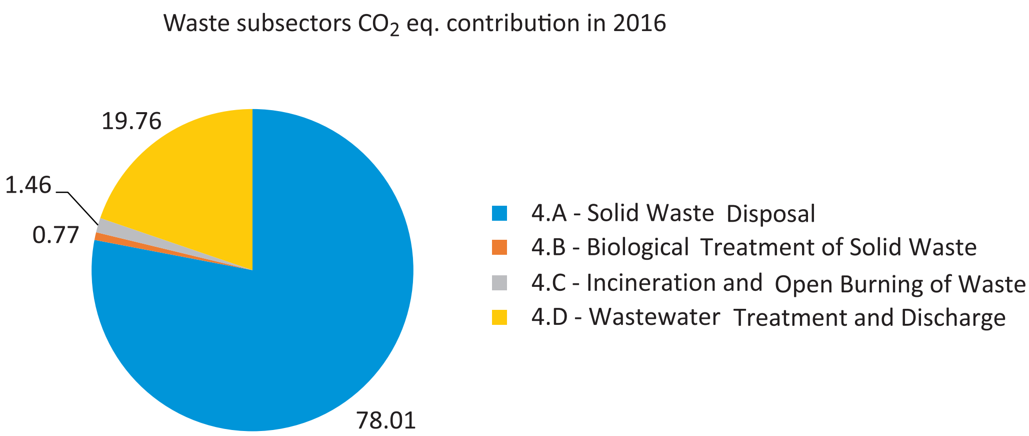


Figure 6.6: GHG emissions from Waste Sector in percentage (2016)

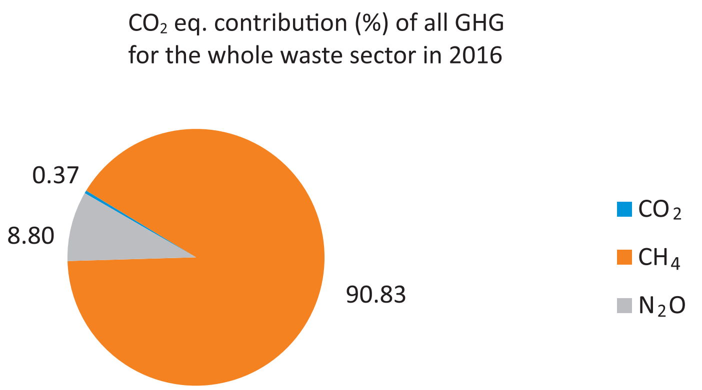


Table 6.2 below gives the GHG emissions of individual waste subsector for the year 2016.

Table 6.2: GHG emissions in 2016 from Waste sector, by category (Gg CO_2 eq.)

Categories	Emissions [Gg]			CO_2eq. all gasses	%CO_2eq.
	CO_2	CH_4	N_2O		
4 - Waste	3.10	36.29	0.24	**838.98**	
4.A - Solid Waste Disposal	0.00	31.16	0.00	***654.46***	78.01
4.A.1 - Managed Waste Disposal Sites				0,00	
4.A.2 - Unmanaged Waste Disposal Sites				0,00	
4.A.3 - Uncategorised Waste Disposal Sites				0,00	
4.B - Biological Treatment of Solid Waste		0.16	0.01	***6.49***	0.77
4.C - Incineration and Open Burning of Waste	3.10	0.34	0.01	***12.25***	1.46
4.C.1 - Waste Incineration	0.02	0.00	0.00	0.02	
4.C.2 - Open Burning of Waste	3.07	0.34	0.01	12.23	
4.D - Wastewater Treatment and Discharge	0.00	4.62	0.22	***165.78***	19.76
4.D.1 - Domestic Wastewater Treatment and Discharge		3.86	0.22	149.74	
4.D.2 - Industrial Wastewater Treatment and Discharge		0.76		16.04	
4.E - Other (please specify)				***0.00***	

6.2.1 Solid Waste Disposal

Treatment and disposal of municipal, industrial, and other solid waste produce significant amounts of methane (CH_4). This category is the main GHG contributor in the whole waste sector. The high content of Degradable Organic Carbon (DOC) in the mass of waste generates the CH_4 emissions in a constant increasing order. The trend of degradable solid waste deposits in the waste disposal sites is rather unchanged in the period 2009 -2016. So are the emissions of CH_4 from the deposits of previous years. The population decrease on the second half of this period slightly influences the CH_4 emissions trend at the end of this period. This will be more noticeable in the immediate years following 2016. Table 6.3 and Figure 6.7 give the GHG emissions from the Solid Waste Disposal category during 2009-2016.

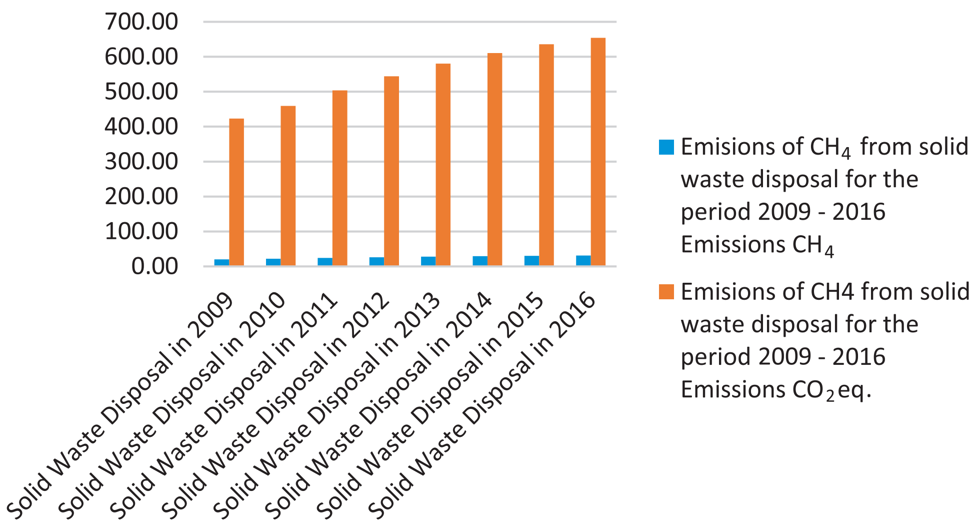
The main contributor of emissions in the solid waste disposal category is the solid waste disposal in unmanaged disposal sites. This is the most common practice of waste disposal in the country for the period 2009 - 2016. Every municipality has a main unmanaged disposal site and, in many cases, a secondary one. There are many unmanaged disposal sites not in use any more situated everywhere in the country. These sites are nearby the main city of the region they serve. In many cases they started as informal dumping sites. They continued to be used by local governments due to lack of alternative

sound treatments. They are usually small fields near urban areas or ravines in rural areas. They are mostly shallow and with no defined containment border. In the last years of the period 2009 - 2016 mild attempts of local governments to contain the further extension of these sites brought to the deepening of many of these sites. Usually, a bulldozer was used to keep the waste contained into a smaller area. This caused the deepening of the disposal sites. In some cases, some digging and soil covering took place. All these small operations aiming the containment of the sites are not to be confused with managed sites operations.
There is no sewage sludge deposited at any disposal site in the country as there is no water treatment industry in the country for this period.

Table 6.3: Emisions of CH_4 from solid waste disposal for the period 2009 - 2016

Categories	Emissions	
	CH_4	CO_2eq.
Solid Waste Disposal in 2009	20.14	423.00
Solid Waste Disposal in 2010	21.87	459.18
Solid Waste Disposal in 2011	24.00	503.91
Solid Waste Disposal in 2012	25.91	544,15
Solid Waste Disposal in 2013	27.64	580.43
Solid Waste Disposal in 2014	29,09	610.81
Solid Waste Disposal in 2015	30.28	635.92
Solid Waste Disposal in 2016	31.16	654.46

Figure 6.7: GHG Emisions from solid waste disposal for the period 2009 – 2016 (Gg)



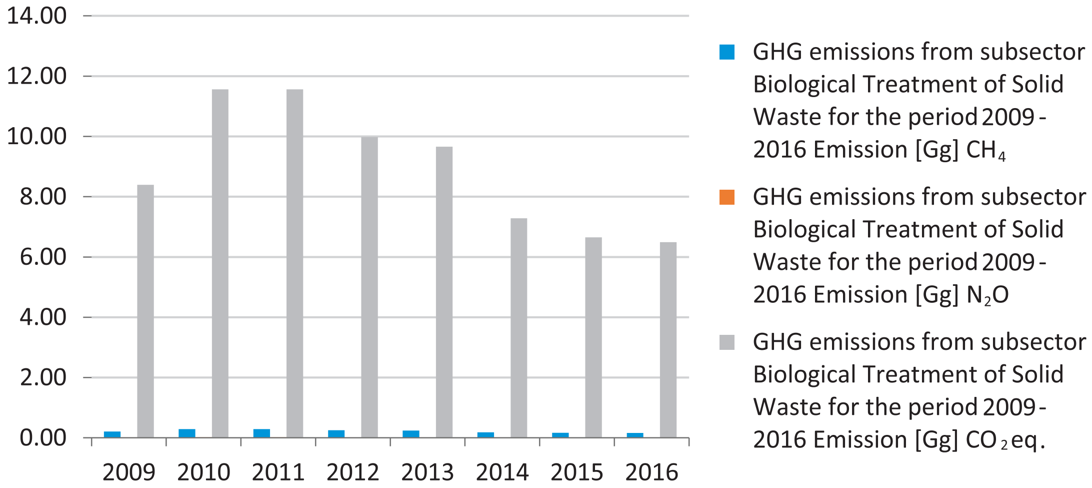
6.2.2 Biological treatment of solid waste

This is the subsector with the smallest contribution of GHG in the whole waste sector. With the new 2006 IPCC methodology there is the chance however to measure these emissions. There is no anaerobic digestion process or any mechanical -biological treatment of solid waste at the time the emissions from this subsector are calculated. There are however some small GHG emissions generated from composting in rural areas which are calculated using Tier 1 method. The figures are based on the percentage of rural population carrying out this practice. With the population decrease in the period 2009 - 2016 the GHG emissions of this subsector decrease also. The GHG generated from this subsector are CH_4 and N_2O. In the Table 6.4 and Figure 6.8 below it is shown the total contribution (in Gg CO_2 eq.) of these two gasses for the period 2009 – 2016 from the Biological Treatment of Solid Waste.

Table 6.4: GHG emissions from subsector Biological Treatment of Solid Waste for the period 2009-2016

Year	Emission [Gg]		
	CH_4	N_2O	CO_2eq.
2009	0.21	0.01	8.40
2010	0.29	0.02	11.56
2011	0.29	0.02	11.56
2012	0.25	0,02	9.98
2013	0.24	0.01	9.66
2014	0.18	0.01	7.29
2015	0.17	0.01	6.65
2016	0.16	0.01	6.49

Figure 6.8: GHG Emisions from Biological Treatment of Solid Waste for the period 2009 – 2016 (Gg)



6.2.3 Incineration and open burning of waste

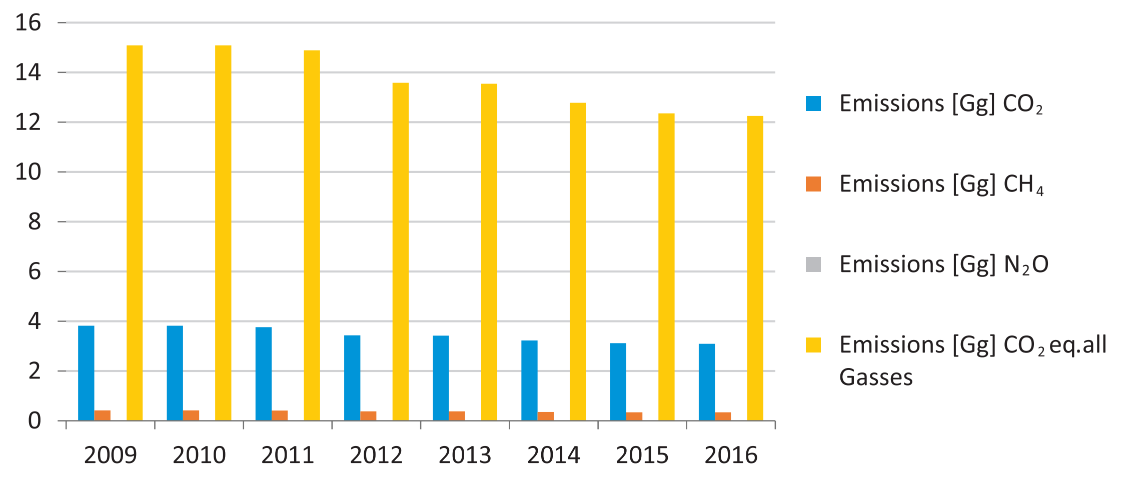
This is the second smallest subsector after Biological Treatment of Solid Waste. In 2016 it accounted for 1% of the total GHG emissions from the waste sector. Incineration refers to some small clinical waste incinerators in the healthcare institutions of the country. Due to inefficiency and heavy air pollution the main one was permanently shut down in 2010 reducing total emissions from incineration of clinical waste. In the last years there is a will to substitute clinical waste incinerators with autoclaves further reducing GHG emissions.

Intentional open burning of waste appears in the rural areas or remote places where there is no collection system. Unintentional open burning appears mostly during hot months in the dumpsites. The calculations are based on the tier 1 method. Open burning is estimated for a fraction of population which waste is open burned thus is a direct function of the population figures. With the decrease of the population in the period 2010 - 2016 the GHG emissions from the open burning of waste are also reduced. CH_4, CO_2 and very small amounts of N_2O are generated from this subsector as given in table 6.5 and Figure 6.9 below.

Table 6.5: GHG emissions from Incineration and Open Burning of Waste 2009 - 2016

Categories	Emissions [Gg]			
	CO_2	CH_4	N_2O	**CO_2eq. all Gasses**
Incineration and Open Burning of Waste in 2009	3.82	0.42	0.01	**15.09**
Waste Incineration	0.03	0.00	0.00	0.04
Open Burning of Waste	3.78	0.42	0.01	15.05
Incineration and Open Burning of Waste in 2010	3.82	0.42	0.01	**15.09**
Waste Incineration	0.03	0.00	0.00	0.04
Open Burning of Waste	3.78	0.42	0.01	15.05
Incineration and Open Burning of Waste in 2011	3.76	0.41	0.01	**14.89**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.74	0.41	0.01	14.87
Incineration and Open Burning of Waste in 2012	3.43	0.38	0.01	**13.59**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.41	0.38	0.01	13.56
Incineration and Open Burning of Waste in 2013	3.42	0.38	0.01	**13.54**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.40	0.38	0.01	13.52
Incineration and Open Burning of Waste in 2014	3.23	0.35	0.01	**12.78**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.21	0.35	0.01	12.75
Incineration and Open Burning of Waste in 2015	3.12	0.34	0.01	**12.35**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.10	0.34	0.01	12.33
Incineration and Open Burning of Waste in 2016	3.10	0.34	0.01	**12.25**
Waste Incineration	0.02	0.00	0.00	0.02
Open Burning of Waste	3.07	0.34	0.01	12.23

Figure 6.9: GHG Emisions from Incineration and Open Burning of Waste 2009 - 2016



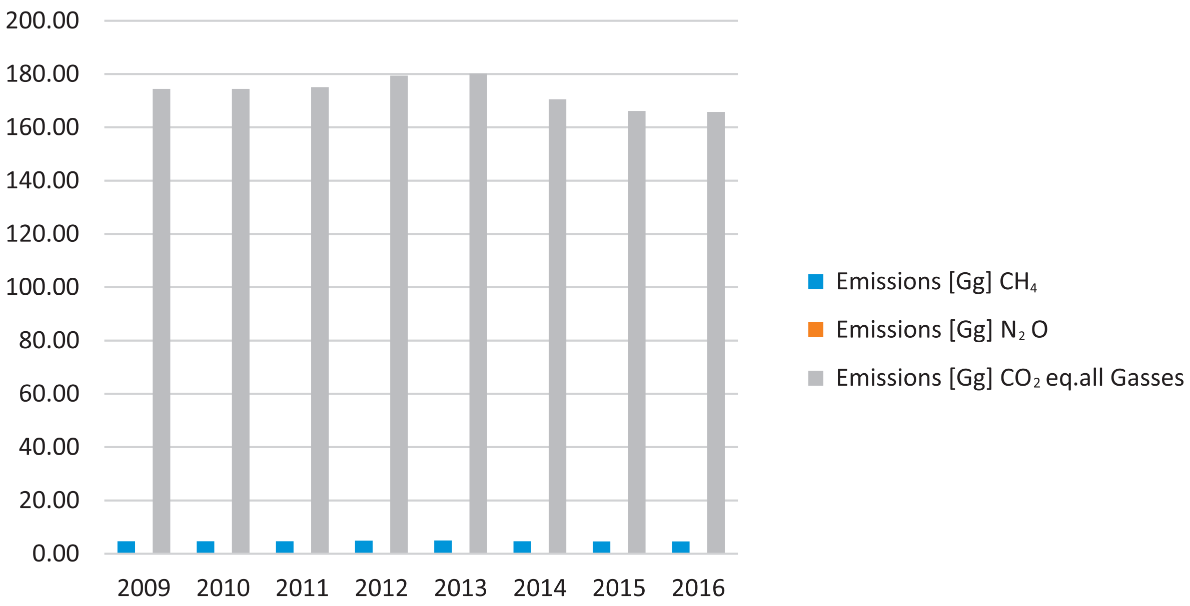
6.2.3 Wastewater treatment and discharge

GHG emissions from this sector are calculated using Tier 1 method. The emissions from the domestic wastewater treatment are a function of the population and there is a decrease in the total emissions as a result of the population decrease in this time series. The GHG emissions from the industrial wastewater treatment are a function of the total industrial product. There has been an increase of the total industry product in this time series as a result there is an increase in the total GHG emissions from industrial wastewater treatment. The GHG emission from Wastewater Treatment and Discharge for the time period under the BUR1 (2009-2016) are given Table 6.6 and Figure 6.10 below.

Table 6.6: GHG emissions from Wastewater treatment and discharge 2009 - 2016

Categories	Emissions [Gg]		
	CH_4	N_2O	CO_2eq. all Gasses
Wastewater Treatment and Discharge in 2009	4,67	0,25	174.41
Domestic Wastewaster Treatment and Discharge	4,24	0,25	165.29
Industrial Wastewater Treatment and Discharge	0,43		9.12
Wastewater Treatment and Discharge in 2010	4,67	0,25	174.41
Domestic Wastewaster Treatment and Discharge	4,24	0,25	165.29
Industrial Wastewater Treatment and Discharge	0,43		9.12
Wastewater Treatment and Discharge in 2011	4,71	0,25	175.08
Domestic Wastewaster Treatment and Discharge	4,26	0,25	165.73
Industrial Wastewater Treatment and Discharge	0,45		9.35
Wastewater Treatment and Discharge in 2012	4,91	0,25	179.42
Domestic Wastewaster Treatment and Discharge	4,23	0,25	165.14
Industrial Wastewater Treatment and Discharge	0,68		14.28
Wastewater Treatment and Discharge in 2013	4,96	0,25	180.15
Domestic Wastewaster Treatment and Discharge	4,25	0,25	165.32
Industrial Wastewater Treatment and Discharge	0,71		14.83
Wastewater Treatment and Discharge in 2014	4,71	0,23	170.52
Domestic Wastewaster Treatment and Discharge	3,99	0,23	155.47
Industrial Wastewater Treatment and Discharge	0,72		15.06
Wastewater Treatment and Discharge in 2015	4,61	0,22	166.12
Domestic Wastewaster Treatment and Discharge	3,86	0,22	150.28
Industrial Wastewater Treatment and Discharge	0,75		15.84
Wastewater Treatment and Discharge in 2016	4,62	0,22	165.78
Domestic Wastewaster Treatment and Discharge	3,86	0.22	149.74
Industrial Wastewater Treatment and Discharge	0,76		16.04

Figure 6.10: GHG Emisions from Wastewater treatment and discharge 2009 - 2016



6.3 Methodology and emission factors

In the inventory prepared under the BUR1, the Solid Waste Disposal emissions are estimated in accordance with the IPCC Guidelines using the IPCC 2006 - Inventory software, (version 2.691), which impose the First Order Decay (FOD) methodology. It produces a time-dependent emission profile that reflects the true pattern of the degradation process over time. Tier 1 methodology has been used.

The emission factors used for the estimation of the GHG emissions are presented in Table 6.7 as provided in the IPCC 2006 Guidelines.

Table 6.7: The Emission factors used for the calculation of GHG emissions from the Waste Sector

Subsector GHG	Annotation and formula used for the calculation	EF and related parameters	Notes
CH_4 generation from **solid waste disposal** (Q)	Q = E * 16/12 * F E is DDOCm E= C + H(y-1)*(1-exp1) C= D * (1-exp2) H= B + (H(y-1)*exp1) B= D * exp2 D= (W * DOC * DOCf * MCF) W is the amount deposited in Gg Half - life time is h h = [ln(2)/k]	F is fraction of methane in developed gas = 0,5 DOC = 0,26 DOCf = 0,5 k = 0,09 h = 7,7016353 M is the month when the reaction is set to start. M = 13 exp1 = exp(-k) = 0,9139 exp2 = exp(-k((13-M)/12)) = 1 16 / 12 is the default conversion ratio of C to CH_4 OX = 0	Equation 5.1 on Page 5.6 and Equation 5.3 on Page 5.7 of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. MCF is 0,4 for unmanaged shallow and 0,8 for unmanaged deep EFDB. Fraction of Degradable Organic Carbon Dissimilated (DOCF) - 0.5. F (fraction of methane in generated landfill gas) - 0,5 - p. 3.15, p.3.26 of IPCC Good Practice Guidance and Uncertainties Management (p.5.10) OX (oxidation factor for SWDS) - 0 - unmanaged and uncategorized SWDS. Equation 3.1 in Chapter 3 of Volume 5, IPCC Guidelines Equation 5.1 on Page 5.6 and Equation 5.3 on Page 5.7 of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. table 3.2, p. 3.15 of IPCC Guidelines Degradable organic carbon (DOC) content of each MSW component in % of wet waste - 20 - garden. Category 4A:IPCC Waste model, Equation 3.2 in Chapter 3. Table 2.4, p.2.14 in 2006 IPCC Guidelines Degradable organic carbon (DOC) content of each MSW component in % of wet waste - 40 - paper/cardboard. Category 4A:IPCC Waste model, Equation 3.2 in Chapter 3. Table 2.4, p.2.14 in IPCC Guidelines. Degradable organic carbon (DOC) content of each MSW component in % of wet waste - 43 - Wood and straw Category 4A:IPCC Waste model, Equation 3.2 in Chapter 3. Table 2.4, p.2.14 in IPCC Guidelines. Recommended default methane generation rate (k) values under tier 1 - 0,09. Table 3.3 Volume 5: Waste. Chapter 3. IPCC Guidelines for National Greenhouse Gas Inventories. For domestic sludge, the default DOC is 5 percent .
E is Net CH_4 and N_2O emissions from **composting**	E = C - D C = (A*B)/1000 A = Total amount treated by biological treatment facilities B is the emission factor	B = 4 g CH_4 / kg waste treated (default) B = 0,24 gN_2O / kg waste treated (default)	Table 4.1 default emission factors for CH_4 and N_2O emissions from composting. Chapter 4, Biological Treatment of Solid Waste: Volume 5: Waste. IPCC Guidelines for National Greenhouse Gas Inventories.

