TurkStat

NATIONAL GREENHOUSE GAS INVENTORY REPORT 1990-2011

Annual Report submission under the "Framework Convention on Climate Change"

TURKISH STATISTICAL INSTITUTE

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Note: The sections pertaining to the related sectors in this report and the CRF tables are prepared by the related organizations described above. LULUCF NIR is prepared by “Ministry of Food, Agriculture and Livestock” and “Ministry of Forestry and Water Affairs”.

Executive Summary

In 2004, the United Nations Framework Convention on Climate Change (UNFCCC) and in 2009, The Kyoto Protocol were ratified by Turkey. As an Annex I party to Convention, Turkey is required to develop annual inventories on emissions and removals of greenhouse gases (GHG), not controlled by the Montreal Protocol, using the Intergovernmental Panel on Climate Change (IPCC) methodology and sent to the UNFCCC Secretariat. Turkey prepared its first national inventory report (NIR) and common reporting format (CRF) tables for the period 1990 - 2004 and submitted to UNFCCC secretariat in 2006. National Inventory Report and CRF tables are prepared by TurkStat and sent to the UNFCCC Secretariat by TurkStat as the focal point of Turkish National Emission Inventory. This publication covers Turkey's seventh NIR for the year 1990 - 2011.

Emissions of the six direct greenhouse gases were covered in the report. These are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFC)
- Sulphur hexafluoride (SF_6)
- Perfluorocarbon (PFC)

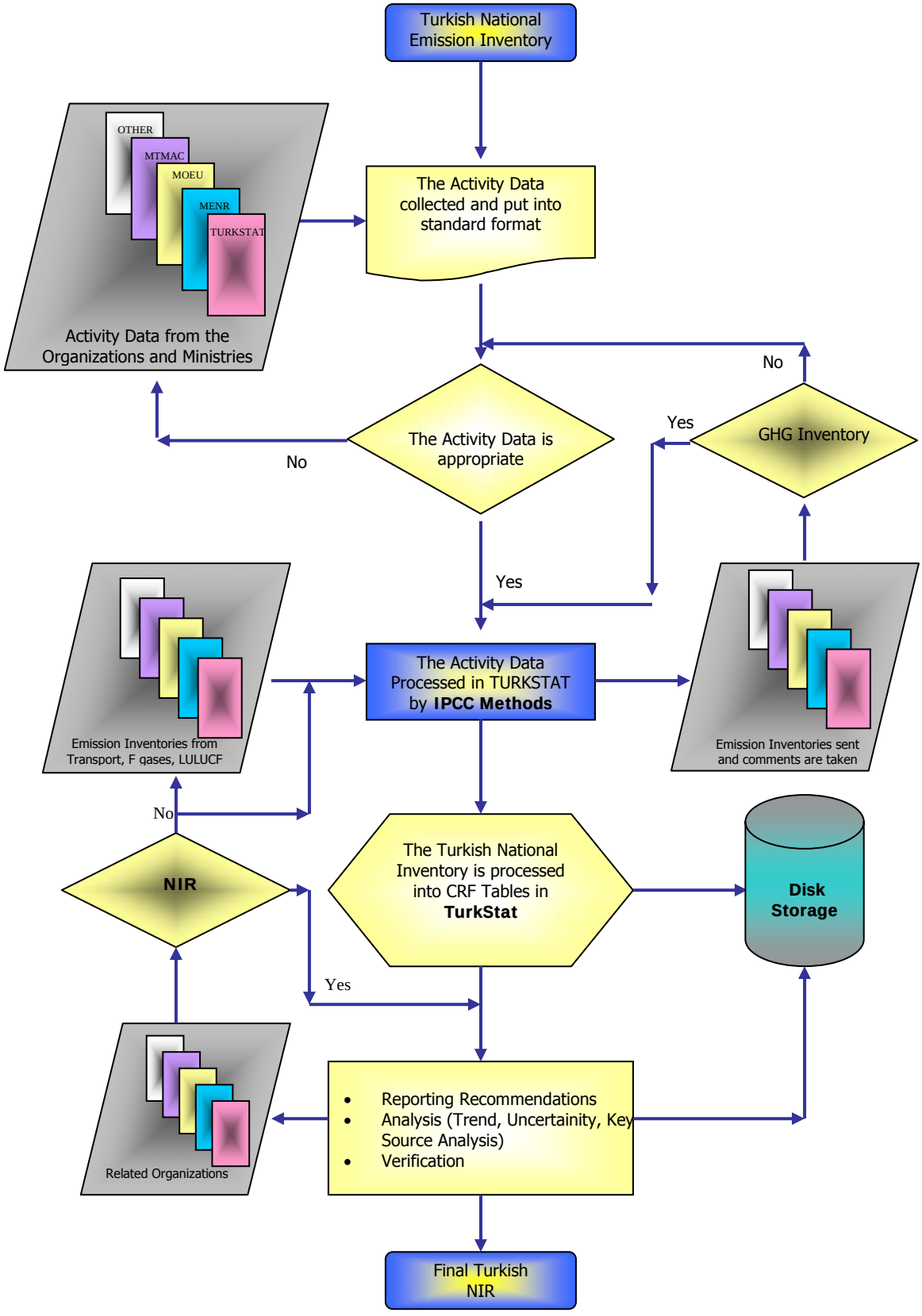
Also the following four indirect greenhouse gases are reported:

- Nitrogen oxides (NO_x)
- Carbon monoxide (CO)
- Non-methane volatile organic compounds (NMVOC)
- Sulphur dioxide (SO_2)

In this National Inventory Report, the source categories according to the IPCC methodology, i.e. energy, industrial processes, solvent and other product use, agriculture, land-use, land use change and forestry (LULUCF) and wastes are considered.

The Turkish Statistical Institute (TurkStat) is designated to be responsible for the national inventory of greenhouse gases in Turkey. The inventory was prepared as a joint work by TurkStat, Ministry of Food, Agriculture and Livestock, Ministry of Environment and Urbanization, Ministry of Transportation, Maritime Affairs and Communications, Ministry of Forestry and Water Affairs and Ministry of Energy and Natural Resources. Each sub-source categories are prepared by responsible organizations and combined by TurkStat.

The National Inventory Report also contains CRF tables, key source, trend and uncertainty analysis.



Schema.1 National emission inventory system

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Schema, Graph, Table List

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Symbol and Abbreviations

AMA	Automotive Manufacturers Association
BOD	Biochemical oxygen demand
C	Data pertaining to units which has less than three statistical units are not given by Law No:5429 which is indicated.
CO	Carbonmonoxide
COPERT	Computer Programme to Calculate Emissions from Road Transport
CO_2	Carbon dioxide
CH_4	Methane
CRF	Common Reporting Format
EF	Emission Factor
FOD	First Order Decay
Gg	Gigagram
GPG	Good Practice Guidance
GDP	Gross Domestic Product
GW	Gigawatt
GWh	Gigawatt Hour
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change and Forestry
LTO	Landing and Takeoff Cycle
MCT	Ministry of Customs and Trade
MENR	Ministry of Energy and Natural Resources
MEU	Ministry of Environment and Urbansation
MFAH	Ministry of Food, Agriculture and Husbandary
MFW	Ministry of Forest and Water Affairs
Mt	Million tonnes
Mtoe	Million Tonnes Oil Equivalent
MTMAC	Ministry of Transport, Maritime Affairs and Communications
MW	Megawatt
N_2O	Nitrousoxide
NO_x	Nitrogenoxide
NMVOC	Non-Methane Volatile Organic Compounds
PFC	Perfluorocarbon
SF_6	Sulphurhexafluoride
SO_2	Sulphurdioxide
TCMA	Turkish Cement Manufacturer's Association
TLA	Turkish Lime Association
TPES	Total Primary Energy Supply
TL	Turkish Liras
TJ	Terajoule
TurkStat	Turkish Statistical Institute
TWh	Terawatt Hour
UNFCCC	United Nations Framework Convention on Climate Change
Note.	Figures in the table may not add up to the total due to rounding to the closest integer

1. INTRODUCTION

In 2004, the United Nations Framework Convention on Climate Change (UNFCCC) and in 2009, The Kyoto Protocol were ratified by Turkey. As an Annex I party to Convention, Turkey is required to develop annual inventories on emissions and removals of greenhouse gases (GHG) not controlled by the Montreal Protocol using the Revised Intergovernmental Panel on Climate Change (IPCC) Guidelines and IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Inventory covers all emissions and removals sources described in IPCC Guidelines.

The National Greenhouse Gas Emissions were calculated by using the Revised 1996 IPCC Guidelines and 2006 IPCC Guidelines. The Emission Inventory includes annual GHGs emissions from energy, industrial processes, solvent and other product use, agricultural activities, waste and the emissions and removals from land use, land-use change and forestry on the scale of Turkey. The emissions from energy sector were calculated by TurkStat using the energy-balance tables of Ministry of Energy and Natural Resources (MENR). The emissions from electricity generation were calculated on the basis of all power plants fuel consumption by the Ministry of Energy and Natural Resources and the emissions from the transportation sector is calculated by the Ministry of Transport, Maritime Affairs and Communications. Emissions and removals from land use, land-use change and forestry were provided by the Ministry of Food, Agriculture and Livestock and the Ministry of Forestry and Water Affairs. Emissions from F-gases are estimated by the Ministry of Environment and Urbanization. The emissions from coal mining, industrial processes, solvent and other product use, agricultural activities, waste and fuel combustion in the energy sectors except for electricity generation and transport were calculated by Turkish Statistical Institute. TurkStat compiles national emission inventory, and sends to the UNFCCC Secretariat.

National Inventory Report covers direct greenhouse gases carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), sulphur hexafluoride (SF_6), perfluorocarbon (PFC) and indirect greenhouse gases nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC), sulphur dioxide (SO_2).

In this report, the national greenhouse gas (GHG) emissions from 1990 to 2011, emission sources, emission factors, difference between reference and sectoral approach, emission

trends, fluctuations, changes, uncertainty estimations and key source categories were evaluated in detail.

According to the IPCC Good Practice Guidance (GPG, 2000), emission sources that consist of the 95% of the total emissions as CO_2 equivalent, are classified as a key source category.

Based on the key source analysis including Land Use, Land-Use Change and Forestry (LULUCF) the followings are determined as key sources in 2011;

- 5. LULUCF (CO_2),
- 1.A.1.a Public electricity and heat production (CO_2),
- 2.A.1 Cement production (mineral products) (CO_2),
- 1.A.3.b Road transportation (CO_2),
- 1.A.4.b Residential usage of natural gas, hard coal, lignite, LPG (CO_2),
- 6.A.1 Solid waste disposal (managed landfill) (CH_4),
- 2.C.1 Iron and steel production (CO_2),
- 4.A Enteric fermentation (CH_4),
- 1.A.4.c Agriculture/Forestry/Fisheries (CO_2),
- 6.A.2 Solid waste disposal (unmanaged landfill) (CH_4),
- 1.A.2.f Other industries (CO_2),
- 1.A.2.f Cement production (CO_2),
- 2.F Emission of HFCs (HFC-134a),
- 1.A.2.a Iron and steel (CO_2),
- 4.D.1.1 Agricultural soil (synthetic fertilizer) (N_2O),
- 2.A.2 Lime production (mineral products) (CO_2),
- 1.A.2.c Chemicals (CO_2),
- 1.A.3.a Civil aviation (CO_2),
- 1.A.1.b Petroleum refining (CO_2),
- 4.B Manure management (N_2O),

- 1.A.3.d Navigation (CO_2),
- 6.B.2 Domestic and commercial wastewater handling (CH_4), (N_2O),
- 4.D.1.2 Agricultural soil (animal manure applied) (N_2O),
- 1.A.2.f Fertilizer (CO_2),
- 1.B.1.a.2 Mining (surface) (CH_4)

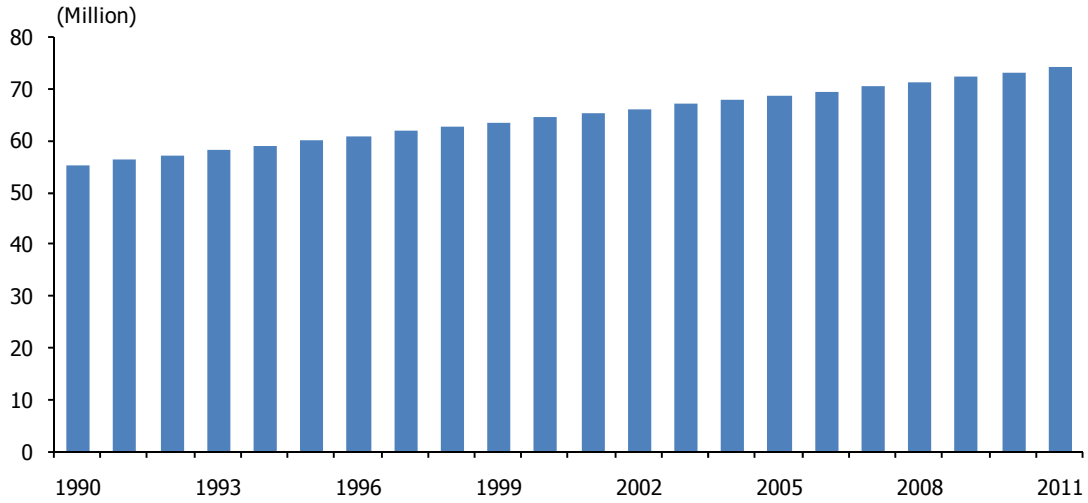
According to the base year considerations of emission trends in CO_2 equivalent, the highest changes are seen in fuel combustion and industrial sectors in 2011. Moreover, the trends in total emissions and sectoral emissions show differences.

Quantitative estimates of the uncertainties in the emissions are calculated using direct expert judgment. The total uncertainty is 5.2%, mainly caused by the high uncertain data of CO_2 uptake by forest.

The general procedures for uncertainty analysis based on the expert judgment are as follows;

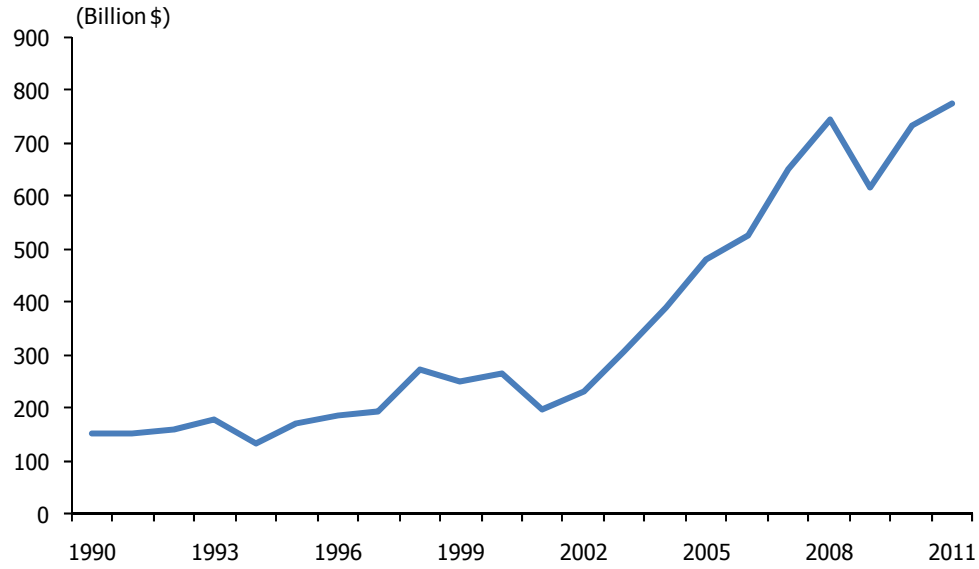
- Uncertainties of each activity are allocated by using emission factor and activity data uncertainties.
- Emissions are estimated for each (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) gases,
- The uncertainties for industrial processes data are estimated by TurkStat,
- The uncertainties of solvent and other product use data are estimated by TurkStat,
- The uncertainties of agricultural activities data are estimated by TurkStat,
- The uncertainties of waste data are estimated by TurkStat,
- The uncertainties for sectoral energy usage data are estimated by MENR,
- The uncertainties of transport sectors data are estimated by MTMAC.

1.1 Population, 1990 - 2011



Population and Gross Domestic Product (GDP) data are regarded as the main indicators in evaluating emission inventories by the UNFCCC Secretariat. The population of Turkey was 74 million in 2011 and the GDP was 774.2 billion US dollars.

1.2 GDP, 1990 - 2011



2. GREENHOUSE GAS EMISSIONS

The national GHG inventory preparation consists of the following basic activities;

- Collecting the data
- Processing the activity data
- Choosing the emission factors for estimating
- Calculation of emissions
- Determination of the key GHG emission sources
- Evaluation of the result (uncertainty and trend analysis)

The data sources of emission inventory in Turkey are;

- Energy balance tables - The Ministry of Energy and Natural Resources,
- Industrial production - TurkStat,
- Agricultural production - TurkStat,
- Land use change data and calculations - The Ministry of Food, Agriculture and Livestock,
- Forest sinks and emissions and calculations - The Ministry of Forestry and Water Affairs,
- Waste - TurkStat,
- Transport data and calculations - Ministry of Transport, Maritime Affairs and Communications,
- HFCs, PFCs and SF_6 data and calculations - Ministry of Environment and Urbanization.

The basic sources for emission factors for this inventory were the Revised 1996 IPCC Guidelines, 2006 IPCC Guidelines and GPG 2000.

The data confidentiality is one of the important problems. This problem was tried to be solved by adding calculated emission into some other upper categories using confidential data notation or not included in the inventory.

Table 2.1 gives summary data for greenhouse gas emissions for the years 1990-2011. The inventory for the year 1990 and 2011 revealed that the overall GHG emissions expressed in CO_2 equivalent were correspondingly 188.43 and 422.42 million tonnes not taking into account the sector LULUCF. The emission trends (not taking into account the LULUCF) of the basic GHGs is

also seen in the same table (1990=100%), the overall emission in 2011 increased by 124.17% according to emission in 1990.

2.1 Aggregated GHG emissions by sectors

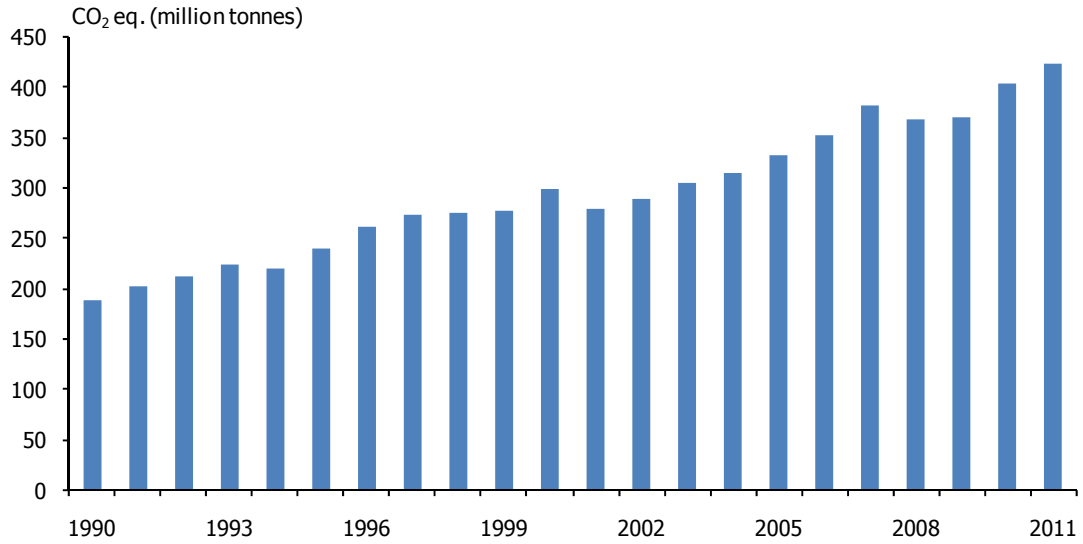
(Million tonnes CO_2 eq.)

Sector	1990	1995	2000	2007
Total (excluding LULUCF)	**188.43**	**238.82**	**298.21**	**380.95**
Energy	132.88	161.50	213.20	289.29
Industrial processes	15.44	24.21	24.37	29.26
Solvent and other product use	0	0	0	0
Agriculture	30.39	29.23	27.85	26.76
Waste	9.72	23.88	32.79	35.64
Compared to 1990 % (excluding LULUCF)	100.00	126.74	158.26	202.16
Land use, land-use change and forestry	-15.38	-20.07	-45.50	-34.43

Sector	2008	2009	2010	2011
Total (excluding LULUCF)	**367.21**	**370.01**	**402.10**	**422.42**
Energy	278.33	278.95	285.07	301.25
Industrial processes	29.83	31.69	53.94	56.21
Solvent and other product use	0	0	0	0
Agriculture	25.47	26.10	27.13	28.83
Waste	33.57	33.27	35.97	36.13
Compared to 1990 % (excluding LULUCF)	194.87	196.36	213.39	224.17
Land use, land-use change and forestry	-39.42	-38.96	-40.60	-43.64

In total emissions in 2011 excluding LULUCF, the emissions from the energy sector is the largest portion with 71.3% and the second largest one is the industrial process with 13.3%. However, the share of the emissions from waste is 8.6%.

2.1 GHGs emission trend, 1990 - 2011



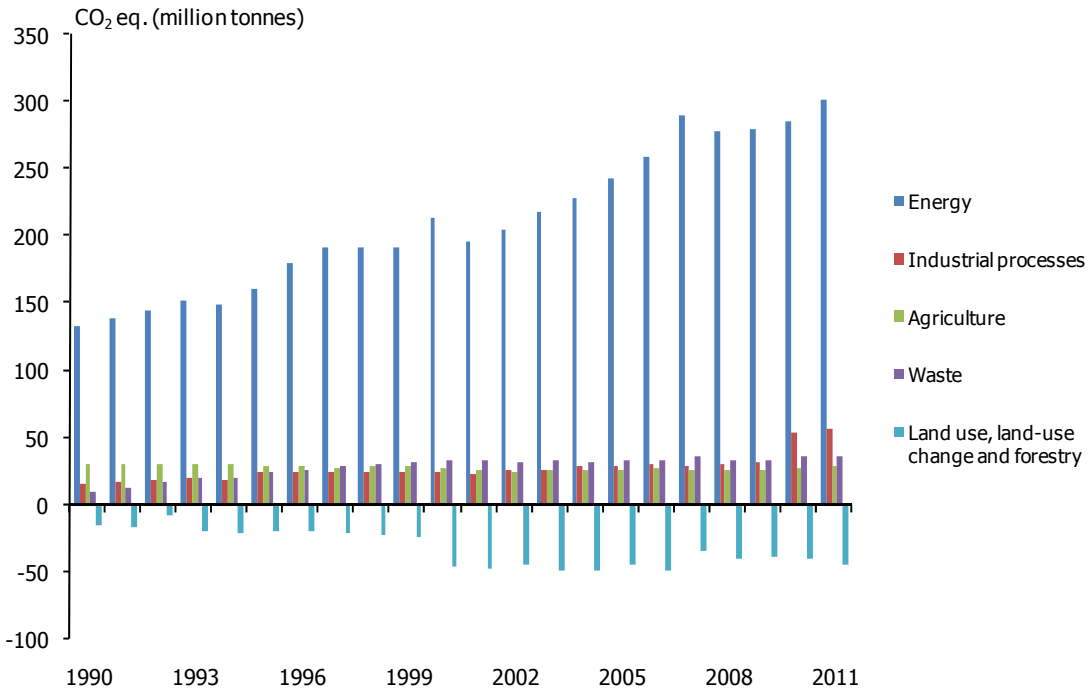
Graph 2.1 presents overall CO_2 equivalent emissions during the period 1990-2011.