F is CO_2 emissions from **incineration**	F = [A * B * C * D * E * (44/12)] A = total amount of waste incinerated B = Dry matter content C = Fraction of carbon in dry matter D = Fraction of fossil carbon in total carbon E = oxidation factor	B = 0,65 [fraction] (default) C = 0,6 [fraction] (default) D = 0,4 [fraction] (default) E = 1 [fraction] (default) 44/12 = the conversion ratio of C to CO_2	Dry matter content value = 0,65. Water content in clinical waste = 35%. Equation 5.5 and 5.6 in Chapter 5 of Vol. 5, IPCC Guidelines, Equation 5.12 and 5.13 in Chapter 5 of IPCC Guidelines Total carbon content in % of dry weight = 60. Table 5.2; default data for CO_2 emission factors for incineration and open burning of waste. IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5- Waste. Fossil carbon fraction in % of total carbon content value = 0,4. Table 5.2 default data for CO_2 emission factors for incineration and open burning of waste. IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5- Waste It is assumed that the combustion efficiencies are close to 100 percent - OF = 1.
F is CH_4 emissions from **incineration**	F = A * E/10^6 A = Amount of waste incinerated E = Emission factor	E = 60 kg CH_4/Gg wet waste	Methane emission factor refers to batch type incinerators. Methane emission factor is assumed a value of 60 kg CH_4/Gg Wet Waste for MSW (Table 5.3 CH_4 emission factors for incineration of MSW, IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste). 10^6 is the conversion factor kg to Gg
F is N_2O emissions from **incineration**	F = A * E/10^6 A = Amount of waste incinerated E = Emission factor	E = 113 kg N_2O/Gg wet waste	Emission factor refers to batch type incinerators. Oxide emission factor of 113 g N_2O / t waste incinerated, is assumed a combined value of 56 g N_2O / t MSW incinerated and 170 g N_2O / t plastic waste incinerated. 10^6 is the conversion factor kg to Gg
F is CO_2 emissions from **open burning of waste**	F = [A * B * C * D * E * (44/12)] A = Amount of waste open burned B = Dry matter content C = Fraction of carbon in dry matter D = Fraction of fossil carbon in total carbon E = oxidation factor	B = 0,83 [fraction] (default) C = 0,37 [fraction] (default) D = 0,09 [fraction] (default) E = 0,58 [fraction] (default) 44/12 = the conversion ratio of C to CO_2	Nitrous oxide emission factor is assumed for Wet Waste for MSW (Table 5.3 emission factors for incineration of MSW, IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste).
F is CH_4 emissions from **open burning of waste**	F = A * E/10^6 A = Amount of waste open burned E = Emission factor	E = 6500 kg CH_4 / kg wet waste	10^6 is the conversion factor kg to Gg

F is N_2O emissions from **open burning of waste**	F = A * E/10^6 A = Amount of waste open burned E = Emission factor	E = 150 kg N_2O / kg wet waste	10^6 is the conversion factor kg to Gg
C is the emission factor for type of treatment in the subsector **domestic wastewater treatment**	C = A * B A = Maximum methane producing capacity B = Methane correction factor (MCFj)	A = 0,6 kg CH_4 / kg BOD for sea, river and lake discharge A = 0,6 kg CH_4 / kg BOD for anaerobic shallow lagoon B = 0,1 for sea, river and lake discharge B = 0,2 for anaerobic shallow lagoon	MCFj - 0,1 Table 6.3 Default MCF values for domestic wastewater; sea, river and lake discharge. Chapter 6: Wastewater Treatment and Discharge. IPCC Guidelines for National Greenhouse Gas Inventories. MCFj - 0,2 Table 6.3 Default MCF values for domestic wastewater; anaerobic shallow lagoon. Chapter 6: Wastewater Treatment and Discharge. IPCC Guidelines for National Greenhouse Gas Inventories.
D is N_20 emissions from **domestic wastewater treatment**	D = (A * B * 44/28) - C A = total N in effluent B = Emission factor C = Emissions from wastewater plants	B = 0,005 kg N_2O / kg N C = 0 (default) 44/28 = conversion factor N to N_20	(kg N_2O-N/ kg N) - IPCC guideline
C is Emission Factor for **Industrial Wastewater Treatment**	C = A * B A = Maximum Methane Producing Capacity B = Methane correction factor for sea, river and lake discharge type of treatment system	A = 0,25 kg CH_4 / kg COD for sea, river and lake discharge type of treatment system. B = 0,1 (default)	Default emission factors values for industrial wastewater treatmen: Chapter 6: Wastewater Treatment and Discharge. IPCC Guidelines for National Greenhouse Gas Inventories.

6.4 Data sources

The activity data for the Waste sector are generated mainly by the "Annual register of urban and inert waste production according to municipalities and districts". However, those data were not fully complete due to:

- lack of measurements of daily amount of the waste production.
- lack of their registration.
- contradictory data with regards to the population figures registered by Institute of Statistics (INSTAT) and figures declared by Municipalities.
- lack of solid waste data produced by industry/private enterprises related to industry of steel and ferro-chromium, food industry, cement production, textile industry/ confection production; leather processing/leather confection production, tyre industry (especial in cover up of used tyres), plastic industry/production of different articles through plastic waste recycle, and detergents industry.

To complete the activity data, the following sources are used:

Table 6.8: Data sources for the Waste Sector

Ministry of Environment	List of Industries in Albania selected for Emissions Inventory, 2012
Ministry of Environment, UNDP	Albania's FNC and SNC to UNFCCC (2002, 2009)
Ministry of Environment	National Waste Management Plan for Albania
National Environmental Agency	Report on the State of the Environment 2000 - 2009
National Environmental Agency	Report on the State of the Environment 2010 - 2016
Ministry of Environment (EU project CARDS)	Regional Waste Management Plans
EU Project CARDS	Mercological Composition of Urban Solid Waste in Albania
EU Project CARDS	Distribution, location and extension of dumpsites in Albania
FAO database	FAO nutritional data
FAO database	World Development Indicators. Dietary Energy and Protein consumption http://www.fao.org
UNFCCC	Annex of decision 17/CP.8. Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention
IPCC	2006 IPCC Guidelines for National Greenhouse Gas Inventories
IPCC	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Vol.5.
UNDP Albania	Third National Communication of Albania to the United Nations Framework Convention on Climate Change.
EFDB	Emission Factor Data Base web site.
official data of waste and wastewater handling	http://www.akm.gov.al/cilësia-e-mjedisit.html#raporte_publikime
INSTAT	Population and GDP of Albania for the years 1950 - 2016
INSTAT	Total Industry Product for the years 2010 - 2016
FAO	FAO nutritional data - Albania protein consumption

7 Precursors and Indirect Emissions

Although they are not included in global warming potential-weighted greenhouse gas emissions totals, emissions of carbon monoxide (CO), oxides of nitrogen (NOx), non-methane volatile organic compounds (NMVOCs), and sulphur dioxide (SO_2) are reported in greenhouse gas inventories. CO, NOx and NMVOCs in the presence of sunlight contribute to the formation of the greenhouse gas Ozone (O_3) in the troposphere and are therefore often called "ozone precursors". Furthermore, NOx emission plays an important role in the earth's nitrogen cycle. SO_2 emissions lead to formation of sulphate particles, which also plays a role in climate change. Ammonia (NH_3) is an aerosol precursor but is less important for aerosol formation than SO_2.

The most recent 2006 IPCC Guidelines for National Greenhouse Gas Inventories, chapter 7 "Precursors and Indirect Emissions" introduces ways to adopt methodologies to calculate the non-GHG emissions by providing a link to relevant methodology chapters in the EMEP/CORINAIR Emission Inventory Guidebook.

Taking into consideration the recommendations provided in the chapter 7 as above-mentioned, the emissions of NO_x, CO, NMVOCs and SO_2 were added in the framework of the BUR1 preparation, in a consistent, complete, and comparable manner for the entire inventory period 2009-2016. Unfortunately, the IPCC Inventory Software doesn't contain a module which supports calculation of the precursors, and the estimation of the emissions of these gases was done in separate excel files, based on the reports Albania has provided under the UNECE/1979 Convention on Long-Range Transboundary Air Pollution (LRTAP).

On the other side section 7.3 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories addresses nitrous oxide (N_2O) emissions that results from the deposition of the nitrogen emitted as NOx and NH_3. Nitrous oxide is produced in soils through the biological processes of nitrification and denitrification. N_2O emissions will also be enhanced of nitrogen deposited in the ocean or lakes. For this reason, the 2006 Guidelines include guidance for estimating N_2O emissions resulting from nitrogen deposition of all anthropogenic sources of NOx and NH_3.

Taking into consideration the recommendations given in Section 7.3 as above mentioned, the indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3 are provided in the BUR1 of Albania to the UNFCCC. The NO_2 emissions from the atmospheric deposition of nitrogen compounds from all other sources of NO_x and NH_3 emissions such as fuel combustion, industrial process, and burning of crop residues and agricultures wastes are calculated on the basis of the provided activity data under the UNECE/1979 Convention on Long-Range Transboundary Air Pollution (LRTAP) for years 2009 – 2016 in the section 5 of the 2006 IPCC Software for National Greenhouse Gas Inventories, while the N_2O emissions from soil amendment are directly provided under the section 3/AFOLU.

7.1 Emissions trends

The emission trend of the precursor gases for all sectors for Albania for the period 2009-2016 are presented in Table 7.1. The assessment of the overall sectoral precursor emissions for the year 2016 shows that the energy sector is the most significant contributor with 99% in 2016, followed by IPPU for NO_x, CO, NMVOCs and SO_2.

Table 7.1: Summary of the Precursor emissions from all sectors

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NOx	NOx	NOx	NOx	NOx	NOx	NOx	NOx
1-Energy	23.828	25.656	26.183	26.526	27.401	32.834	33.063	39.200
2-Industrial Processes and Product Use	0.259	0.055	0.063	0.049	0.011	0.060	0.000	0.010
3-Agriculture, Forestry, and Other Land Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4-Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**24.09**	**25.71**	**26.25**	**26.58**	**27.41**	**32.89**	**33.06**	**39.21**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO	CO	CO	CO	CO	CO	CO	CO
1-Energy	76.674	75.289	86.716	93.645	148.731	1700.892	195.842	77.48
2-Industrial Processes and Product Use	14.868	0.551	0.616	0.489	0.137	0.575	0.000	2.100
3-Agriculture, Forestry, and Other Land Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4-Waste	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Total	**91.54**	**75.84**	**87.33**	**94.14**	**148.87**	**1701.47**	**195.84**	**79.58**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs
1-Energy	15.435	14.292	16.427	17.785	28.78	33.033	38.932	15.170
2-Industrial Processes and Product Use	1.630	0.015	0.020	0.015	0.001	0.016	0.000	0.520
3-Agriculture, Forestry, and Other Land Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4-Waste	0.107	0.134	0.166	0.145	0.117	0.154	0.166	2.000
Total	**17.17**	**14.44**	**16.61**	**17.95**	**28.90**	**33.20**	**39.10**	**17.69**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
1-Energy	20.877	14.54	15.517	16.318	18.243	24.134	22.561	25.180
2-Industrial Processes and Product Use	0.086	0.019	0.024	0.018	0.003	0.022	0.000	0.430
3-Agriculture, Forestry, and Other Land Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4-Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total	**20.96**	**14.56**	**15.54**	**16.34**	**18.25**	**24.16**	**22.56**	**25.61**

7.2 Energy

The values of precursor gases emissions, provided under the UNECE/1979 Convention on Long-Range Transboundary Air Pollution (LRTAP), are inserted in the IPCC GHG calculation programme multiplied by the corresponding EF. The emission trend of the precursor gases, for energy and transport sectors, for Albania for the period 2009-2016 are presented in Table 7.2. Analysis shows that transport sector is contributing almost 65-75% of total precursor gases for each year.

Table 7.2: Summary of the Precursor emissions from Energy sector

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NOx	NOx	NOx	NOx	NOx	NOx	NOx	NOx
1-Energy	23.828	25.656	26.183	26.526	27.401	32.834	33.063	39.200
1.A-Fuel Combastion Activities	23.828	25.656	26.183	26.526	27.401	32.834	33.063	39.200
1.A.1-Energy Industries	0.214	0.000	0.000	0.000	0.000	0.000	0.000	1.460
1.A.2-Manufacturing Industries and Construction	3.304	2.940	3.648	3.538	3.639	6.756	5.990	7.020
1.A.3-Transport	17.585	21.733	21.452	21.794	21.879	23.967	24.665	21.980
1.A.4-Other Sectors	2.725	0.983	1.083	1.194	1.883	2.111	2.408	8.740
1.A.5-Non-Specifies	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B-Fugitive emissions from fuels	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
1.C-CO_2 Transport and Storage	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
Total	**71.48**	**76.97**	**78.55**	**79.58**	**82.20**	**98.50**	**99.19**	**117.60**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO	CO	CO	CO	CO	CO	CO	CO
1-Energy	76.674	75.289	86.716	93.645	148.731	1700.892	195.842	77.48
1.A-Fuel Combastion Activities	76.674	75.289	86.716	93.645	148.731	1700.892	195.842	77.480
1.A.1-Energy Industries	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.160
1.A.2-Manufacturing Industries and Construction	2.251	2.301	2.733	2.457	2.766	4.178	3.713	9.230
1.A.3-Transport	22.116	20.986	21.666	22.607	22.658	24.830	25.911	35.900
1.A.4-Other Sectors	52.275	52.002	62.317	68.581	123.307	1671.884	166.218	32.190
1.A.5-Non-Specifies	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B-Fugitive emissions from fuels	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
1.C-CO_2 Transport and Storage	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
Total	**230.02**	**225.87**	**260.15**	**280.94**	**446.19**	**5102.68**	**587.53**	**232.44**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs
1-Energy	15.435	14.292	16.427	17.785	28.78	33.033	38.932	15.170
1.A-Fuel Combastion Activities	15.435	14.292	16.427	17.785	28.780	33.033	38.932	15.170
1.A.1-Energy Industries	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2-Manufacturing Industries and Construction	0.211	0.140	0.180	0.180	0.210	0.350	0.310	0.840
1.A.3-Transport	4.719	3.657	3.701	3.797	3.834	4.161	4.315	9.330
1.A.4-Other Sectors	10.502	10.495	12.546	13.808	24.736	28.522	34.307	5.000
1.A.5-Non-Specifies	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B-Fugitive emissions from fuels	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
1.C-CO_2 Transport and Storage	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
Total	**24.09**	**25.71**	**26.25**	**26.58**	**27.41**	**32.89**	**33.06**	**39.21**

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
1-Energy	20.877	14.54	15.517	16.318	18.243	24.134	22.561	25.180
1.A-Fuel Combastion Activities	20.877	14.54	15.517	16.318	18.243	24.134	22.561	25.180
1.A.1-Energy Industries	2.766	0.000	0.000	0.000	0.000	0.000	0.000	14.070
1.A.2-Manufacturing Industries and Construction	4.839	6.166	7.696	7.696	8.921	14.683	12.986	8.430
1.A.3-Transport	0.264	0.303	0.299	0.302	0.299	0.342	0.347	1.020
1.A.4-Other Sectors	13.008	8.071	7.522	8.320	9.023	9.109	9.228	1.660
1.A.5-Non-Specifies	NO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B-Fugitive emissions from fuels	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
1.C-CO_2 Transport and Storage	NO	0.000	0.000	NO	0.000	0.000	0.000	0.000
Total	**62.63**	**43.62**	**46.55**	**48.95**	**54.73**	**72.40**	**67.68**	**75.54**

7.3 IPPU

The indirect NO_2 emissions from the IPPU sector are coming from Cement production and Iron & Steel production subcategories. The precursors and other gases (CO, NOx, NMVOCs and SO_2) are mainly coming from Cement production and Iron & Steel production subcategories as well as from the Aluminium use, Pulp and Paper Industry and Food and Beverages Industry. These data are also taken from LRTAP and are inserted in the final Excel file of the IPPU sector. The precursor gases are presented in the following table 7.3 while the indirect NO_2 emissions from this sector are neglectable.

Table 7.3: Summary of the Precursor emissions from IPPU sector

Categories	2009				2010				2011				2012			
	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2
	Gg				Gg				Gg				Gg			
2 - Industrial Processes and Product Use	**0.259**	**14.87**	**1.630**	**0.086**	**0.055**	**0.551**	**0.015**	**0.019**	**0.063**	**0.616**	**0.020**	**0.024**	**0.049**	**0.484**	**0.015**	**0.018**
2.A - Mineral Industry	0.000	0.000	0.000	0.000	0.015	0.191	0.001	0.004	0.010	0.135	0.001	0.003	0.010	0.134	0.001	0.003
2.A.1 - Cement production	0.000	0.000	0.000	0.000	0.015	0.191	0.001	0.004	0.010	0.135	0.001	0.003	0.010	0.134	0.001	0.003
2.B - Chemical Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.1 - Ammonia Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	0.259	14.868	0.140	0.086	0.040	0.360	0.014	0.015	0.053	0.481	0.019	0.021	0.039	0.350	0.014	0.015
2.C.1 - Iron and Steel Production	0.030	0.391	0.012	0.014	0.040	0.360	0.014	0.015	0.053	0.481	0.019	0.021	0.039	0.350	0.014	0.015
2.C.2 - Ferroalloys Production	0.229	14.477	0.000	0.072	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.3 - Aluminium production	0.000	0.000	0.128	0.000	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.D - Non-Energy Products from Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E - Electronics Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F - Product Uses as Substitutes for ODS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G - Other Product Manufacture and Use	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.4 - Other (Please specify)	0.000	0.000	0.003	0.000	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	0.000	0.000	1.487	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H.1 - Pulp and Paper Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	0.000	0.000	1.487	0.000	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Categories	2013				2014				2015				2016			
	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2	NO_x	CO	NMVOCs	SO_2
	Gg				Gg				Gg				Gg			
2 - Industrial Processes and Product Use	**0.052**	**0.174**	**0.016**	**0.019**	**0.060**	**0.575**	**0.016**	**0.022**	**0.000**	**0.000**	**0.000**	**0.000**	**0.010**	**2.100**	**0.520**	**0.430**
2.A - Mineral Industry	0.011	0.137	0.001	0.003	0.009	0.117	0.001	0.002	0.010	0.124	0.001	0.002	0.000	0.000	0.000	0.000
2.A.1 - Cement production	0.011	0.137	0.001	0.003	0.009	0.117	0.001	0.002	0.010	0.124	0.001	0.002	<0.01	NE	NA	<0.01
2.B - Chemical Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	1.000	0.000	0.000
2.B.1 - Ammonia Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.010	1.000	NA	NA
2.C - Metal Industry	0.041	0.037	0.015	0.016	0.051	0.458	0.015	0.020	0.032	0.292	0.011	0.012	0.000	1.090	0.050	0.430
2.C.1 - Iron and Steel Production	0.041	0.037	0.015	0.016	0.051	0.458	0.015	0.020	0.032	0.292	0.011	0.012	<0.01	1.090	0.050	NE
2.C.2 - Ferroalloys Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NA	NA	NA	NA
2.C.3 - Aluminium production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NE	NA	0.430
2.D - Non-Energy Products from Fuels	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E - Electronics Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F - Product Uses as Substitutes for ODS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G - Other Product Manufacture and Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H - Other	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.470	0.000
2.H.1 - Pulp and Paper Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	<0.01	0.010	<0.01	NE
2.H.2 - Food and Beverages Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NA	NE	0.470	NA

7.4 AFOLU

The indirect sources of N_2O emissions from AFOLU sector are related to the volatilisation of N as NH_3 and oxides of N (NOx), and the deposition of these gases and their products NH_4 + and NO_3 in soils and waters. The sources of N as NH_3 and NOx are mostly from agricultural synthetic and organic fertilisers, leaching and runoff from land of N from fertilizers, crop residues, mineralisation of N, urine, and dung deposition from grazing animals as well form biomass burning.

Table 7.4: Summary of the Precursor emissions from AFOLU sector

Categories	2009				2010				2011				2012			
	N_2O	NO_x	CO	$NMVOC_x$	N_2O	NO_x	CO	$NMVOC_x$	N_2O	NOx	CO	NMVOCx	N_2O	NOx	CO	$NMVOC_x$
3-Agriculture, Forestry, and Other Land Use	**0.681**	**0.000**	**0.000**	**0.000**	**0.669**	**0.000**	**0.000**	**0.000**	**0.669**	**0.000**	**0.000**	**0.000**	**0.707**	**0.000**	**0.000**	**0.000**
3.C-Agregate sources and non-CO_2 emissions sources on land	**0.681**	**0.000**	**0.000**	**0.000**	**0.669**	**0.000**	**0.000**	**0.000**	**0.669**	**0.000**	**0.000**	**0.000**	**0.707**	**0.000**	**0.000**	**0.000**
3.C1-Emissions from biomass burning	0.000	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.033	0.000	0.000	0.000	0.015	0.000	0.000	0.000
3.C1a-Biomass burning in forest lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C1b-Biomass burning in crop lands	0.003	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C1a-Biomass burning in grass lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000
3.C1a-Biomass burning in all other lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C2-Liming	0.000	NO	NO	NO	0.000	NO	NO	NO	0.000	NO	NO	NO	0.000	NO	NO	NO
3.C3-Urea application	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C5-Indirect N_2O Emissions from managed soil	0.548	0.000	0.000	0.000	0.536	0.000	0.000	0.000	0.536	0.000	0.000	0.000	0.565	0.000	0.000	0.000
3.C6-Indirect N_2O Emissions from manure management	0.130	0.000	0.000	0.000	0.130	0.000	0.000	0.000	0.130	0.000	0.000	0.000	0.131	0.000	0.000	0.000
3.C7-Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	2013				2014				2015				2016			
	N_2O	NO_x	CO	NMVOCx	N_2O	NOx	CO	NMVOCx	N2O	NO_x	CO	$NMVOC_x$	N_2O	NO_x	CO	$NMVOC_x$
3-Agriculture, Forestry, and Other Land Use	**0.704**	**0.000**	**0.000**	**0.000**	**0.722**	**0.000**	**0.000**	**0.000**	**0.725**	**0.000**	**0.000**	**0.000**	**0.730**	**0.000**	**0.000**	**0.000**
3.C-Agregate sources and non-CO_2 emissions sources on land	**0.704**	**0.000**	**0.000**	**0.000**	**0.722**	**0.000**	**0.000**	**0.000**	**0.725**	**0.000**	**0.000**	**0.000**	**0.730**	**0.000**	**0.000**	**0.000**
3.C1-Emissions from biomass burning	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.003	0.000	0.000	0.000
3.C1a-Biomass burning in forest lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C1b-Biomass burning in crop lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	0.000
3.C1a-Biomass burning in grass lands	0.011	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.003	0.000	0.000	0.000
3.C1a-Biomass burning in all other lands	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C2-Liming	0.000	NO	NO	NO	0.000	NO	NO	NO	0.000	NO	NO	NO	0.000	NO	NO	NO
3.C3-Urea application	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C5-Indirect N_2O Emissions from managed soil	0.565	0.000	0.000	0.000	0.589	0.000	0.000	0.000	0.591	0.000	0.000	0.000	0.596	0.000	0.000	0.000
3.C6-Indirect N_2O Emissions from manure management	0.131	0.000	0.000	0.000	0.131	0.000	0.000	0.000	0.133	0.000	0.000	0.000	0.133	0.000	0.000	0.000
3.C7-Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

7.5 Waste

The indirect NO_2 emissions from the waste sector are generated in the solid waste disposal on land category as a result of NH_3 depositions. These depositions are reported in line with the UNECE/1979 Convention on Long-Range Transboundary Air Pollution. The resulting indirect NO_2 emissions are very small. These emissions are 0,0008 Gg for the year 2009 and 0,0014 Gg for the year 2016. In regard to the precursors the reported emissions for the waste sector are those reported in LRTAP. These emissions are NMVOCs for the categories solid waste disposal and biological treatment of solid waste. These emissions are 0.107 Gg in 2009 increasing gradually up to 0.2 Gg in 2016 for both categories. Table 7.5 presents the summary of the Precursor emissions from waste sector.

Table 7.5: Summary of the Precursor emissions from Waste sector

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NO_x	NO_x	NO_x	NO_x	NO_x	NO_x	NO_x	NO_x
4-Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.A-Solid Waste Disposal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.B-Biological Treatment of Solid Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.C-Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NE	NE
4.D-Wastewater Treatment and Discharge	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4-Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	CO	CO	CO	CO	CO	CO	CO	CO
4-Waste	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.A-Solid Waste Disposal	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
4.B-Biological Treatment of Solid Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.C-Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NE	NE
4.D-Wastewater Treatment and Discharge	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4-Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs	NMVOCs
4-Waste	0.107	0.134	0.166	0.145	0.117	0.154	0.166	2.000
4.A-Solid Waste Disposal	0.107	0.134	0.166	0.145	0.117	0.154	0.166	2.000
4.B-Biological Treatment of Solid Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.C-Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NE	NE
4.D-Wastewater Treatment and Discharge	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4-Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE

	2009	2010	2011	2012	2013	2014	2015	2016
Categories	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2	SO_2
4-Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.A-Solid Waste Disposal	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.B-Biological Treatment of Solid Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.C-Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NE	NE
4.D-Wastewater Treatment and Discharge	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4-Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE

8 Key source analysis

This section on key sources can help to prioritize the use of available time and money in a cost-effective manner. In all inventories, some parameters or source categories will be more important for the inventory calculations than others. A ***key source category*** is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs, in terms of the absolute emissions ***level and trend***. The key source method does not just look at the largest sources, but it also looks at sources that may be small now but could become important in the future. It does this by looking at the trend in emissions.

The analysis of key categories that contribute the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment), is conducted using the Approach 1. According to this approach, key categories are those that, when summed together in descending order of magnitude, add up to 95% of the total level/trend. On other words, a key source category is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs, in terms of the absolute emissions level and trend. The key source method does not just look at the largest sources, but it also looks at sources that may be small now but could become important in the future. It does this by looking at the trend in emissions.

Analysis performed under the BUR1 (in terms of the highest absolute values of Gg CO_2 eq. for both GHG emissions and removals for the year 2016) show that key sources are:

1. Road Transportation, CO_2 (23.30%);
2. Forest land Remaining Forest land, CO_2 (12.03%);
3. Enteric Fermentation, CH_4 (11.80%);
4. Manufacturing Industries and Construction - Liquid Fuels, CO_2 (10.15%);
5. Cement production, CO_2 (7.40%);
6. Solid Waste Disposal, CH_4 (6.23%);
7. Direct N_2O Emissions from managed soils (5.26%)
8. Other Sectors - Liquid Fuels, CO_2 (4.24%);
9. Energy Industries - Liquid Fuels, CO_2 (2.99%);
10. Non-Specified - Liquid Fuels, CO_2 (2.00%);
11. Manure Management, CH_4 (1.96%).
12. Indirect N_2O Emissions from managed soils (1.76%);
13. Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3 (1.27%);
14. Oil, CH_4 (0.96%);

15. Wastewater Treatment and Discharge, CH_4 (0.92%)
16. Land Converted to Settlements, CO_2 (0.89%)
17. Manure Management, N_2O (0.81%)
18. Cropland Remaining Cropland, CO_2 (0.69%)

Figure 8.1 presents all categories ranked from the maximum up to the moment reaching 95% of total GHG emissions.

Figure 8.1: GHG Key Source Emissions, 2016 (Gg)

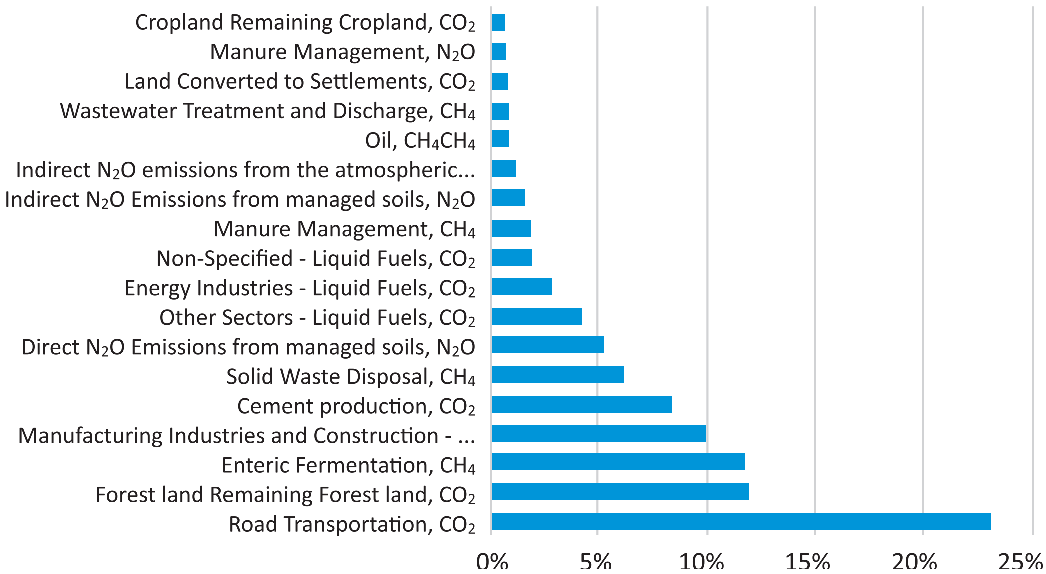
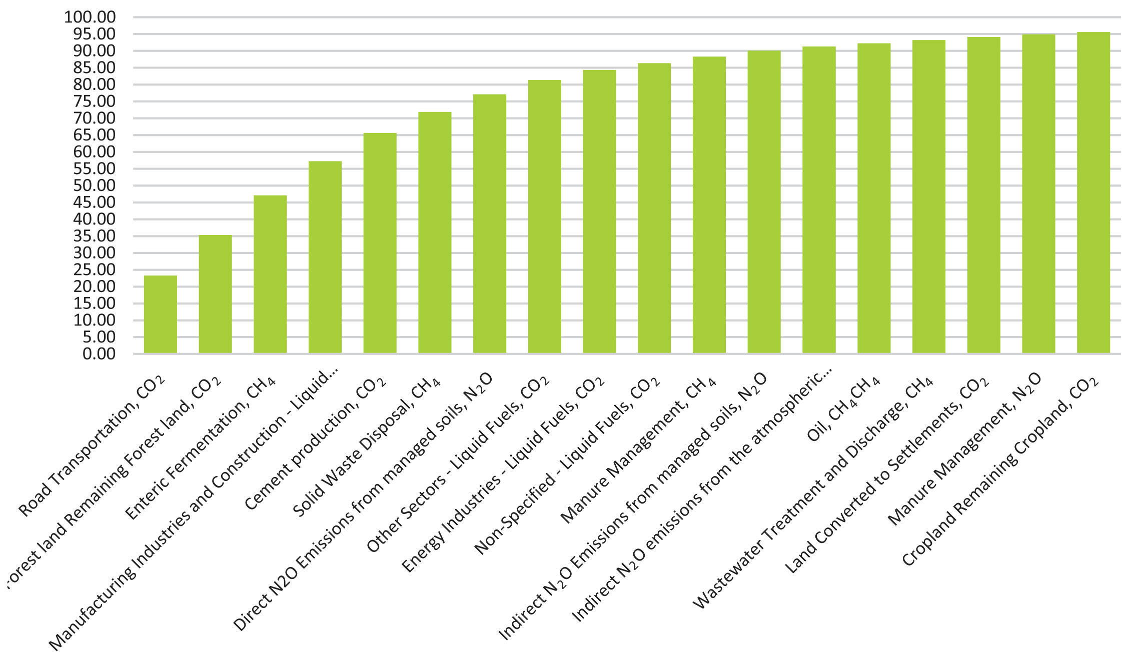


Figure 8.2 gives the cumulative of GHG Key Source Emissions for the year 2016.

Figure 8.2: Cumulative of GHG Key Source Emissions, 2016 (Gg)



The trend assessment of source categories is also executed, taking 2009 as base year and 2016 as latest inventory year. The purpose of this trend is to emphasize the categories whose trend is significantly different from the trend of the overall inventory, regardless whether the category trend is increasing or decreasing, or is a sink or source. Table 8.1 presents trend assessment of source categories for the period 2009-2016.

Key categories-trend assessment of source categories shows that the largest changes for the period of 2009-2016 have been for the following subcategories: Iron and Steel Production; Manufacturing Industries and Construction - Liquid Fuels; Cement production; Solid Waste Disposal; Forest land Remaining Forest land; Manufacturing Industries and Construction - Solid Fuels; Road Transportation; Lime production; Other Sectors - Liquid Fuels; Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3 and Direct N_2O Emissions from managed soils.

Table 8.1: Trend assessment of source categories for the period 2009-2016

IPCC Category code	IPCC Category	Green-house gas	2009 Year Estimate Ex0 (Gg CO_2 eq.)	2016 Year Estimate Ext (Gg CO_2 eq.)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
2.C.1	Iron and Steel Production	CO_2	635.10	18.58	0.0620	26.28%	26.28%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	620.20	1066.29	0.0419	17.79%	44.07%
2.A.1	Cement production	CO_2	585.00	880.47	0.0273	11.58%	55.65%
4.A	Solid Waste Disposal	CH_4	423.00	654.46	0.0215	9.11%	64.77%
3.B.1.a	Forest land Remaining Forest land	CO_2	1425.63	1263.97	0.0196	8.33%	73.09%
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CO_2	174.74	0.59	0.0175	7.42%	80.51%
1.A.3.b	Road Transportation	CO_2	2259.85	2448.98	0.0124	5.27%	85.78%
2.A.2	Lime production	CO_2	86.45	13.78	0.0073	3.11%	88.89%
1.A.4	Other Sectors - Liquid Fuels	CO_2	499.67	445.66	0.0066	2.81%	91.69%
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3	N_2O	74.63	133.65	0.0056	2.36%	94.06%
3.C.4	Direct N_2O Emissions from managed soils	N_2O	510.92	552.40	0.0027	1.14%	95.19%

9 Uncertainty estimation

The uncertainty estimation is an essential element of emissions inventory to help prioritize efforts to improve the accuracy of inventory. National inventories contain a wide range of emission estimates, varying from carefully measured to order-of-magnitude estimates. The sources of uncertainties are numerous, and it is difficult to estimate all from data analysis. The pragmatic approach suggested by "***Good Practice Guidance and Uncertainty Management in National GHG Inventory***[9]" to produce quantitative estimates consists in using the best available estimates, a combination of available measured data and expert judgement. Uncertainties found in inventory source categories vary from a few percentages to orders of magnitude, and may be correlated, so the results obtained by combining uncertainties are approximated.

9.1 Input data

In order to calculate the uncertainty of the emissions for each sector separately, as well as the uncertainty of the total annual emissions, it is first needed to define uncertainty values for the input data. The IPCC Inventory software allows input of uncertainty for activity data and emissions factors. Based on these data the software automatically calculates uncertainty using the Error Propagation methods (Approach 1).

For most of emission factors or activity data in the other sectors, default uncertainty estimate provided by Good Practice are used. To evaluate the highest possible level of uncertainty most of estimates are made using highest limit of IPCC default values recommended by *Good Practice* for quality of activity data and default of emission factors used in GHG Inventory. However, where possible, there are fourteen sectors where expert judgments have provided estimates of a little bit lower value than highest limit of IPCC default values (energy consumption by: industry and all sub-industrial sectors, service, residential, road transport and all sub-categories, agriculture, by district heating plant, chemical industry, metal production and land-use and forestry for CO_2 production.

The input data in the Energy sector, according to the Guidelines, as well as according to the confidentiality of the available resources in Albania is the most reliable. Accordingly, the values of the uncertainty for activity data and emission factors are set to 5% (Table 9.1). In the same table are presented also emission factor uncertainty level, uncertainty in trend in national emissions introduced by emission factor uncertainty and uncertainty in trend in national emissions introduced by activity data uncertainty for each category for this sector.

9 IPCC: Good Practice Guidance and Uncertainty Management in National GHG Inventory.

Table 9.1: Input data for uncertainty in the IPCC Inventory for energy sector (year 2016, in %)

2006 IPCC Categories	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Contribution to Variance by Category in Year T	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)
1.A - Fuel Combustion Activities						
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO_2	5	5.332954443	0.0001709	0.000263299	0.012986824
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH_4	5	50.79	8.25866E-09	1.67451E-06	1.29315E-05
1.A.1.a.iii - Heat Plants - Liquid Fuels	N_2O	5	200.79	1.11497E-06	1.95445E-05	3.81788E-05
1.A.1.a.iii - Heat Plants - Solid Fuels	CO_2	5	5.48	1.2274E-05	0.000254765	0.003429727
1.A.1.a.iii - Heat Plants - Solid Fuels	CH_4	5	50	2.43468E-11	4.83313E-07	7.13112E-07
1.A.1.a.iii - Heat Plants - Solid Fuels	N_2O	5	200.22	1.89642E-07	4.28549E-05	1.57903E-05
1.A.1.b - Petroleum Refining - Liquid Fuels	CO_2	5	5.332954443	0.033034441	0.001061047	0.18055762
1.A.1.b - Petroleum Refining - Liquid Fuels	CH_4	5	50.79	1.08339E-06	8.23444E-06	0.000148111
1.A.1.b - Petroleum Refining - Liquid Fuels	N_2O	5	200.79	0.000146264	9.61103E-05	0.000437279
1.A.1.b - Petroleum Refining - Gaseous Fuels	CO_2	5	3.921568627	8.44066E-05	0.000157383	0.010499759
1.A.1.b - Petroleum Refining - Gaseous Fuels	CH_4	5	200	1.17238E-08	3.00463E-06	3.93039E-06
1.A.1.b - Petroleum Refining - Gaseous Fuels	N_2O	5	200	2.55478E-08	4.43541E-06	5.80201E-06
1.A.2.a - Iron and Steel - Liquid Fuels	CO_2	5	5.332954443	0.018805712	0.052012195	0.136231403
1.A.2.a - Iron and Steel - Liquid Fuels	CH_4	5	50.79	5.43147E-07	0.000389817	0.000104871
1.A.2.a - Iron and Steel - Liquid Fuels	N_2O	5	200.79	7.33282E-05	0.004549853	0.000309618
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO_2	5	5.332954443	0.018508074	0.044447126	0.135149037
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH_4	5	50.79	5.09421E-07	0.000320691	0.000101562
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N_2O	5	200.79	6.87749E-05	0.003743027	0.000299851
1.A.2.c - Chemicals - Liquid Fuels	CO_2	5	5.332954443	0.003304743	0.025816109	0.057108558
1.A.2.c - Chemicals - Liquid Fuels	CH_4	5	50.79	9.27737E-08	0.000192193	4.33418E-05
1.A.2.c - Chemicals - Liquid Fuels	N_2O	5	200.79	1.2525E-05	0.002243225	0.000127962
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO_2	5	5.332954443	0.000101535	0.000824483	0.010010152
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH_4	5	50.79	3.43236E-09	8.42975E-06	8.33665E-06
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N_2O	5	200.79	4.6339E-07	9.839E-05	2.4613E-05
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	5	5.332954443	0.002729656	0.003478151	0.051902265
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	5	50.79	8.97718E-08	2.13943E-05	4.26349E-05

1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N_2O	5	200.79	1.17616E-05	0.000248282	0.000124
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO_2	5	5.332954443	0.000102022	0.000806391	0.01003414
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH_4	5	50.79	3.43218E-09	8.4314E-06	8.33642E-06
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N_2O	5	200.79	4.63364E-07	9.84092E-05	2.46123E-05
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO_2	5	12.46005477	4.30828E-07	0.007028898	0.00035504
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH_4	5	200	4.1357E-10	0.000251867	7.38203E-07
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N_2O	5	222.2222222	2.50311E-09	0.000619672	1.63459E-06
1.A.2.g - Transport Equipment - Liquid Fuels	CO_2	5	5.332954443	1.95455E-05	0.000940423	0.004391937
1.A.2.g - Transport Equipment - Liquid Fuels	CH_4	5	50.79	6.61476E-10	7.86783E-06	3.65975E-06
1.A.2.g - Transport Equipment - Liquid Fuels	N_2O	5	200.79	8.93033E-08	9.18313E-05	1.0805E-05
1.A.2.h - Machinery - Liquid Fuels	CO_2	5	5.332954443	0.000266953	0.002589303	0.016231156
1.A.2.h - Machinery - Liquid Fuels	CH_4	5	50.79	8.95329E-09	2.28312E-05	1.34644E-05
1.A.2.h - Machinery - Liquid Fuels	N_2O	5	200.79	1.20875E-06	0.00026648	3.97519E-05
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO_2	5	5.332954443	0.032976201	0.085176033	0.180398387
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH_4	5	50.79	7.81696E-07	0.000547	0.00012581
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N_2O	5	200.79	0.000105534	0.006384456	0.000371438
1.A.2.j - Wood and wood products - Liquid Fuels	CO_2	5	5.332954443	0.000331441	0.000961503	0.018085696
1.A.2.j - Wood and wood products - Liquid Fuels	CH_4	5	50.79	1.13302E-08	6.32889E-06	1.51465E-05
1.A.2.j - Wood and wood products - Liquid Fuels	N_2O	5	200.79	1.52964E-06	7.38693E-05	4.47183E-05
1.A.2.k - Construction - Liquid Fuels	CO_2	5	5.332954443	0.000397093	0.004205078	0.019796044
1.A.2.k - Construction - Liquid Fuels	CH_4	5	50.79	1.37317E-08	3.39276E-05	1.66746E-05
1.A.2.k - Construction - Liquid Fuels	N_2O	5	200.79	1.85386E-06	0.000395995	4.92299E-05
1.A.2.l - Textile and Leather - Liquid Fuels	CO_2	5	5.332954443	0.00021198	0.002571817	0.014463726
1.A.2.l - Textile and Leather - Liquid Fuels	CH_4	5	50.79	5.00815E-09	2.24194E-05	1.00701E-05
1.A.2.l - Textile and Leather - Liquid Fuels	N_2O	5	200.79	5.93413E-07	0.000260358	2.78528E-05
1.A.2.m - Non-specified Industry - Liquid Fuels	CO_2	5	5.332954443	7.67726E-05	0.001809307	0.008704334
1.A.2.m - Non-specified Industry - Liquid Fuels	CH_4	5	50.79	2.55555E-09	1.66412E-05	7.19344E-06
1.A.2.m - Non-specified Industry - Liquid Fuels	N_2O	5	200.79	3.45014E-07	0.000194232	2.12378E-05
1.A.2.m - Non-specified Industry - Solid Fuels	CO_2	5	12.46005477	0	0.007654517	0
1.A.2.m - Non-specified Industry - Solid Fuels	CH_4	5	200	0	0.000272746	0

1.A.2.m - Non-specified Industry - Solid Fuels	N_2O	5	222.2222222	0	0.000671042	0
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO_2	5	5.97	0.00100705	0.000811898	0.029594417
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH_4	5	100	3.59034E-09	1.99723E-06	4.34603E-06
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N_2O	5	150	2.81269E-05	0.000176897	0.000256623
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO_2	5	5.97	5.46434E-05	0.000179539	0.006893716
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH_4	5	100	1.94815E-10	4.41642E-07	1.01236E-06
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N_2O	5	150	1.52619E-06	3.91169E-05	5.97777E-05
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO_2	5	5.09	0.648178272	0.029494794	0.819447235
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH_4	5	100.69	0.000575685	0.000276806	0.001728377
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N_2O	5	150.94	0.075179613	0.014596664	0.013184837
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO_2	5	5.09	0.005356845	0.002683958	0.074495204
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH_4	5	100.69	4.75773E-06	2.51641E-05	0.000157125
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N_2O	5	150.94	0.000621319	0.001326991	0.001198622
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO_2	5	5	0.131532243	0.013177368	0.372476017
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH_4	5	100	0.000117323	0.000124958	0.000785626
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N_2O	5	150.67	0.015477518	0.006623042	0.005993108
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO_2	5	5	0.001454878	0.000627924	0.039173787
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH_4	5	100	2.91703E-05	0.000125592	0.000391738
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N_2O	5	150.67	0.000135502	0.000270873	0.000560756
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO_2	5	5	0.018695895	0.004870368	0.140428525
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH_4	5	100	0.000374853	0.000974251	0.001404285
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	5	150	0.00172583	0.002091896	0.002010175
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	5	4.09	0.000624103	0.000796743	0.028085417

1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	5	100.69	1.52009E-05	0.000196154	0.000280854
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	5	150.94	6.98987E-05	0.000420914	0.000402031
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO_2	5	3.068260841	0	0	0
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH_4	5	244.6927575	0	0	0
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N_2O	5	209.9375843	0	0	0
1.A.3.c - Railways - Liquid Fuels	CO_2	5	5.02	2.77985E-05	0.000103693	0.005404113
1.A.3.c - Railways - Liquid Fuels	CH_4	5	100.6	5.618E-07	2.07801E-05	5.40411E-05
1.A.3.c - Railways - Liquid Fuels	N_2O	5	150	2.55585E-06	4.43527E-05	7.73576E-05
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO_2	5	4.53	0.000327596	0.000417299	0.019481895
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CH_4	5	100	2.55321E-06	5.32834E-05	0.000115896
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	N_2O	5	140	1.8407E-05	0.000143155	0.00022241
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO_2	5	4.53	0.000618875	0.000408333	0.026777075
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH_4	5	100	5.87747E-06	5.50048E-05	0.000175841
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N_2O	5	140	3.74375E-05	0.000145271	0.000317187
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO_2	5	5.332954443	0.008296871	0.006264054	0.090487693
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH_4	5	50	1.68103E-06	0.00031427	0.00018738
1.A.4.a - Commercial/Institutional - Liquid Fuels	N_2O	5	200.79	1.67937E-05	0.000748865	0.000148171
1.A.4.b - Residential - Liquid Fuels	CO_2	5	5.332954443	0.01938094	0.009373552	0.138299231
1.A.4.b - Residential - Liquid Fuels	CH_4	5	50	2.6766E-06	0.000124836	0.000236444
1.A.4.b - Residential - Liquid Fuels	N_2O	5	200.36	4.73869E-06	1.54064E-05	7.8877E-05
1.A.4.c.i - Stationary - Liquid Fuels	CO_2	5	5.332954443	0.00174165	0.033979702	0.04145842
1.A.4.c.i - Stationary - Liquid Fuels	CH_4	5	50	6.25189E-07	0.000872853	0.000114273
1.A.4.c.i - Stationary - Liquid Fuels	N_2O	5	200.36	7.80242E-06	0.003097961	0.000101213
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CO_2	5	5	0.015380607	0.00816801	0.127370524
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CH_4	5	100	0.000308381	0.00163386	0.001273705
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	N_2O	5	150	0.001419793	0.003508199	0.001823255

The input data in the Industrial Processes and Product Use sector, according to the Guidelines, as well as according to the INSTAT is the most reliable. Accordingly, the values of the uncertainty for activity data and emission factors are set to 10% (Table 9.2). In the same table are presented also emission factor uncertainty level, uncertainty in trend in national emissions introduced by emission factor uncertainty and uncertainty in trend in national emissions introduced by activity data.