2.2 Aggregated GHG emissions excluding LULUCF

(Million tonnes CO_2 eq.)

Gas	1990	1995	2000	2006	2007	2008	2009	2010	2011
Total (excluding LULUCF)	**188.43**	**238.82**	**298.21**	**350.74**	**380.95**	**367.21**	**370.01**	**402.10**	**422.42**
CO_2	141.56	174.09	225.61	276.88	308.07	297.28	299.27	326.55	344.69
CH_4	34.05	47.39	53.81	53.76	55.90	54.36	54.11	57.59	58.81
N_2O	12.22	16.82	17.14	16.05	12.85	12.05	13.00	13.08	12.65
HFCs	0.00	0.00	0.82	2.73	3.17	2.67	2.84	4.01	5.31
PFCs	0.60	0.52	0.52	0.40	0.00	0.00	0.00	0.00	0.00
SF_6	0.00	0.00	0.32	0.91	0.95	0.84	0.80	0.88	0.95

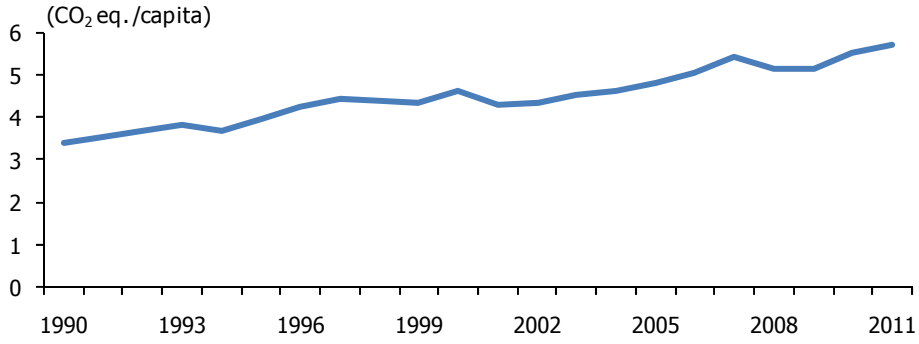
2.2 GHGs emission trend by sectors, 1990 - 2011



As shown in graph 2.2, the energy sector has the largest share in the overall emissions between the years 1990 and 2011.

As seen in graph 2.3, CO_2 emission per capita shows an increasing trend and it is parallel to the Turkey's total emissions trend.

2.3 GHGs emission per capita, 1990 - 2011

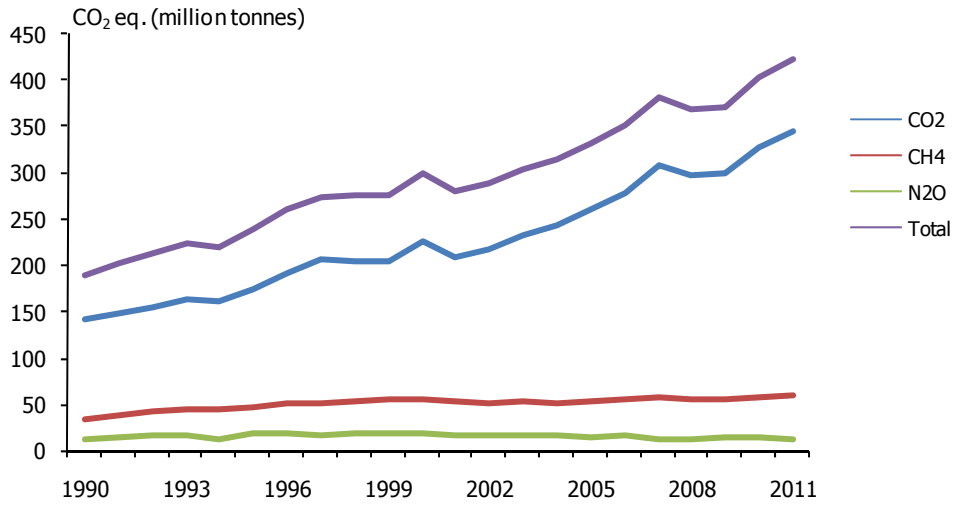


2.3 Contribution of sectors to the total emission

(%)

	1990	1995	2000	2007	2008	2009	2010	2011
Energy	76.79	73.83	84.36	83.49	84.91	84.26	78.86	79.53
Industrial processes	8.92	11.07	9.64	8.44	9.10	9.57	14.92	14.84
Agriculture	17.56	13.36	11.02	7.72	7.77	7.89	7.50	7.61
Waste	5.62	10.92	12.98	10.28	10.24	10.05	9.95	9.54
LULUCF	-8.89	-9.18	-18.00	-9.94	-12.02	-11.77	-11.23	-11.52

2.4 Emission trend of main GHGs, 1990 - 2011



As shown in graph 2.4, the CO_2 emissions show a general increasing trend, while N_2O and CH_4 emissions did not change considerably.

There are some points to consider in the methodology and the input data;

- The emission from the combustion of biomass was separated after 2005.
- Some sectors are presented as aggregated quantities due to data confidentiality of the production data such as limestone and dolomite use. The production data is confidential in accordance with law no 5429.
- The waste data has been gathered with surveys from all municipalities. However, the annual survey has been done discontinuously. Only the data for years 1994, 1995, 1996, 1997, 1998, 2001, 2002, 2003, 2004, 2005, 2006, 2008 and 2010 are available and others were estimated.

- The national energy conversion factors are applied for the reference approach on calculations of domestic lignite, hard coal and petroleum products. Average conversion factors for lignite and hard coal change for each year due to the changing quality those fuels.

- Emissions from International Bunkers are not included in the inventory until the year 2007, due to lack of data.

- Since the data on fuel transmission is not available as a time series in the energy balance tables. GHG emissions are not estimated.

- All emission from large scale iron and steel industry was considered under the energy sector for the period of 1990-2009. But, after 2010, the process emission for the iron and steel production is seperated and the entire quantity of coke is deducted from energy to prevent double counting.

- The emissions from the small and medium scale iron and steel industry are included in other (industries) since their fuel combustion can not be obtained separately in the energy balance tables.

3. ENERGY

3.1 Fuel Combustion

The major source of GHGs in Turkey was the fossil fuel combustion. The emissions from fossil fuel combustion are calculated by TurkStat with cooperation of the Ministry of Energy and Natural Resources (MENR) and the Ministry of Transport, Maritime Affairs and Communications. The emissions from thermal power plants were calculated by MENR and the emissions from transport were calculated by Ministry of Transport, Maritime Affairs and Communications. And the other energy sub-sectors were calculated by TurkStat.

According to the IPCC, the emissions from the energy sector mainly are released from the fuel combustion. As it can be seen almost in all countries, the energy sector in Turkey is also the key category for the emission of GHGs. Approximately 90% of the total CO_2 emission was emitted from the fuel consumptions. In energy sector, the sub-sectors were categorized based on the energy balance tables. These sectors were energy industries, manufacturing industries, transport and other sectors (including residential, agriculture, forestry and fisheries). The emission from the energy sector except for "transport sectors" and "public electricity and heat production" were estimated by IPCC Tier 1 approach. For those sectors, Tier 2 methodology has been used.

Energy balance tables were used to calculate emissions from fuel combustion. Energy balance tables are prepared by MENR, in both the original mass units and energy conversion units.

MENR, is the only data source of energy balance tables for both IEA and UNFCCC. The data is sent to the IEA at the beginning of the year. However, the data is sent to the UNFCCC at the end of the year with some revisions. Therefore the data sent to the UNFCCC is more updated compared to that of IEA.

Transportation sector consists of road transportation, domestic civil aviation, railways and national navigation. Emissions from international bunkers are included from 2008 onwards due to lack of data. Data availability in navigion sector and railways allows only Tier 1 methodology in the estimations. IPCC Tier 2 methodology was used for the calculation of emissions from road transportation and civil aviation. According to the IPCC recommendations, some

modifications based on country specific conditions were made on emission factors for road transportation.

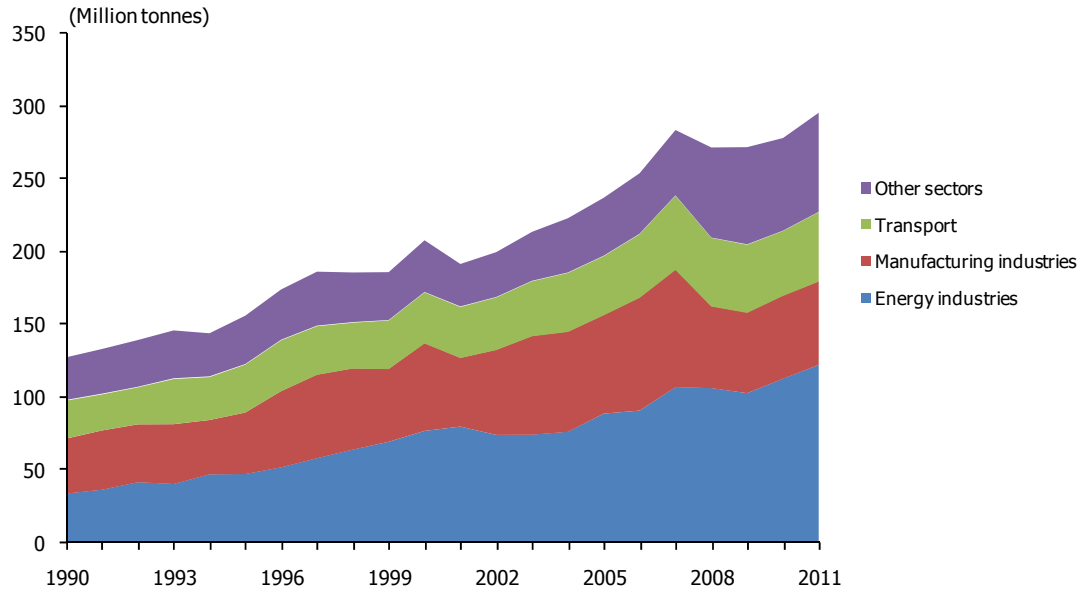
CO_2, CH_4, N_2O, NO_x, CO, NMVOC and SO_2 emissions from fuel combustion were calculated for the period 1990-2011.

3.1 Emissions from fuel combustion

(Gg)

	CO_2	CH_4	N_2O	NO_x	CO	NMVOC
1990	126 701.07	143.02	3.21	628.65	3 445.45	445.99
1991	132 470.80	146.04	3.25	634.17	3 422.75	445.61
1992	138 638.26	147.30	3.29	652.98	3 593.41	472.20
1993	145 246.92	143.04	3.44	723.75	3 891.86	515.23
1994	143 208.79	132.54	3.43	743.43	4 294.52	572.99
1995	155 347.30	137.27	3.59	789.51	4 491.64	610.59
1996	173 367.39	136.96	3.89	869.29	4 609.80	637.46
1997	185 596.47	142.00	3.94	897.78	4 723.85	654.21
1998	185 004.09	132.50	3.88	888.57	4 649.10	649.92
1999	185 203.17	124.00	3.93	920.20	4 438.16	634.04
2000	207 054.44	122.46	4.20	1 009.66	4 090.47	588.01
2001	190 878.73	109.01	3.97	969.21	3 691.24	538.27
2002	198 951.36	111.65	4.13	1 000.92	3 604.69	524.29
2003	212 964.27	114.08	4.36	1 061.18	3 511.87	516.27
2004	222 283.61	115.94	4.78	1 117.47	3 407.55	509.10
2005	236 355.33	114.38	4.89	1 049.19	3 036.11	459.78
2006	253 150.17	113.31	4.57	1 088.29	3 141.82	485.26
2007	282 833.96	115.89	5.12	1 175.51	3 093.49	489.98
2008	270 862.11	160.28	4.97	1 269.66	2 702.07	517.11
2009	271 109.03	176.58	4.89	1 410.41	3 276.37	519.77
2010	277 315.57	175.94	5.14	1 256.35	3 287.61	513.09
2011	294 649.14	147.56	3.22	1 259.71	2 751.33	410.65

3.1 CO_2 emissions from fuel combustion by sectors, 1990 - 2011



Carbon Dioxide (CO_2): The main contributor to the enhanced (manmade) greenhouse effect is CO_2. Globally, it accounts for over 60% of the enhanced greenhouse gas effect. In industrialised countries, CO_2 makes up more than 80% of greenhouse gas emissions. As it can be seen from graph 3.1, the distribution of CO_2 emission from the fuel combustion by sectors is not changing considerably until the year 1994. There is a slight increase. However, between the year 1995 and 1997, the increase is sharp. While, the trend is steady for the years 1997-1999 period and it reaches its highest value in 2000 and 2007.

In Turkey, the highest CO_2 emission increase is observed in energy industries with 258.0%. Then it is followed by other sectors with 132.7% and transport with 83.7%. The total CO_2 increase in fuel combustion activities in 2011 compared to 1990 is 132.6%.

3.2 CO_2 emissions from fuel combustion by sectors, 1990 - 2011

The highest proportion of CO_2 emissions from combustion is from manufacturing industries in 1990, while it is from energy industries in 2011.

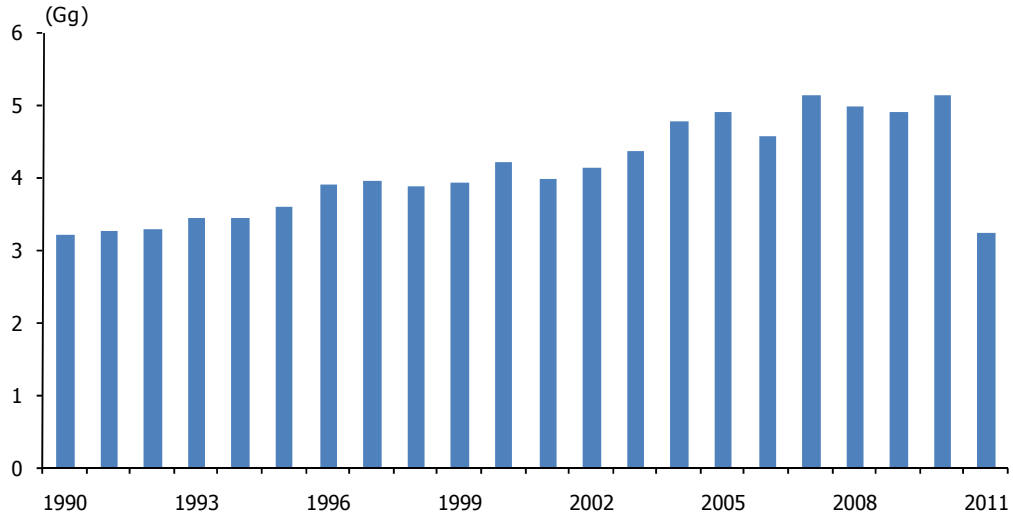
The CO_2 emission and conversion factors which are used in calculations are given in table 3.2.

3.2 Emission and conversion factors for CO_2

Fuel	CO_2 EF (tC/TJ)	Efficiency	C-CO_2
Hard coal	25.80	0.98	3.67
Lignite	27.60	0.98	3.67
Asphalt	25.80	0.98	3.67
Second fuel coal	25.80	0.98	3.67
Petroleum coke	25.80	0.98	3.67
Natural gas	15.30	1.00	3.67
Petrol	20.00	0.99	3.67
Residual fuel oil	21.10	0.99	3.67
Gas/Diesel oil	20.20	0.99	3.67
Gasoline	18.90	0.99	3.67
LPG	17.20	0.99	3.67
Refinery gas	20.00	0.99	3.67
Jet Kerosene	19.50	0.99	3.67
Naphta	20.00	0.99	3.67

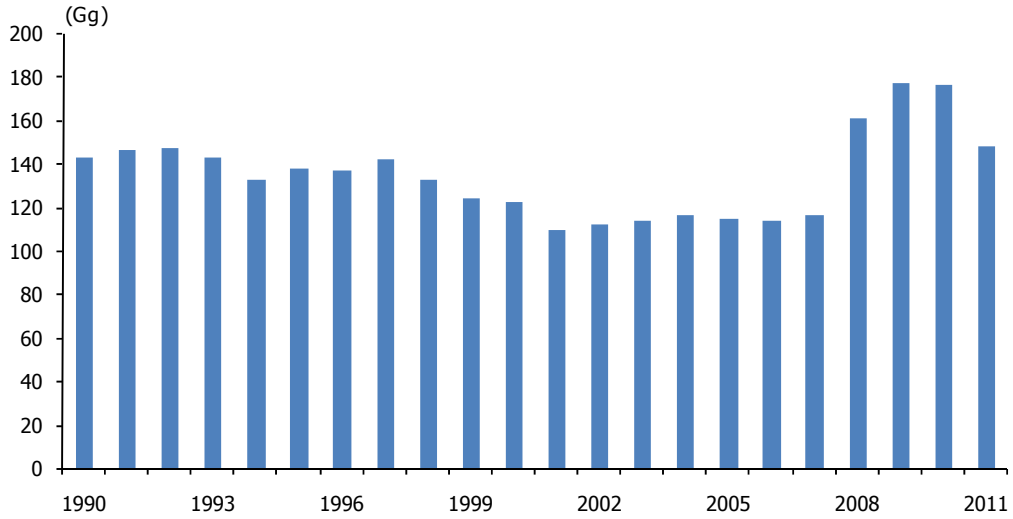
Nitrous Oxides (N_2O): N_2O emission from fuel combustion is increased approximately 0.54% during the period 1990-2011. The highest increase is observed in energy industries with a value of 191.1%. The increase in manufacturing industries is around 19.4%.

3.3 N_2O emissions from fuel combustion, 1990 - 2011



Methane (CH_4): CH_4 emission from fuel combustion doesn't change considerably till 2008. But it increases after 2008. The rate of change in 2011 emissions compared to 1990 is 3.17%.

3.4 CH_4 emissions from fuel combustion, 1990 - 2011



The emissions of other gases NO_x, CO and NMVOC from fuel combustion are also calculated for the period 1990-2011. While an increasing trend is observed for NO_x emission, declining trends are obtained for CO and NMVOC after 1997 (table 3.1).

Emissions from combustion are calculated on the basis of the following sub-categories of the IPCC.

3.1.1 Energy Industries (1.A.1)

Source Category Description: This source category includes the emission from the electricity generation and petroleum refining in Turkey. For this sector general fuel consumption data are taken from energy balance tables.

Methodological Issues: The fuel consumption data is multiplied by emission factors (EF) to give an estimation of the direct and indirect greenhouse gas emission. For thermal power plants, the individual emission data for each plant were calculated by Ministry of Energy and Natural Resources. Each power plant reported its net calorific values (NCVs) of the fuels used. The calorific values, in terms of Tj, of the fuel consumed are calculated by multiplying NCVs and fuel amounts. Carbon contents and oxidation rates, on the other hand, are directly taken from

IPCC Guideline. The aggregated emission data are then compared with the emission estimated by simple multiplication of consumption and EF. The main aim is to verify the emissions.

Emissions from petroleum refining are calculated according to IPCC T1 methodology by TurkStat. Fuel data are taken from the energy balance tables. The default IPCC emission factors in the guidelines are used.

Uncertainties and time-series consistency: The activity data for energy sectors are, completely taken from energy balance tables. Uncertainties in the emission factor and fuel used are determined by experts of MENR. After calculating the emissions from all sectors, the GWP weighted emission of CO_2, N_2O and CH_4 are multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use expert judgment as described in IPCC Good Practice Guidance and Uncertainty Management (2000). The combine uncertainties in emission factors and activity data are explained in annex 7 in detail.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance was used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. For the quality control purposes, GHGs emissions estimated by using Tier 2 approach were compared with emissions estimated by using Tier 1 approach. If the difference between the emission values obtained by both methods is less than 5%, then it is considered as appropriate. For the calculation of 2011, the difference is not more than 5%. In addition, emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

3.3 Time series consistency of emission factor for (1.A.1)

Source category	Gas	Fuel type	Comments on time series consistency
1.A.1	CO_2	All Fuels	EF was not varying until 2004 for (1.A.1.a). Then CS EF was used for (1.A.1.a). All EFs are constant over the entire time series for Petroleum Refining (1.A.1.b).
1.A.1	N_2O, CH_4 and NO_X, CO, NMVOC	All Fuels	EF was not varying until 2004 for (1.A.1.a). Then CS EF was used for (1.A.1.a). All EFs are constant over the entire time series for Petroleum Refining (1.A.1.b).

Recalculation: There is no recalculation in sector 1.A.1 for 1990-2011.

3.1.1.1 Public Electricity and Heat Production (1.A.1.a)

Source Category Description: In terms of emissions levels and trends, the source category public electricity and heat production is a key category in terms of CO_2 emissions from the secondary fuel coal, hard coal, lignite, natural gas and residual fuel oil. Under source category public electricity and heat production, the data includes electricity and heat production of all power plants in operation. For this sector fuel consumption data are taken from the energy balance tables.

In 2011, electricity production kept its major role in GHG emissions. The installed capacity reached to 52.91 GW with 6.84% increase from the previous year and about 3 times higher than the 1990 values. The total net electricity consumption has increased in 2011 compared to the previous year. In the year 2011, net consumption was 186.09 TWh meanwhile in 2010 this figure realized as 171.99 TWh. Natural gas had a very high share of 45.3% in electricity production, which was followed by coal (28.86%), hydro and geothermal (23.11%), other renewable (2.05%) and oil (1.0%).

Hydropower production has increased by 1.04% from 51.80 TWh in 2010 to 52.34 TWh in 2011, owing to the capacity additions. In 2010 thermal power plants produced 155.8 TWh of electricity with 0.7% decrease from the previous year, meeting 74% of the total electricity demand with 65.2% share of total installed capacity.
There was an accelerated increase in wind installed capacity from 1320.2 MW in 2009 to 1728.7 MW in the year 2011. Renewable Law which came into force in 2005 later revised in 2011 providing some supporting mechanism for purchasing electricity from solar, biomass, geothermal, wind and hydraulic energy. The role of voluntary carbon market is important to mention here, as many of the wind projects in the country generate and sell the voluntary carbon credits.

Electricity generation from animal and vegetal waste has increased by 2.45% compared to the previous year, reaching to 115.4 MWs of installed power, generating 469.2 GWh of power in 2011.

In 2011, Turkey's Total Primary Energy Supply (TPES) was 114.5 mtoe, a 4.75% increase compared to 2010. Oil had a share of 30.50 mtoe while coal and gas accounted for 33.88 mtoe and 36.91 mtoe respectively. Renewables accounted for 9.69 mtoe.

Primary energy (domestic) production decreased by 1% from 32.49 Mtoe in 2010 to 32.23 Mtoe in 2011 and provided 28.15% of overall energy supply. Import dependency of the country increased to 71.61% from previous years' 72.41%.

The production of solid fossil fuels, excluding animal & vegetal waste, has slightly decreased from 20.91 Mtoe in 2010 to 20.32 Mtoe in 2011. Decrease in indigenous oil production is 4.34%. There is a slight increase in domestic natural gas production, from 0,625 Mtoe in 2010 to 0,652 Mtoe in 2011. The main domestic energy source remains as coal with a production increased by 3.5% from 73.4 million tonnes in 2010 to 75.98 million tonnes (Mt) in 2011.

The activity data for fuels are taken directly from the Energy Balance Sheets. More information on energy balance tables are presented in Annex 8.

Heat content of fuels for source category 1.A.1.a was calculated with the help of data directly collected from electricity generation installations, using real plant values, through questionnaires. The amount of main fuel used was multiplied by plant specific NCVs to obtain heat values in terms of Tj. The average NCV are given in the Table A4.3.