Table 9.2: Input data for uncertainty in the IPCC Inventory Software for the Industrial Processes and Product Use sector (year 2016, in %)

2006 IPCC Categories	Gas	Activity Data	Emission Factor	Contribution to Variance by Category in Year T	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)
2.A - Mineral Industry						
2.A.1 - Cement production	CO_2	10	5	0.6756241	0.1198521	1.0678119
2.A.2 - Lime production	CO_2	6	2	5.296E-05	0.0225071	0.0100271
2.C - Metal Industry						
2.C.1 - Iron and Steel Production	CO_2	10	0	0.0002407	0	0.0225317
2.C.2 - Ferroalloys Production	CO_2	4	0	0.0003742	0	0.0280958
2.C.5 - Lead Production	CO_2	10	50	1.945E-06	0.0014047	0.0003973

Cement production is a key category related to GHG emissions in Albania. When using the estimated country (or aggregated plant) production data from national statistics, the Uncertainty for Activity data recommended is 10%, while when Reported (plant-level) cement production data are available the Uncertainty reduces to 1-2%. Assumption regarding the percentage of clinker in cement brings to an EF Uncertainty of 2-7%. The combination of both Uncertainties in Cement Category results to 11.98%.

There are limited data on forestry sector formatted as per the needs for the calculation of GHGs emissions/removals, therefore uncertainty for activity data for this sector are high, because there is lack of national cadaster to reflect all types of land use (agricultural land, forest, pastures, abandoned lands, water areas, urban area, etc.) and annual changes. Also, based on IPCC 2006 and the respective tier 1 approach results that emission factors uncertainty are with very high values as well as for the forestry sector.

Table 9.3: Input data for uncertainty in the IPCC Inventory Software for Agriculture, Forestry, and Other Land Use sector (in % year 2016)

2006 IPCC Categories	Gas	Activity Data	Emission Factor	Contribution to Variance by Category in Year T	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)
3.A - Livestock						
3.A.1.a.i - Dairy Cows	CH_4	5	30	3.5129616	0.0403075	0.4475412
3.A.1.a.ii - Other Cattle	CH_4	5	30	0.179574	0.0244721	0.1011854
3.A.1.b - Buffalo	CH_4	5	30	1.302E-07	0.0003655	8.615E-05
3.A.1.c - Sheep	CH_4	5	30	0.2765032	0.0421919	0.1255586
3.A.1.d - Goats	CH_4	5	30	0.0629601	0.0400131	0.0599141
3.A.1.f - Horses	CH_4	5	30	0.0009436	0.0038373	0.0073349
3.A.1.g - Mules and Asses	CH_4	5	30	0.0010933	0.002015	0.0078952
3.A.1.h - Swine	CH_4	5	30	9.318E-05	0.0009009	0.0023049
3.A.2.a.i - Dairy cows	CH_4	5	30	0.1433716	0.008147	0.0904124
3.A.2.a.i - Dairy cows	N_2O	5	50	0.0702831	0.0057546	0.0383144
3.A.2.a.ii - Other cattle	CH_4	5	50	0.011803	0.0063298	0.0157012
3.A.2.a.ii - Other cattle	N_2O	5	50	0.0022773	0.0027804	0.0068967
3.A.2.b - Buffalo	CH_4	5	0	5.698E-11	0	1.096E-05
3.A.2.b - Buffalo	N_2O	5	50	6.277E-09	8.096E-05	1.145E-05
3.A.2.c - Sheep	CH_4	5	0	6.726E-06	0	0.0037668
3.A.2.c - Sheep	N_2O	5	50	0.0003436	0.0015006	0.002679
3.A.2.d - Goats	CH_4	5	0	1.967E-06	0	0.0020371
3.A.2.d - Goats	N_2O	5	50	0.0001817	0.0021684	0.001948

The activity data for the Waste sector have uncertainty related to lack of measurements of daily amount of the waste production; lack of their registration; lack of solid waste data produced by industry/private enterprises and contradictory data with regards to the resident figures related to the population for the respective analyzed years. Also, based on IPCC 2006 and the respective tier 1 approach results that emission factors uncertainty are with high values as well as for the waste sector.

Table 9.4: Input data for uncertainty in the IPCC Inventory Software for Waste sector (in %, year 2016)

2006 IPCC Categories	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Contribution to Variance by Category in Year T	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)
4.A - Solid Waste Disposal						
4.A - Solid Waste Disposal	CH_4	5	30	2.762278446	0.565835745	0.396853363
4.B - Biological Treatment of Solid Waste						
4.B - Biological Treatment of Solid Waste	CH_4	30	5	7.64952E-05	0.000483803	0.01253039
4.B - Biological Treatment of Solid Waste	N_2O	30	5	6.00097E-05	0.000428512	0.011098345
4.C - Incineration and Open Burning of Waste						
4.C.1 - Waste Incineration	CO_2	5	40	5.93105E-09	4.24239E-05	1.38741E-05
4.C.1 - Waste Incineration	CH_4	5	10	2.21379E-15	2.33627E-08	3.05619E-08
4.C.1 - Waste Incineration	N_2O	5	10	1.7111E-12	6.49523E-07	8.4967E-07
4.C.2 - Open Burning of Waste	CO_2	5	40	0.000106976	0.002789498	0.001863301
4.C.2 - Open Burning of Waste	CH_4	5	10	4.43776E-05	0.001619478	0.00432707
4.C.2 - Open Burning of Waste	N_2O	5	10	3.54781E-06	0.000457906	0.001223467
4.D - Wastewater Treatment and Discharge						
4.D.1 - Domestic Waste waster Treatment and Discharge	CH_4	5	30	0.042324664	0.026575923	0.049123929
4.D.1 - Domestic Waste waster Treatment and Discharge	N_2O	5	30	0.030463684	0.024917689	0.041676146
4.D.2 - Industrial Wastewater Treatment and Discharge	CH_4	5	10	0.000224294	0.005720781	0.009727945

9.2 Results

Some of the main cause of uncertainties is related to use of proxies, extrapolations in the data collection process, use of data that do not truly represent reality, missing data, statistical random sampling error, measurement and misreporting error. The emission factor uncertainties are all IPCC 2006 methodology default. The use of default range uncertainties causes random error. Table 9.5 presents the results of the combined uncertainty for each sector and for the total whole Albanian GHG Inventory.

Table 9.5: Combined uncertainty for year 2016 using the error Propagation method by subcategory

2006 IPCC Categories	Activity Data Uncertainty	Emission Factor Uncertainty	**Combined Uncertainty**	**Uncertainty introduced into the trend in total national emissions**
	(%)	(%)	**(%)**	**(%)**
1 - Energy	22.59%	432.62%	**33.17%**	**1.92%**
2 - Industrial Processes and Product Use	8.36%	24.57%	**6.37%**	**0.37%**
3 - Agriculture, Forestry, and Other Land Use	147.62%	147.62%	**50.98%**	**2.96%**
4 - Waste	17.72%	37.04%	**8.59%**	**0.50%**
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	6.70%	6.70%	**0.88%**	**0.05%**
Total	28.91%	226.19%	**100.00%**	**5.802%**

Following very important conclusion could be withdrawn analyzing the results presented in the above-mentioned table 9.5: combined uncertainty for the year 2016 of for Albanian GHG inventory is 5.802%. Base year for assessment of uncertainty in trend 2009 – 2016) and this is acceptable for the year 2016:

- **Contribution of the Agriculture, Forestry, and Other Land Use sector in total uncertainty is the highest one with 50.98% versus total one. This very high contribution to total uncertainty of AFOLU is related to limited data on forestry sector, lack of national cadastre and emission factors uncertainty which are with very high values for the forestry sector.**
- Contribution of the Energy sector in total uncertainty is the second one with 33.17% versus total one;
- Contribution of the Waste sector in total uncertainty is the third one with 8.59% versus total one;
- Contribution of the Industrial Processes and Product Use sector in total uncertainty is the lowest one with 6.37% versus total one.

- Total uncertainty of the trend in total national emissions of for Albanian GHG inventory is 5.161% and this is relatively acceptable for the whole time series 2009-2016.

For more detailed analyses regarding the full evaluation of uncertainty level please look at the Annex V.

10 QA/QC and verification Activities

The implementation of Quality Assurance and Quality Control (QA/QC) procedures is an important part of the development of national GHG inventories. As described in the IPCC Good Practice Guidance and the latest IPCC Guidelines (2006), an adequate QA/QC program ensures:

- Continuous improvement;
- Transparency;
- Consistency;
- Comparability;
- Completeness;
- Accuracy and;
- Timeliness of the national GHG inventories.

Quality Assurance and Quality Control measures are two distinct types of activities. The IPCC defines each as follows:

- Quality Assurance (QA) - a planned system of review procedures conducted by personnel not involved in the inventory development process;
- Quality Control (QC) - a system of routine technical activities implemented by the inventory development team to measure and control the quality of the inventory as it is prepared.

An effective QA/QC plan contains the following elements:

- GHG Inventory team;
- General QC activities and procedures;
- Source-specific QC activities and procedures (optional, as resources allow);
- QA review procedures.

The Albanian approach towards QA/QC introduction in the national GHG inventory process is based on the in-depth analyses of the current practices of the inventory compilation in the country and the relevant international best practices. The resulting QA/QC plan was presented/adopted in previous national communications and is proved to be effective in achieving the above-mentioned objectives and as such is planned to be implemented even in the process of development of the Fourth national Communication and forthcoming Biennial Update Reports.

10.1 Organisational mandates

The Ministry of Tourism and Environment, as the national focal point for climate change, was responsible for the final sign-off of the GHG inventory contained in this report. National technical experts were contracted by the UNDP under the Climate Change Programme to carry out the update of the GHG inventory/national report. This project-based update was performed over a yearlong project by six national experts: Technical Coordinator, Energy Sector, IPPU Sector expert, AFOLU Sector expert, Waste Sector expert, and a national data collection expert. The project was co-ordinated by UNDP in collaboration with the National Environment Agency and the Ministry for Tourism and Environment. The data collection process for the GHG inventory have not yet been formalized in Albania. However, many of the key datasets including the Energy Balance are officially reported datasets by organisations such as INSTAT, which ensures the quality and completeness of the data.

Albania recently endorsed the Climate Change Law (December 2020), after which the Decision on MRV will formalize roles and responsibilities for the co-ordination, monitoring, reporting and verification of the GHG inventory. This Decision will also formalize data collection ensuring that data providers produce relevant datasets to the national compilation teams in a timely manner and in the format required for their calculations. These are detailed in data reporting templates within the Decision itself. It is envisaged that the corresponding Decision on MRV will be endorsed by mid-2022.

10.2 Expertise

Although the work was performed by experts contracted for a short-term project, the national individuals chosen for the work have a wealth of experience in compiling the Albanian national inventory. For the Energy, AFOLU and Waste sectors, the national experts were also involved in the TNC, SNC and FNC. For the IPPU sector, there was a new national expert who was able to communicate with and learn from the national expert that was involved in the previous inventory. This shows that whilst Albania has a short-term project-based system for developing GHG inventories and projections, there is strong national knowledge and pool of experts present within the country ensuring the previous work is built upon to improve the next cycle of work.

Several trainings were provided to the national experts, besides a through week-long course focussing on the 2006 IPCC Guidelines and the accompanying IPCC Software, all of them funded by the UNDP/UNEP/GEF Global Support Programme. They enabled the national experts to use the 2006 Guidelines when developing the inventory rather than the 1996 Guidelines, which were used for the TNC. The project team undertook an impact assessment of the change in Guidelines to fully understand the implications of moving to the newer Guidelines.

The national experts also had access to GHG Management Institute's online IPCC training courses, which provides training on emission sources and estimation methodologies based on the 2006 IPCC Guidelines. Although the work is conducted through short-term, project-based contracts, the national experts could attend all meetings, discussions, and training regarding the GHG inventory and projections.

Throughout the compilation process, QA/QC activities were performed by the national experts and relevant stakeholders. The Technical Coordinator was responsible for checking the calculations and outputs for all sectors; there were weekly meetings with the team to discuss quality issues and agree on solutions; the UNDP Climate Change Programme as co-ordinator of the project reviewed the outputs; a stakeholder workshop was performed to present the preliminary results to relevant stakeholders and therefore receive their feedback to improve the data, assumptions and methodologies; a peer review exercise was conducted through UNDP during which the information was reviewed and recommendations on improvements were provided. Finally, another round of deep QA/QC is performed in the frame of the revision of the Albanian NDC. An international consortium in cooperation with the Albanian national experts looked very closely to the activity data and calculations to provide for the GHG emissions (2009-2016) as to ensure alignment with the analysis performed to revise the national target for GHG reduction until 2030 with 2016 as the base year. Two Steering Committee meetings were organised, one to present the preliminary findings of the NIR and the second one to come up with the endorsement of the report. Finally, Albania looks forward to benefitting from the International Consultation and Analysis (ICA) process, which will contribute towards capacity-building and lead to further improvements in the quality of subsequent BURs.

The national experts provide, along with the required reporting outputs for the BUR, methodological documentation to transparently explain the assumptions, methods and data used to compile the estimates. This supports the sustainability of the MRV system.

Through the Climate Change Law, it is envisaged that the National Environment Agency (NEA) will take a more active role in the development of the GHG inventory and projections. The NEA currently compiles the air pollution inventory under the CLRTAP and, therefore, has knowledge of the compilation processes for an inventory. However, it does not currently have knowledge of the GHG inventory and projections. If the NEA are to provide a more active role in this area, then knowledge transfer is key. This could be conducted through a project during which the national experts support the designated experts in the NEA with the compilation of the next GHG inventory and projections.

10.3 Data flows

The data used in the compilation of the GHG inventory is provided on an ad-hoc basis and the data requests are not formalized to ensure that the information is provided to the team in a timely manner. Some of the key datasets including the Energy Balance are published and therefore publicly available to the team. For other datasets, the national experts provide a template for the information that they require in the format needed for their calculations. There are still gaps in the data obtained for the calculations and areas where expert judgement, interpolation or extrapolation has been used. There are some instances where data provided by stakeholders did not meet the quality standards required to be included in the calculations. These data availability limitations lead to increased uncertainties in the resulting analyses.

The Implementation of the Climate Change Law will formalize the data request process and timelines for the GHG inventory. The accompanying MRV Decision will provide data providers with clear templates for the data required. This formalization of the data flow is seen as a priority improvement to the current QA/QC system for the GHG inventories.

10.4 Systems and tools

The underlying data, information and documentation related to the GHG inventory is archived at UNDP. The information is also stored on the local computers of the national experts. There are, therefore, two copies of all electronic files in two different locations. This comprehensive archiving process supports the robustness of the QA system.

The GHG inventory was compiled using the IPCC Software (version 2.691). Training in the use of all this software packages has been provided to the national experts.

The Climate Change Law envisages the Ministry of Tourism and Environment, and the NEA having a more active role in the coordination and compilation work regarding the GHG inventory. As such, the knowledge of the application of these tools will need to be transferred to these organisations. There is currently no system used to collate information related to these activities and Albania envisages the implementation of an MRV tool to support this collation and tracking of information.

10.5 Stakeholder engagement

During the project, stakeholder engagement activities took place. The national experts had meetings with data providers to discuss the reliability and trends of the data. There is a steering committee for the project, which includes representatives from relevant ministries, NEA and INSTAT, who were consulted on the preliminary findings of the project. There was a national stakeholder workshop during which the draft outputs were presented for comment. Through these engagement activities, the national experts also conducted training for the ministries, NEA and universities to develop additional national expertise and understanding of the process and outputs.

During the project, a Steering Committee was established to provide information and policy guidance. The Steering Committee was regularly updated on the progress and outcomes from the project. This approach to stakeholder engagement was also implemented during the Third National Communication project. These Steering Committees are not permanent structures and do not run beyond the end of the project. This approach to stakeholder engagement is affective during the project, but the envisaged reestablishment of the Inter-ministerial Committee on Climate Change will provide a long-term and stable forum for these activities.

There has not yet been any engagement with the public. It is envisaged that a public facing website will be developed by the end of 2021 to provide visitors with information related to climate change. This information may also include summaries of the GHG inventories.

10.6 Recommendations

Table 10.1: Recommendations for future inventories

Element	Recommendation	Priority
Organisational mandates	Finalise and implement the Decision on monitoring and reporting GHG emissions and other information relevant to climate change at the national level	Medium
Organisational mandates	Clarify the roles and responsibilities within the GHG inventory system considering the data flows	Medium
Organisational mandates	Increase the capacity of the Ministry for Tourism and Environment allocating personnel to the management of GHG inventories' related analysis	High
Organisational mandates	Increase the capacity of the NEA so they can take on the new roles and responsibilities detailed in the Decision.	High
Organisational mandates	Transfer knowledge from project-based national experts to the NEA	Low
Expertise	Training for the NEA on GHG inventories.	Low
Expertise	Mentoring for the next inventory compilation team through which international and national experts are available throughout the compilation process to answer questions and provide guidance.	Medium
Expertise	Nominate experts to take part in the UNFCCC Review of GHG inventories and therefore undertake the training and examinations for GHG inventories provided by UNFCCC	Low
Data flows	Map the data flows applicable to the GHG inventory system to highlight gaps and weaknesses in the data flows and then identify actions to overcome these gaps and weaknesses	Medium
Systems and tools	Set-up a central file storage system managed by the Ministry of Tourism and Environment where all files can be stored and accessed by relevant stakeholders.	Low
Stakeholder engagement	Re-establish the Inter-ministerial Committee on Climate Change	High
Stakeholder engagement	Identify engagement activities that can be carried out to increase the publicity and understanding of climate change activities in Albania. This could include a public-facing website via Ministry of Tourism and Environment containing information and infographics that are easy to digest.	Low

11 Good practices, problems encountered, improvements and recommendation

The following section describes the methodologies applied for filling data gaps used almost for all sectors. Application of the proposed methodologies for filling the data gaps can be used at a later stage, likely under preparation of the GHG Inventory for the needs of the Fourth national Communication of Albania oi the UNFCCC and forthcoming BURs, which is expected to start soon. The proposed methodology is subject to further adjustments and improvement, based on other countries experiences, proposals and methodologies developed under a previous regional project on GHG inventories and previous National Communications.

11.1 Energy sector

Good practices/improvements:

- *Interpolation and extrapolation* used for filling different data gaps where possible and give reliable results.
- *Data* and *inventories* produced under *other domestic and international projects* (studies) in the frame of other international agreements where Albania is a Party to in the field of environmental protection as well as in the field of energy/transport, agriculture, land use change and forestry, industry and solvents:
    - *1st, 2nd and 3rd Energy Efficiency Action Plan and 1st and 2nd RES Action Plan* have also been used for calibrating different activity data for the energy and transport sector.
    - *NAMA study "Financing Mechanism for Energy Efficiency in Buildings (Energy Efficiency Fund)"* related to supporting the implementation of the National Energy Efficiency Action Plan (NEEAP) in the residential, public and commercial sector - has been used for calibrating different activity data for the energy consumption and the residential and service sector.
    - *Revised NDC and the draft National Action plan on Climate and Energy* – both processes are used to calibrate for the results of the GHG inventory.

Recommendations for future inventories:

- INSTAT is the State Statistics Office which has an intention to fully respond to EU requirements for information in all sectors. There is a need to establish a suitable category of disaggregated information/data which can be easily used for the needs of the GHG inventories preparation. The necessary secondary legislation and guidelines should be developed to specify the types of data to be provided, the data providers, the data collection forms to be used, and procedures and requirements for providing the data to INSTAT, as appropriate, from all relevant economic sectors in terms of climate change.

- Ministry of Infrastructure and Energy must prepare a Road Map for establishment of energy data base/preparation of the National Energy Balances of Albania (Road Map). The Road Map will provide a long-term legal framework for data collection from the whole range of Albania's energy sources, including supply, transformation, losses, and consumption. Approval and implementation of this Road Map will be the top important base for improvement of GHG Inventory from Energy, Transport and part of Fuel Wood consumption for energy purposes: based on the key source analysis this will improve almost 65% of total GHG emission categories and will create the basis for establishment of the Biennial GHG Inventory.

- There is a need to develop a data collection system to capture/improve data on the characteristics of the Albanian vehicle (passenger and freight) road transport stock.

11.2 IPPU sector

Good practices/improvements:

- Double check of the collected/reported data from different Institutions before their using. It is reported a considerable amount of Aluminum production in Albania, while in fact is not production rather than use in different sectors of industry. The emissions in this category are created during the production and not during use, as such even there is a reported amount of aluminum production in Albania, no emissions are considered from this category, as aluminum is imported in ingots.

- *NAMA study "Fuel switch in the cement sector – use of non-hazardous waste as fuel"* has been used for calibrating activity data related to the cement sector.

- The calculations of the emissions from the F-gases is complicated, while you must consider also the "bank" of gases in every year. For the F-gases, their emissions are calculated using the Excel file recommended by the IPCC. Use of data reported under the LRTAP Convention and UNIDO data base were of assistance in the process.

- *Revised NDC*- process used to calibrate for the results of the GHG inventory.

Recommendations for future inventories:

- For the key category of cement production, detailed or reported data (plant-level) for cement production and export, identifying each type of cement produced/exported, would be better in the future in order to lower the uncertainty in this category.

- For the F-gases used as substitutes of Ozone Depleting Substances, national statistics have been available for the total use of these gases in different subcategories such as refrigeration, air conditioning, foam blowing agents and fire protection. As Albania is a net importer of these gases, a detailed inventory of these gases at the custom offices would be ideal for future inventories, keeping also regular data for the total amount of different gases imported for each subcategory.

- The data required in the GHG inventory should be part of usual reporting of related businesses by the in-line ministries in charge of Energy and Environment or their agencies. Such data should be a must in the annual reporting of those ministries, such as the "Annual Environment Report".

- Most of the data required in the GHG inventory are not part of the National Statistics – INSTAT. It is recommended that these data be also part of INSTAT, increasing as such the collaboration between Institutions.

11.3 AFOLU sector

Good practices/improvements

- Under BUR1, all GHGs inventories are based on IPCC software, which consists in a significant improvement regarding GHGs calculation for AFOLU sector. Different from previous inventories, Agriculture and FOLU are now a single sector. In this way, systematization and processing of data is easier thanks to the software. Besides, the software offers a better opportunity to choose variables closer to situations like Albania.

- The calculations of the sub-sectors and specific aspects of land use categories give a more reliable result on the total GHG estimate from AFOLU sector and gives a more detailed view.

- Another improvement comes from assessment of uncertainty for each subcategory and emission factor. This makes the GHG inventory more detailed and complete.

- On the other side, the drastic changes in the forest fund have complicated the situation regarding the accurate data from this subsector. Furthermore, since AFOLU covers all land use categories, specific data from each of those land use categories is a significant shortcoming in the calculation of GHGs.
- *Using the data from the recent draft of improved forest cadaster* and the national cadaster of the territory of the Republic of Albania are a necessary condition for having correct data regarding land use change.
- *Revised NDC*- process used to calibrate for the results of the GHG inventory.
- AFOLU includes greenhouse gas emissions released from burning of fuel wood, charcoal, and vegetal wastes, which activity data especially as concerns the rural areas have data gaps. Therefore, it is very important to have a clearer situation concerning fuel wood consumption in different economic sectors especially in households, services, and industry sectors. To cope with*, the results of the biomass survey carried out by the end of the TNC* are used under the BUR1 to mitigate the uncertainties regarding the fuel wood consumption.

Recommendations for the future inventories:

- Monitoring of surfaces that are forested in years: during the past years, there are implemented afforestation/reforestations with forest species in the country, but no accurate data exist on the state of those afforestation. It is important to verify in the field those surfaces, to see the effectiveness of afforestation/reforestations, and to provide relevant recommendations to improve the situation in several fields.
- Monitoring of silvicultural interventions in forest areas: although considerable funds are spent for the improvement of forest, no accurate data exist on the change of biomass in the areas with silvicultural interventions. Therefore, the monitoring of those surfaces is proposed to analyze the effectiveness of the performed silvicultural interventions.
- Monitoring of burned surfaces: it poses a problem associated with GHG inventory for the FOLU sector. This is because the staff of foresters that make the reporting cadaster are not trained in qualitative and quantitative assessment of forest burned areas.
- Planting of fast-growing species: due to the increasing demand for firewood, as well as the high price of electricity and the necessity to protect the river embankments, the process of planting with fast growing species (poplar, willow etc.) is proposed and has started. Those species, except for the function of firewood production, offer protection from floods and soil degradation and contribute to climate change mitigation.
- Improving the energy efficiency of firewood: most of firewood consumers, do not know how to efficiently benefit from the use of firewood. A part of them do not have the necessary equipment (e.g., efficient stoves, special places for storage of firewood, etc.), while another part do not have relevant knowledge on the issue. Therefore, a public awareness campaign is proposed to be combined with some pilot projects as good examples.
- Enteric fermentation and manure management figures for each animal category for the years 2010-2016 are gathered from different publications of the Institute of Veterinary. To reduce uncertainty for enteric fermentation and manure management categories, it is very important to collaborate with INSTAT to introduce a Survey for defining the activity data about enteric fermentation and manure management for each animal category of Albanian Livestock.
- Also, in addition to the quantitative aspect of the data, they must be qualitative, giving details about the changes in the respective biomass.

11.4 Waste sector

Good practices/improvements:

There have been several improvements from the Third National Communication Assessment:

- There are new estimates for the subsectors of Biological treatment of solid waste, Waste incineration, Open burning of waste, Industrial wastewater treatment and discharge. The calculations of the new subcategories give a more reliable result on the total GHG estimate.

- The country efforts in solid waste management and wastewater treatment have also brought to better waste datasets. The continuous work for the preparation of National Communications and their findings and publications has improved the climate change awareness of environmental institutions and other stakeholders.

- *NAMA study "Fuel switch in the cement industry"*.
- *Revised NDC*- process used to calibrate for the results of the GHG inventory.

Recommendations for future inventories:

- The MSW data should be based on direct measurements of the incoming flows at each waste collection facility. The measurements should be reported regularly to the regional and national environmental agency to process the data further. There is no separate register for waste generation from non-household activities. There should be a register of waste generated by industrial activities or any kind of non-household activity. Related data should contain at least the quantity of waste, its composition, its generation date, and the final disposal destination of them.

- One of the biggest environmental challenges Albania is facing is the establishment of the collection and treatment system of the wastewater. For the time series 2005, 2009-2016 all the wastewater emission data are obtained through the population figures and IPCC methodology default values. There should be set up a register of wastewater quantities, collection, and treatment routes. The treatment systems should be reported in detail in order to obtain emissions and residues from the treatment process. The register should clearly specify what percentage of population is served by the respective wastewater treatment system.

- Industrial wastewater should be reported separately. Their treatment systems should be constructed according to the quantities and composition of this wastewater. The industrial wastewater register should contain data at least regarding the quantities, time and location of generation, treatment system technology and respective treatment time and the treated water receiving environment.

- There should be a clear definition of roles and responsibilities within environmental and other related institutions regarding data collection. There should be capacity building programs for the data quantity and quality. With the application of the higher tiers', quality data will be always more obligatory. As the communication and digitalization of information move fast forward so should the data flow necessary for more accurate, complete, comparable, consistent, and transparent inventory.

Finally, in view of their importance to national policy, statistics on emissions should become part of the regular production and dissemination process of official statistics at national level with appropriate institutional arrangements firstly established in the Ministry of Tourism and Environment, National Environmental Agency and in INSTAT.

Attachments

ANNEX I: Contribution of CO_2, CH_4, N_2O and CO_2eq. GHGs from the Energy subsectors (Gg)

Sub sector	Gases	2009	2010	2011	2012	2013	2014	2015	2016
1 - Energy	CO_2	4121.56	4125.98	4175.47	4032.26	4052.31	4465.48	4593.53	4560.50
	CH_4	7.755	7.922	7.898	7.860	7.854	10.191	7.706	7.691
	N_2O	0.179	0.175	0.182	0.175	0.578	0.216	0.187	0.189
	CO_2 eq.	**4339.96**	**4346.70**	**4397.87**	**4251.64**	**5026.37**	**4746.43**	**4813.45**	**4780.71**
1.A - Fuel Combustion Activities	CO_2	4117.98	4122.41	4171.90	4028.68	4048.74	4461.90	4589.96	4556.92
	CH_4	2.964	3.130	3.106	3.067	3.061	5.398	2.912	2.898
	N_2O	0.170	0.166	0.173	0.166	0.568	0.206	0.178	0.180
	CO_2 eq.	**4232.79**	**4239.52**	**4290.69**	**4144.44**	**4919.17**	**4639.23**	**4706.24**	**4673.50**
1.A.1 - Energy Industries	CO_2	330.73	335.20	332.25	332.39	335.93	336.39	336.70	337.05
	CH_4	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
	N_2O	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	CO_2 eq.	**331.78**	**336.26**	**333.31**	**333.44**	**337.00**	**337.46**	**337.77**	**338.13**
1.A.2 Manufacturing and Construction	CO_2	801.97	835.45	1061.31	874.10	811.63	1119.28	1134.60	1074.74
	CH_4	0.046	0.035	0.049	0.041	0.039	0.049	0.051	0.051
	N_2O	0.008	0.007	0.009	0.007	0.007	0.009	0.009	0.009
	CO_2 eq.	**805.38**	**838.23**	**1065.14**	**877.19**	**814.56**	**1122.99**	**1138.45**	**1078.74**
1.A.3 Transport	CO_2	2299.64	2325.48	2327.04	2217.25	2278.29	2383.35	2462.94	2489.42
	CH_4	0.366	0.398	0.379	0.353	0.368	0.380	0.389	0.379
	N_2O	0.116	0.117	0.117	0.111	0.114	0.120	0.124	0.125
	CO_2 eq.	**2343.34**	**2369.95**	**2371.23**	**2259.21**	**2321.49**	**2428.47**	**2509.53**	**2536.27**
1.A.4 - Other Sectors (Residential & Service)	CO_2	499.67	569.96	257.24	407.01	421.00	421.00	445.66	445.66
	CH_4	2.451	2.657	2.573	2.566	3.254	4.860	2.360	2.355
	N_2O	0.034	0.037	0.035	0.035	0.044	0.066	0.033	0.033
	CO_2 eq.	**561.80**	**637.38**	**322.24**	**471.85**	**502.83**	**543.51**	**505.34**	**505.21**
1.A.5 - Non-Specified (Agriculture)	CO_2	185.97	56.33	194.05	197.93	201.89	201.89	210.05	210.05
	CH_4	0.089	0.027	0.092	0.094	0.096	0.096	0.100	0.100
	N_2O	0.009	0.003	0.009	0.009	0.009	0.009	0.010	0.010
	CO_2 eq.	**190.49**	**57.69**	**198.77**	**202.75**	**206.80**	**206.80**	**215.16**	**215.16**

1.B - Fugitive emissions from fuels	CO_2	3.5760	3.5761	3.5761	3.5762	3.5764	3.5764	3.5765	3.5765
	CH_4	4.791	4.792	4.792	4.793	4.793	4.793	4.793	4.793
	N_2O	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	CO_2 eq.	**107.17**	**107.18**	**107.18**	**107.20**	**107.20**	**107.20**	**107.21**	**107.21**
	CO_2	15.8826	16.0412	16.2020	16.5273	16.6925	16.6925	16.8600	16.85997
	CH_4	0.0015	0.0015	0.0015	0.0016	0.0016	0.0016	0.0016	0.0016
	N_2O	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	0.0005
International Marine Bunkers	**CO2 eq.**	**16.047**	**16.207**	**16.370**	**16.698**	**16.865**	**16.865**	**17.034**	**17.034**
	CO_2	46.381	46.524	47.313	48.265	48.747	48.747	49.235	49.235
	CH_4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
	N_2O	0.0013	0.0013	0.0013	0.0013	0.0014	0.0014	0.0014	0.0014
International Aviation Bunkers	**CO2 eq..**	**46.38**	**46.53**	**47.31**	**48.27**	**48.75**	**48.75**	**49.24**	**49.24**
	CO_2	61.8585	62.1587	63.1017	64.3701	65.0136	65.0136	65.6644	65.6644
	CH_4	0.0018	0.0018	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019
	N_2O	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
International Bunkers	**CO_2 eq.**	**62.428**	**62.731**	**63.683**	**64.963**	**65.613**	**65.613**	**66.269**	**66.269**

ANNEX II: Contribution of CO_2, CH_4, N_2O and CO_2eq. GHGs from the Industrial Processes and Product Use subsectors (Gg)

Categories	2009			2010			2011			2012			2013			2014			2015			2016		
	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N2O	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N_2O	Net CO_2	CH_4	N_2O
	(Gg)			(Gg)			(Gg)			(Gg)			(Gg)			(Gg)			(Gg)			(Gg)		
2 - Industrial Processes and Product Use	**1357.642**	**0.000**	**0.000**	**967.320**	**0.000**	**0.000**	**1124.811**	**0.000**	**0.000**	**1153.718**	**0.000**	**0.000**	**1244.833**	**0.000**	**0.000**	**1193.813**	**0.000**	**0.000**	**1080.837**	**0.000**	**0.000**	**1019.892**	**0.000**	**0.000**
2.A - Mineral Industry	671.446	0.000	0.000	872.404	0.000	0.000	1011.379	0.000	0.000	1056.891	0.000	0.000	1145.924	0.000	0.000	1065.005	0.000	0.000	974.293	0.000	0.000	894.250	0.000	0.000
2.A.1 - Cement production	585.000	NA	NA	837.737	NA	NA	1011.379	NA	NA	1056.891	NA	NA	1128.600	NA	NA	1044.900	NA	NA	954.113	NA	NA	880.470	NA	NA
2.A.2 - Lime production	86.446	NA	NA	34.667	NA	NA	34.879	NA	NA	17.391	NA	NA	17.324	NA	NA	20.105	NA	NA	20.180	NA	NA	13.780	NA	NA
2.A.3 - Glass Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	#REF!	#REF!	#REF!	NO	NO	NO	NO	NO	NO
2.B - Chemical Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C - Metal Industry	671.351	0.000	0.000	80.034	0.000	0.000	98.444	0.000	0.000	82.099	0.000	0.000	77.507	0.000	0.000	102.389	0.000	0.000	95.068	0.000	0.000	76.823	0.000	0.000
2.C.1 - Iron and Steel Production	635.104	0.000	NA	50.139	0.000	NA	60.721	0.000	NA	50.402	0.000	NA	44.981	0.000	NA	56.502	0.000	NA	37.880	0.000	NA	18.579	0.000	NA
2.C.2 - Ferroalloys Production	35.447	0.000	NA	29.273	0.000	NA	37.053	0.000	NA	31.223	0.000	NA	32.110	0.000	NA	45.366	0.000	NA	56.770	0.000	NA	57.916	0.000	NA
2.C.3 - Aluminium production	0.800	NA	NA	0.000	NA	NA	0.000	NA	NA	0.000	NA	NA	0.000	NA	NA	0.000	NA	NA	0.000	NA	NA	0.000	NA	NA
2.C.4 - Magnesium production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.5 - Lead Production	0.000	NA	NA	0.622	NA	NA	0.670	NA	NA	0.474	NA	NA	0.416	NA	NA	0.521	NA	NA	0.418	NA	NA	0.328	NA	NA
2.C.6 - Zinc Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

2.D - Non-Energy Products from Fuels and Solvent Use	14.844	0.000	0.000	14.882	0.000	0.000	14.988	0.000	0.000	14.579	0.000	0.000	13.807	0.000	0.000	10.469	0.000	0.000	11.477	0.000	0.000	14.277	0.000	0.000
2.D.1 - Lubricant Use	14.844	0.000	0.000	14.882	0.000	0.000	14.988	0.000	0.000	14.579	0.000	0.000	13.807	0.000	0.000	10.469	0.000	0.000	11.477	0.000	0.000	14.277	0.000	0.000
2.D.2 - Paraffin Wax Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.3 - Solvent Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.D.4 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E - Electronics Industry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F - Product Uses as Substitutes for ODS	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.148	0.000	0.000	7.594	0.000	0.000	15.950	0.000	0.000	24.663	0.000	0.000	34.543	0.000	0.000
2.F.1 - Refrigera-tion and Air Condi-tioning	NE	NA	NA	NE	NA	NA	NE	NA	NA	0.148	NA	NA	7.594	NA	NA	15.950	NA	NA	24.663	NA	NA	34.543	NA	NA
2.F.2 - Foam Blow-ing Agents	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA
2.F.3 - Fire Pro-tection	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA	IE	NA	NA
2.F.4 - Aerosols	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA
2.F.5 - Solvents	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA	NE	NA	NA
2.F.6 - Other Applications (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H - Other	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H.1 - Pulp and Paper Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2.H.2 - Food and Beverages Industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.470	NA
2.H.3 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

ANNEX III: Contribution of CO_2, CH_4, N_2O and CO_2eq. GHGs from the Agriculture, Land Use Change and Forestry subsectors (Gg)

Sub sector	GHG Gas	2009	2010	2011	2012	2013	2014	2015	2016
3 - Agriculture, Forestry, and Other Land Use	CO_2	1749.061	4499.488	5472.631	1457.538	1345.247	1417.835	1463.036	1618.136
	CH_4	67.271	67.072	67.968	68.193	68.860	69.340	68.859	66.937
	N_2O	2.280	2.423	2.406	2.422	2.486	2.493	2.512	2.329
	CO_2 eq.	**3953.164**	**6743.303**	**7731.212**	**3725.690**	**3648.188**	**3733.379**	**3773.418**	**3829.997**
3.A - Livestock	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CH_4	67.228	66.743	67.833	68.185	68.856	69.325	68.828	66.902
	N_2O	0.273	0.272	0.275	0.275	0.278	0.279	0.276	0.272
	CO_2 eq.	**1496.360**	**1485.884**	**1509.891**	**1517.234**	**1532.200**	**1542.363**	**1531.031**	**1489.212**
3.B - Land	CO_2	1726.056	4469.280	5444.205	1428.771	1314.081	1385.935	1430.403	1592.056
	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CO_2 eq.	**1726.056**	**4469.280**	**5444.205**	**1428.771**	**1314.081**	**1385.935**	**1430.403**	**1592.056**
3.C - Aggregate sources and non-CO2 emissions sources on land	CO_2	23.005	30.208	28.426	28.767	31.167	31.900	32.633	26.080
	CH_4	0.043	0.328	0.135	0.009	0.004	0.015	0.031	0.035
	N_2O	2.280	2.423	2.406	2.422	2.486	2.493	2.512	2.329
	CO_2 eq.	**730.749**	**788.139**	**777.116**	**779.685**	**801.907**	**805.081**	**811.984**	**748.729**
3.D - Other	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	CO_2 eq.	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

ANNEX IV: Contribution of CO_2, CH_4, N_2O and CO_2eq. GHGs from the Waste subsectors (Gg)

Sub sector	GHG gas	2009	2010	2011	2012	2013	2014	2015	2016
4 - Waste	CO_2	3,82	3,82	3,76	3,43	3,42	3,23	3,12	3,10
	CH_4	25,44	27,25	29,41	31,45	33,22	34,33	35,40	36,29
	N_2O	0,27	0,27	0,27	0,27	0,27	0,25	0,24	0,24
	CO_2 eq.	620,89	660,30	705,34	747,05	783,78	801,37	820,99	838,97
4.A - Solid Waste Disposal	CO_2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CH_4	20,14	21,87	24,00	25,91	27,64	29,09	30,28	31,16
	N_2O	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CO_2 eq.	423,00	459,18	503,91	544,15	580,43	610,81	635,92	654,36
4.B - Biological Treatment of Solid Waste	CO_2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CH_4	0,21	0,29	0,29	0,25	0,24	0,18	0,17	0,16
	N_2O	0,01	0,02	0,02	0,02	0,02	0,01	0,01	0,01
	CO_2 eq.	8,44	11,67	11,67	9,90	9,69	7,19	6,67	6,46
4.C - Incineration and Open Burning of Waste	CO_2	3,82	3,82	3,76	3,43	3,42	3,23	3,12	3,10
	CH_4	0,42	0,42	0,41	0,38	0,38	0,35	0,34	0,34
	N_2O	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
	CO_2 eq.	15,12	15,12	14,85	13,58	13,57	12,75	12,43	12,41
4.D - Wastewater Treatment and Discharge	CO_2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CH_4	4,67	4,67	4,71	4,91	4,96	4,71	4,61	4,62
	N_2O	0,25	0,25	0,25	0,25	0,25	0,23	0,22	0,22
	CO_2 eq.	174,33	174,33	175,17	179,37	180,11	170,52	166,25	165,84
4.E - Other (please specify)	CO_2	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CH_4	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	N_2O	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	CO_2 eq.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

ANNEX V: Base year for assessment of uncertainty in trend 2009 – 2016

ANNEX V: Base year for assessment of uncertainty in trend 2009 – 2016										
A	B	C	D	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO_2 equivalent)	Year T emissions or removals (Gg CO_2 equivalent)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities										
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO_2	0	0	7.915	0	0	0	0	0	0
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH_4	0	0	228.843	0	0	0	0	0	0
1.A.1.a.i - Electricity Generation - Liquid Fuels	N_2O	0	0	228.843	0	0	0	0	0	0
1.A.1.a.i - Electricity Generation - Solid Fuels	CO_2	0	0	13.381	0	0	0	0	0	0
1.A.1.a.i - Electricity Generation - Solid Fuels	CH_4	0	0	200.062	0	0	0	0	0	0
1.A.1.a.i - Electricity Generation - Solid Fuels	N_2O	0	0	222.278	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO_2	0	0	7.915	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH_4	0	0	228.843	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N_2O	0	0	228.843	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CO_2	0	0	13.381	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	CH_4	0	0	200.062	0	0	0	0	0	0
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Solid Fuels	N_2O	0	0	222.278	0	0	0	0	0	0
1.A.1.a.iii - Heat Plants - Liquid Fuels	CO_2	20.293	21.417	7.310	0.000	0.000	0.002	0.000	0.014	0.000
1.A.1.a.iii - Heat Plants - Liquid Fuels	CH_4	0.020	0.021	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.a.iii - Heat Plants - Liquid Fuels	N_2O	0.060	0.063	200.852	0.000	0.000	0.000	0.000	0.000	0.000