3.1.1.2 Petroleum refining (1.A.1.b)

Petroleum refining was a key category in terms of emissions level for CO_2 emissions from refinery gas and natural gas consumption. The contribution to total CO_2 emission from petroleum refining was ranging between 1.6% and 3.3% throughout the years. Fuel inputs in petroleum refineries were taken from energy balance tables. The emission factors were default from the IPCC Guidelines. The uncertainty of activity data were estimated by MENR experts.

3.1.1.3 Manufacture of solid fuels and other energy industries (1.A.1.c)

This section was not evaluated under a separate category. It has been included in the Public Electricity and Heat Production and Coal Mining and Handling section.

3.1.2 Manufacturing industries and construction (1.A.2)

Source Category Description: This source category consists of manufacturing industries sectors. IPCC categorizes manufacturing industry as iron and steel, nonferrous metal, chemicals, pulp, paper and print, food processing, beverages and tobacco. However, depend on energy balance tables, pulp, paper and print and food processing, beverages and tobacco can not be separated and considered in the section Other Industries (1.A.2.f). Moreover, for the years between 1990 and 2004, cement production, sugar production, fertilizer industries and other industries were given as aggregated. Each of these mentioned sectors was categorized separately under the other industries after the year 2005.

Since in the energy balance tables, fuel consumption for energy production of manufacturing industry can not be separated, emissions of manufacturing industry from energy production can not be separated, and included in the section Public Electricity and Heat Production (1.A.1.a)

Methodological Issues: GHG emissions from this sector were calculated by using IPCC T1 approach. The fuel consumption data is multiplied by emission factors (EF) to give an estimation of the direct and indirect greenhouse gas emission. The emission factors are given in annex 2.

Uncertainties and time-series consistency: The activity data for manufacturing industry sector are, completely taken from energy balance tables. Uncertainties in the emission factor and fuel used are determined by experts of MENR. After calculating the emissions from all sectors, the GWP weighted emission of CO_2, N_2O and CH_4 are multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use expert judgment as described in IPCC Good Practice Guidance and Uncertainty Management (2000). The combine uncertainties in emission factors and activity data are explained in annex 7 in detail.

3.4 Time series consistency of emission factor for (1.A.2)

Source category	Gas	Fuel type	Comments on time series consistency
1.A.2	CO_2	All Fuels	All EFs are constant over the entire time series.
1.A.2	N_2O, CH_4	All Fuels	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance was used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in sector 1.A.2 for 1990-2011.

3.1.2.1. Iron and Steel Industries (1.A.2.a)

The source category iron and steel industries under manufacturing industries and construction is a key category, in terms of CO_2 emissions from hard coal and natural gas. The emissions from the iron and steel industry are very high compared to other sectors due to high energy consumption.

There are two different technologies used in iron and steel industry; integrated facilities (BOF) and electric arc furnaces (EAF). Iron and steel industry consumes energy and raw materials intensively. Currently, 3 integrated facilities and 27 electric arc furnace mills are in operation in Turkey.

The fuel consumption amounts are taken from energy balance tables. Energy balance tables provided fuel consumptions of large scale iron and steel industry separately till 2008, and fuel consumption of electric arc furnace mills is included in the section Other Industries (1.A.2.f). After 2008, the fuel consumption of electric arc furnace mills is separated and included in iron and steel production industries instead of other sector. For that reason, the emissions have increased since that year.

Process emissions and energy emissions from iron and steel industry are considered together under this section (1.A.2.a) for 1990-2009 periods. However, after 2010 inventory, process emissions and energy emissions from iron and steel industry are estimated separately. Only energy emissions given in this section, process emissions are given under section 2.C.1. In order to prevent double counting the entire quantity of coke used for iron and steel production is deducted from total coke consumption.

3.1.2.2 Non Ferrous Metal (1.A.2.b)

The source category non ferrous metal is not a key category. The CO_2 emission compared to total CO_2 emission from Manufacturing Industries and Construction is ranging between 0.47% and 12.39%.

3.1.2.3 Chemicals (1.A.2.c)

The source category of chemicals is a key category in terms of CO_2 emissions from natural gas in 2011. Emissions from chemicals are calculated according to IPCC T1 methodology by TurkStat. Fuel data are taken from the energy balance tables. The default IPCC emission factors in the guidelines are used.

3.1.2.4 Pulp, Paper and Print (1.A.2.d)

The energy consumption for production of pulp, paper and printed products is not separated in the energy balance tables. Therefore emissions from this sector are evaluated under the section 1.A.2.f-other.

3.1.2.5 Food Processing, Beverages and Tobacco (1.A.2.e)

The energy consumption for this sector and production was not separated in the energy balance tables. Therefore emissions from the sector were evaluated under the section 1.A.2.f - other.

3.1.2.6 Other - Cement Production (1.A.2.f)

The source category cement production was a key category in terms of CO_2 emissions from lignite, petroleum coke and hard coal. Emissions from cement production are calculated according to IPCC T1 methodology by TurkStat. Fuel data are taken from the energy balance tables. The default IPCC emission factors in the guidelines are used.

3.1.2.7 Other - Sugar (1.A.2.f)

This sector is not a key category. The energy consumption is taken from the energy balance tables.

3.1.2.8 Other - Fertilizer (1.A.2.f)

This sector was a key category in terms of CO_2 emissions from natural gas in 2011. The energy consumption is taken from the energy balance tables.

3.1.2.9 Other Non-Specified (1.A.2.f)

The manufacturing industry sectors which are not specified above covered in this section. The source category other non-specified was a key category in terms of CO_2 emissions from natural gas, lignite and gas/diesel oil. Emissions from cement production are calculated according to IPCC T1 methodology by TurkStat. Fuel data are taken from the energy balance tables. The default IPCC emission factors in the guidelines are used.

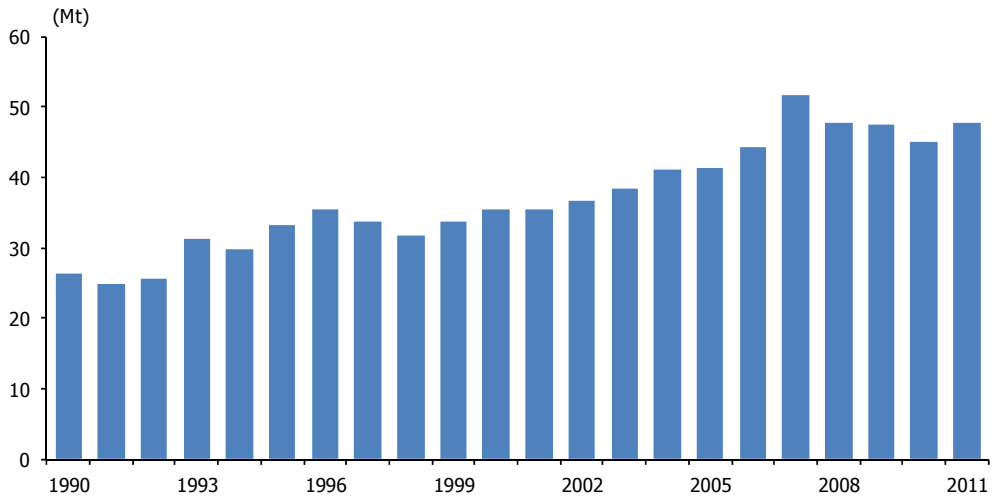
3.1.3 Transport

Estimation of emissions in Transport sector are carried out in sub-categories listed below:

- Civil Aviation (1.A.3.a)
- Road Transportation (1.A.3.b)
- Railways (1.A.3.c)
- Water-borne Navigation (1.A.3.d)

Transport emissions are one of the main sources of GHG emissions in Turkey. Emissions from this sector are 82.07% higher in 2011 than in 1990 (Graph 3.5), and on average emissions are increased by over 3.9% annually.

3.5 CO_2 equivalent of emissions for transport sector, 1990 -2011



In 2011 transport sector contributed 47.86 Mt CO_2 equivalent emissions. The distributions and changes from the year 1990 to the year 2011 are given in Table 3.5. According to the graph 3.6, road transportation is the major CO_2 source and contributing 87.22% of total. Contribution of the domestic aviation is 7.11%, domestic water-borne navigation is 4.66%, and railway is 1.01%.

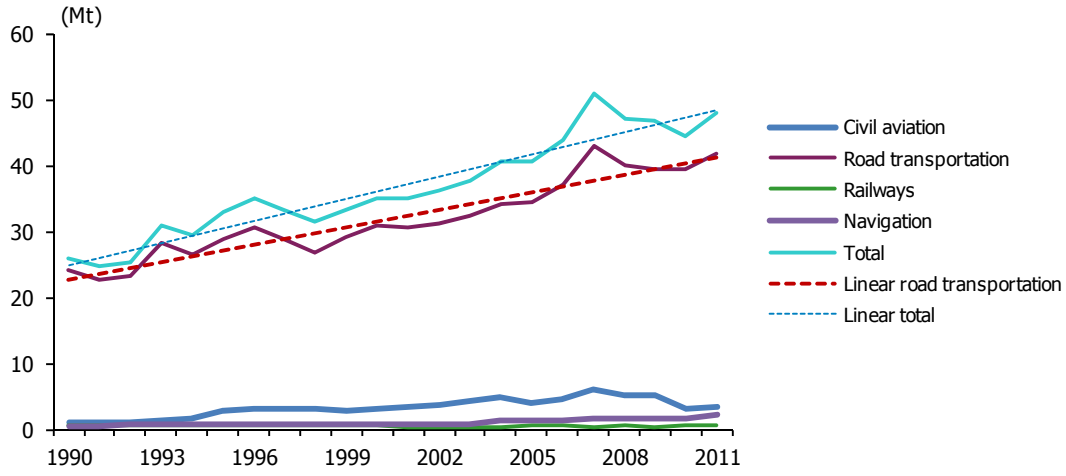
3.5 Transport GHG Contribution in CO_2 Equivalent

Modes of transport	CO_2 Equivalent Emissions (Gg) 1990	2010	2011	Share in Transport Sector (%) 2011
Road transportation	24 350.70	39 955.30	41 742.53	87.22
Domestic aviation	914.98	3.026.53	3.404.39	7.11
Railways	521.52	474.66	482.12	1.01
Domestic navigation	499.39	1 685.92	2.230.34	4.66

	Change between 2010-2011 CO_2 Eq. (Gg)	(%)	Change between 1990-2011 CO_2 Eq. (Gg)	(%)
Road transportation	1 787.23	4.3	17 391.83	71.42
Domestic aviation	377.85	11.1	2 489.41	272.07
Railways	7.46	1.5	-39.40	-7.55
Domestic navigation	544.42	24.4	1 730.95	346.61

Source: Ministry of Transport, Maritime Affairs and Communications

3.6 CO_2 emission trend in modes of transport, 1990 - 2011



Source Category Description: The source category comprises GHG emissions resulted from transport sector as follows; aviation, railways, road transportation and navigation. In addition to these, international aviation and international navigation are also included in this category. Among these categories;

- Civil Aviation in terms of CO_2 emissions from jet fuel
- Road transportation in terms of CO_2 emissions from diesel fuel, LPG and gasoline
- Water-borne Navigation in terms of CO_2 emissions from diesel fuel and fuel oil

are the key categories.

Emissions from civil aviation are covered as international aviation and domestic aviation under both (1.A.3.a.i) and (1.A.3.a.ii) categories.

Road transportation is the largest contributor to transport emissions and estimations are made under a wide variety of vehicle types using not only gasoline but also diesel fuel and LPG. It is covered under category (1.A.3.b).

Emissions from railways are reported under category (1.A.3.c).

Emission estimates from the navigation section cover international water-borne navigation (1.A.3.d.i) and domestic navigation-coastal shipping (1.A.3.d.ii).

Methodological Issues: Methodology used for the estimation of GHG emissions of mobile sources for time series 1990-2011 is the multiplication of fuel data with corresponding emission factors. All emission factors are taken from IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996).

The IPCC methods used in transport sector calculations are listed in Table 3.6.

3.6 Method used in the calculation of GHG emissions by transport modes

Modes of transport	CO_2	CH_4	CO	N_2O	NOx	NMVOC	SO_2	TIER I	TIER II
Domestic aviation	√	√	√	√	√	√	√	X	X
International aviation	√	√	√	√	√	√	√	X	
Road transportation	√	√	√	√	√	√	√	X	X
Railways	√	√	√	√	√	√	√	X	
Domestic navigation	√	√	√	√	√	√	√	X	
International navigation	√	√	√	√	√	√	√	X	

Source: Ministry of Transport, Maritime Affairs and Communications

For the Transport source category (1.A.3), the following data sources are used to estimate and calculate emissions:

- Fuel consumption values for source categories (1.A.3.a.i), (1.A.3.a.ii), (1.A.3.b), (1.A.3.c), (1.A.3.d.i) and (1.A.3.d.ii) are provided by Energy Market Regulatory Authority and Ministry of Energy and Natural Resources in the form of the national energy balance tables.

- Air traffic data is provided by DG of State Airports Authority for National Aviation (1.A.3.a.ii). Emissions are estimated by using IPCC Tier 2 methodology explained in IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996). The calculation methodology is based on the national energy consumption data and air traffic data for each airport in terms of aircraft type. For the activities default emission factors are used. Air traffic data which consists of landing and take-off (LTO) cycles and cruise is processed for all 47 airports in Turkey. All activities below 914 m are included in LTO cycle; movements over 914 m altitude are covered in the cruise phase. Domestic flights for all aircraft types have been accounted considering estimated individual fuel consumption values. The necessary emission factors for LTO and cruise for each type of aircraft have been chosen from IPPC reference manual.

- The emissions from road transportation are calculated by using IPCC Tier 2methodology. Vehicle types and other important data necessary for calculations are provided from DG of Highways and Turkish Statistical Institute.

- Other values for database improvement are provided from DG of Highways, DG of Turkish State Railways and DG of Civil Aviation.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National Greenhouse Gases Emission Inventory. For the quality control purposes, GHGs emissions, estimated by using Tier 2 approach, were compared with emissions estimated by using Tier 1 approach. When the difference between the emission values obtained by both methods is less than 5%, calculations are considered to be appropriate.

3.1.3.1 Civil Aviation (1.A.3.a)

The civil aviation source category was a key category, in terms of CO_2 emissions from the jet fuel.

3.1.3.1.1 International Aviation (1.A.3.a.i)

The fuel type used in international aviation is jet fuel. Table 3.7 shows the trend in emissions of CO_2, CH_4, N_2O, NO_x, CO, NMVOC and SO_2 from international aviation between 2010 and 2011.

Due to increase in fuel consumption, all emissions increased in year 2011 comparing to year 2010. Graph 3.7 and Graph 3.8 illustrate respectively the total GHG emissions and the emissions of N_2O and CH_4 increasing trends as Gg CO_2 equivalents. According to Table 3.7, total CO_2 emission reached to 7.419 Gg. The emissions of nitrous oxide and methane reached 65.1 Gg CO_2equivalents and 1.05 Gg CO_2 equivalents, respectively.

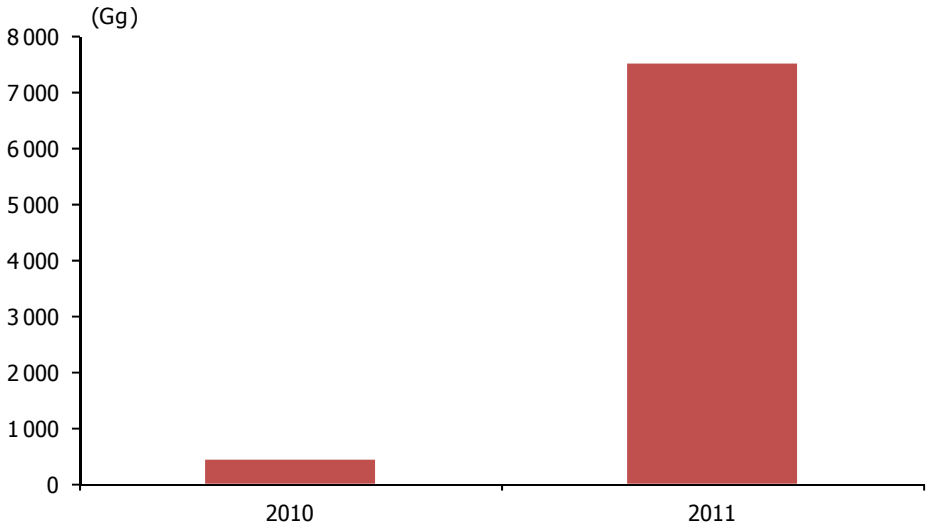
Table 3.7 GHG emissions from international aviation

(Gg)

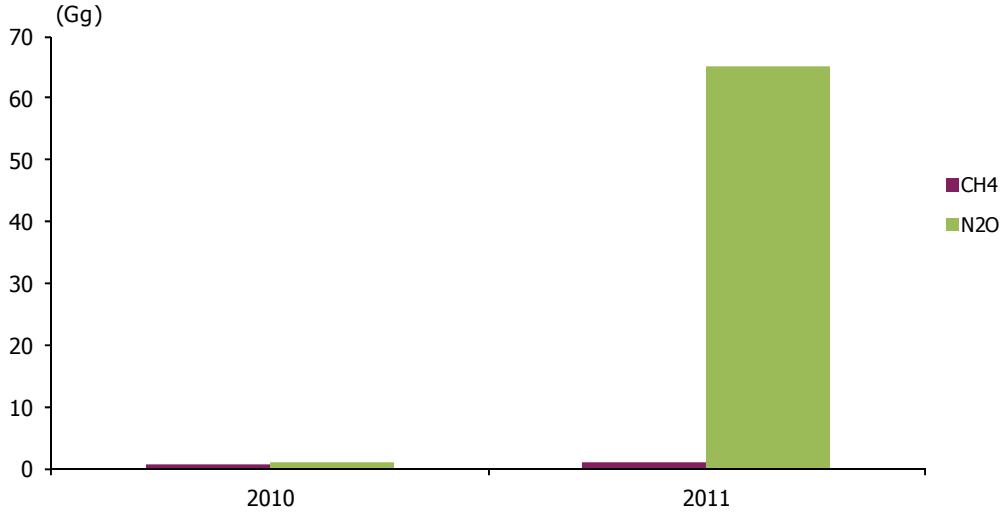
	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
2010	432.92	0.0303	0.00363	1.82	0.61	0.303	0.128
2011	7 419.22	0.05	0.21	31.13	10.38	5.19	1.16

Source: Ministry of Transport, Maritime Affairs and Communications

3.7 CO_2 equivalent for international aviation, 2010-2011



3.8 CO_2 equivalent of CH_4 and N_2O emissions for international aviation, 2010-2011



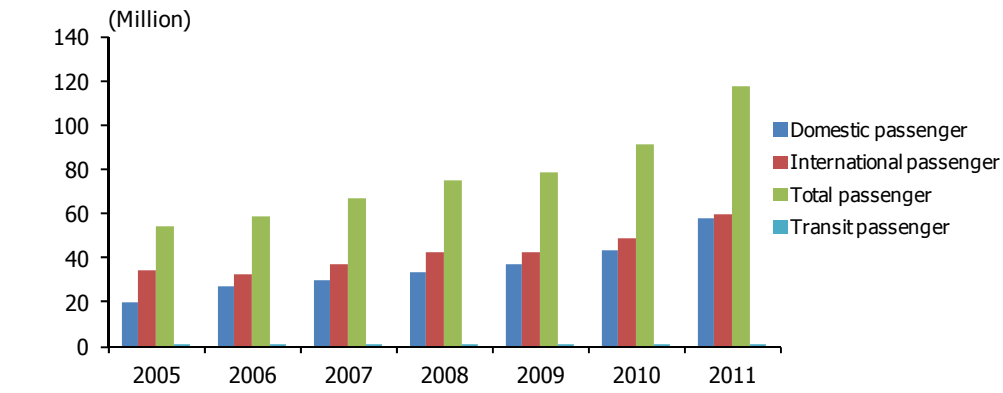
Uncertainties and time-series consistency: Uncertainties may arise due to the verification of the international fuel data which is solely provided by Energy Market Regulatory Authority. It is necessary to study with all firms in this sector and Ministry of Energy and Natural Sources for determining international fuel usages. Discussions about this issue are in progress.

Recalculation: There is no recalculation in this sector.

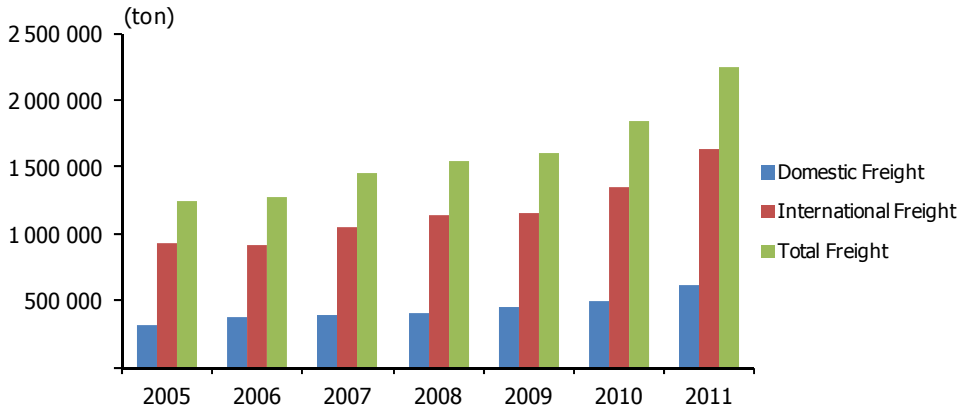
3.1.3.1.2 Domestic Aviation (1.A.3.a.ii)

In domestic aviation only jet fuel is consumed. Air traffic data is provided by DG of State Airports Authority for all civil airports in Turkey. The number of LTO values for all aircraft types are provided for each airport. In the year 2011 total number of LTO's in domestic travel for all air craft types is 579.488. The increase in passenger and freight traffic from 2005 to 2011 is also given in Graph 3.9 and Graph 3.10 respectively. Table 3.8 shows air traffic in Turkish airports in 2011.

3.9 Passenger traffic, 2005 - 2011



3.10 Freight traffic, 2005 - 2011



Emission factors for all aircraft types are obtained from IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996). Default values are applied for aircrafts where specific data is not available.

In the light of these explanations, the total fuel consumption for domestic aviation is 1.058 Mt. The calculated total LTO fuel consumption is 0.509 Mt and cruise fuel consumption is 0.550 Mt, giving CO_2 emission values of 1.598 Mt and 1.732 Mt for LTO and cruise respectively. CO_2, CH_4 and N_2O emission values and average emission factors are given in Table 3.9 for domestic aviation.

3.8 Air traffic, 2011

Airports	Domestic		International		Total	
	Number of flight	Number of passengers	Number of flight	Number of passengers	Number of flight	Number of passengers
İstanbul Atatürk	118 588	13 421 536	206 621	23 973 158	325 209	37 394 694
Ankara Esenboğa	67 513	7 080 072	15 452	1 405 395	82 965	8 485 467
İzmir Adnan Menderes	51 700	6 125 076	18 627	2 398 457	70 327	8 523 533
Antalya	39 061	4 516 485	125 671	20 511 172	164 732	25 027 657
Muğla Dalaman	9 888	696 644	17 977	3 035 730	27 865	3 732 374
Muğla Milas-Bodrum	13 952	1 396 493	14 011	1 991 842	27 963	3 388 335
Adana	29 624	2 651 873	5 342	589 094	34 966	3 240 967
Trabzon	16 529	2 190 503	3 025	89 514	19 554	2 280 017
Isparta Süleyman Demirel	8 838	20 724	32	835	8 870	21 559
Nevşehir Kapadokya	1 743	127 730	274	30 062	2 017	157 792
Erzurum	7 531	788 128	330	17 209	7 861	805 337
Gaziantep	10 064	1 170 025	3 035	144 483	13 099	1 314 508
Adıyaman	578	45 346	-	-	578	45 346
Ağrı	1 334	134 519	-	-	1 334	134 519
Balıkesir Merkez	313	6 674	-	-	313	6 674
Balıkesir Körfez	2 499	56 933	33	2 723	2 532	59 656
Batman	1 597	173 943	-	-	1 597	173 943
Bursa Yenişehir	4 964	67 410	601	44 140	5 565	111 550
Çanakkale	2 680	60 543	19	-	2 699	60 543
Çardak	2 234	168 260	65	6 367	2 299	174 627
Diyarbakır	13 735	1 714 423	174	18 951	13 909	1 733 374
Elazığ	4 289	513 804	288	35 250	4 577	549 054
Erzincan	2 485	207 074	2	-	2 487	207 074
Gökçeada	132	1 106	-	-	132	1 106
Hatay	5 030	553 527	1 313	136 059	6 343	689 586
Kahramanmaraş	1 492	95 740	-	-	1 492	95 740
Kars	2 976	377 584	2		2 978	377 584
Kayseri	9 006	968 942	1 985	254 818	10 991	1 223 760
Kocaeli Cengiz Topel	121	11 851	-	-	121	11 851
Konya	5 693	530 509	827	70 362	6 520	600 871
Malatya	6 769	553 142	167	17 463	6 936	570 605
Mardin	1 252	122 912	-	-	1 252	122 912
Merzifon	557	48 035	5		562	48 035
Muş	1 797	195 784	7	762	1 804	196 546
Samsun Çarşamba	9 658	1 064 301	956	90 857	10 614	1 155 158
Siirt	748	31 420	-	-	748	31 420
Sinop	781	58 438	-	-	781	58 438
Sivas Nuri Demirağ	2 300	221 049	82	7 550	2 382	228 599
Şanlıurfa Gap	2 396	224 677	78	6 646	2 474	231 323
Tekirdağ Çorlu	21 734	42 839	1 473	281	23 207	43 120
Tokat	852	30 516	1	-	853	30 516
Uşak	701	15 267	5	-	706	15 267
Van Ferit Melen	10 217	1 055 358	53	1 774	10 270	1 057 132
İstanbul Sabiha Gökçen	77 676	8 704 249	43 731	4 420 421	121 407	13 124 670
Eskişehir Anadolu	5 577	12 508	354	30 530	5 931	43 038
Zonguldak Çaycuma	167	160	162	20 302	329	20 462
Antalya Gazipaşa	117	4 192	101	9 938	218	14 130

Source: Ministry of Transport, Maritime Affairs and Communications

3.9 GHG emissions for LTO and cruise in aviation

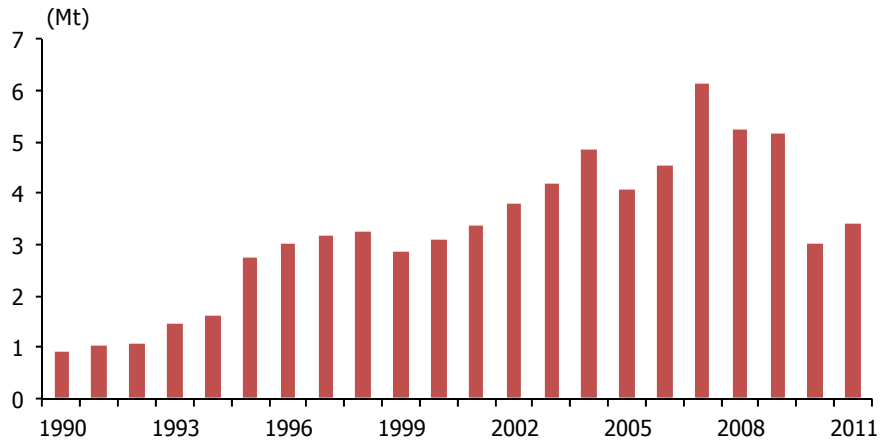
(Gg)

	CO_2	CH_4	N_2O
Emissions			
Total emissions	3 330.57	0.05	0.12
LTO emissions	1 598.60	0.05	0.06
Cruise emissions	1 731.97	-	0.05

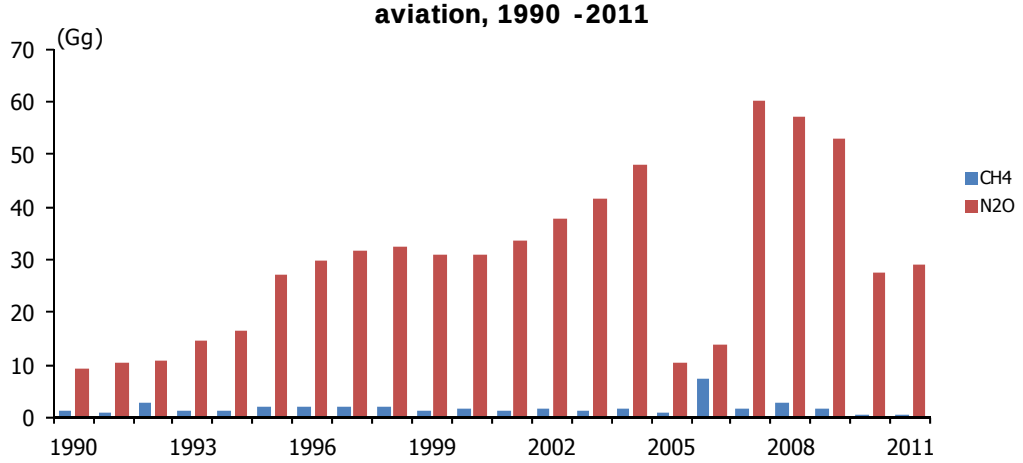
Source: Ministry of Transport, Maritime Affairs and Communications

Graph 3.11 and Graph 3.12 illustrate the total emissions and the emissions of N_2O and CH_4 increasing trends as CO_2 equivalents. CO_2 equivalent emissions have increased approximately 272.07% since 1990 and reached to 3.40 Mt CO_2 in 2011. The calculated amounts of N_2O and CH_4 emissions are 29.14 Gg CO_2 equivalents and 0.50 Gg CO_2 equivalents, respectively in 2011.

3.11 CO_2 equivalent for domestic aviation, 1990 - 2011



3.12 CO_2 equivalent of CH_4 and N_2O emissions for domestic aviation, 1990 -2011



Uncertainties and time-series consistency: Uncertainties arise from the lack of data concerning the types of aircraft which are evaluated with default values for fuel consumption and emission production. IPCC default values of 7% for the activities and 7% for the fuel consumption are accepted for domestic aviation sector.

3.1.3.2 Road Transportation (1.A.3.b)

The Road Transportation source category is a key category, in terms of CO_2 emissions from diesel fuel, LPG and gasoline.

The model method used for the estimation of emissions arising from road transportation was developed by Istanbul Technical University (ITU) in 2006. The model is based on COPERT with certain modifications according to country specifications. Energy based emission calculations are conducted according to IPCC Tier 1 approach initially to obtain CO_2 emissions for basis of model result comparisons. Then IPCC Tier 2 approach is conducted using the vehicle fleet and traffic activity data to calculate CO_2 emissions. Both results are compared for consistency in an iterative approach. Further the model is used to calculate other GHG emissions.

As the complete statistical data for the annual mileage of the vehicle classes in Turkey are not available, travelled distance for vehicles are obtained from an algorithm based on total fuel consumed and fuel consumption assumptions per unit distance travelled. In case of gasoline fuelled passenger cars, total fuel consumed is proportional to the number of vehicles in traffic.

As the gasoline is used only by passenger cars, yearly average mileage can be obtained from the consumption and the number of vehicles in traffic for any model year. The solution algorithm for other vehicle classes (fuelled with diesel oil) is based on the minimization of differences between energy consumption as reported in the national energy balance tables and the estimated energy consumption. This is achieved by appropriately adjusting the covered mileage and the fuel consumption of each category (Table 3.10).

Annual mileages calculated are then used for obtaining GHG emissions from road transportation. CO_2 emissions reported are obtained by IPCC Tier 1 approach based on energy consumption, whereas emissions other than CO_2 are calculated by IPCC Tier 2 approach. Tier 2 results are compared with Tier 1 results for validation (Graph 3.13).

The predictions for the distance travelled are given in Table 3.10 for different vehicle categories. Improvements for the predictions of distance travelled for each vehicle category are in progress for future studies. Emission factors for vehicle categories are given in Table 3.11.

3.10 Yearly travelled distances by vehicle classes (predictions)

(km)

	Passenger cars							
Year	**Diesel**	**Gasoline**	**LPG**	**HD Trucks**	**LDV**	**Minibuses**	**Buses**	**Motorcyles**
2011	5 000	4 885	22 750	13 000	10 000	14 000	51 000	1 250
2010	6 580	6 580	27 930	15 000	10 055	16 000	70 000	1 350
2009	6 500	6 500	31 050	19 268	16 000	22 500	77 500	1 450
2008	7 540	7 540	26 400	19 500	14 000	14 750	53 000	1 550
2007	7 850	7 850	17 500	19 500	14 000	14 750	53 000	1 550
2006	8 400	8 400	16 970	15 000	13 250	14 250	52 500	1 650
2005	8 900	8 900	18 060	14 000	13 000	14 000	52 000	1 700
2004	9 400	9 400	19 230	18 000	11 800	12 400	51 000	1 750
2003	9 750	9 750	24 200	25 500	17 000	17 500	55 500	1 800
2002	10 400	10 400	24 500	25 500	14 750	15 250	55 000	1 800
2001	10 550	10 550	28 500	24 500	12 900	13 100	54 500	2 000
2000	12 400	12 400	28 200	22 500	11 700	12 600	53 500	2 250
1999	14 800	14 800	23 500	21 000	10 600	11 700	51 500	3 250
1998	16 000	16 000	23 200	18 000	8 400	9 450	43 500	3 250
1997	16 000	16 000	23 200	25 000	11 250	12 270	58 000	3 500
1996	15 600	15 600	-	33 000	15 100	15 930	80 000	3 700
1995	15 250	15 250	-	34 500	14 525	15 640	77 500	3 700
1994	14 400	14 400	-	33 000	14 030	14 975	76 000	3 350
1993	15 300	15 300	-	39 200	16 400	17 535	84 000	3 350
1992	15 200	15 200	-	34 200	14 200	15 135	76 000	3 350
1991	15 900	15 900	-	36 700	17 300	18 300	85 500	3 000
1990	18 400	18 400	-	44 000	22 500	22 500	89 000	3 000

Source: Ministry of Transport, Maritime Affairs and Communications

3.11 Emission factors for vehicle categories

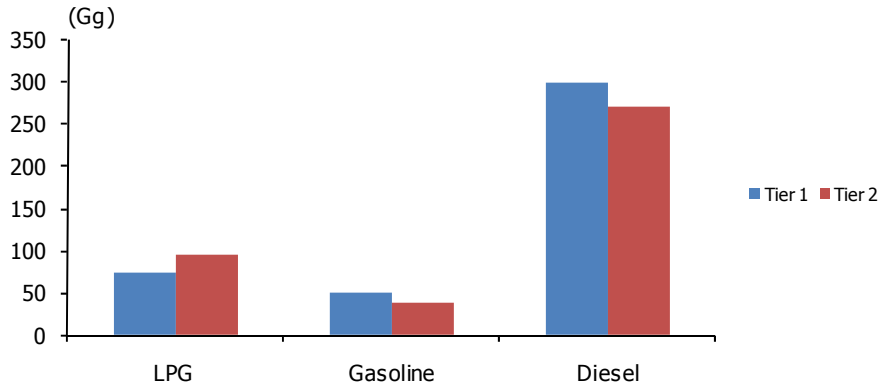
(g/km)

Vehicle classes								
	Passenger cars							
Model Year	Diesel	Gasoline	LPG	HD Trucks	LDV	Minibuses	Buses	Motorcyles
				CH_4				
1990-2001	0.005	0.07	0.06	0.06	0.005	0.005	0.06	0.15
2002-2011	0.005	0.02	0.06	0.06	0.005	0.005	0.06	0.15
				N_2O				
1990-2001	0.01	0.005	0.0	0.03	0.02	0.02	0.03	0.002
2002-2011	0.01	0.05	0.0	0.03	0.02	0.02	0.03	0.002
				CO				
1990-1993	-	46	7.10	9	1.60	1.60	9.00	22.00
1994-2001	-	19	7.10	9	1.60	1.60	9.00	22.00
2002-2011	0.7	2.90	7.10	9	1.60	1.60	9.00	22.00
				NMVOC				
1990-1993	0.2	5.30	1.50	1.90	0.40	0.40	1.90	16.00
1994-2001	0.2	4.50	1.50	1.90	0.40	0.40	1.90	16.00
2002-2011	0.2	0.50	1.50	1.90	0.40	0.40	1.90	16.00
				Fuel consumptions				(l/100 km)
1990-1993	7.30	11.20	-	-	-	-	-	-
1994-2001	7.30	8.30	-	-	-	-	-	-
2002-2009	7.30	8.50	-	-	-	-	-	-
2011	7.30	8.50	11.20	29.90	10.90	10.90	29.90	8.50

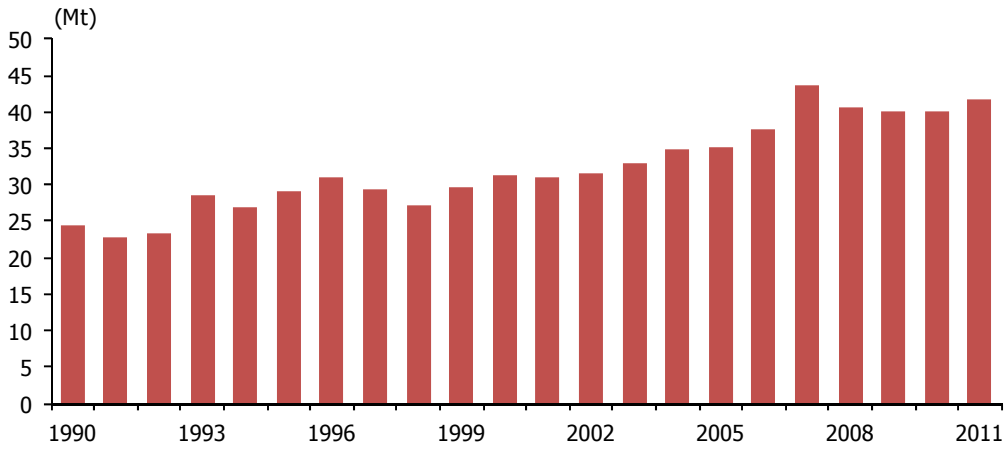
Source: Ministry of Transport, Maritime Affairs and Communications

In road transportation, gasoline, diesel, LPG, natural gas and biodiesel are used as fuel. Road transportation being the major source within transportation sector contributed 41.74 Mt of CO_2 equivalents in 2011 with 87.22% of the total (Graph 3.14). The emissions of N_2O decreased to 0.084 Mt CO_2 equivalents and CH_4 increased to 0.14 Mt CO_2 equivalents in 2011 (Graph 3.15). Emissions from the consumption of bio fuels are taken into consideration for CH_4 and N_2O emissions.

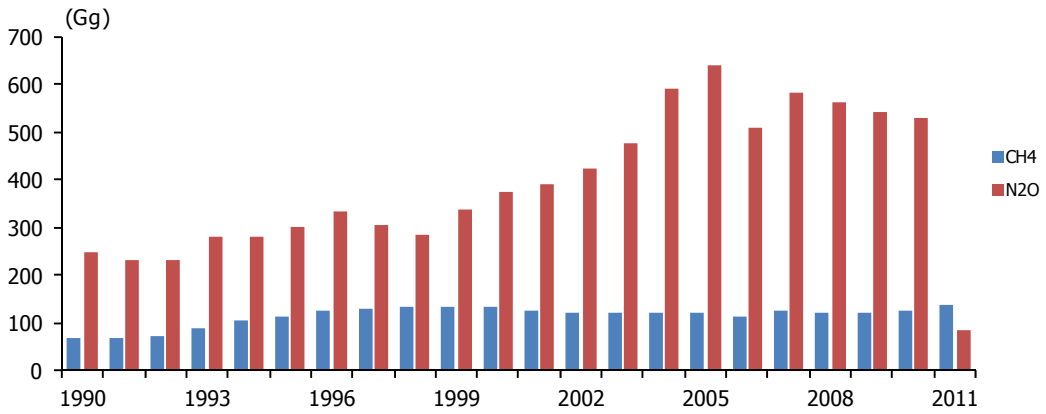
3.13 Comparison of NO_x emissions for validation, 2011



3.14 CO_2 equivalent for road transportation, 1990 - 2011

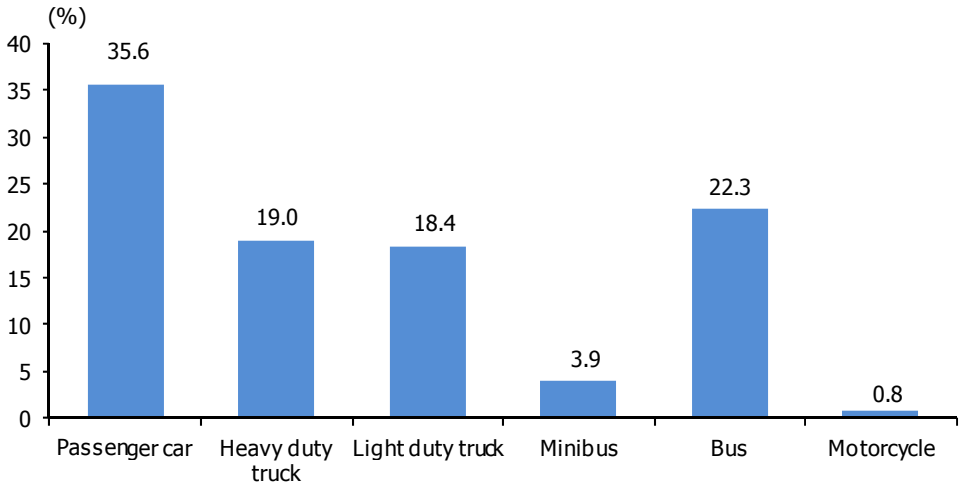


3.15 CO_2 equivalent of CH_4 and N_2O emissions for road transportation, 1990 - 2011

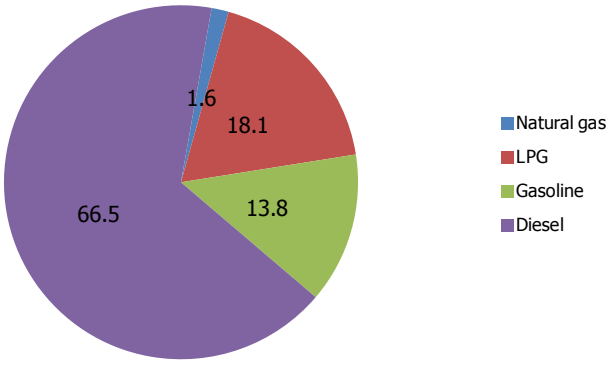


Emissions from road transportation are estimated using Tier 2 approach. According to the results, 35.6% (14.75 Mt CO_2 equivalents) of emissions is from passenger cars, 19.03% from Heavy Duty (HD) Truck, 18.4% from Light Duty Vehicle (LDV), 3.9% from Minibus, 22.3% from bus and 0.8% from motorcycles (Graph 3.16). CO_2 emissions according to fuel types are illustrated in Graph 3.17. Most important portion of CO_2 emission is occurred from diesel fuel consumptions, which is about 66.54% of total emissions of road transportation.

3.16 CO_2 equivalent distributions with respect to types of vehicle, 2011



3.17 CO_2 emission distributions with respect to fuel types, 2011

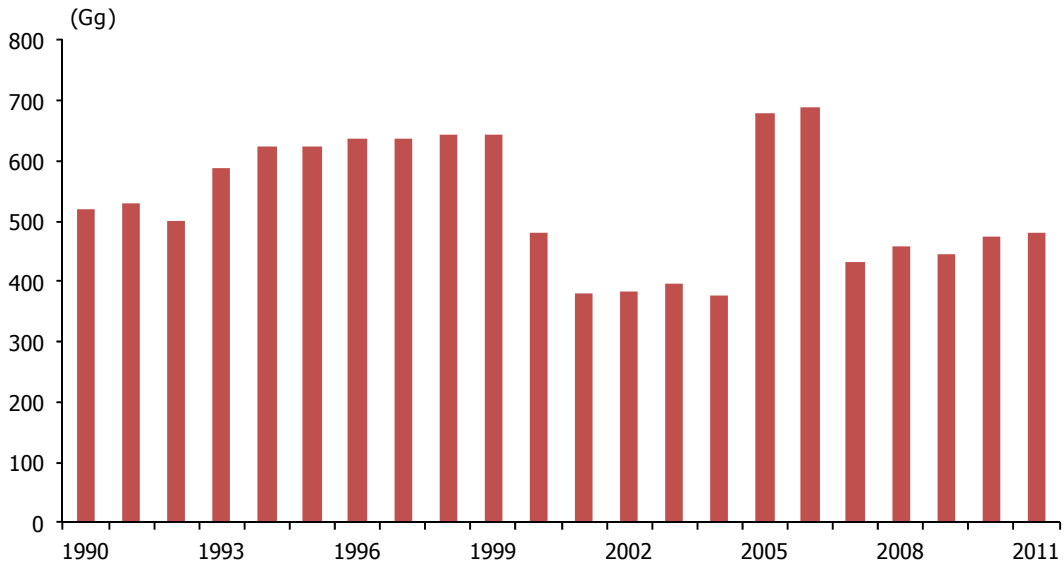


3.1.3.3 Railways (1.A.3.c)

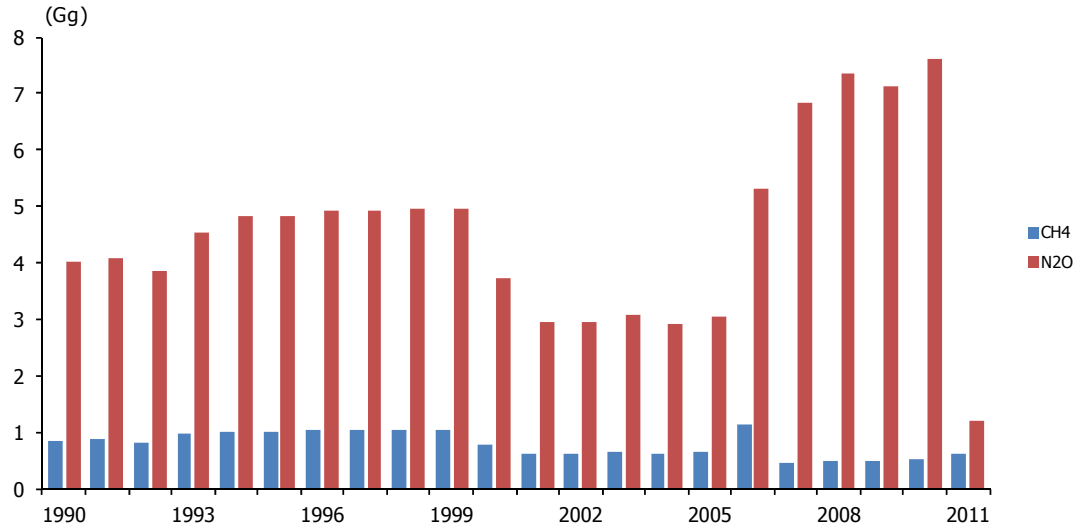
The data availability for railways is limited. Therefore IPCC Tier 1 approach has been used for this subsector. Diesel oil used in railways is taken into consideration.