1.A.1.a.iii - Heat Plants - Solid Fuels	CO_2	4.979	5.656	7.418	0.000	0.000	0.001	0.000	0.004	0.000
1.A.1.a.iii - Heat Plants - Solid Fuels	CH_4	0.001	0.001	50.249	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.a.iii - Heat Plants - Solid Fuels	N_2O	0.023	0.026	200.282	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Liquid Fuels	CO_2	288.145	292.666	7.310	0.035	0.000	0.026	0.001	0.185	0.034
1.A.1.b - Petroleum Refining - Liquid Fuels	CH_4	0.235	0.239	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Liquid Fuels	N_2O	0.695	0.706	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Solid Fuels	CO_2	0.000	0.000	13.381	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Solid Fuels	N_2O	0.000	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Gaseous Fuels	CO_2	17.315	17.315	6.354	0.000	0.000	0.002	0.000	0.011	0.000
1.A.1.b - Petroleum Refining - Gaseous Fuels	CH_4	0.006	0.006	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.1.b - Petroleum Refining - Gaseous Fuels	N_2O	0.010	0.010	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.a - Iron and Steel - Liquid Fuels	CO_2	104.989	221.885	7.310	0.020	0.010	0.020	0.054	0.140	0.023
1.A.2.a - Iron and Steel - Liquid Fuels	CH_4	0.078	0.170	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.a - Iron and Steel - Liquid Fuels	N_2O	0.231	0.502	200.852	0.000	0.000	0.000	0.005	0.000	0.000
1.A.2.a - Iron and Steel - Solid Fuels	CO_2	23.029	0.000	13.426	0.000	0.002	0.000	0.026	0.000	0.001
1.A.2.a - Iron and Steel - Solid Fuels	CH_4	0.050	0.000	200.062	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.a - Iron and Steel - Solid Fuels	N_2O	0.111	0.000	222.278	0.000	0.000	0.000	0.002	0.000	0.000
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CO_2	119.087	219.848	7.310	0.020	0.009	0.020	0.047	0.139	0.021
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	CH_4	0.088	0.164	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.b - Non-Ferrous Metals - Liquid Fuels	N_2O	0.260	0.486	200.852	0.000	0.000	0.000	0.004	0.000	0.000
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CO_2	24.413	0.000	13.426	0.000	0.002	0.000	0.028	0.000	0.001
1.A.2.b - Non-Ferrous Metals - Solid Fuels	CH_4	0.054	0.000	200.062	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.b - Non-Ferrous Metals - Solid Fuels	N_2O	0.120	0.000	222.278	0.000	0.000	0.000	0.002	0.000	0.000
1.A.2.c - Chemicals - Liquid Fuels	CO_2	36.424	93.442	7.310	0.004	0.005	0.008	0.027	0.059	0.004
1.A.2.c - Chemicals - Liquid Fuels	CH_4	0.026	0.071	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.c - Chemicals - Liquid Fuels	N_2O	0.077	0.209	200.852	0.000	0.000	0.000	0.002	0.000	0.000
1.A.2.c - Chemicals - Solid Fuels	CO_2	5.231	0.000	13.426	0.000	0.000	0.000	0.006	0.000	0.000
1.A.2.c - Chemicals - Solid Fuels	CH_4	0.012	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.c - Chemicals - Solid Fuels	N_2O	0.026	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO_2	17.248	15.550	7.310	0.000	0.000	0.001	0.001	0.010	0.000
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH_4	0.014	0.013	51.036	0.000	0.000	0.000	0.000	0.000	0.000

1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N_2O	0.042	0.038	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.d - Pulp, Paper and Print - Solid Fuels	CO_2	6.975	0.000	13.426	0.000	0.001	0.000	0.008	0.000	0.000
1.A.2.d - Pulp, Paper and Print - Solid Fuels	CH_4	0.015	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.d - Pulp, Paper and Print - Solid Fuels	N_2O	0.034	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	78.849	74.963	7.310	0.002	0.001	0.007	0.003	0.047	0.002
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	0.063	0.060	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N_2O	0.183	0.175	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	31.388	0.000	13.426	0.000	0.003	0.000	0.036	0.000	0.001
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH_4	0.070	0.000	200.062	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N_2O	0.154	0.000	222.278	0.000	0.000	0.000	0.003	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CO_2	6.093	6.093	6.354	0.000	0.000	0.001	0.000	0.004	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	CH_4	0.006	0.006	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Gaseous Fuels	N_2O	0.018	0.018	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CO_2	15.324	47.012	19.351	0.006	0.003	0.004	0.052	0.030	0.004
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	CH_4	0.092	0.270	245.505	0.000	0.000	0.000	0.004	0.000	0.000
1.A.2.e - Food Processing, Beverages and Tobacco - Biomass	N_2O	0.181	0.532	281.863	0.000	0.000	0.000	0.009	0.000	0.000
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CO_2	17.248	15.549	7.310	0.000	0.000	0.001	0.001	0.010	0.000
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	CH_4	0.014	0.013	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.f - Non-Metallic Minerals - Liquid Fuels	N_2O	0.042	0.038	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CO_2	6.975	0.586	13.426	0.000	0.001	0.000	0.007	0.000	0.000
1.A.2.f - Non-Metallic Minerals - Solid Fuels	CH_4	0.015	0.001	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.f - Non-Metallic Minerals - Solid Fuels	N_2O	0.034	0.003	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.g - Transport Equipment - Liquid Fuels	CO_2	8.624	6.799	7.310	0.000	0.000	0.001	0.001	0.004	0.000
1.A.2.g - Transport Equipment - Liquid Fuels	CH_4	0.007	0.006	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.g - Transport Equipment - Liquid Fuels	N_2O	0.021	0.017	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.g - Transport Equipment - Solid Fuels	CO_2	3.488	0.000	13.426	0.000	0.000	0.000	0.004	0.000	0.000
1.A.2.g - Transport Equipment - Solid Fuels	CH_4	0.008	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.g - Transport Equipment - Solid Fuels	N_2O	0.017	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.h - Machinery - Liquid Fuels	CO_2	22.117	25.053	7.310	0.000	0.000	0.002	0.001	0.016	0.000
1.A.2.h - Machinery - Liquid Fuels	CH_4	0.019	0.021	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.h - Machinery - Liquid Fuels	N_2O	0.055	0.061	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.h - Machinery - Solid Fuels	CO_2	12.207	0.000	13.426	0.000	0.001	0.000	0.014	0.000	0.000
1.A.2.h - Machinery - Solid Fuels	CH_4	0.027	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000

1.A.2.h - Machinery - Solid Fuels	N_2O	0.060	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CO_2	105.835	296.590	7.310	0.036	0.017	0.026	0.090	0.187	0.043
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	CH_4	0.077	0.207	51.036	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.i - Mining (excluding fuels) and Quarrying - Liquid Fuels	N_2O	0.228	0.610	200.852	0.000	0.000	0.000	0.007	0.000	0.000
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	CO_2	19.182	0.000	13.426	0.000	0.002	0.000	0.022	0.000	0.000
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	CH_4	0.043	0.000	200.062	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.i - Mining (excluding fuels) and Quarrying - Solid Fuels	N_2O	0.094	0.000	222.278	0.000	0.000	0.000	0.002	0.000	0.000
1.A.2.j - Wood and wood products - Liquid Fuels	CO_2	25.872	28.057	7.310	0.000	0.000	0.003	0.001	0.018	0.000
1.A.2.j - Wood and wood products - Liquid Fuels	CH_4	0.022	0.023	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.j - Wood and wood products - Liquid Fuels	N_2O	0.064	0.068	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.j - Wood and wood products - Solid Fuels	CO_2	10.463	0.000	13.426	0.000	0.001	0.000	0.012	0.000	0.000
1.A.2.j - Wood and wood products - Solid Fuels	CH_4	0.023	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.j - Wood and wood products - Solid Fuels	N_2O	0.051	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.k - Construction - Liquid Fuels	CO_2	38.808	31.436	7.310	0.000	0.001	0.003	0.004	0.020	0.000
1.A.2.k - Construction - Liquid Fuels	CH_4	0.032	0.026	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.k - Construction - Liquid Fuels	N_2O	0.095	0.078	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.k - Construction - Solid Fuels	CO_2	15.694	0.000	13.426	0.000	0.001	0.000	0.018	0.000	0.000
1.A.2.k - Construction - Solid Fuels	CH_4	0.035	0.000	200.062	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.k - Construction - Solid Fuels	N_2O	0.077	0.000	222.278	0.000	0.000	0.000	0.002	0.000	0.000
1.A.2.l - Textile and Leather - Liquid Fuels	CO_2	27.849	23.763	7.310	0.000	0.000	0.002	0.002	0.015	0.000
1.A.2.l - Textile and Leather - Liquid Fuels	CH_4	0.020	0.016	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.l - Textile and Leather - Liquid Fuels	N_2O	0.056	0.046	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.l - Textile and Leather - Solid Fuels	CO_2	8.719	0.000	13.426	0.000	0.001	0.000	0.010	0.000	0.000
1.A.2.l - Textile and Leather - Solid Fuels	CH_4	0.019	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.l - Textile and Leather - Solid Fuels	N_2O	0.043	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.2.m - Non-specified Industry - Liquid Fuels	CO_2	17.248	13.356	7.310	0.000	0.000	0.001	0.002	0.008	0.000
1.A.2.m - Non-specified Industry - Liquid Fuels	CH_4	0.014	0.011	51.036	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.m - Non-specified Industry - Liquid Fuels	N_2O	0.042	0.032	200.852	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.m - Non-specified Industry - Solid Fuels	CO_2	6.975	0.000	13.426	0.000	0.001	0.000	0.008	0.000	0.000
1.A.2.m - Non-specified Industry - Solid Fuels	CH_4	0.015	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.2.m - Non-specified Industry - Solid Fuels	N_2O	0.034	0.000	222.278	0.000	0.000	0.000	0.001	0.000	0.000
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO_2	45.976	48.804	7.787	0.001	0.000	0.004	0.001	0.031	0.001
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH_4	0.007	0.007	100.125	0.000	0.000	0.000	0.000	0.000	0.000

1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N_2O	0.399	0.423	150.083	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO_2	10.728	11.369	7.787	0.000	0.000	0.001	0.000	0.007	0.000
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH_4	0.002	0.002	100.125	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N_2O	0.093	0.099	150.083	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO_2	1249.933	1351.359	7.135	0.705	0.006	0.121	0.032	0.853	0.729
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH_4	2.806	2.850	100.814	0.001	0.000	0.000	0.000	0.002	0.000
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N_2O	20.073	21.743	151.023	0.082	0.000	0.002	0.016	0.014	0.000
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO_2	113.630	122.851	7.135	0.006	0.001	0.011	0.003	0.078	0.006
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH_4	0.255	0.259	100.814	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N_2O	1.825	1.977	151.023	0.001	0.000	0.000	0.001	0.001	0.000
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO_2	568.151	614.254	7.071	0.143	0.003	0.055	0.014	0.388	0.151
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH_4	1.276	1.296	100.125	0.000	0.000	0.000	0.000	0.001	0.000
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N_2O	9.124	9.883	150.753	0.017	0.000	0.001	0.007	0.006	0.000
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO_2	70.825	68.500	7.071	0.002	0.000	0.006	0.002	0.043	0.002
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH_4	0.643	0.646	100.125	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N_2O	0.921	0.925	150.753	0.000	0.000	0.000	0.000	0.001	0.000
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO_2	214.426	245.702	7.071	0.023	0.002	0.022	0.012	0.155	0.024
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH_4	2.144	2.316	100.125	0.000	0.000	0.000	0.001	0.001	0.000
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	3.069	3.315	150.083	0.002	0.000	0.000	0.002	0.002	0.000
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	42.885	46.316	6.460	0.001	0.000	0.004	0.001	0.029	0.001
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	0.429	0.463	100.814	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	0.614	0.663	151.023	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CO_2	0.000	0.000	5.866	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	CH_4	0.000	0.000	244.744	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.v - Evaporative emissions from vehicles - Liquid Fuels	N_2O	0.000	0.000	209.997	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c - Railways - Liquid Fuels	CO_2	9.529	9.529	7.085	0.000	0.000	0.001	0.000	0.006	0.000
1.A.3.c - Railways - Liquid Fuels	CH_4	0.089	0.089	100.724	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.c - Railways - Liquid Fuels	N_2O	0.128	0.128	150.083	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO_2	15.883	16.860	6.747	0.000	0.000	0.002	0.000	0.011	0.000
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CH_4	0.032	0.033	100.125	0.000	0.000	0.000	0.000	0.000	0.000

1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	N_2O	0.133	0.141	140.089	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO_2	19.536	19.536	6.747	0.000	0.000	0.002	0.000	0.012	0.000
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH_4	0.039	0.039	100.125	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N_2O	0.163	0.163	140.089	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i - Pipeline Transport - Liquid Fuels	CO_2	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i - Pipeline Transport - Liquid Fuels	CH_4	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.i - Pipeline Transport - Liquid Fuels	N_2O	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.ii - Off-road - Liquid Fuels	CO_2	0.000	0.000	6.325	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.ii - Off-road - Liquid Fuels	CH_4	0.000	0.000	150.302	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.e.ii - Off-road - Liquid Fuels	N_2O	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO_2	158.635	149.224	7.310	0.009	0.001	0.013	0.006	0.094	0.009
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH_4	0.372	0.309	50.249	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.a - Commercial/Institutional - Liquid Fuels	N_2O	0.280	0.244	200.852	0.000	0.000	0.000	0.001	0.000	0.000
1.A.4.a - Commercial/Institutional - Solid Fuels	CO_2	0.000	0.000	13.426	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.a - Commercial/Institutional - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.a - Commercial/Institutional - Solid Fuels	N_2O	0.000	0.000	217.835	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.a - Commercial/Institutional - Biomass	CO_2	48.492	84.462	19.351	0.020	0.003	0.008	0.058	0.053	0.006
1.A.4.a - Commercial/Institutional - Biomass	CH_4	2.728	4.807	227.328	0.009	0.000	0.000	0.041	0.003	0.002
1.A.4.a - Commercial/Institutional - Biomass	N_2O	0.537	0.946	297.769	0.001	0.000	0.000	0.011	0.001	0.000
1.A.4.b - Residential - Liquid Fuels	CO_2	202.109	228.071	7.310	0.021	0.002	0.020	0.010	0.144	0.021
1.A.4.b - Residential - Liquid Fuels	CH_4	0.351	0.390	50.249	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.b - Residential - Liquid Fuels	N_2O	0.126	0.130	200.422	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.b - Residential - Solid Fuels	CO_2	0.000	0.000	13.426	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.b - Residential - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.b - Residential - Solid Fuels	N_2O	0.000	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.b - Residential - Biomass	CO_2	821.968	719.182	19.351	1.469	0.011	0.064	0.206	0.454	0.248
1.A.4.b - Residential - Biomass	CH_4	46.236	40.510	227.328	0.643	0.001	0.004	0.140	0.026	0.020
1.A.4.b - Residential - Biomass	N_2O	9.100	7.973	297.769	0.043	0.000	0.001	0.036	0.005	0.001
1.A.4.c.i - Stationary - Liquid Fuels	CO_2	138.923	68.370	7.310	0.002	0.007	0.006	0.035	0.043	0.003
1.A.4.c.i - Stationary - Liquid Fuels	CH_4	0.382	0.188	50.249	0.000	0.000	0.000	0.001	0.000	0.000
1.A.4.c.i - Stationary - Liquid Fuels	N_2O	0.338	0.167	200.422	0.000	0.000	0.000	0.003	0.000	0.000
1.A.4.c.i - Stationary - Solid Fuels	CO_2	0.000	0.000	13.426	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.i - Stationary - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.i - Stationary - Solid Fuels	N_2O	0.000	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000

1.A.4.c.i - Stationary - Biomass	CO_2	24.966	56.615	19.351	0.009	0.003	0.005	0.052	0.036	0.004
1.A.4.c.i - Stationary - Biomass	CH_4	1.404	3.241	227.328	0.004	0.000	0.000	0.037	0.002	0.001
1.A.4.c.i - Stationary - Biomass	N_2O	0.276	0.638	297.769	0.000	0.000	0.000	0.009	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CO_2	0.000	0.000	7.310	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CH_4	0.000	0.000	50.249	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	N_2O	0.000	0.000	200.422	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	CO_2	0.000	0.000	13.426	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Solid Fuels	N_2O	0.000	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO_2	0.000	0.000	7.915	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N_2O	0.000	0.000	236.417	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	CO_2	0.000	0.000	13.426	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	CH_4	0.000	0.000	200.062	0.000	0.000	0.000	0.000	0.000	0.000
1.A.4.c.iii - Fishing (mobile combustion) - Solid Fuels	N_2O	0.000	0.000	222.278	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Liquid Fuels	CO_2	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Liquid Fuels	CH_4	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Liquid Fuels	N_2O	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Solid Fuels	CO_2	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Solid Fuels	CH_4	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.a - Stationary - Solid Fuels	N_2O	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	CO_2	0.000	0.000	6.511	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	CH_4	0.000	0.000	100.125	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.i - Mobile (aviation component) - Liquid Fuels	N_2O	0.000	0.000	150.083	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	CO_2	0.000	0.000	6.596	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	CH_4	0.000	0.000	50.249	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.ii - Mobile (water-borne component) - Liquid Fuels	N_2O	0.000	0.000	140.089	0.000	0.000	0.000	0.000	0.000	0.000
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CO_2	185.969	210.048	7.071	0.017	0.002	0.019	0.009	0.133	0.018
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	CH_4	1.860	2.100	100.125	0.000	0.000	0.000	0.002	0.001	0.000
1.A.5.b.iii - Mobile (Other) - Liquid Fuels	N_2O	2.662	3.007	150.083	0.002	0.000	0.000	0.004	0.002	0.000
1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	CO_2	0.000	0.000	9.668	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	CH_4	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000

1.B.1.b - Uncontrolled combustion and burning coal dumps - Solid Fuels	N_2O	0.000	0.000	7.071	0.000	0.000	0.000	0.000	0.000	0.000
1.A.3.b.vi - Urea-based catalysts	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels										
1.B.1.a.i.1 - Mining	CO_2	2.392	2.392	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.1 - Mining	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.2 - Post-mining seam gas emissions	CO_2	1.096	1.096	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.2 - Post-mining seam gas emissions	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.3 - Abandoned underground mines	CH_4	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CH_4	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.ii.1 - Mining	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.ii.1 - Mining	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas										
1.B.2.a.iii.1 - Exploration	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.1 - Exploration	CH_4	1.035	1.073	5.000	0.000	0.000	0.000	0.000	0.001	0.000
1.B.2.a.iii.1 - Exploration	N_2O	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.2 - Production and Upgrading	CO_2	0.024	0.024	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.2 - Production and Upgrading	CH_4	6.808	6.808	5.000	0.000	0.000	0.001	0.000	0.004	0.000
1.B.2.a.iii.2 - Production and Upgrading	N_2O	1.703	1.703	5.000	0.000	0.000	0.000	0.000	0.001	0.000
1.B.2.a.iii.3 - Transport	CO_2	0.041	0.041	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.3 - Transport	CH_4	85.960	85.962	5.000	0.001	0.000	0.008	0.000	0.054	0.003
1.B.2.a.iii.3 - Transport	N_2O	1.269	1.269	5.000	0.000	0.000	0.000	0.000	0.001	0.000
1.B.2.a.iii.4 - Refining	CO_2	0.020	0.020	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.4 - Refining	CH_4	5.688	5.688	5.000	0.000	0.000	0.001	0.000	0.004	0.000
1.B.2.a.iii.4 - Refining	N_2O	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.5 - Distribution of oil products	CO_2	0.004	0.004	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.a.iii.5 - Distribution of oil products	CH_4	1.129	1.129	5.000	0.000	0.000	0.000	0.000	0.001	0.000
1.B.2.a.iii.5 - Distribution of oil products	N_2O	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b.i - Venting	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b.i - Venting	CH_4	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b.i - Venting	N_2O	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000

1.B.2.b.ii - Flaring	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b.ii - Flaring	CH_4	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.B.2.b.ii - Flaring	N_2O	0.001	0.001	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C - CO2 Transport Injection and Storage										
1.C.1.a - Pipelines	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C.1.b - Ships	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C.1.c - Other (please specify)	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C.2.a - Injection	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C.2.b - Storage	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
1.C.3 - Other	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A - Mineral Industry										
2.A.1 - Cement production	CO_2	585.000	880.470	11.180	0.735	0.025	0.079	0.125	1.112	1.251
2.A.2 - Lime production	CO_2	86.446	13.780	6.325	0.000	0.007	0.001	0.013	0.010	0.000
2.A.3 - Glass Production	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.a - Ceramics	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.b - Other Uses of Soda Ash	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.c - Non Metallurgical Magnesia Production	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.A.4.d - Other (please specify)	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B - Chemical Industry										
2.B.1 - Ammonia Production	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.2 - Nitric Acid Production	N_2O	0.000	0.000	2.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.3 - Adipic Acid Production	N_2O	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.5 - Carbide Production	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.5 - Carbide Production	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.6 - Titanium Dioxide Production	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.7 - Soda Ash Production	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.a - Methanol	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.a - Methanol	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.b - Ethylene	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.b - Ethylene	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.d - Ethylene Oxide	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000

2.B.8.d - Ethylene Oxide	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.e - Acrylonitrile	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.e - Acrylonitrile	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.f - Carbon Black	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.8.f - Carbon Black	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CHF_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CH_2F_2	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CH_3F	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	$CF_3CHFCHFCF_2CF_3$	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CHF_2CF_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CHF_2CHF_2	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CH_2FCF_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CH_3CHF_2	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CHF_2CH_2F	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CF_3CH_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CF_3CHFCF_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	$CF_3CH_2CF_3$	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	$CH_2FCF_2CHF_2$	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CF_4	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	C_2F_6	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	C_3F_8	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	C_4F_{10}	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	$c\text{-}C_4F_8$	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	C_5F_{12}	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	C_6F_{14}	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	SF_6	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	$CHCl_3$	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CH_2Cl_2	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.a - By-product emissions	CF_3I	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.B.9.b - Fugitive Emissions	CHF_3	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C - Metal Industry										
2.C.1 - Iron and Steel Production	CO_2	635.104	18.579	10.000	0.000	0.056	0.002	0.000	0.023	0.001
2.C.1 - Iron and Steel Production	CH_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.2 - Ferroalloys Production	CO_2	35.447	57.916	4.000	0.000	0.002	0.005	0.000	0.029	0.001
2.C.2 - Ferroalloys Production	CH_4	0.000	0.000	4.000	0.000	0.000	0.000	0.000	0.000	0.000