Graph 3.18 and Graph 3.19 show the total emissions and the emissions of N_2O and CH_4 increasing trends as CO_2 equivalents. CO_2 equivalent emissions have declined 7.6% since 1990. The amount of emissions calculated for railways is 0.48 Mt CO_2 in 2011. The emissions of N_2O decreased to 1.21 Gg CO_2 equivalents and CH_4 increased to 0.63 Gg CO_2 equivalents in 2011 compared to 2010.

3.18 CO_2 equivalent for railways, 1990 - 2011



3.19 CO_2 equivalent of CH_4 and N_2O emissions for railways, 1990 - 2011



3.1.3.4 Water-borne Navigation (1.A.3.d)

3.1.3.4.1 International Water-borne Navigation (1.A.3.d.i)

Table 3.12 shows the trend in emissions of CO_2, CH_4, N_2O, NO_X, CO, NMVOC and SO_2 from international water-borne navigation for 2010 and 2011. Graph 3.20 and Graph 3.21 illustrate the total emissions and the emissions of N_2O and CH_4 trends as CO_2 equivalents. Total emission reached to 6.13 Mt CO_2 equivalents. The emissions of N_2O and CH_4 reached to 14.84 Gg CO_2 equivalents and 8.4 Gg CO_2 equivalents, respectively.

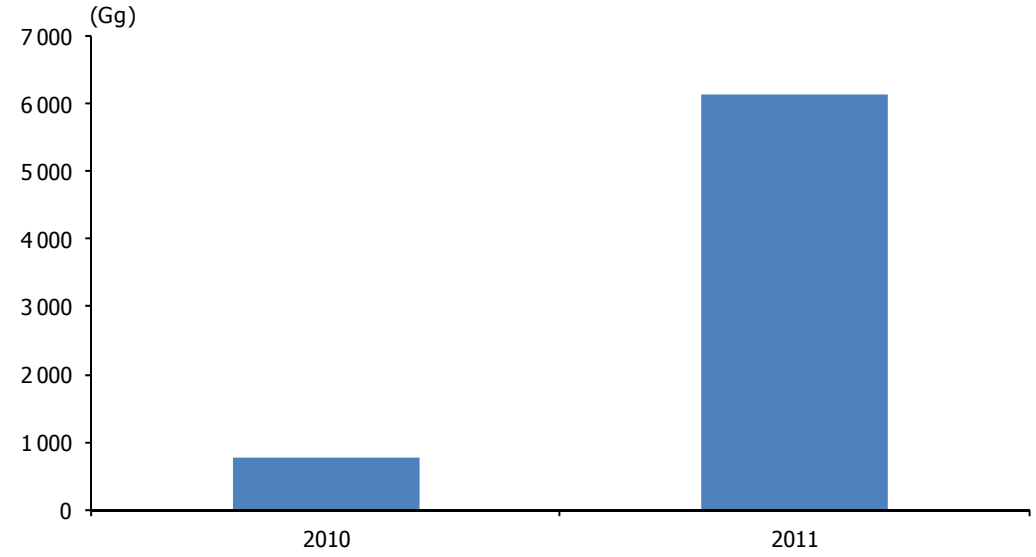
3.12 GHG emissions from marine bunker fuels

(Gg)

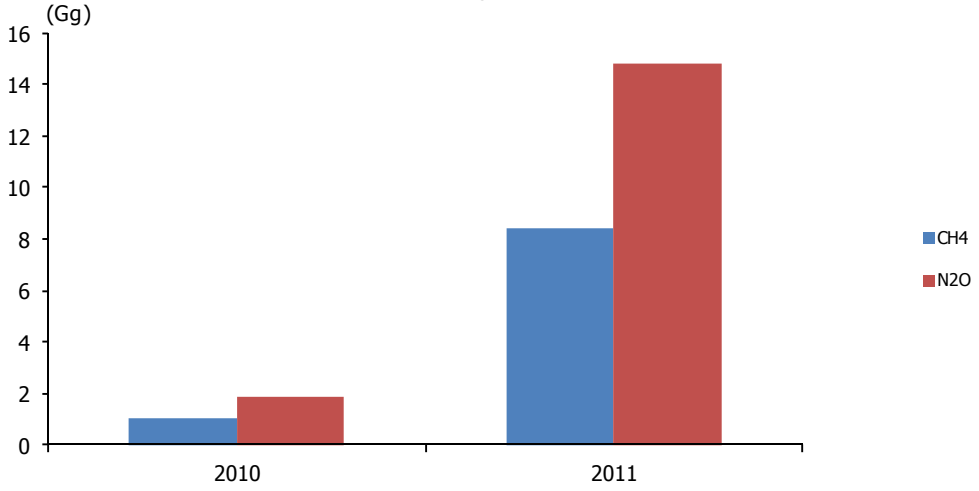
		CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
2010	Diesel	747.95	0.05	0.01	15.15	10.10	2.02	0.70
	Fuel Oil	4.54	0.00	0.00	0.09	0.06	0.01	0.04
	Total	752.49	0.05	0.01	15.24	10.16	2.03	0.75
2011	Diesel	1488.57	0.10	0.01	30.17	20.11	4.02	1.39
	Fuel Oil	4618.67	0.30	0.04	89.55	59.70	11.94	44.56
	Total	6107.24	0.40	0.05	119.72	79.81	15.96	45.95

Source: Ministry of Transport, Maritime Affairs and Communications

3.20 CO_2 equivalent for international water-borne navigation, 2010-2011



3.21 CO_2 equivalent of CH_4 and N_2O emissions for international water-borne navigation, 2010 - 2011

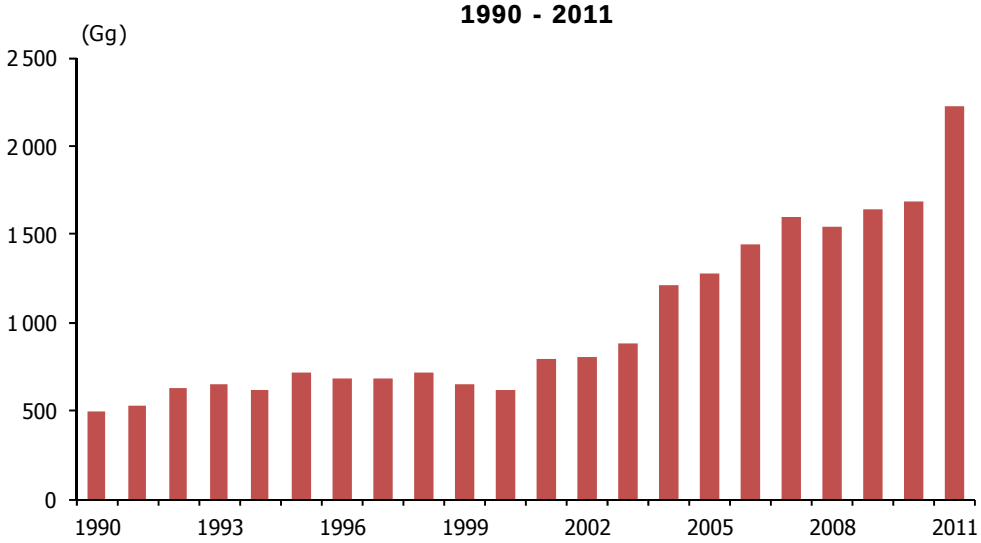


3.1.3.4.2 Domestic Water-borne Navigation (1.A.3.d.ii)

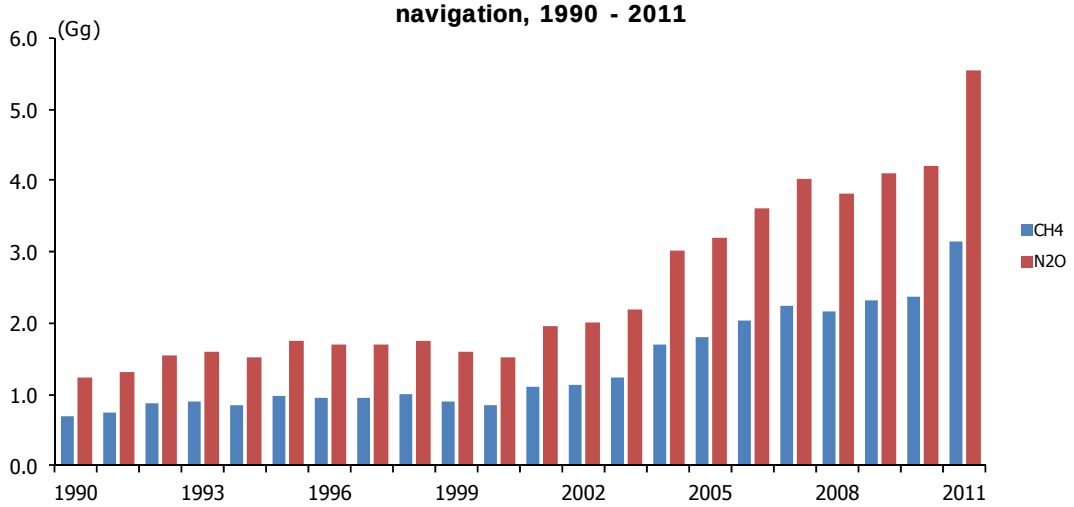
The data availability is limited in this sub-sector. In domestic water-borne navigation only diesel and residual fuel oil are consumed as energy source. In emission calculation, IPCC Tier 1 approach is used.

Domestic water-borne navigation contributed 2.23 Mt of CO_2 in 2011 with 4.66% of the total emissions (Graph 3.22). The emissions of N_2O increased to 5.56 Gg CO_2 equivalents and CH_4 increased to 3.15 Gg CO_2 equivalents in 2011 compared to 2010 (Graph 3.23).

3.22 CO_2 equivalent for national domestic water-borne navigation, 1990 - 2011



3.23 CO_2 equivalent of CH_4 and N_2O emissions for domestic water-borne navigation, 1990 - 2011



3.1.4 Other Sectors (1.A.4)

Source Category Description: The emissions that are included in this category mainly arise from fuel consumption in heating of the sectors of commercial/institutional, residential and agriculture/forestry/fisheries. The source category (1.A.4.a) and (1.A.4.b) are considered together depend on the disaggregation of energy balance tables.

Methodological Issues: GHG emissions from this sector are calculated by using IPCC T1 approach. The fuel consumption data is multiplied by emission factors (EF) to give an estimation of the direct and indirect greenhouse gas emission. The emission factors are given in annex 2.

Uncertainties and time-series consistency: The activity data for energy sectors are, completely taken from energy balance tables. Uncertainties in the emission factor and fuel used are determined by experts of MENR. After calculating the emissions from all sectors, the GWP weighted emission of CO_2, N_2O and CH_4 are multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use expert judgment as described in IPCC Good Practice Guidance and Uncertainty Management (2000). The combine uncertainties in emission factors and activity data are explained in annex 7 in detail.

3.13 Time series consistency of emission factor for (1.A.4)

Source category	Gas	Fuel type	Comments on time series consistency
1.A.4	CO_2	All Fuels	All EFs are constant over the entire time series.
1.A.4	N_2O, CH_4	All Fuels	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance was used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in sector 1.A.4.

3.1.4.1 Commercial/Institutional (1.A.4.a)

The fuel consumption of commercial/institutional is not separated in the energy balance tables, and given together with residential sector. Therefore emissions are given under category (1.A.4.b).

3.1.4.2 Residential (1.A.4.b)

The source category residential is a key category in terms of CO_2 emissions from natural gas, hard coal, lignite and LPG. Fuel consumption data are taken from the energy balance tables.
Although, residential and commercial/institutional fuel consumptions are not separable in energy balance tables, the high percentage of fuel is consumed in households. Share of lignite and petroleum have been considerably decreasing in this sector. The main reason is the shifting from lignite to natural gas.

3.1.4.3 Agriculture/Forestry/Fisheries (1.A.4.c)

The source category is only including the emission from the consumption of fuel in agricultural activities. This source category is a key category in terms of CO_2 from gas/diesel oil.

3.1.5 Other Sectors (1.A.5)

Energy production from the recovered CH_4 gas in waste disposal sites is considered under this category. The collected CH_4 gas is used for the electricity production. Although, the resulting of emissions are so small that it is good practice to estimate CH_4 and N_2O emissions from this source. The emissions from the recovered CH_4 are calculated first time after the year 2010.

3.2 Fugitive Emission from Fuels

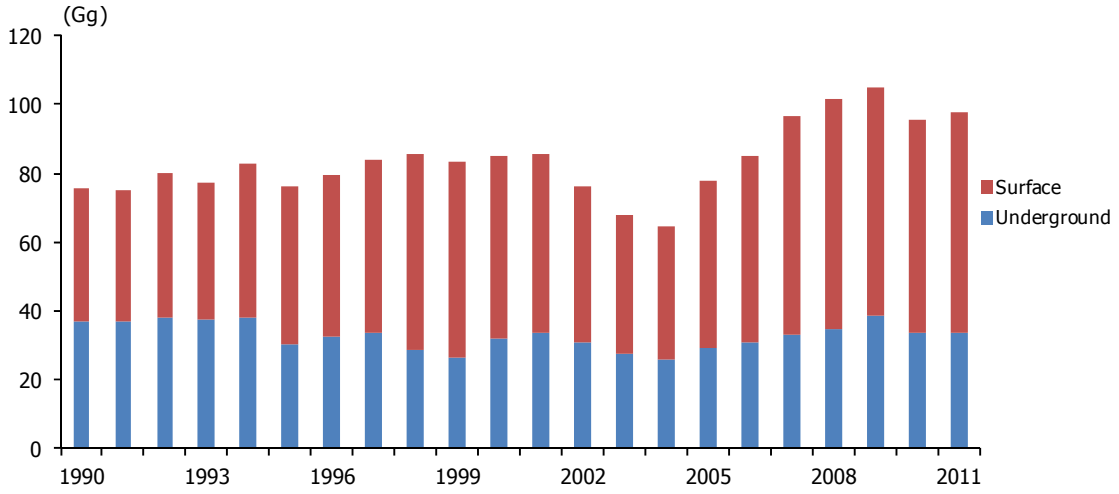
During all stages of fuel production and use, from extraction of fossil fuels to their final use, fuel components can be released as fugitive emissions. CH_4 emission is the most important emission within the source category solid fuels, especially coal mining and handling (1.B.1.a). Moreover, the emissions for the post-mining activities under (1.B.1.a) are also calculated after the year 2010. The calculations of fugitive emissions that occur during the exploration, production (processing), transport (transmission), refining and storage of domestic oil and natural gas (1.B.2), are also calculated first time after the year 2010. The time series of emissions are submitted in the submission of 2011.

Methane (CH_4): In Turkey, the main fugitive emissions are the CH_4 from the coal mining, especially the lignite and hard coal mining from underground and surface mines.

The emission factors of underground and surface mines differ considerably. IPCC Tier 1 approach is used for the emission estimation. The emission from the coal mining is given in table 3.14 and graph 3.24. Moreover, the total amount of extracted coal is also given in graph 3.25.

As shown Table 3.14 and in graph 3.24, the CH_4 emission from coal mining changed between 64 776 tonnes and 105 112 tonnes. The highest CH_4 emission is observed in 2009 and the lowest emission is observed in 2004. CH_4 emission also consists of the emission from the post-mining activities in 2011.

3.24 CH_4 emissions from coal mining, 1990 - 2011

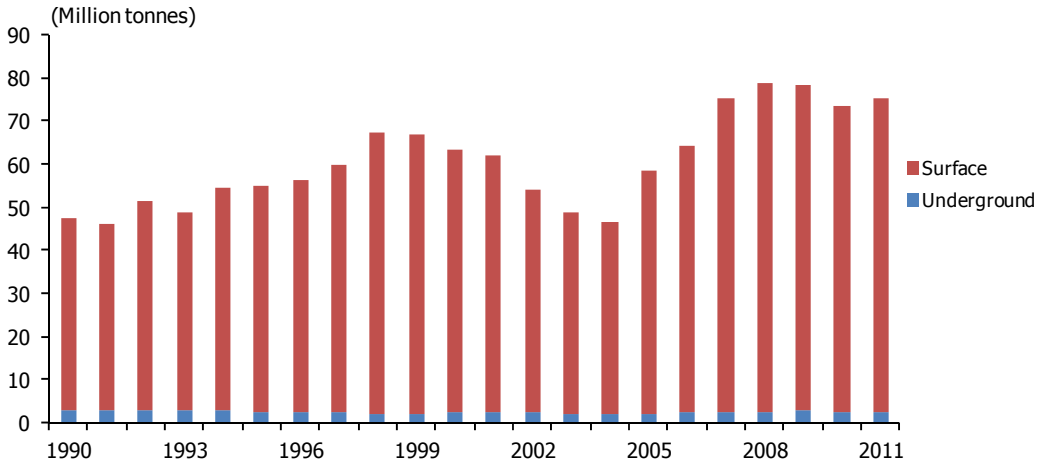


3.14 CH_4 emissions from coal mining

(Gg)

	1990	1995	2000	2005	2007	2008	2009	2010	2011
Underground	36.78	30.12	32.05	29.07	32.99	34.85	38.36	33.82	33.88
Surface	38.92	46.01	53.02	48.92	63.50	66.89	66.75	61.73	63.97

3.25 Coal extraction, 1990 - 2011



The underground coal mining decreased throughout the years. In 1990, approximately 5.8% of the total extracted coal was obtained from underground mining. However, this ratio in 2011 was only 3.4%.

During surface and underground mining, methane escaping is not related to any specific conditions. Therefore, default IPCC emission factors are used to calculate methane emissions. Activity data of the coal extraction is taken from the energy balance table.

3.2.1 Solid Fuels (1.B.1)

Although this source category solid fuels (1.B.1) consists of three sub-source categories; coal mining and handling (1.B.1.a), solid fuel transformation (1.B.1.b) and other (1.B.1.c). The inventory consists of only the CH_4 emission from the coal mining and handling.

Source Category Description: This source category covers CH_4 emissions which occur during the surface and underground extraction of solid fuels and post-mining activities. The emissions due to combustions of those fuels to support product activities is not included in this section. Under this category only methane emissions from coal mining and handling were calculated.

Methodological Issues: The methodology used for emissions calculation is IPCC T1 method. Methane emission is estimated by multiplying coal production with methane emission factors. IPCC default emission factors are used in the calculation of emissions. The amount of coal extraction is taken from energy balance tables. All hard coal is produced in underground mining and lignite and asphaltite are produced on surface mining.

Uncertainties and time-series consistency: The activity data for energy sectors are, completely taken from energy balance tables. Uncertainties in the emission factor and fuel used are determined by experts of MENR. After calculating the emissions from all sectors, the GWP weighted emission of CH_4 is multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use expert judgment as described in IPCC Good Practice Guidance and Uncertainty Management (2000). The combine uncertainties in emission factors and activity data are explained in annex 7 in detail.

3.15 Time series consistency of emission factor for (1.B.1)

Source category	Gas	Fuel type	Comments on time series consistency
1.B.1	CH_4	Solid Fuels	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in sector 1.B.1.

3.2.1.1 Coal Mining and Handling (1.B.1.a)

The amount of coal extraction is taken from energy balance tables. The average percent of extracted coal from underground mines is approximately 4.2% for the years 1990-2011. For year 2011, the percentage with a value of 3.4% is even lower than the average.

3.2.2 Oil and Natural Gas (1.B.2)

This source category oil and natural gas (1.B.2) consists of three sub-source categories, oil (1.B.2.a), natural gas (1.B.2.b) and venting and flaring (1.B.2.c). The inventory consists of CO_2, N_2O, CH_4 emissions. The emissions from this section are calculated first time after the year 2010. The time series are submitted in the submission of 2011.

Source Category Description: This source category covers CO_2, N_2O, CH_4 emissions which occur during the exploration, production (processing), transport (transmission), refining and storage of domestic oil and natural gas.

Methodological Issues: The methodology used for emissions calculation is IPCC T1 methodology. The emissions are estimated by multiplying extraction quantity of oil and natural gas with carbon dioxide, methane and nitrous oxide emission factors. IPCC default emission factors are used in the calculation of emissions. The amount of extraction data is taken from the energy balance tables.

Uncertainties and time-series consistency: The activity data for energy sectors are, completely taken from energy balance tables. Uncertainties in the emission factor and fuel used are determined by experts of MENR. After calculating the emissions from all sectors, the GWP weighted emission of CO_2, N_2O and CH_4 are multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use

expert judgment as described in IPCC Good Practice Guidance and Uncertainty Management (2000). The combine uncertainties in emission factors and activity data are explained in annex 7 in detail.

3.16 Time series consistency of emission factor for (1.B.2)

Source category	Gas	Fuel type	Comments on time series consistency
1.B.2	CO_2, N_2O, CH_4	Oil and natural gas	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is recalculation in sector 1.B.2 for 1990-2009.

3.2.2.1 Oil (1.B.2.a)

The data were gathered from energy balance tables. The emissions for the oil activities under (1.B.2.a) were only calculated first time after the year 2010. The time series are submitted in the submission of 2011. The emission from this sector is not a key category.

3.2.2.2 Natural gas (1.B.2.b)

The data is taken from the energy balance tables. The emissions for the natural gas activities under (1.B.2.b) are only calculated first time after the year 2010. The time series are submitted in the submission of 2011. The emission from this sector is not a key category.

3.2.2.3 Venting and Flaring (1.B.2.c)

The data is taken from the energy balance tables. The venting and flaring emissions for the oil and natural gas activities under (1.B.2.c) are calculated first time after the year 2010. The time series are submitted in the submission of 2011. The emission from this sector is not a key category.

4. INDUSTRIAL PROCESSES

The GHG emissions from industrial processes are released as a result of manufacturing processes. It means this category includes only emissions from processes and not from fuel combustion used to supply energy for carrying out the processes. For that reason, emissions from industrial processes are referred to as non-combustion.

The TurkStat was the basic data source for the quantities of materials and goods produced. During the preparation of the inventory, data confidentiality is taken into account according to law No. 5429. If the number of the statistical unit in any cell of the data table formed by aggregating the individual data is less than three or one or two of the statistical units are dominant even if the number of units is three or more, the data in the concerned cell is considered confidential. Confidential data can be published only as combined with other data so as not to allow any direct or indirect identification. For that reason, some emissions are given as aggregated into appropriate IPCC category in CRF tables and national inventory report.

Emission is usually obtained according to the IPCC T1 or CORINAIR methods by multiplying production quantity with emission factors. IPCC or CORINAIR default emission factors are used in the calculations. In this category, as well as CO_2, CH_4, N_2O, NO_x, CO, NMVOC and SO_2 emissions, HFC, PFC and SF_6 emissions are also calculated for the period 1990-2011.

Carbondioxide (CO_2): In industrial processes, 56.6% of the CO_2 emission is coming from the cement production (Table 4.1), which is also one of the key sources. The main emission source is clinker production. From the table, it might be concluded that the highest emission ratio is observed in 2010 with an approximate value of 28.9 million tonnes CO_2. In 2011, the other CO_2 emission source in industries is iron and steel production with 35.9%. In this inventory, process emissions from iron and steel industry are calculated under industrial process sector for the years 2010 and 2011. CO_2 emissions from iron and steel production are considered under energy sector. In order to prevent double counting, the amount of fuel used as a reducing agent is deducted from energy balance table. Because the studies on gathering activity data for the previous years are still in process, the time series will be submitted in the next submission.