2.C.3 - Aluminium production	CO_2	0.800	0.000	9.055	0.000	0.000	0.000	0.001	0.000	0.000
2.C.3 - Aluminium production	CF_4	5.200	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.3 - Aluminium production	C_2F_6	1.840	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.4 - Magnesium production	CO_2	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.4 - Magnesium production	SF_6	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.C.5 - Lead Production	CO_2	0.000	0.328	50.990	0.000	0.000	0.000	0.001	0.000	0.000
2.C.6 - Zinc Production	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.D - Non-Energy Products from Fuels and Solvent Use										
2.D.1 - Lubricant Use	CO_2	14.844	14.277	10.000	0.000	0.000	0.001	0.000	0.018	0.000
2.D.2 - Paraffin Wax Use	CO_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E - Electronics Industry										
2.E.1 - Integrated Circuit or Semiconductor	C_2F_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 - Integrated Circuit or Semiconductor	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 - Integrated Circuit or Semiconductor	CHF_3	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 - Integrated Circuit or Semiconductor	C_3F_8	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.1 - Integrated Circuit or Semiconductor	SF_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.2 - TFT Flat Panel Display	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.2 - TFT Flat Panel Display	SF_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 - Photovoltaics	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.3 - Photovoltaics	C_2F_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.E.4 - Heat Transfer Fluid	C_6F_{14}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F - Product Uses as Substitutes for Ozone Depleting Substances										
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF_3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH_2FCF_3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.1.b - Mobile Air Conditioning	CH_2FCF_3	0.000	0.000	5.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.3 - Fire Protection	CH_2FCF_3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 - Aerosols	CH_2FCF_3	0.000	0.000	14.142	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 - Aerosols	CH_3CHF_2	0.000	0.000	14.142	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 - Aerosols	CF_3CHFCF_3	0.000	0.000	14.142	0.000	0.000	0.000	0.000	0.000	0.000
2.F.4 - Aerosols	$CF_3CHFCHF$-CF_2CF_3	0.000	0.000	14.142	0.000	0.000	0.000	0.000	0.000	0.000
2.F.5 - Solvents	$CF_3CHFCHF$-CF_2CF_3	0.000	0.000	50.990	0.000	0.000	0.000	0.000	0.000	0.000
2.F.5 - Solvents	C_6F_{14}	0.000	0.000	50.990	0.000	0.000	0.000	0.000	0.000	0.000

2.F.6 - Other Applications (please specify)	CHF_3	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CH_2F_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CH_3F	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	$CF_3CHFCHF$-CF_2CF_3	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CHF_2CF_3	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CHF_2CHF_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CH_2FCF_3	0.000	0.000	50.990	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CH_3CHF_2	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CHF_2CH_2F	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CF_3CH_3	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CF_3CHFCF_3	0.000	0.000	50.990	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	$CF_3CH_2CF_3$	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	$CH_2FCF_2CHF_2$	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	C_2F_6	0.000	0.000	50.990	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	C_3F_8	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	C_4F_{10}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	c-C_4F_8	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	C_5F_{12}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.F.6 - Other Applications (please specify)	C_6F_{14}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G - Electrical Equipment										
2.G.1.a - Manufacture of Electrical Equipment	SF_6	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	CF_4	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	C_2F_6	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	C_3F_8	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	C_4F_{10}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	c-C_4F_8	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	C_5F_{12}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.a - Manufacture of Electrical Equipment	C_6F_{14}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	SF_6	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	CF_4	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	C_2F_6	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	C_3F_8	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000

2.G.1.b - Use of Electrical Equipment	C_4F_{10}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	$c\text{-}C_4F_8$	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	C_5F_{12}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.b - Use of Electrical Equipment	C_6F_{14}	0.000	0.000	42.426	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	SF_6	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	CF_4	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	C_2F_6	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	C_3F_8	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	C_4F_{10}	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	$c\text{-}C_4F_8$	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	C_5F_{12}	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.1.c - Disposal of Electrical Equipment	C_6F_{14}	0.000	0.000	56.569	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	SF_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	C_2F_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	C_3F_8	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	C_4F_{10}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	$c\text{-}C_4F_8$	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	C_5F_{12}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.a - Military Applications	C_6F_{14}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	SF_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	CF_4	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	C_2F_6	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	C_3F_8	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	C_4F_{10}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	$c\text{-}C_4F_8$	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	C_5F_{12}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.b - Accelerators	C_6F_{14}	0.000	0.000	10.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	SF_6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	CF_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	C_2F_6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	C_3F_8	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	C_4F_{10}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	$c\text{-}C_4F_8$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.2.c - Other (please specify)	C_5F_{12}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

2.G.2.c - Other (please specify)	C_6F_{14}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.3.a - Medical Applications	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.3.b - Propellant for pressure and aerosol products	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.G.3.c - Other (Please specify)	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2.H - Other										
2.H.1 - Pulp and Paper Industry	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A - Livestock										
3.A.1.a.i - Dairy Cows	CH_4	733.887	738.045	30.414	3.821	0.001	0.066	0.038	0.466	0.218
3.A.1.a.ii - Other Cattle	CH_4	171.738	166.866	30.414	0.195	0.001	0.015	0.025	0.105	0.012
3.A.1.b - Buffalo	CH_4	0.000	0.142	30.414	0.000	0.000	0.000	0.000	0.000	0.000
3.A.1.c - Sheep	CH_4	185.640	207.060	30.414	0.301	0.001	0.018	0.045	0.131	0.019
3.A.1.d - Goats	CH_4	81.060	98.805	30.414	0.068	0.001	0.009	0.042	0.062	0.006
3.A.1.e - Camels	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.1.f - Horses	CH_4	13.230	12.096	30.414	0.001	0.000	0.001	0.004	0.008	0.000
3.A.1.g - Mules and Asses	CH_4	13.440	13.020	30.414	0.001	0.000	0.001	0.002	0.008	0.000
3.A.1.h - Swine	CH_4	3.360	3.801	30.414	0.000	0.000	0.000	0.001	0.002	0.000
3.A.1.j - Other (please specify)	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.a.i - Dairy cows	CH_4	148.260	149.100	30.414	0.156	0.000	0.013	0.008	0.094	0.009
3.A.2.a.i - Dairy cows	N_2O	62.829	63.185	50.249	0.076	0.000	0.006	0.005	0.040	0.002
3.A.2.a.ii - Other cattle	CH_4	26.649	25.893	50.249	0.013	0.000	0.002	0.006	0.016	0.000
3.A.2.a.ii - Other cattle	N_2O	11.706	11.373	50.249	0.002	0.000	0.001	0.003	0.007	0.000
3.A.2.b - Buffalo	CH_4	0.000	0.018	5.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.b - Buffalo	N_2O	0.000	0.019	50.249	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.c - Sheep	CH_4	5.569	6.212	5.000	0.000	0.000	0.001	0.000	0.004	0.000
3.A.2.c - Sheep	N_2O	3.961	4.418	50.249	0.000	0.000	0.000	0.002	0.003	0.000
3.A.2.d - Goats	CH_4	2.756	3.359	5.000	0.000	0.000	0.000	0.000	0.002	0.000
3.A.2.d - Goats	N_2O	2.636	3.212	50.249	0.000	0.000	0.000	0.002	0.002	0.000
3.A.2.e - Camels	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.e - Camels	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.f - Horses	CH_4	1.205	1.102	5.000	0.000	0.000	0.000	0.000	0.001	0.000
3.A.2.f - Horses	N_2O	0.111	0.102	50.249	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.g - Mules and Asses	CH_4	1.210	1.172	5.000	0.000	0.000	0.000	0.000	0.001	0.000
3.A.2.g - Mules and Asses	N_2O	0.111	0.107	50.249	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.h - Swine	CH_4	13.440	15.204	30.414	0.002	0.000	0.001	0.004	0.010	0.000
3.A.2.h - Swine	N_2O	2.269	2.567	50.249	0.000	0.000	0.000	0.001	0.002	0.000

3.A.2.i - Poultry	CH_4	3.491	3.497	5.000	0.000	0.000	0.000	0.000	0.002	0.000
3.A.2.i - Poultry	N_2O	0.655	0.656	50.249	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.j - Other (please specify)	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.A.2.j - Other (please specify)	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B - Land										
3.B.1.a - Forest land Remaining Forest land	CO_2	1425.627	1263.974	42.426	21.806	0.018	0.113	0.528	4.787	23.194
3.B.1.b.i - Cropland converted to Forest Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.1.b.ii - Grassland converted to Forest Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.1.b.iii - Wetlands converted to Forest Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.1.b.iv - Settlements converted to Forest Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.1.b.v - Other Land converted to Forest Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.2.a - Cropland Remaining Cropland	CO_2	72.929	72.929	31.623	0.040	0.000	0.007	0.005	0.092	0.009
3.B.2.b.i - Forest Land converted to Cropland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.2.b.ii - Grassland converted to Cropland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.2.b.iii - Wetlands converted to Cropland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.2.b.iv - Settlements converted to Cropland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.2.b.v - Other Land converted to Cropland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.a - Grassland Remaining Grassland	CO_2	0.000	0.000	50.359	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.b.i - Forest Land converted to Grassland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.b.ii - Cropland converted to Grassland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.b.iii - Wetlands converted to Grassland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.b.iv - Settlements converted to Grassland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.3.b.v - Other Land converted to Grassland	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.4.a.i - Peatlands remaining peatlands	CO_2	0.000	0.000	90.139	0.000	0.000	0.000	0.000	0.000	0.000
3.B.4.a.i - Peatlands remaining peatlands	N_2O	0.000	0.000	50.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.4.b.i - Land converted for peat extraction	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.4.b.ii - Land converted to flooded land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.5.a - Settlements Remaining Settlements	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.5.b.i - Forest Land converted to Settlements	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.5.b.ii - Cropland converted to Settlements	CO_2	93.500	93.500	0.000	0.000	0.000	0.008	0.000	0.000	0.000
3.B.5.b.iii - Grassland converted to Settlements	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.5.b.iv - Wetlands converted to Settlements	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.5.b.v - Other Land converted to Settlements	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.6.b.i - Forest Land converted to Other Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.6.b.ii - Cropland converted to Other Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3.B.6.b.iii - Grassland converted to Other Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.6.b.iv - Wetlands converted to Other Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.B.6.b.v - Settlements converted to Other Land	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C - Aggregate sources and non-CO2 emissions sources on land										
3.C.1.a - Biomass burning in forest lands	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.a - Biomass burning in forest lands	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.b - Biomass burning in croplands	CH_4	0.099	0.056	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.b - Biomass burning in croplands	N_2O	0.041	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.c - Biomass burning in grasslands	CH_4	0.636	0.601	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.c - Biomass burning in grasslands	N_2O	0.857	0.810	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.d - Biomass burning in all other land	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.1.d - Biomass burning in all other land	N_2O	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.2 - Liming	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.C.3 - Urea application	CO_2	26.080	32.633	0.000	0.000	0.001	0.003	0.000	0.000	0.000
3.C.4 - Direct N2O Emissions from managed soils	N_2O	510.920	552.399	0.000	0.000	0.003	0.049	0.000	0.000	0.000
3.C.5 - Indirect N2O Emissions from managed soils	N_2O	169.959	184.853	0.000	0.000	0.001	0.017	0.000	0.000	0.000
3.C.6 - Indirect N2O Emissions from manure management	N_2O	40.137	40.609	0.000	0.000	0.000	0.004	0.000	0.000	0.000
3.C.7 - Rice cultivation	CH_4	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3.D - Other										
3.D.1 - Harvested Wood Products	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4.A - Solid Waste Disposal										
4.A - Solid Waste Disposal	CH_4	423.003	654.455	30.414	3.004	0.020	0.058	0.591	0.413	0.520
4.B - Biological Treatment of Solid Waste										
4.B - Biological Treatment of Solid Waste	CH_4	4.452	3.444	30.414	0.000	0.000	0.000	0.000	0.013	0.000
4.B - Biological Treatment of Solid Waste	N_2O	3.943	3.050	30.414	0.000	0.000	0.000	0.000	0.012	0.000
4.C - Incineration and Open Burning of Waste										
4.C.1 - Waste Incineration	CO_2	0.034	0.023	40.311	0.000	0.000	0.000	0.000	0.000	0.000
4.C.1 - Waste Incineration	CH_4	0.000	0.000	11.180	0.000	0.000	0.000	0.000	0.000	0.000
4.C.1 - Waste Incineration	N_2O	0.002	0.001	11.180	0.000	0.000	0.000	0.000	0.000	0.000
4.C.2 - Open Burning of Waste	CO_2	3.784	3.073	40.311	0.000	0.000	0.000	0.003	0.002	0.000
4.C.2 - Open Burning of Waste	CH_4	8.787	7.136	11.180	0.000	0.000	0.001	0.002	0.005	0.000
4.C.2 - Open Burning of Waste	N_2O	2.484	2.018	11.180	0.000	0.000	0.000	0.000	0.001	0.000
4.D - Wastewater Treatment and Discharge										
4.D.1 - Domestic Wastewaster Treatment and Discharge	CH_4	88.938	81.011	30.414	0.046	0.001	0.007	0.027	0.051	0.003
4.D.1 - Domestic Wastewaster Treatment and Discharge	N_2O	76.351	68.729	30.414	0.033	0.001	0.006	0.026	0.043	0.003

4.D.2 - Industrial Wastewater Treatment and Discharge	CH_4	9.125	16.042	11.180	0.000	0.001	0.001	0.006	0.010	0.000
4.E - Other (please specify)										
4.E - Other (please specify)	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3										
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3	N_2O	74.626	133.653	25.520	0.000	0.005	0.012	0.000	0.000	0.000
5.B - Other (please specify)										
5.B - Other (please specify)	CO_2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total										
		Sum(C): 11202.405	Sum(D): 11483.874		Sum(H): 33.661					Sum(M): 26.637
			11483		Uncertainty in total inventory: 5.802					Trend uncertainty: 5.161

ANNEX VI: Key source analysis - Main categories of GHG emissions expressed in Gg

IPCC Category code	IPCC Category	Greenhouse gas	2016 Ex,t (Gg CO_2 eq.)	|Ex,t| (Gg CO_2 eq.)	Lx,t	Cumulative Total of Column F
1.A.3.b	Road Transportation, CO_2	CARBON DIOXIDE (CO_2)	2448.982	2448.982	0.233	0.233
3.B.1.a	Forest land Remaining Forest land, CO_2	CARBON DIOXIDE (CO_2)	1263.974	1263.974	0.120	0.353
3.A.1	Enteric Fermentation, CH_4	METHANE (CH_4)	1239.835	1239.835	0.118	0.471
1.A.2	Manufacturing Industries and Construction - Liquid Fuels, CO_2	CARBON DIOXIDE (CO_2)	1066.291	1066.291	0.101	0.573
2.A.1	Cement production, CO_2	CARBON DIOXIDE (CO_2)	880.47	880.47	0.084	0.656
4.A	Solid Waste Disposal, CH_4	METHANE (CH_4)	654.455	654.455	0.062	0.719
3.C.4	Direct N_2O Emissions from managed soils, N_2O	NITROUS OXIDE (N_2O)	552.399	552.399	0.053	0.771
1.A.4	Other Sectors - Liquid Fuels, CO_2	CARBON DIOXIDE (CO_2)	445.664	445.664	0.042	0.814
1.A.1	Energy Industries - Liquid Fuels, CO_2	CARBON DIOXIDE (CO_2)	314.082	314.082	0.030	0.844
1.A.5	Non-Specified - Liquid Fuels, CO_2	CARBON DIOXIDE (CO_2)	210.048	210.048	0.020	0.864
3.A.2	Manure Management, CH_4	METHANE (CH_4)	205.557	205.557	0.020	0.883
3.C.5	Indirect N_2O Emissions from managed soils, N2O	NITROUS OXIDE (N_2O)	184.853	184.853	0.018	0.901
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3, N_2O	NITROUS OXIDE (N_2O)	133.653	133.653	0.013	0.913
1.B.2.a	Oil, CH_4CH_4	METHANE (CH_4)	100.660	100.660	0.010	0.923
4.D	Wastewater Treatment and Discharge, CH_4	METHANE (CH_4)	97.053	97.053	0.009	0.932
3.B.5.b	Land Converted to Settlements, CO_2	CARBON DIOXIDE (CO_2)	93.5	93.5	0.009	0.941
3.A.2	Manure Management, N_2O	NITROUS OXIDE (N_2O)	85.639	85.639	0.008	0.949
3.B.2.a	Cropland Remaining Cropland, CO_2	CARBON DIOXIDE (CO_2)	72.929	72.929	0.007	0.956
4.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N_2O)	68.729	68.729	0.007	0.963
2.C.2	Ferroalloys Production	CARBON DIOXIDE (CO_2)	57.916	57.916	0.006	0.968
1.A.4	Other Sectors - Biomass	METHANE (CH_4)	48.558	48.558	0.005	0.973
3.C.6	Indirect N2O Emissions from manure management	NITROUS OXIDE (N_2O)	40.609	40.609	0.004	0.977
1.A.3.b	Road Transportation	NITROUS OXIDE (N_2O)	38.506	38.506	0.004	0.980
3.C.3	Urea application	CARBON DIOXIDE (CO_2)	32.633	32.633	0.003	0.984
1.A.3.d	Water-borne Navigation - Liquid Fuels	CARBON DIOXIDE (CO_2)	19.536	19.536	0.002	0.985
2.C.1	Iron and Steel Production	CARBON DIOXIDE (CO_2)	18.579	18.579	0.002	0.987
1.A.1	Energy Industries - Gaseous Fuels	CARBON DIOXIDE (CO_2)	17.315	17.315	0.002	0.989
2.D	Non-Energy Products from Fuels and Solvent Use	CARBON DIOXIDE (CO_2)	14.277	14.277	0.001	0.990
2.A.2	Lime production	CARBON DIOXIDE (CO_2)	13.780	13.780	0.001	0.991

1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO_2)	11.369	11.369	0.001	0.993
1.A.4	Other Sectors - Biomass	NITROUS OXIDE (N_2O)	9.558	9.558	0.001	0.993
1.A.3.c	Railways	CARBON DIOXIDE (CO_2)	9.529	9.529	0.001	0.994
1.A.3.b	Road Transportation	METHANE (CH_4)	7.830	7.830	0.001	0.995
4.C	Incineration and Open Burning of Waste	METHANE (CH_4)	7.136	7.136	0.001	0.996
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CARBON DIOXIDE (CO_2)	6.093	6.093	0.001	0.996
1.A.1	Energy Industries - Solid Fuels	CARBON DIOXIDE (CO_2)	5.656	5.656	0.001	0.997
1.B.1	Solid Fuels	CARBON DIOXIDE (CO_2)	3.488	3.488	0.000	0.997
4.B	Biological Treatment of Solid Waste	METHANE (CH_4)	3.444	3.444	0.000	0.998
4.C	Incineration and Open Burning of Waste	CARBON DIOXIDE (CO_2)	3.096	3.096	0.000	0.998
4.B	Biological Treatment of Solid Waste	NITROUS OXIDE (N_2O)	3.050	3.050	0.000	0.998
1.A.5	Non-Specified - Liquid Fuels	NITROUS OXIDE (N_2O)	3.007	3.007	0.000	0.998
1.B.2.a	Oil	NITROUS OXIDE (N_2O)	2.972	2.972	0.000	0.999
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	NITROUS OXIDE (N_2O)	2.360	2.360	0.000	0.999
1.A.5	Non-Specified - Liquid Fuels	METHANE (CH_4)	2.100	2.100	0.000	0.999
4.C	Incineration and Open Burning of Waste	NITROUS OXIDE (N_2O)	2.019	2.019	0.000	0.999
1.A.4	Other Sectors - Liquid Fuels	METHANE (CH_4)	0.887	0.887	0.000	0.999
3.C.1	Emissions from biomass burning	NITROUS OXIDE (N_2O)	0.833	0.833	0.000	0.999
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	METHANE (CH4)	0.801	0.801	0.000	0.100
1.A.1	Energy Industries - Liquid Fuels	NITROUS OXIDE (N2O)	0.769	0.769	0.000	0.100
3.C.1	Emissions from biomass burning	METHANE (CH_4)	0.657	0.657	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CARBON DIOXIDE (CO_2)	0.586	0.586	0.000	0.100
1.A.4	Other Sectors - Liquid Fuels	NITROUS OXIDE (N_2O)	0.541	0.541	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Biomass	NITROUS OXIDE (N_2O)	0.532	0.532	0.000	0.100
2.C.5	Lead Production	CARBON DIOXIDE (CO_2)	0.328	0.328	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Biomass	METHANE (CH_4)	0.270	0.270	0.000	0.100
1.A.1	Energy Industries - Liquid Fuels	METHANE (CH_4)	0.260	0.260	0.000	0.100
1.A.3.d	Water-borne Navigation - Liquid Fuels	NITROUS OXIDE (N_2O)	0.163	0.163	0.000	0.100
1.A.3.c	Railways	NITROUS OXIDE (N_2O)	0.128	0.128	0.000	0.100
1.A.3.a	Civil Aviation	NITROUS OXIDE (N_2O)	0.099	0.099	0.000	0.100
1.A.3.c	Railways	METHANE (CH_4)	0.089	0.089	0.000	0.100
1.B.2.a	Oil	CARBON DIOXIDE (CO_2)	0.088	0.088	0.000	0.100

1.A.3.d	Water-borne Navigation - Liquid Fuels	METHANE (CH_4)	0.039	0.039	0.000	0.100
1.A.1	Energy Industries - Solid Fuels	NITROUS OXIDE (N_2O)	0.026	0.026	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	NITROUS OXIDE (N_2O)	0.018	0.018	0.000	0.100
1.A.1	Energy Industries - Gaseous Fuels	NITROUS OXIDE (N_2O)	0.010	0.010	0.000	0.100
1.A.1	Energy Industries - Gaseous Fuels	METHANE (CH_4)	0.006	0.006	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	METHANE (CH_4)	0.006	0.006	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Solid Fuels	NITROUS OXIDE (N_2O)	0.003	0.003	0.000	0.100
1.A.3.a	Civil Aviation	METHANE (CH_4)	0.002	0.002	0.000	0.100
1.A.2	Manufacturing Industries and Construction - Solid Fuels	METHANE (CH_4)	0.001	0.001	0.000	0.100
1.A.1	Energy Industries - Solid Fuels	METHANE (CH_4)	0.001	0.001	0.000	0.100
1.B.2.b	Natural Gas	NITROUS OXIDE (N_2O)	0.001	0.001	0.000	0.100
1.B.2.b	Natural Gas	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.B.2.b	Natural Gas	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Other Fossil Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Other Fossil Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Other Fossil Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Peat	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Peat	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Peat	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Biomass	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Biomass	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.1	Energy Industries - Biomass	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Peat	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Peat	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Peat	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.2	Manufacturing Industries and Construction - Biomass	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Solid Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Solid Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Solid Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Gaseous Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000

1.A.3.d	Water-borne Navigation - Gaseous Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Peat	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Peat	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Peat	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Biomass	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Biomass	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.3.d	Water-borne Navigation - Biomass	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.3.e	Other Transportation	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.3.e	Other Transportation	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.3.e	Other Transportation	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Solid Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Solid Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Solid Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Gaseous Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Gaseous Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Gaseous Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Other Fossil Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Other Fossil Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Other Fossil Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Peat	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Peat	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Peat	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.4	Other Sectors - Biomass	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Solid Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Solid Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Solid Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Gaseous Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Gaseous Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Gaseous Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Other Fossil Fuels	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Other Fossil Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000

1.A.5	Non-Specified - Other Fossil Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Peat	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Peat	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Peat	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Biomass	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Biomass	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.A.5	Non-Specified - Biomass	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.B.1	Solid Fuels	METHANE (CH_4)	0.000	0.000	0.000	1.000
1.B.1	Solid Fuels	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
1.C	Carbon dioxide Transport and Storage	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.A.3	Glass Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.A.4	Other Process Uses of Carbonates	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.1	Ammonia Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.2	Nitric Acid Production	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
2.B.3	Adipic Acid Production	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
2.B.5	Carbide Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.5	Carbide Production	METHANE (CH4)	0.000	0.000	0.000	1.000
2.B.6	Titanium Dioxide Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.7	Soda Ash Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.8	Petrochemical and Carbon Black Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.B.8	Petrochemical and Carbon Black Production	METHANE (CH_4)	0.000	0.000	0.000	1.000
2.B.9	Fluorochemical Production	SF_6, PFCs, HFCs and other halogenated gases	0.000	0.000	0.000	1.000
2.C.1	Iron and Steel Production	METHANE (CH_4)	0.000	0.000	0.000	1.000
2.C.2	Ferroalloys Production	METHANE (CH_4)	0.000	0.000	0.000	1.000
2.C.3	Aluminium production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.C.3	Aluminium production	PFCs (PFCs)	0.000	0.000	0.000	1.000
2.C.4	Magnesium production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.C.4	Magnesium production	Sulphur Hexafluoride (SF_6)	0.000	0.000	0.000	1.000
2.C.6	Zinc Production	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
2.E	Electronics Industry	SF_6, PFCs, HFCs and other halogenated gases	0.000	0.000	0.000	1.000
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0.000	0.000	0.000	1.000
2.F.2	Foam Blowing Agents	HFCs (HFCs)	0.000	0.000	0.000	1.000

2.F.3	Fire Protection	HFCs, PFCs	0.000	0.000	0.000	1.000
2.F.4	Aerosols	HFCs, PFCs	0.000	0.000	0.000	1.000
2.F.5	Solvents	HFCs, PFCs	0.000	0.000	0.000	1.000
2.F.6	Other Applications (please specify)	HFCs, PFCs	0.000	0.000	0.000	1.000
2.G	Other Product Manufacture and Use	SF6, PFCs	0.000	0.000	0.000	1.000
2.G	Other Product Manufacture and Use	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
2.H	Other	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.1.b	Land Converted to Forest land	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.2.b	Land Converted to Cropland	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.3.a	Grassland Remaining Grassland	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.3.b	Land Converted to Grassland	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.4.a.i	Peatlands remaining peatlands	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.4.a.i	Peatlands remaining peatlands	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
3.B.4.b	Land Converted to Wetlands	NITROUS OXIDE (N_2O)	0.000	0.000	0.000	1.000
3.B.4.b	Land Converted to Wetlands	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.5.a	Settlements Remaining Settlements	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.B.6.b	Land Converted to Other land	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.C.2	Liming	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
3.C.7	Rice cultivation	METHANE (CH_4)	0.000	0.000	0.000	1.000
3.D.1	Harvested Wood Products	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
4.E	Other (please specify)	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000
5.B	Other (please specify)	CARBON DIOXIDE (CO_2)	0.000	0.000	0.000	1.000

ANNEX VII: Trend Assessment of source categories of GHG emissions expressed in Gg

IPCC Category code	IPCC Category	Greenhouse gas	2009 Year Estimate Ex0 (Gg CO_2 eq.)	2016 Year Estimate Ext (Gg CO_2 eq.)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
2.C.1	**Iron and Steel Production**	**CO_2**	**635.1**	**18.58**	**0.062**	**26.28%**	**26.28%**
1.A.2	**Manufacturing Industries and Construction - Liquid Fuels**	**CO_2**	**620.2**	**1066.29**	**0.042**	**17.79%**	**44.07%**
2.A.1	**Cement production**	**CO_2**	**585**	**880.47**	**0.027**	**11.58%**	**55.65%**
4.A	**Solid Waste Disposal**	**CH_4**	**423**	**654.46**	**0.022**	**9.11%**	**64.77%**
3.B.1.a	**Forest land Remaining Forest land**	**CO_2**	**1425.63**	**1263.97**	**0.020**	**8.33%**	**73.09%**
1.A.2	**Manufacturing Industries and Construction - Solid Fuels**	**CO_2**	**174.74**	**0.59**	**0.018**	**7.42%**	**80.51%**
1.A.3.b	**Road Transportation**	**CO_2**	**2259.85**	**2448.98**	**0.012**	**5.27%**	**85.78%**
2.A.2	**Lime production**	**CO_2**	**86.45**	**13.78**	**0.007**	**3.11%**	**88.89%**
1.A.4	**Other Sectors - Liquid Fuels**	**CO_2**	**499.67**	**445.66**	**0.007**	**2.81%**	**91.69%**
5.A	**Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3**	**N_2O**	**74.63**	**133.65**	**0.006**	**2.36%**	**94.06%**
3.C.4	**Direct N_2O Emissions from managed soils**	**N_2O**	**510.92**	**552.4**	**0.003**	**1.14%**	**95.19%**
2.C.2	Ferroalloys Production	CO_2	35.447	57.916	0	0.89%	96.09%
1.A.5	Non-Specified - Liquid Fuels	CO_2	185.969	210.048	0	0.79%	96.87%
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	169.959	184.854	0	0.42%	97.30%
4.D	Wastewater Treatment and Discharge	N_2O	76.351	68.729	0	0.40%	97.70%
2.C.3	Aluminium production	PFCs (PFCs)	7.04	0	0	0.30%	98.00%
3.C.3	Urea application	CO_2	26.080	32.633	0	0.24%	98.24%
3.A.1	Enteric Fermentation	CH_4	1202.355	1239.835	0	0.18%	98.43%
4.D	Wastewater Treatment and Discharge	CH_4	98.063	97.053	0	0.15%	98.58%
1.A.4	Other Sectors - Biomass	CH_4	50.368	48.558	0	0.13%	98.71%
1.A.1	Energy Industries - Liquid Fuels	CO_2	308.438	314.082	0	0.12%	98.83%
1.B.2.a	Oil	CH_4	100.619	100.660	0	0.11%	98.94%
3.A.2	Manure Management	CH_4	202.581	205.557	0	0.11%	99.05%
3.B.5.b	Land Converted to Settlements	CO_2	93.5	93.5	0	0.11%	99.16%
3.B.2.a	Cropland Remaining Cropland	CO_2	72.929	72.929	0	0.08%	99.24%
1.A.3.b	Road Transportation	N_2O	35.626	38.506	0	0.08%	99.32%
4.C	Incineration and Open Burning of Waste	CH_4	8.787	7.136	0	0.08%	99.40%
4.B	Biological Treatment of Solid Waste	CH_4	4.452	3.444	0	0.05%	99.44%

4.B	Biological Treatment of Solid Waste	N_2O	3.943	3.050	0	0.04%	99.48%
2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	14.844	14.277	0	0.04%	99.52%
3.A.2	Manure Management	N_2O	84.276	85.639	0	0.04%	99.56%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	1.397	2.360	0	0.04%	99.60%
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	0.857	0.003	0	0.04%	99.64%
4.C	Incineration and Open Burning of Waste	CO_2	3.818	3.096	0	0.03%	99.67%
2.C.3	Aluminium production	CO_2	0.8	0	0	0.03%	99.71%
3.C.6	Indirect N_2O Emissions from manure management	N_2O	40.137	40.609	0	0.03%	99.73%
1.A.4	Other Sectors - Biomass	N_2O	9.914	9.558	0	0.03%	99.76%
1.A.1	Energy Industries - Solid Fuels	CO_2	4.979	5.656	0	0.02%	99.78%
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO_2	19.536	19.536	0	0.02%	99.80%
4.C	Incineration and Open Burning of Waste	N_2O	2.487	2.019	0	0.02%	99.83%
1.A.1	Energy Industries - Gaseous Fuels	CO_2	17.315	17.315	0	0.02%	99.85%
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.387	0.001	0	0.02%	99.86%
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	0.181	0.532	0	0.01%	99.88%
1.A.3.a	Civil Aviation	CO_2	10.728	11.369	0	0.01%	99.89%
2.C.5	Lead Production	CO_2	0	0.328	0	0.01%	99.90%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.475	0.802	0	0.01%	99.92%
1.A.5	Non-Specified - Liquid Fuels	N_2O	2.662	3.007	0	0.01%	99.93%
1.A.3.c	Railways	CO_2	9.529	9.529	0	0.01%	99.94%
1.A.4	Other Sectors - Liquid Fuels	CH_4	1.105	0.887	0	0.01%	99.95%
1.A.4	Other Sectors - Liquid Fuels	N_2O	0.744	0.541	0	0.01%	99.96%
1.A.5	Non-Specified - Liquid Fuels	CH_4	1.860	2.101	0	0.01%	99.97%
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	0.092	0.270	0	0.01%	99.97%
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	6.093	6.093	0	0.01%	99.98%
3.C.1	Emissions from biomass burning	CH_4	0.735	0.657	0	0.00%	99.99%
1.B.1	Solid Fuels	CO_2	3.488	3.488	0	0.00%	99.99%
3.C.1	Emissions from biomass burning	N_2O	0.898	0.833	0	0.00%	99.99%
1.B.2.a	Oil	N_2O	2.972	2.972	0	0.00%	100.00%
1.A.3.b	Road Transportation	CH_4	7.554	7.83	0	0.00%	100.00%
1.A.1	Energy Industries - Liquid Fuels	N_2O	0.755	0.769	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.164	0.164	0	0.00%	100.00%
1.A.3.c	Railways	N_2O	0.128	0.128	0	0.00%	100.00%
1.A.3.a	Civil Aviation	N_2O	0.093	0.099	0	0.00%	100.00%

1.A.1	Energy Industries - Solid Fuels	N_2O	0.023	0.026	0	0.00%	100.00%
1.A.3.c	Railways	CH_4	0.089	0.089	0	0.00%	100.00%
1.B.2.a	Oil	CO_2	0.088	0.088	0	0.00%	100.00%
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.256	0.260	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.039	0.039	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.018	0.018	0	0.00%	100.00%
1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.010	0.010	0	0.00%	100.00%
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.007	0.007	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.006	0.006	0	0.00%	100.00%
1.A.1	Energy Industries - Solid Fuels	CH_4	0.001	0.001	0	0.00%	100.00%
1.A.3.a	Civil Aviation	CH_4	0.002	0.002	0	0.00%	100.00%
1.B.2.b	Natural Gas	N_2O	0.001	0.001	0	0.00%	100.00%
1.B.2.b	Natural Gas	CH_4	0.000	0.000	0	0.00%	100.00%
1.B.2.b	Natural Gas	CO_2	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Peat	CO_2	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Peat	CH_4	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Peat	N_2O	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Biomass	CO_2	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Biomass	CH_4	0	0	0	0.00%	100.00%
1.A.1	Energy Industries - Biomass	N_2O	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0	0	0	0.00%	100.00%
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0	0	0	0.00%	100.00%

1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Peat	CO_2	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Peat	CH_4	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Peat	N_2O	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0	0	0	0.00%	100.00%
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0	0	0	0.00%	100.00%
1.A.3.e	Other Transportation	CO_2	0	0	0	0.00%	100.00%
1.A.3.e	Other Transportation	METHANE (CH_4)	0	0	0	0.00%	100.00%
1.A.3.e	Other Transportation	NITROUS OXIDE (N_2O)	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Solid Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Solid Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Solid Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Peat	CO_2	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Peat	CH_4	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Peat	N_2O	0	0	0	0.00%	100.00%
1.A.4	Other Sectors - Biomass	CO_2	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Solid Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Solid Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Solid Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0	0	0	0.00%	100.00%

1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Peat	CO_2	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Peat	CH_4	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Peat	N_2O	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Biomass	CO_2	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Biomass	CH_4	0	0	0	0.00%	100.00%
1.A.5	Non-Specified - Biomass	N_2O	0	0	0	0.00%	100.00%
1.B.1	Solid Fuels	METHANE (CH_4)	0	0	0	0.00%	100.00%
1.B.1	Solid Fuels	NITROUS OXIDE (N_2O)	0	0	0	0.00%	100.00%
1.C	Carbon dioxide Transport and Storage	CO_2	0	0	0	0.00%	100.00%
2.A.3	Glass Production	CO_2	0	0	0	0.00%	100.00%
2.A.4	Other Process Uses of Carbonates	CO_2	0	0	0	0.00%	100.00%
2.B.1	Ammonia Production	CO_2	0	0	0	0.00%	100.00%
2.B.2	Nitric Acid Production	NITROUS OXIDE (N_2O)	0	0	0	0.00%	100.00%
2.B.3	Adipic Acid Production	NITROUS OXIDE (N_2O)	0	0	0	0.00%	100.00%
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	NITROUS OXIDE (N_2O)	0	0	0	0.00%	100.00%
2.B.5	Carbide Production	CO_2	0	0	0	0.00%	100.00%
2.B.5	Carbide Production	METHANE (CH_4)	0	0	0	0.00%	100.00%
2.B.6	Titanium Dioxide Production	CO_2	0	0	0	0.00%	100.00%
2.B.7	Soda Ash Production	CO_2	0	0	0	0.00%	100.00%
2.B.8	Petrochemical and Carbon Black Production	CO_2	0	0	0	0.00%	100.00%
2.B.8	Petrochemical and Carbon Black Production	METHANE (CH_4)	0	0	0	0.00%	100.00%
2.B.9	Fluorochemical Production	SF_6, PFCs, HFCs and other halogenated gases	0	0	0	0.00%	100.00%
2.C.1	Iron and Steel Production	METHANE (CH_4)	0	0	0	0.00%	100.00%
2.C.2	Ferroalloys Production	METHANE (CH_4)	0	0	0	0.00%	100.00%
2.C.4	Magnesium production	CO_2	0	0	0	0	1
2.C.4	Magnesium production	SOx	0	0	0	0	1
2.C.6	Zinc Production	CO_2	0	0	0	0	1
2.E	Electronics Industry	SF_6, PFCs, HFCs and other halogenated gases	0	0	0	0	1
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0	0	0	0	1
2.F.2	Foam Blowing Agents	HFCs (HFCs)	0	0	0	0	1

2.F.3	Fire Protection	HFCs, PFCs	0	0	0	0	1
2.F.4	Aerosols	HFCs, PFCs	0	0	0	0	1
2.F.5	Solvents	HFCs, PFCs	0	0	0	0	1
2.F.6	Other Applications (please specify)	HFCs, PFCs	0	0	0	0	1
2.G	Other Product Manufacture and Use	SF6, PFCs	0	0	0	0	1
2.G	Other Product Manufacture and Use	NITROUS OXIDE (N_2O)	0	0	0	0	1
2.H	Other	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.1.b	Land Converted to Forest land	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.2.b	Land Converted to Cropland	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.3.a	Grassland Remaining Grassland	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.3.b	Land Converted to Grassland	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.4.a.i	Peatlands remaining peatlands	NITROUS OXIDE (N_2O)	0	0	0	0	1
3.B.4.b	Land Converted to Wetlands	NITROUS OXIDE (N_2O)	0	0	0	0	1
3.B.4.b	Land Converted to Wetlands	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.5.a	Settlements Remaining Settlements	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.B.6.b	Land Converted to Other land	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.C.2	Liming	CARBON DIOXIDE (CO_2)	0	0	0	0	1
3.C.7	Rice cultivation	METHANE (CH4)	0	0	0	0	1
3.D.1	Harvested Wood Products	CARBON DIOXIDE (CO_2)	0	0	0	0	1
4.E	Other (please specify)	CARBON DIOXIDE (CO_2)	0	0	0	0	1
5.B	Other (please specify)	CARBON DIOXIDE (CO_2)	0	0	0	0	1

ANNEX VIII: Literature Data Sources

IPCC	2006 IPCC Guidelines on Greenhouse Gas Inventory
INSTAT	Annual Statistical Book of Albania for 2009-2016: Institute of Statistics for Albania, INSTAT.
INSTAT	Production and Consumption of all energy commodities of the Republic of Albania (Albania in figures, 2005, 2009-2016).
Ministry of Tourism and Environment/EU	National Climate Change Strategy and Plan EuropeAid/135700/DH/SER/AL
Ministry of Tourism and Environment, UNDP	Albania's FNC, SNC and TNC to UNFCCC (2002, 2009,2016)
Ministry of Tourisms and Environment	National Waste Management Plan for Albania
Ministry of Tourisms and Environment	National Determined Contribution (NDC approved by the Albanian Government on September 2015)
National Environmental Agency	Reports on the State of the Environment 2009 - 2016
Council of Ministers	National Strategy for Development and Integration – 2015-2020 (Albanian Council of Ministers, 2017) National Programs for Economic Reforms (NPER) 2015-2017 and 2016-2018 Albanian Council of Ministers, 2017)
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	Albanian Renewable Energy Source Action Plan (NREAP adopted by the Governmental Decree no.27, dated 20.01.2016)
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	1st National Energy Efficiency Action Plan 2011-2018 (Government Decree no. 619, date 7.09.2011) 2nd and 3rd Albanian Energy Efficiency Action Plan 2017-2020 (Government Decree no.709, date 1.12.2017);
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	Albanian National Gas Master Plan (November 2016);
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	Transport Sector Strategy in Albania – Final Strategy & Action Plan (DCM No. 811, dated 16.11.2016); Albanian Sustainable Transport Plan (Draft Jane 2016);
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	Official Albanian Energy Balance prepared from AKBN for years 2005, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016; Official ERE Annual reports related to Power Sector Electricity Balance prepared from ERE for years 2005, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)/AKBN	Production and Consumption of the Republic of Albania Yearly Energy Balance, 2009-2016.
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)/AKBN	"Forecast of Energy and Electricity Demand and Financial Evaluation of Expansion Power Sector for Albania" 2000-2015.
KESH	Electricity Balance – Production and Consumption of the Republic of Albania; 2009-2016.

Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)/AKBN	Oil Production; Oil derivatives imported and exported – Production and Consumption of the Republic of Albania; 2000-2009.
ERE, OST Electricity Import-Export Balance	ERE, OST Electricity Import-Export Balance of the Republic of Albania; 2009-2016.
Ministry of Infrastructure and Energy (ex Ministry of Energy and Industry)	Strategy of Non-Food Industry, 2009-2016
Ministry of Agriculture and Rural Development (ex Ministry of Agriculture and Food)	Agricultural production in Albania, 2009-2016
Scientific Research Institute of Veterinary	Livestock of Albania, 2009-2016
Bank of Albania	AGRICULTURE; VALUE ADDED (% OF GDP) IN ALBANIA. http://www.tradingeconomics.com/albania/agriculture-value-added-percent-of-gdp-wb-data.html
INSTAT	http://www.instat.gov.al/al/figures/statistical-databases/select.aspx?rxid=23f2ca58-3015-4ace-8036-1a4d7ce1a0e6&px_tableid=BU0020;
WB Albania	http://data.worldbank.org/country/albania
FAO Publication	AN ASSESSMENT OF THE COMPETITIVENESS OF THE DAIRY FOOD CHAIN IN ALBANIA (2009). Available in: http://www.euroqualityfiles.net/AgriPolicy/ Report%202.1/Albania%20 Agripolicy%20D2-1.pdf
Prof. Andrea Shundi	Country Pasture/Forage Resource Profiles. file:///C:/Users/perdorues/Downloads/Shundi_2006_Pasture-and-forage-profile_Albania_FAO.pdf
Group of authors	CH4 emissions form the enteric fermentation - Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/4_1_CH4_Enteric_Fermentation.pdf
FAO Publication	http://www.fao.org/wairdocs/lead/x6116e/x6116e01.htm
Ministry of Tourism and Environment	National Waste Management Plan for Albania
Ministry of Infrastructure and Energy (ex Ministry of Transport)	Oil by products consumed on Transport Sector, 2009-2016
Ministry of Finance and Economy	Annual Statistics related with GDP sectors contribution, 2009-2016
Agrotec spa	Albanian National Forest Inventory (2004)
Ministry of Environment, Forests and Water Administration	Forestry cadastre for the year 2012

UNFCCC	Decision -/CP.9 Good practice guidance for land use, land-use change and forestry in the preparation of national greenhouse gas inventories under the Convention
Ministry of Environment (EU project CARDS)	Regional Waste Management Plans
EU Project CARDS	Mercological Composition of Urban Solid Waste in Albania
EU CARDS	Distribution, location and extension of dumpsites in Albania
FAO database	FAO nutritional data http://www.fao.org/infoods/infoods/en/
FAO database	World Development Indicators. Dietary Energy and Protein consumption http://www.fao.org
UNFCCC	Annex of decision 17/CP.8. Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention
IPCC	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Vol.5. 2006 IPCC Guidelines for Guidelines for National Greenhouse Gas Inventories
EFDB	Emission Factor Data Base web site (http://www.ipcc-nggip.iges.or.jp/EFDB/main.php).
official data of waste and waste water handling	http://www.akm.gov.al/cilësia-e-mjedisit.html#raporte_publikime
INSTAT	Population and GDP of Albania for the years 1950 - 2016
INSTAT	Total Industry Product for the years 2010 - 2016
Fushe-Kruja Cement Factory	https://www.globalcement.com/magazine/articles/1107-fushe-kruje-cement-factory-a-hybrid-plant
Titan Cement	http://www.anteacement.com/_home/product/
Colacem Factory	https://www.colacem.com/al/en
Article for Steel Factory in Elbasan, Albania	https://www.see-industry.com/en/energy-efficiency-improvement-in-steel-factory-in-elbasan-albania/2/590/
Ozone Secretariat webpage	https://ozone.unep.org/countries/data-table

CIP Katalogimi në botim BK Tiranë

UNDP Albania
Albania’s National Greenhouse Gas Inventory Report
under the First Biennial Update Report/Mirela Kamberi,
Besim Islami, Abdulla Diku, Dritan Profka, Gjergji Selfo.
- Tirane : Gent Grafik, 2021
166 f. ; 21 x 29.7 cm.
ISBN 978-9928-294-54-8

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