4.1 CO_2 emission contribution of cement production

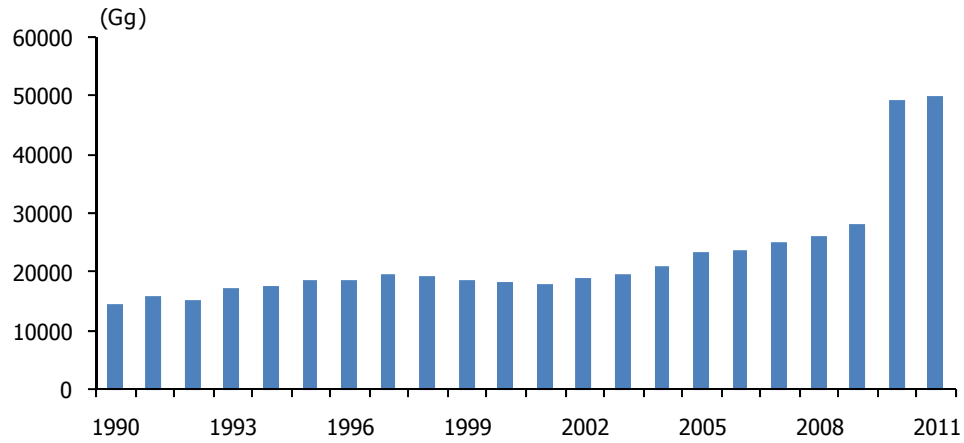
(%)

1990	1995	2000	2005	2007	2008	2009	2010	2011
71.9	76	81.9	81.4	86.2	88.6	91.1	59.0	56.6

Emissions are calculated according to the IPCC T1 and T2 approach

The total CO_2 emission from the industrial processes which is given in graph 4.1 shows a steady increase till 2009. After 2010, sharp increase is observed since the process emission in iron and steel industry is included.

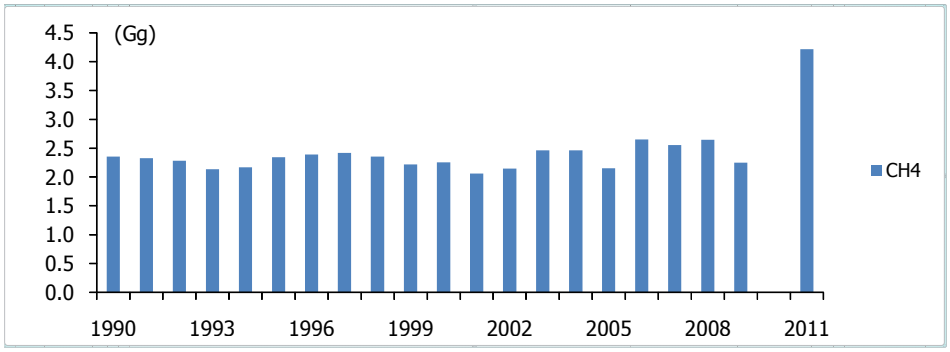
4.1 CO_2 emissions from industrial processes, 1990 - 2011

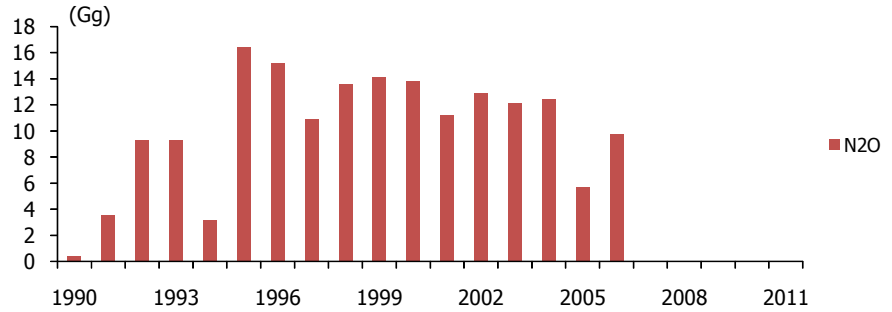


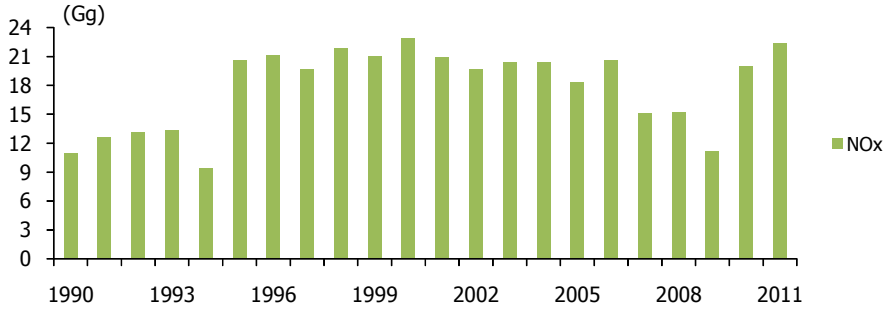
Nitrous Oxides (N_2O): The source of N_2O emission is the chemical industry, especially the nitric acid production. Between the years 1990 and 2006, the N_2O emission trend shows a great variety and fluctuations. The main reason was the changes in nitric acid demands in domestic markets. This was also affecting the NO_X emissions. The main emission sources for NO_X can be categorized as follows; glass production, road paving with asphalt, nitric acid production, other chemical productions, iron and steel production, aluminium industry, pulp and paper, and petroleum industry. The NO_X emission from glass production and petroleum industry is estimated by the CORINAIR methodology. The IPCC Guidelines don't provide methodology for estimating the emissions for these processes. For the other industrial processes, the emission factors are the default from the IPCC Guidelines. Until the year 1993, the NO_X emission trend shows an increase; afterwards it involves great variations. After year 2006, the data is confidential due to Law No: 5429. Emissions from nitric acid production cannot be disclosed since number of establishments in this category is less than 3.

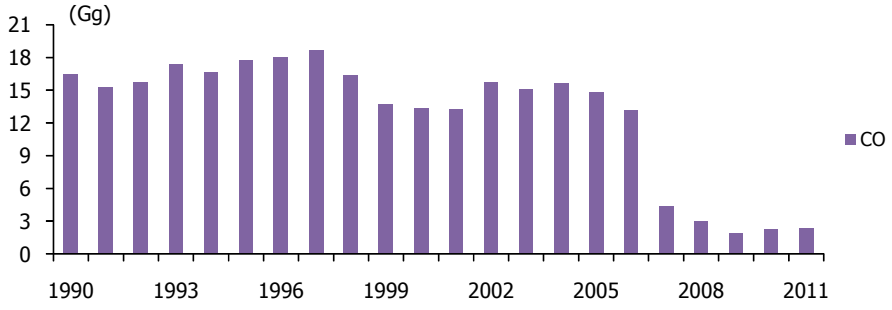
Methane (CH_4): In Turkey, the main source of the industrial CH_4 emission is the chemical industry. The annual emissions from the industries are ranging between 2 062 and 4 220 tonnes. Amounts of methane and other GHG emissions can be seen in graph 4.2.

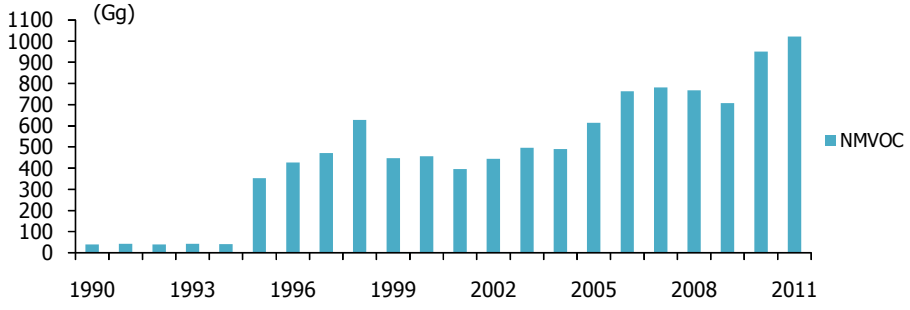
4.2 CH_4, N_2O, NO_x, CO and NMVOC emissions from industrial processes, 1990 - 2011











The main sources of CO emissions are road paving with asphalt, asphalt roofing, other chemical productions and petroleum industry.

The CORINAIR methodology is used for estimating the CO emission from petroleum industry. The IPCC Guidelines don't provide methodology for estimating the emission for this process. For the other industrial processes, the emission factors are the default from the IPCC. The total CO emission range is changing between 2 342 tonnes (in 2011) to 18 640 tonnes (in 1997).

The main sources of NMVOC emissions are road paving with asphalt, asphalt roofing, petroleum industry and food and drink industry. The highest NMVOC emission is coming from the food and drink industries. The emission trend shows fluctuations throughout the years. The CORINAIR methodology is used for estimating the NMVOC emission from petroleum industry. The IPCC Guidelines don't provide methodology for estimating the emission for this process.

The CORINAIR emission factors for NO_X, CO and NMVOC are given in the following Table 4.2.

4.2 CORINAIR emission factors

	(kg NO_X / tonnes production)
Glass production type	**EF**
Plain glass	10
Bottle	5
Others	6
Petroleum Industry	**EF**
NO_X	0.05 kg/m^3
CO	0.08 kg/m^3
NMVOC	0.25 g/kg

There's no production of PFC, HFC and SF_6 in Turkey. All demand is met by import. The methodology has been based on the IPCC Guidelines and the IPCC Good Practice Guidance. Emissions calculations have been based on the import data.

4.1 Mineral Products (2.A)

Source Category Description: This source category, mainly, includes the cement production, lime production, asphalt roofing, road paving with asphalt and glass production. Emissions of CO_2 from industrial processes are reported under (2.A). The industrial processes also include

the emissions of NO_X, NMVOC, CO and SO_2. The main activity data is provided by TurkStat and Turkish Cement Manufacturers' Association.

Methodological Issues: The production data is multiplied by corresponding emission factors (EF) for the estimation of the direct and indirect greenhouse gas emissions.

Uncertainties and time-series consistency: The activity data for industrial processes are, gathered from industrial production statistics of TurkStat. Uncertainties in the emission factor and production data are determined by experts of TurkStat. Uncertainties in emission factors and activity data are given in annex 7 in detail.

4.3 Time series consistency of emission factor for (2.A)

Source category	Gas	Comments on time series consistency
2.A	CO_2	All EFs are constant over the entire time series.
2.A	NO_X, CO, NMVOC, SO_2	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation for industrial processes.

4.1.1 Cement Production (2.A.1)

In cement production, a mixture of raw materials containing calcium carbonate (CaCO3), silica, alumina and iron oxides forms a by-product called as clinker. During the production of clinker, limestone is heated (calcined) to produce lime (CaO) and CO_2, then reacts with silica, aluminum and iron oxides in the raw materials. The clinker is then removed from the kiln, cooled and grinded. After addition of certain minerals to this grinded clinker, cement is produced as the final product.

The methodology used for estimating CO_2 emissions from calcinations is the IPCC Tier 2 approach (The Revised 1996 IPCC Guidelines, Good Practice Guidance 2000).

In Turkey, clinker production data is available. Aggregated country specific activity data (clinker production data) is received from Turkish Cement Manufacturers' Association (TCMA). Data for CaO content in clinker and Cement Kiln Dust (CKD) is IPCC defaults. Thus, weight fraction of 65% for CaO and CKD correction factor of 1.02 is used. The EF is consistent for the years between 1990 and 2011. This sector is a key category in terms of CO_2 emissions from kiln production.

There are 48 integrated cement plants in Turkey, which produce clinker and final product cement. There are also 19 cement plants in Turkey producing only cement from the clinker and final product cement. The clinker production was around 54.3 million tonnes and cement production was around 63.4 million tonnes in 2011 (data consist of TCMA Members & estimations for non-members). In Turkey, about 98% of the cement kilns (not the plants) are based on dry systems (with or without pre-calciner). The remaining 2% covers semi-wet (Lepol) or wet systems.

In Turkey, cement plants can co-incinerate waste via securing a license from the Turkish Ministry of Environment and Urbanization. The license requires stack gas emissions and analyses according to the regulation prepared in accordance with the "EU incineration of waste directive 2000/76/EC". Wastes co-incinerated by license are: waste plastics, used tyres, waste oils, industrial sludge, tank bottom sludge and biomass. It is considered in Energy Sector.

Sulphurdioxide is not a main emission item in cement sector. However, as given in the Revised 1996 IPCC Guidelines (Section 2.3.3.) SO_2 emission is also estimated.

4.1.2. Lime Production (2.A.2)

Lime (CaO) is manufactured by the calcinations. Until 2008, industrial lime production data were obtained from TurkStat. Later, the production data are collected from Turkish Lime Association. Therefore, the emission is recalculated due to change in activity data for the years 1990-2007. The IPCC T1 emission factors are used. The uncertainty for the activity data is estimated as 15%. This sector is a key category in terms of CO_2 emissions.

4.1.3 Lime Stone and Dolomite Use (2.A.3)

The emission from this category is confidential due to the Law No: 5429, For that reason, the CO_2 emission is aggregated to lime production category (2.A.2).

4.1.4 Soda Ash Production and Use (2.A.4)

The emission from this category is confidential due to the Law No: 5429. Moreover, the calculated CO_2 emission can not be included in any other category, which is kept as confidential.

4.1.5 Asphalt Roofing (2.A.5)

CO and NMVOC are calculated in this category. The contribution from this source to total emission is extremely small.

4.1.6 Road Paving with Asphalt (2.A.6)

NO_x, CO, NMVOC and SO_2 were calculated in this category. The contribution from this source to total emission is extremely small.

4.1.7. Other – Glass Production (2.A.7)

NO_x emissions from glass production are calculated and reported under (2.A.7) category. The source category is not a key category. CO_2 emissions can not be estimated since the Revised 1996 IPPC Guidelines does not provide any information for CO_2 emissions from glass industry.

4.2 Chemical Industry (2.B)

Source Category Description: This source category mainly includes the ammonia production, nitric acid production, adipic acid production, carbide production and other chemicals (carbon black, ethylene, dichloroethylene, styrene, methonal) production. The main data source is TurkStat, the Industrial Production Statistics.

Methodological Issues: The direct and indirect greenhouse gas emissions are estimated by using IPCC T1 methodology.

Uncertainties and time-series consistency: The activity data for industrial processes are, gathered from industrial production statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. After calculating the emissions, the GWP weighted emissions of gases are multiplied by source specific data uncertainty to obtain overall uncertainty. The approach to produce quantitative uncertainty estimates is to use expert judgment as described in IPCC Good Practice Guidance 2000. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

4.4 Time series consistency of emission factor for (2.B)

Source category	Gas	Comments on time series consistency
2.B	CO_2, CH_4, N_2O	All EFs are constant over the entire time series.
2.B	NO_X, CO, NMVOC, SO_2	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance 2000 is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in chemical industry.

4.2.1. Ammonia Production (2.B.1)

The source category is not a key category. Ammonia is produced on the basis of hydrogen and nitrogen. The amount of production data is gathered from industrial production Statistics. The methodology used for emissions calculation is IPCC T1 methods by multiplying production quantity with emission factors. In IPCC guideline, the default emission factor is 1 600 kg CO_2/t NH_3.

4.2.2 Nitric Acid Production (2.B.2)

The activity data is confidential due to Law No: 5429 and the emissions have not been published since 2006. At the beginning of 1990s, there was no catalytic reduction. However for

the latest year, the plants have equipped with non-selective catalytic reduction (NSCR). For the consistency of IPCC GPG (2000), sectors (2.B.2) for plants without NSCR, the (EF) is taken as 19 kg/t.

Basically, the nitric acid and ammonium productions are used for artificial fertilizers. The values given below on the graphs are intermediate products and are directly used for fertilizer productions. Market demand for agricultural activities (domestic markets) has determined the production quantity of fertilizers. Therefore the trends for either ammonia or nitric acid basis fertilizers produced according to the agricultural demand. The production data for NH_3 and HNO_3 are gathered from TurkStat industrial production survey results. This sector Nitric Acid Production is not key category in terms of N_2O emissions.

4.2.3 Adipic Acid Production (2.B.3)

There is no adipic acid plant in Turkey.

4.2.4 Carbide Production (2.B.4)

The activity data is confidential due to Law No: 5429. The production data are gathered from TurkStat industrial production statistics.

4.2.5 Emission from Other Chemical Production (2.B.5)

This section includes carbon black, ethylene, dichloroethylene, styrene and methanol production. The production data are gathered from TurkStat industrial production statistics. The activity data is confidential due to Law No: 5429. For that reason, the emissions are not given as separately for each product.

There is no recalculation for other chemical production.

4.3 Metal Production (2.C)

Source Category Description: This source category mainly includes iron and steel production, ferroalloys production and aluminium production. The main activity data is TurkStat industrial production statistics.

Methodological Issues: The estimation of the direct and indirect greenhouse gas emissions, IPCC Tier 1 approach is used.

Uncertainties and time-series consistency: The activity data for industrial processes are, gathered from industrial production statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

4.5 Time series consistency of emission factor for (2.C)

Source category	Gas	Comments on time series consistency
2.C	CO_2	All EFs are constant over the entire time series.
2.C	NO_X, CO, NMVOC, SO_2	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in this sector.

4.3.1. Iron and Steel Production (2.C.1)

Crude steel in iron and steel industry is produced by 2 different processes using different technologies: integrated facilities (BOF) and electric arc furnaces (EAF). Iron and steel industry consumes energy and raw materials intensively. Currently, 3 integrated facilities and 27 electric arc furnace mills are operating in Turkey.

Because of high energy consumption and slow operation, open hearth furnace (OHF) technology was replaced by basic oxygen furnace (BOF) and electric arc furnace (EAF) processes in 1999. Since then, steel production has been realized using latest technologies and under similar conditions of European steel production facilities.

Integrated iron and steel production process begins with the preparation of iron ores by crushing, screening and sintering process or direct charging of lump ore into the blast furnace. Iron ore reduced by the carbon monoxide formed as the coke burns with blast air and melted with the heat energy, turns into hot metal. During primary steelmaking process, a certain amount of scrap and alloying elements are added to hot metal in converter. In BOF technology, pure oxygen is blown on to the alloy and then the liquid steel is obtained. After refining process in ladle, liquid steel is transformed into the desired size of semi-finished products (billet, bloom, slab) at the continuous casting machine.

In electric arc furnaces, liquid steel is produced by melting the steel scrap with the help of graphite electrodes. After refining process, liquid steel transferred from the ladle to the continuous casting machine is solidified and finally shaped as the desired size of semi-finished products.

In iron and steel industry, crude steel production is realized both in integrated facilities and electric arc furnaces. In iron and steel sector where 3 integrated facilities and 27 electric arc furmaces are operating, energy and raw material are consumed intensively,

Process emissions and energy emissions from iron and steel industry are considered together under section (1.A.2.a) for 1990-2009 periods. However, since 2010 inventory, process emissions and energy emissions from iron and steel industry are estimated separately. Energy emissions are given under section (1.A.2.a), process emissions are given under this section 2.C.1. In order to prevent double counting the entire quantity of coke used for iron and steel production is deducted from total coke consumption. The studies on collecting the activity data to estimate the emissions for years before 2010 are still ongoing.

The source category iron and steel production is a key category, in terms of CO_2 emissions.

4.3.2. Ferroalloys Production (2.C.2)

This category is not a key category. The emissions from fuel consumption are reported under CRF category 1.A.2.

4.3.3. Aluminium Production (2.C.3)

The CO_2 emission from this sector is considerably small. The production data is confidential due to Law No: 5429.

4.3.4. SF_6 used in Aluminium and Magnesium Foundries (2.C.4)

The production data is confidential due to Law No: 5429. Therefore, the emissions are not published.

4.3.5. Other Metal production (2.C.5)

This category was not relevant to Turkey.

4.4 Other Production (2.D)

Source Category Description: This source category, mainly includes pulp and paper production and food and drink production. The main activity data is gathered from TurkStat industrial production statistics.

Methodological Issues: for the estimation of the direct and indirect greenhouse gas emissions, IPCC Tier 1 approach is used.

4.6 Time series consistency of emission factor for (2.D)

Source category	Gas	Comments on time series consistency
2.D	NO_X, CO, NMVOC, SO_2	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in this sector.

4.4.1 Pulp and Paper Production (2.D.1)

In this sector, there is only one company in pulp production in Turkey since 2008. Therefore the activity data is confidential due to Law No: 5429. For that reason, the SO_2, NO_x, CO and NMVOC emissions can not be given after 2008.

4.4.2 Food and Drink (2.D.2)

A number of food and drink manufacturing processes such as: whisky, wine, bear, beverage, meal, fish, sugar, margarine, cake, biscuits, bread, animal's feed productions and etc. is included in this category. The methodology used for NMVOC emissions calculation is IPCC T1 methods. This source category is not a key category.

4.5 Production of Halocarbons and SF_6 (2.E)

There is no production in Turkey and the demand is met by imports. For that reason, there is no emission.

4.6 Consumption of Halocarbons and SF_6 (2.F)

Source Category Description: Emissions from this category is estimated by the Ministry of Environment and Urbanization. There's no production of PFC, HFC and SF6 in Turkey. All demand is met by imports. The methodology has been based on the IPCC Guidelines and the Good Practice Guidance. Inventory calculations have been based on the raw import data provided by TurkStat. This source category is a key category in terms of HFC-134a emission.

Methodological Issues: for the estimation of the direct greenhouse gas emissions, IPCC Tier 1 approach is used.

HFCs: HFCs are mostly consumed in the production processes. A major portion of HFCs are used in refrigeration and air conditoning sector. HFCs are being used as alternatives to CFCs since 1999 mainly in refrigeration air conditoning sector. There is an increase throughout the years. Table 4.7 and graph 4.3 show the HFC emission trends as CO_2 equivalents.

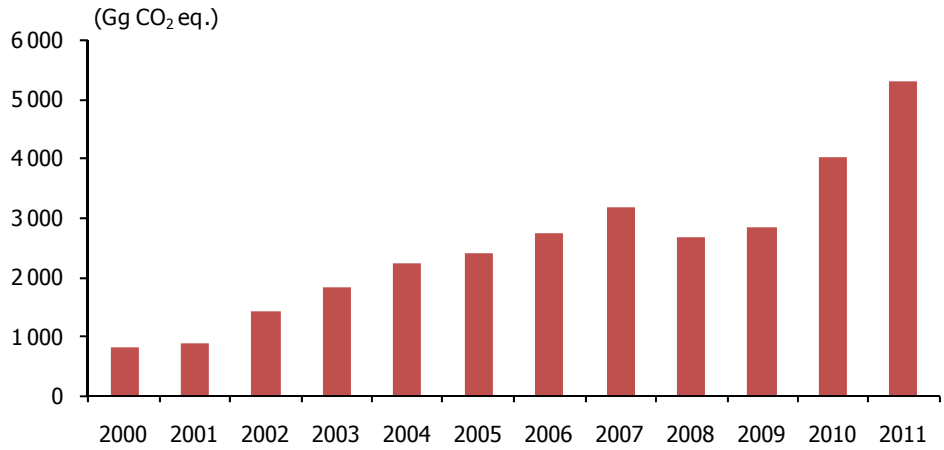
Import licenses until 2008 are registered by the Ministry of Environment and Urbanization. Import data for HFCs are gathered from TurkStat foreign trade statistics.

4.7 HFC emissions

(Gg CO_2 eq.)

2000	2001	2002	2003	2004	2005
818.43	871.48	1 418.94	1 806.71	2 228.73	2 379.00
2006	**2007**	**2008**	**2009**	**2010**	**2011**
2 729.75	3 174.30	2 669.43	2 839.25	4009.304	5308.29

4.3 HFC emissions, 2000 - 2011



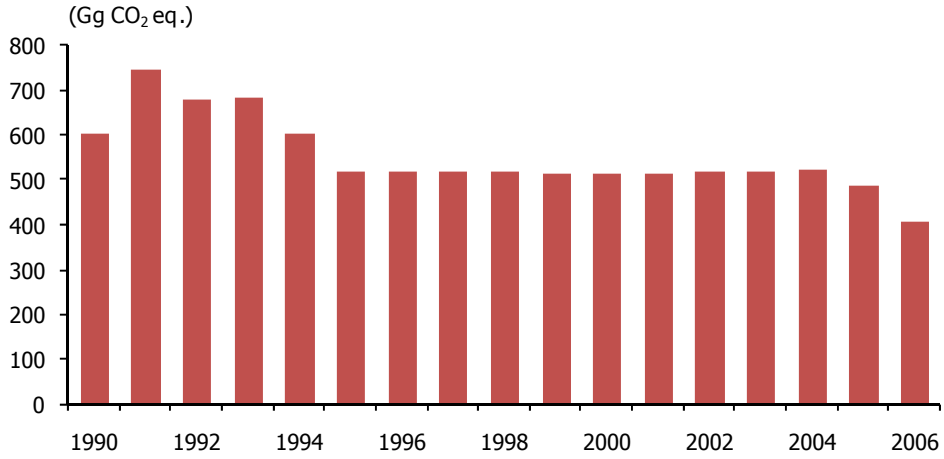
PFCs: Data is being collected from the aluminium production plant and metal foundries. For year 2006, PFC emissions from the aluminium production plant are estimated using Tier 3 methodology. Emissions from this plant for the years 2007 to 2011 could not be included in the inventory due to confidentiality. Table 4.8 and Figure 4.4 show the PFC emission trends resulting from aluminium production.

4.8 PFC emissions

(Gg CO_2 eq.)

	1990	1995	2000	2005	2007	2008	2009	2010	2011
Emissions	603.40	516.40	515.1	487.8	C	C	C	C	C

4.4 PFC emissions, 1990 - 2006



Higher emissions observed between years 1990 and 1994 due to the low quality pitch used in the process. Starting from year 1995, high quality pitch began to be imported from France which resulted in an increase in process efficiency. In addition to this, there's an ongoing technology renewing project in the plant which will reduce the PFC emissions from electrolytic cell process considerably.

SF_6: There's no production of SF6 in Turkey. All demand is met by imports. The methodology has been based on the IPCC Guidelines and the Good Practice Guidance. Inventory calculations have been based on the import data provided by TurkStat. Emissions are calculted from import data for 1990-2005. For year 2006, 2007, 2008 and 2009 emissions from SF6 are estimated using annual growth rates of Turkey due to lack of import data.

A major portion of SF_6 is used in electrical instruments. The increase in the import data from 2004 is mainly because of the increasing amount of circuit breakers being installed in Turkey.

Unfortunately there's no reliable data source on SF_6 imports, both for amounts coming as gas and inside electrical equipment. However, Ministry of Environment and Urbanization have worked on collection of the data together with related institutions. After a licensing and data collection system is established more reliable data will be obtained and previous years' data will be recalculated if possible.

The only available data for electrical equipments is the imported SF_6 data. There is no information about the number and the capacity of the used, imported or exported equipments

and the number of destroyed equipments. The imported amount has been assumed as completely emitted. Since, electrical equipment production is the main consumer of SF_6, this assumption leads to high emission rates which is thought to be less in practice.

SF_6 data has been classified according to the company's name and the activity. When necessary, companies have been asked (i.e. leather industry) to clarify the emission rates.

Leather industry is a new sector which uses SF_6 and not listed in guidelines. It has been determined that SF_6 is used to prevent wrinkling during processing of leathers. In the same way as metal, all SF_6 used in leather industry has been taken as equal to amount emitted.

SF_6 imported by laboratories, universities, medical industries have also been calculated in the same way and it has been assumed that all SF_6 is emitted in two years in equal amounts as suggested in guidelines. Amounts imported by unidentified users have also been calculated in the same way.

SF_6 used in "fire extinguishers" has been calculated by contacting the importing company. Emission factor of fire extinguishers depends on whether they are used is fixed systems or portable systems. Since there is no data about the place, according to the interview with the importer, it has been assumed that 2/3 of the imported amount is used in fixed systems and 1/3 is used in portable systems. Therefore this assumption may contain some error. Emission factors have been taken as 60% and 35% for portable and fixed systems respectively.

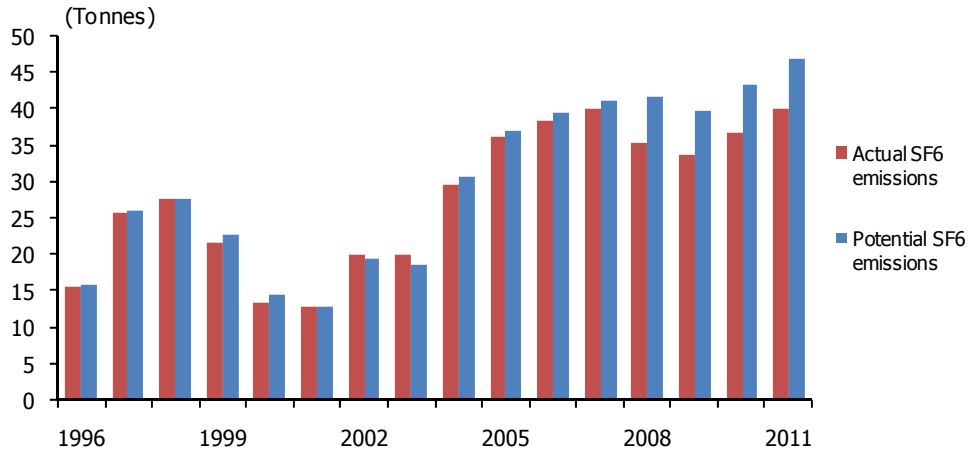
Table 4.9 and graph 4.5 show the SF_6 emission trends.

4.9 SF_6 emissions

(Gg CO_2 eq.)

	1996	2000	2005	2007	2008	2009	2010	2011
Actual emissions	15.60	13.50	35.90	39.80	35.30	33.60	36.64	39.76
Potential emissions	15.90	14.60	37.00	41.00	41.50	39.50	43.08	46.74

4.5 SF_6 emissions, 1996 - 2011



Source Category Description: The consumption of PFC, HFC and SF_6 has been collected by by Ministry of Environment and Urbanization. Uncertainties in the emission factor and production data are determined by experts of the Ministry. After the HFC, PFC and SF_6 emissions are calculated, the approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data were given in annex 7 in detail.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Import data of HFCs are cross-checked between import data available in TurkStat and import licenses available in MoEU.

Recalculation: SF_6 emissions are assumed to increase by the same percentage with overall economic growth of Turkey. Overall economic growth data is taken from TurkStat. There was no recalculation. However, the empty cells in CRF are filled with appropriate notation keys.

4.7. Other (2.G)

Source Category Description: This source category mainly includes petroleum industry. Production data is gathered from TurkStat industrial production statistics.

Methodological Issues: for the estimation of the NO_x, CO and NMVOC emissions, IPCC Tier 1 approach is used.

4.10 Time series consistency of emission factor for (2.G)

Source category	Gas	Comments on time series consistency
2.G	NO_X, CO, NMVOC	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation in this sector.

4.7.1 Petroleum Industry (2.G)

NO_x, CO, NMVOC emissions are calculated as process emissions from Petroleum Industry. IPCC Tier 1 approach is used. Production data is gathered from TurkStat industrial production statistics. The energy-related emissions are reported in the section (1.A.2.b). This source category is not a key category.

5. SOLVENT AND OTHER PRODUCT USE

Source Category Description: This category includes paint application, chemical products, (cosmetics and toiletries, DIY/buildings, households products, car-care products), manufacture and processing. The main activity data provider is TurkStat and Automotive Manufacturers Association. The population and household numbers are provided by TurkStat and the annual automobile production is provided by Automotive Manufacturers Association.

Basically, it is very difficult to gather the information about solvent consumption by their usage purposes. For that reason, the usage of solvent was tried to be estimated based on average consumption of solvent per vehicle in the production stage of vehicles and the average consumption of cosmetics and toiletries, diy/buildings, household products and car care products per households. NMVOC emission is calculated for this category. The lack of data for solvent use hinders to estimate the CO_2 and N_2O emissions from this sector.

Methodological Issues: for the estimation of the NMVOC emission, CORINAIR methodology is used.

5.1 Time series consistency of emission factor for (3.A, 3.C)

Source category	Gas	Comments on time series consistency
3.A, 3.C	NMVOC	All EFs are constant over the entire time series.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

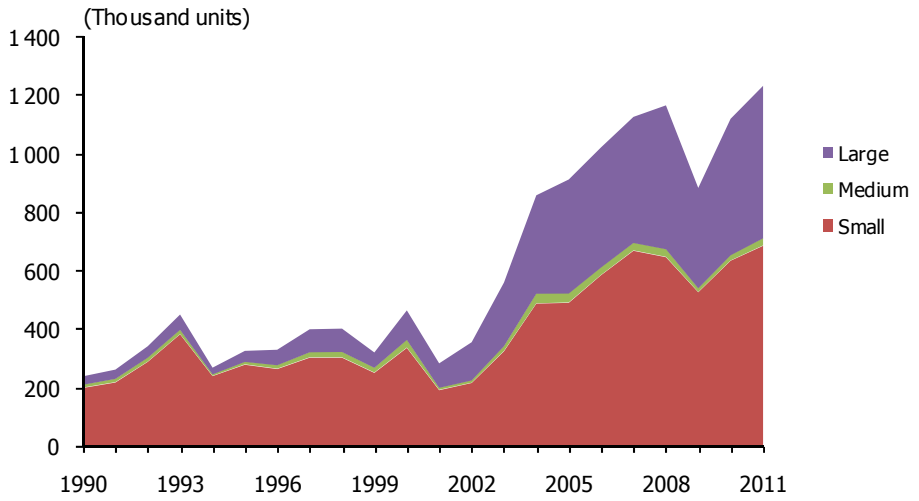
Recalculation: There is no recalculation in this sector.

5.1 Paint Application (3.A)

In this source category, only the paint applications for the production of vehicles are covered. CORINAIR methodology is used for the estimation of the NMVOC emission. Vehicles production data is taken from Automotive Manufacturers Association. The vehicles production is given in graph 5.1 according to its size. Automobile and tractor are considered as small size vehicles,

minibuses and midibuses are considered as medium size vehicles and trucks and buses are considered as large size vehicles. The source category (3.A) is not a key source with regard to production of vehicles.

5.1 Total vehicle production, 1990 - 2011



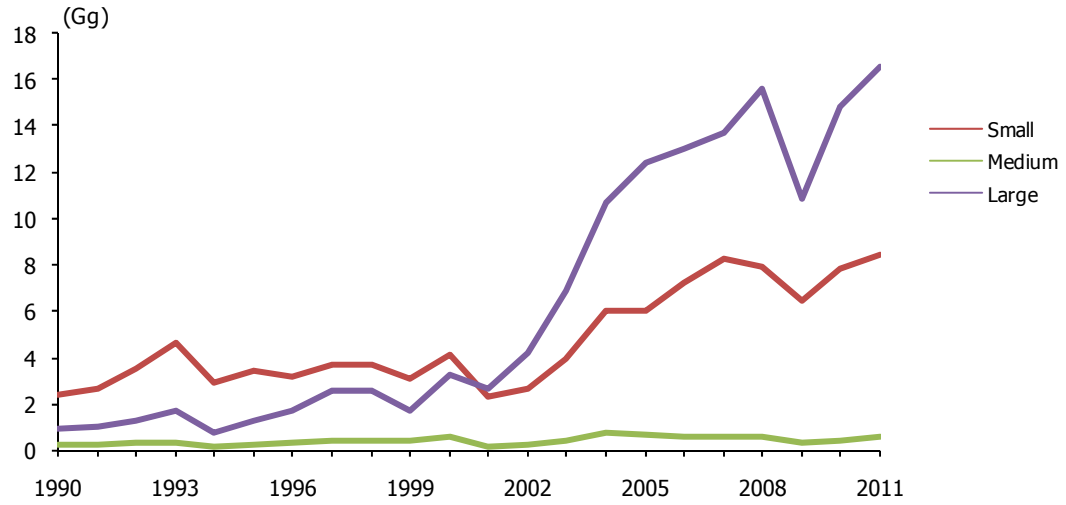
The emission factors for the production of vehicle are given in Table 5.2.

5.2 Emission factors for car size

	(Kg/car)
Paint (Vehicle production)	**NMVOC**
Small	12.30
Medium	21.95
Large	31.60

And the emission from this sector is given below in graph 5.2. After year 2002, there was a sharp increase in the emission due to increase in the automobile production.

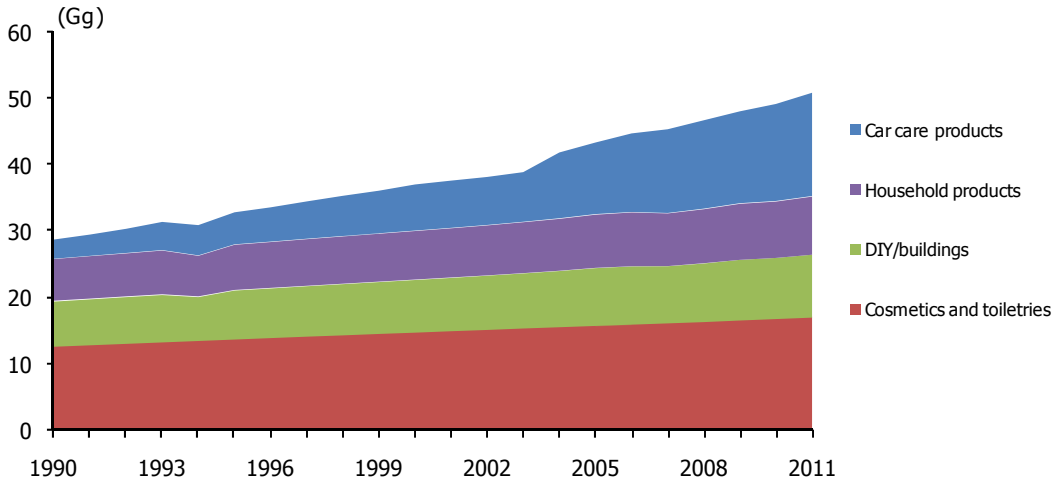
5.2 NMVOC emissions from vehicle production, 1990 - 2011



5.2. Chemical Products, Manufacture and Processing (3.C)

NMVOC emission from this source is basically from car care products, household products, DIY/buildings, cosmetics and toiletries. CORINAIR methodology is used for the estimation of the NMVOC emission. The NMVOC emission is tried to be estimated based on household number, and total vehicle numbers since consumption by usage purposes is not known. As seen in graph 5.3, the emission of NMVOC has been increasing.

5.3 NMVOC emissions from chemical products, manufacture and processing, 1990 - 2011



6. AGRICULTURE

In Turkey, the GHG emissions from agriculture activities are released as a result of the production and processing of agricultural crop, livestock (enteric fermentation, manure management), rice cultivation, agricultural soil and field burning of agricultural residue.

The agricultural activities are mainly sources of CH_4 and N_2O. However, the field burning of agricultural residues also emits CO and NO_X.

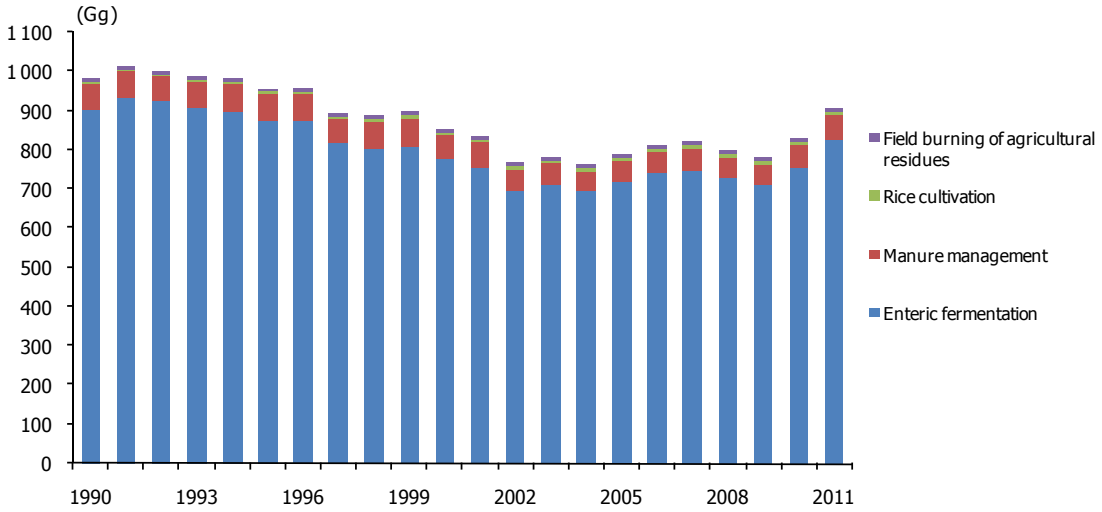
The activity data is provided by the TurkStat and The Ministry of Food, Agriculture and Livestock. The methodology for estimating the GHG emissions from this sector are the IPCC Tier 1.

In Turkey, there are two types of dairy cattle as culture cattle and domestic cattle. The emission factor for culture cattle is taken as the average of Eastern Europe and Asia EF, since based on the expert judgement the culture dairy cattle properties are assumed in between Eastern European and Asian cattle properties. The emission factor for domestic cattle is taken as Asia EF. Because, the domestic cattle is not as strong as cultural cattle and has low milk production yield and domestic dairy cattle has almost similar properties with Asian cattle.

Sheep is categorized as merinos and domestic sheep. The merinos are also a kinds of domestic sheep breeded for its plumage. The weight is less compared to domestic sheeps. Their feeding rate is a little more compared to domestic ones. For that reason its emission factor is taken as more (Which is also ERT Recommendations) compared to domestic sheep.

Methane (CH_4): It includes the emissions from enteric fermentation, manure management, rice cultivation and field burning of agricultural residue. In this sector, the highest methane emission is coming from the enteric fermentation. It could be seen from graph 6.1 that, the CH_4 emission trend has been decreasing since 1990. This is mainly due to the decrease in the number of livestock (Table 6.1).

6.1 CH_4 emissions from agricultural activities, 1990 - 2011



6.1 The number of animals in the latest year

(Thousand)

	1990	1995	2000	2005	2006
Dairy cattle	6 080	6 007.957	5 349.171	4 036.302	4 224.485
Other cattle	5 485	5 903	5 481	6 528	6 683
Buffalo	183	133	76	67	64
Sheep	40 553	33 791	28 492	25 304	25 617
Goats	10 926	9 111	7 201	6 517	6 643
Camels	2	2	1	1	1
Horse	513	415	271	208	204
Mules&Donkeys	1 187	900	588	423	404
Swine	12	5	3	2	1
Poultry	99 148	131 960	260 769	319 220	346 175

	2007	2008	2009	2010	2011
Dairy cattle	4 260	4 112	4 166	4 397	4 801
Other cattle	6 807	6 780	6 591	7 008	7 625
Buffalo	54	55	55	49	57
Sheep	25 462	23 975	21 750	23 090	25 032
Goats	6 286	5 594	5 128	6 293	7 278
Camels	1	1	1	1	1
Horse	189	180	167	155	151
Mules&Donkeys	364	336	286	260	248
Swine	2	2	2	2	2
Poultry	270 873	245 813	234 082	238 973	241 499

Emissions from enteric fermentation and manure management are calculated by using IPCC Tier 1 approach. The annual average temperatures of the provinces are taken into account in order to select the emission factors for manure management. Temperature data are taken from the General Directorate of Meteorology. Considering the annual average air temperature, provinces are categorized as 0°C - 14°C or 15°C - 25°C climate region. The emission factors are used according to these two climate region. They are given in Table 6.2.

Stubble burning is prohibited by the Ministry of Environment and Urbanization. Although most of the farmers obey this regulation, there are still some farmers burning residue. However, exact area of residual burning is not known. Therefore, all cultivated areas for grains are assumed as area of residual burning.

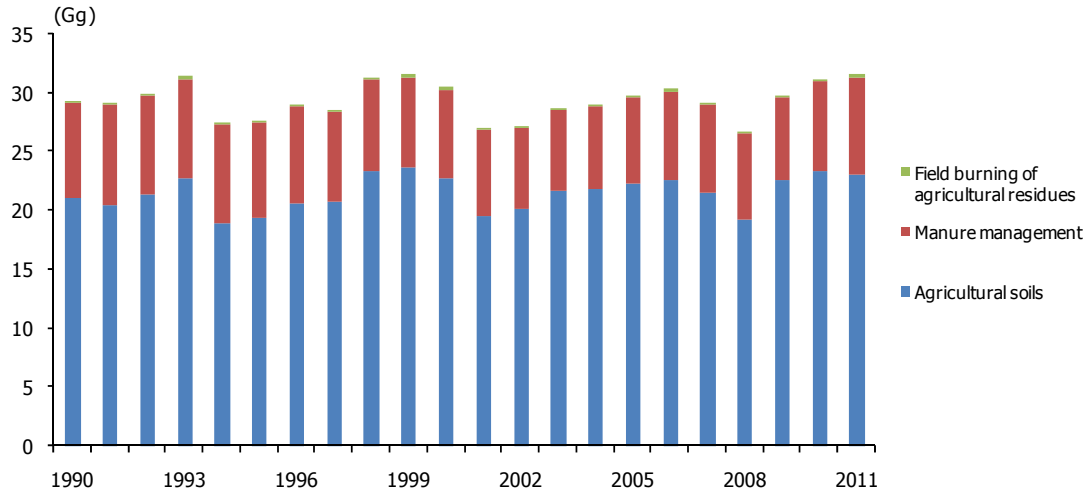
6.2 Emission factors of manure management and enteric fermentation, 2011

(kg CH_4 / head / year)

	Cool EF	Temperate EF	Enteric EF
Cattle			
Dairy Cattle (Culture)	7.000	16.000	68.5
Dairy Cattle (Domestic)	7.000	16.000	56.0
Non-Dairy Cattle	1.000	1.000	44.0
Buffalo	1.000	2.000	55.0
Sheep			
Sheep (Domestic)	0.100	0.160	5.0
Sheep (Merinos)	0.110	0.170	6.5
Goats	0.110	0.170	5.0
Camels and lamas	1.300	1.900	46.0
Horse	1.100	1.600	18.0
Mules and asses	1.000	4.000	1.0
Swine	0.600	0.900	10.0
Poultry	0.120	0.018	.

Nitrous Oxide (N_2O): Includes emissions fromthe manure management, agricultural soils and field burning of agricultural residue. As shown in graph 6.2, N_2O emissions show a fluctuation between the years 1990-2011.

6.2 N_2O emissions from agricultural activities, 1990 - 2011



Other gases: The NO_x and CO emission from the field burning of agricultural residue is covered. The emission trend shows fluctuations between 1990 and 2011. The highest CO emission from field burning is seen in 2005 with a value of 209.7 Gg. The highest NO_X emissions are determined as 4.81 Gg again in 2005.

6.1 Enteric Fermentation (4.A)

Source Category Description: Enteric fermentation is a digestive process whereby carbohydrates are broken down by micro-organism into simple molecules. The main product is the CH_4 gases. All type of animals produces CH_4 during and/or after feed intake. The highest methane emission in agricultural sector in Turkey is coming from the enteric fermentation. The CH_4 emission has been decreasing since 1990. The main reason was the decreasing number of livestock. The main activity data (the population of animals) provider is TurkStat livestock statistics. This source category is a key category in terms of CH_4 emission.

Methodological Issues: The provincial animal population is categorized according to the climate of province, for the selection of appropriate emission factors (EF). The methane emission factors are default IPCC Tier 1 factors. Although GPG (2000) calls for the more detailed Tier 2 method to be used in cases in which a country has listed methane emissions from animal husbandry as a key source for its inventories, the detailed data required by Tier 2 approach can not be obtained. The CS emission factor estimation by experts is almost the same as IPCC Tier 1 factors.

Uncertainties and time-series consistency: The activity data for this sector are gathered from agricultural statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. The CH_4 emission is calculated and then it is converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

6.3 Time series consistency of emission factor for (4.A)

Source category	Gas	Comments on time series consistency
4.A	CH_4	All EFs are constant over the entire time series as given in Table 6.2.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation.

6.2 Manure Management (4.B)

Source Category Description: This source contains the CH_4 and N_2O emissions. This source category is a key category in terms of N_2O emissions.

Methodological Issues: The provincial animal population data collected from TurkStat is categorized according to the climate of province, for the selection of appropriate emission factors (EF). CH_4 and N_2O emissions factors are default IPCC Tier 1 factors.

Uncertainties and time-series consistency: The activity data for this sector are gathered from agricultural statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. The CH_4 and N_2O emissions are calculated and then they are converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates was used as described in IPCC Good Practice

Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

6.4 Time series consistency of emission factor for (4.B)

Source category	Gas	Comments on time series consistency
4.B	CH_4, N_2O	All EFs are constant over the entire time series as given in Table 6.2.

Source-specific QA/QC and verification: The IPCC Good Practice Guidance was used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation.

6.3 Rice Cultivation (4.C)

Source Category Description: This source contains the CH_4 emission. This source category is not a key category in terms of CH_4 emissions.

Methodological Issues: The CH_4 emission is calculated by using IPCC Tier 1 approach. The rice harvested area data are taken from agricultural statistics of TurkStat. The rice cultivation with intermittently flooded single aeration is applied In Turkey. The CH_4 emission factors are default IPCC Tier 1 factors.

Uncertainties and time-series consistency: The activity data for this sector are gathered from agricultural statistics of TurkStat. Uncertainties in the emission factor and production data were determined by TurkStat experts. The CH_4 emission is calculated and then it is converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

6.5 Time series consistency of emission factor for (4.C)

Source category	Gas	Comments on time series consistency
4.C	CH_4, CO, N_2O, NO_x	All EFs are constant over the entire time series

Source-specific QA/QC and verification: The IPCC Good Practice Guidance was used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation.

6.4 Agricultural Soils (4.D)

Source Category Description: This source contains the N_2O emission from synthetic fertilizer, animal manure applied, N-fixing crop and crop residue. This source category is a key category in terms of N_2O emissions from Synthetic fertilizer and Animal manure applied. In this section the N_2O emissions from pasture, range and paddock manure (4.D.2) and indirect emission (4.D.3), which consists of atmospheric deposition (4.D.3.1) and nitrogen leaching and run-off (4.D.3.2), are also calculated first time after the year 2010. The time series of emissions are submitted in the submission of 2011.

Methodological Issues: The N_2O emission is calculated by using IPCC Tier 1 approach. The activity data used in emission calculation is taken from agricultural statistics of TurkStat. The N_2O emission factors are default IPCC Tier 1 factors.

The emission factors are given in annex 2. The the N_2O emissions from crop residues are calculated for plant species in given table 6.6.

Uncertainties and time-series consistency: The activity data for this sector are gathered from agricultural statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat expert. The N_2O emission is calculated and then it is converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates was used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

6.6 Crop production data used for the crop residue

Major Crop Types	Grass-clover mixtures	Millet
Grains	**Individual Crops**	Sorghum
Beans & Pulses (N fix)	Maize	Soyabean
Beans & Pulses (non-N fix)	Wheat	Dry bean
Tubers	Winter wheat	Potato
Root crops and Other	Spring wheat	Peanut (w/pod)
N-fixing forages	Rice	Alfalfa
Non-N-fixing forages	Barley	Non-legume hay
Perennial grasses	Oats	

6.7 Time series consistency of emission factor for (4.D.1)

Source category	Gas	Comments on time series consistency
4.D.1	N_2O	All EFs are constant over the entire time series

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is recalculation in atmospheric deposition (4.D.3.1) for 1990-2009.

6.5 Prescribed Burning of Savannas (4.E)

This category is not relevant to Turkey.

6.6 Field Burning of Agricultural Residues (4.F)

Source Category Description: This source contains the CH_4, CO, N_2O and NO_X emissions. Although the burning of agricultural residues are not considered as a net source of carbon dioxide, because, the carbon released to the atmosphere is reabsorbed during the growing season. This source category is not a key category.

Methodological Issues: Emissions are calculated by using IPCC Tier 1 approach. The estimates are derived from crop production including wheat, barley, maize, oat and rye. The

emission factors are given in annex 2. The activity data used in emission calculation is taken from agricultural statistics of TurkStat.

Uncertainties and time-series consistency: The activity data for this sector were gathered from agricultural statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. After, CH_4 and N_2O emissions are calculated, they are converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

6.8 Time series consistency of emission factor for (4.F)

Source category	Gas	Comments on time series consistency
4.F	CH_4, CO, N_2O, NO_X	All EFs are constant over the entire time series

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation.

6.7 Other (4.G)

There are no other activities to be considered under this category.

7. LAND USE, LAND USE CHANGE AND FORESTRY

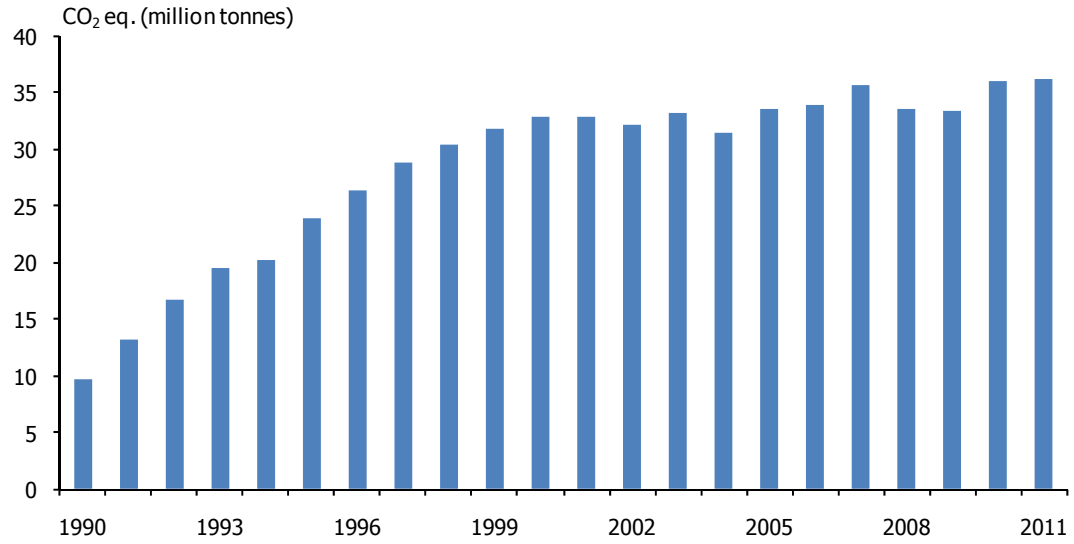
This section is submitted to UNFCCC separately. It is not covered in this publication.

8. WASTE

Emissions of GHGs from the waste sector are mainly released from the disposal of waste, wastewater handling and incineration of waste. The most important GHGs occured in this sector are CH_4 (methane), CO_2 (carbon dioxide) and N_2O (nitrous oxide).

CO_2 equivalent emissions from waste sector inclined 271.61% since 1990 and reached to 36.13 Mt CO_2 equivalents in 2011 as seen in graph 8.1.

8.1 Total GHG emissions of waste sector, 1990 - 2011



Waste disposal is the major GHG emission source and contributing 89.1% of total. Contribution of the wastewater handling is 10.8% and waste incineration is 0.2% in 2011.

The major GHG emissions from this sector are CH_4 emissions, which represent 94.7% of total emissions from this sector in 2011, followed by N_2O and CO_2 as 5.1% and 0.2%, respectively.

8.1 Solid Waste Disposal on Land (6.A)

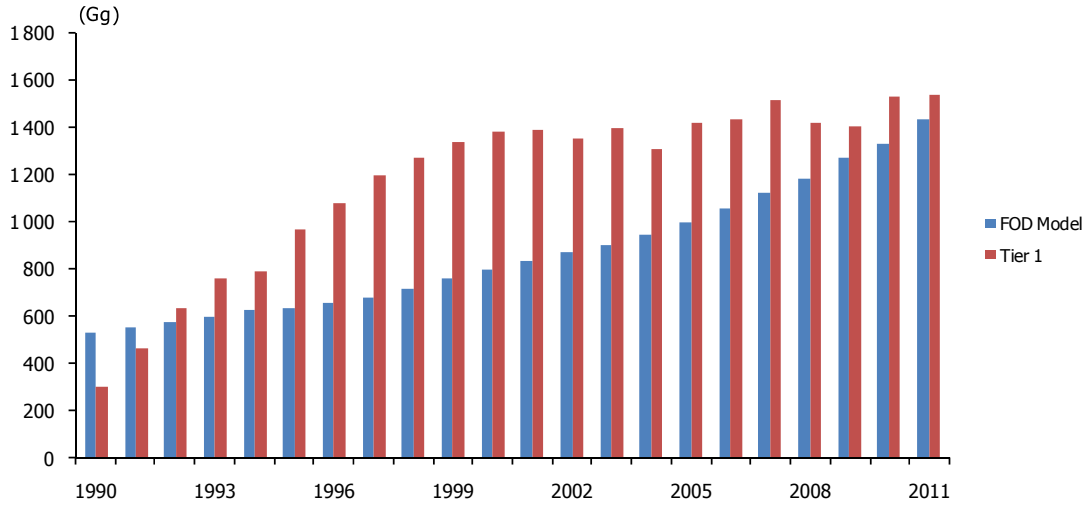
Source Category Description: This sector includes emissions from managed waste disposal and unmanaged waste disposal sites. This category includes CH_4 emissions from municipal

waste disposal on land. This sector is a key category in terms of CH_4 emissions from both managed and unmanaged waste disposal.

Methodological Issues: CH_4 emissions released from waste disposal due to anaerobic and aerobic decomposition of organic matter in the waste. The default IPCC Tier 1 methodology recommended in the IPCC Guidelines is used for estimating the methane emissions.

Methane emissions from waste disposal sites is calculated by using both the Revised 1996 IPCC default emission factors and by using 2006 IPCC Guidelines First Order Decay (FOD) method. The emissions calculated by each method are given in graph 8.2. Using the FOD is basically not considered appropriate due to lack of waste composition data. For this reason, emissions are calculated according to the Revised 1996 IPCC Guidelines using the municipal waste disposal provided by TurkStat environment statistics. The emission calculated by using collected data from municipalities is considered as much more reliable and accurate.

8.2 CH_4 emissions from waste disposal sites by Tier 1 methodology and FOD model, 1990 - 2011



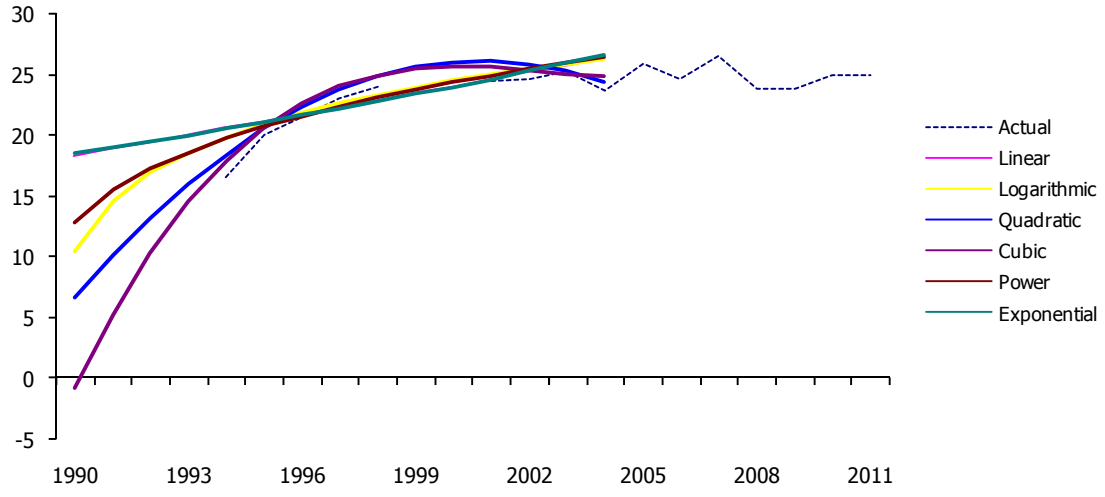
Both managed and unmanaged landfills are considered in the estimations. The annual data on municipal solid waste disposal on landfills are collected by TurkStat via Municipal Waste Statistics Survey. The data are gathered from all municipalities. However, the annual survey has been done discontinuously. Only the data for years 1994, 1995, 1996, 1997, 1998, 2001, 2002, 2003, 2004, 2006, 2008 and 2010 are available. After 2005, managed landfill activity data is gathered via Waste Disposal and Recovery Facilities Statistics Survey by TurkStat. Missing data for the years not surveyed, are estimated by regression analysis. The used regression models

are linear, logarithmic, quadratic, cubic, power and exponential. The best fit model is determined as quadratic and cubic models. The R^2 values for each model are given in table 8.1. As shown in this table, the standard errors for power and exponential regression model are very small. R^2 values are also small. It means, the estimation do not fit for some years. The results can be seen from graph 8.3. So, the missing data are estimated by using the cubic model. In Turkey, there is only one managed landfill site for year 1992 and 1993 but data on waste disposal amount for those years are not available, 1994 waste disposal amount is used for emission estimations for 1992 and 1993. In 2001, only one extra new managed landfill site is added to ones in 1999 and 2000. Therefore, the quantity of waste disposal on managed landfill sites is assumed as same as waste disposed on managed landfill sites in 2001. However, the regression model is preferred to estimate the waste disposed in unmanaged landfill in 1999 and 2000.

8.1 Regression model results

	Linear	Logarithmic	Quadratic	Cubic	Power	Exponential
R^2	0.64	0.76	0.95	0.97	0.74	0.61
Standard error	1 722.44	1 411.12	673.29	575.07	0.07	0.08

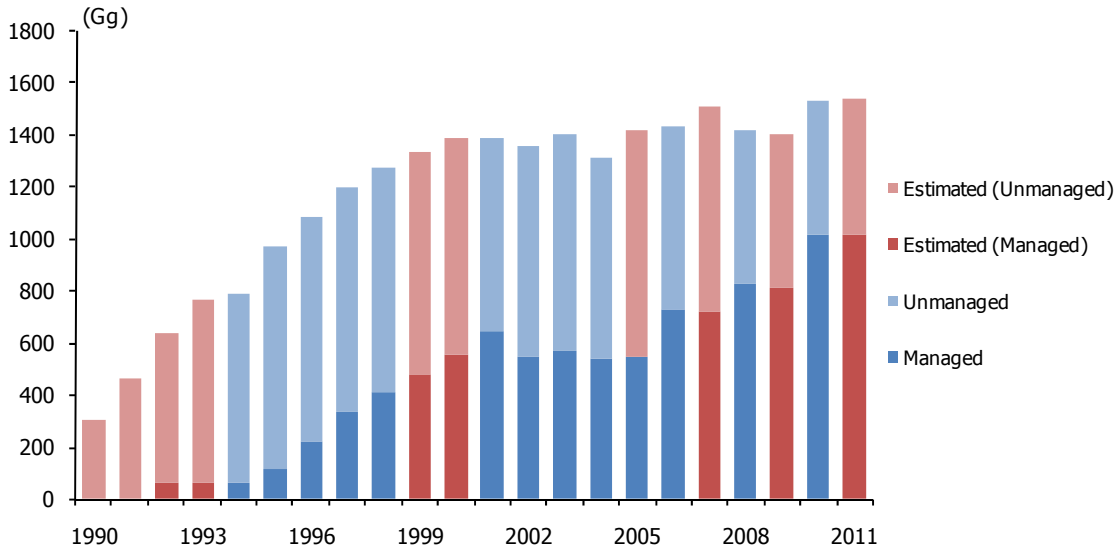
8.3 Best fit regression model, 1990 - 2011



The recovery of methane and its subsequent utilization is also considered in 2011. Methane has been recovered since 2002 in Turkey. Amount of methane recovered is substracted from total methane emissions after 2002.

As seen in graph 8.4, CH_4 emissions from solid waste disposal increased from 304 Gg to 1524 Gg during the period 1990 - 2011. Since 2000, the emission is relatively stable.

8.4 CH_4 emissions from waste disposal, 1990 - 2011



Uncertainties and time-series consistency: The activity data for this sector are gathered from environmental statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. After, CH_4 emission is calculated; it is converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

8.2 Time series consistency of emission factor for (6.A)

Source category	Gas	Comments on time series consistency
6.A	CH_4	All EFs are constant over the entire time series

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is recalculation in managed waste disposal on land (6.A.1) by taking into account the recovery of methane for the period of 2002-2010.

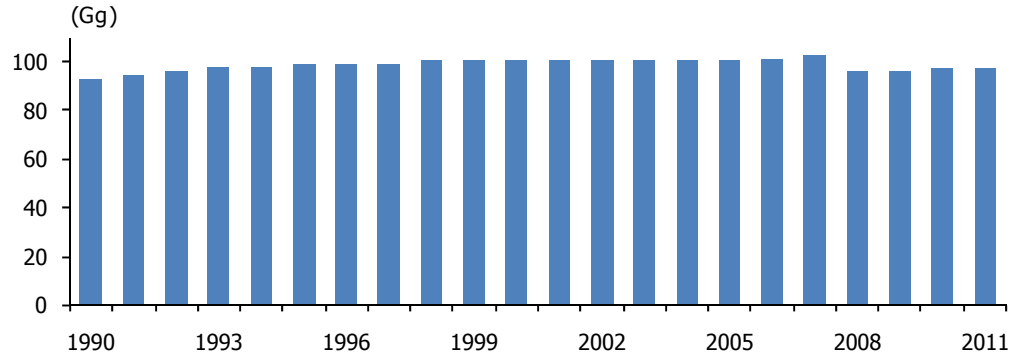
8.2 Wastewater Handling (6.B)

Source Category Description: This sector includes CH_4 and N_2O emissions from domestic wastewater. This sector is a key category in terms of CH_4 and N_2O emissions.

Methodological Issues: The domestic wastewater emits CH_4 and N_2O as a result of the processes of anaerobic and aerobic decomposition of organic mater contained in the wastewater. The default Tier 1 methodology in the 2006 IPCC Guidelines is used for estimating CH_4 and N_2O emissions in Turkey. However, industrial wastewater has not been considered in the inventory due to lack of data.

As shown in graph 8.5, CH_4 emissions from domestic wastewater show insignificant changes. CH_4 emissions increase from 92.89 Gg to 96.93 Gg during the period 1990 - 2011.

8.5 CH_4 emissions from domestic wastewater, 1990 - 2011



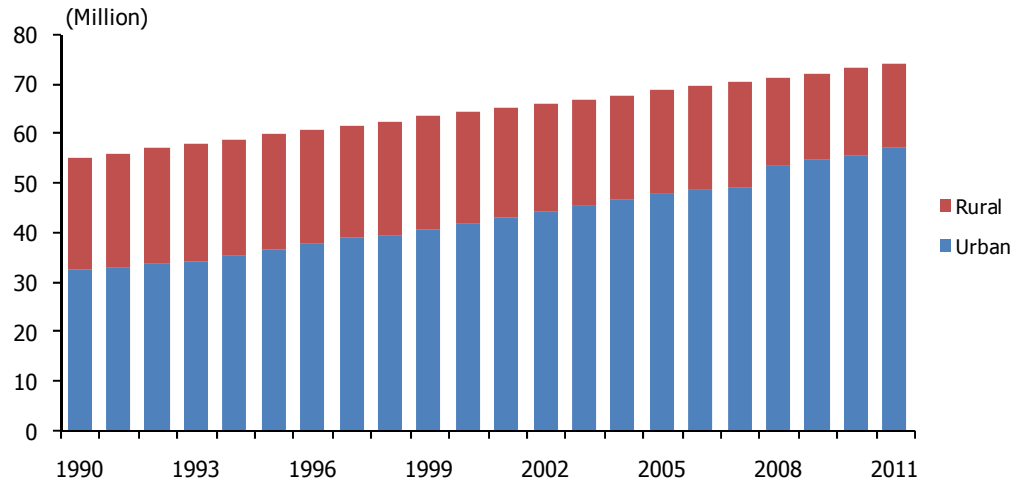
For estimation of CH_4 from domestic wastewater, the total amount of organically degradable material in the wastewater (TOW) is used as activity data. TOW is calculated by multiplying population by the country-specific per capita Biochemical Oxygen Demand (BOD). The IPCC default estimated BOD_5 value for Turkey is used as 38 g/person/day. The urban and rural population is the primary determinant of the organic matter in terms of BOD. The emission factors are used as shown in table 8.3.

8.3 Weighted EFs for domestic wastewater

	kg CH_4 / kg BOD
Urban	**Rural**
0.06	0.21

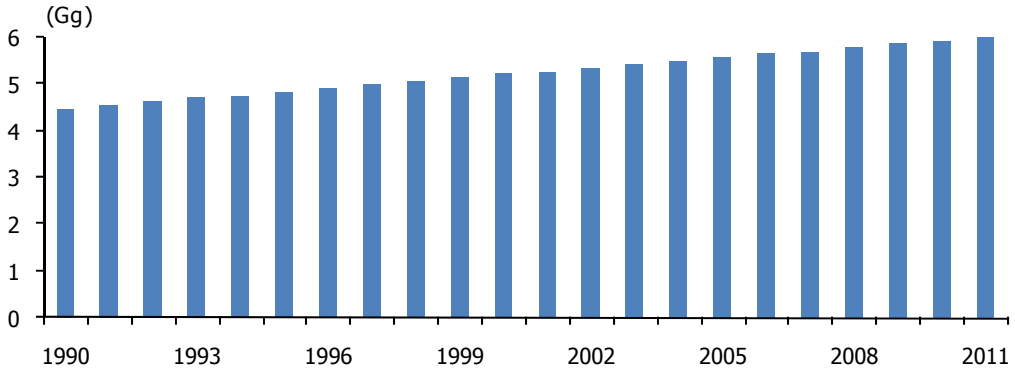
The urban and rural populations are given in graph 8.6.

8.6 Urban and rural population, 1990 - 2011



There has been a steady increase in N_2O emissions from domestic wastewater during the period 1990 - 2011, as shown in graph 8.7. N_2O emissions increase of 34.2% since 1990.

8.7 N_2O emissions from domestic wastewater, 1990 - 2011



For estimation of N_2O from domestic wastewater, total nitrogen in effluent is estimated by using the average of the available years of annual protein consumption data of the FAO (Food and Agriculture Organization) as 36.83 kg/person/year.

Uncertainties and time-series consistency: The population data for this category are gathered from population statistics of TurkStat. Uncertainties in the emission factor and production data are determined by TurkStat experts. After, CH_4 and N_2O emissions are calculated; they are converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

8.4 Time series consistency of emission factor for (6.B.2)

Source category	Gas	Comments on time series consistency
6.B.2	CH_4, N_2O	All EFs are constant over the entire time series

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is no recalculation.

8.3 Waste Incineration (6.C)

Source Category Description: This sector includes CO_2, CH_4 and N_2O emissions from incineration waste plants. This source category is not a key category in terms of CO_2, CH_4 and N_2O emissions.

Methodological Issues: The waste incineration emits CO_2, CH_4 and N_2O as a result of the combustion of solid and liquid waste in controlled incineration facilities. There are two waste incineration plants in Turkey. Types of waste incinerated include industrial, hazardous and clinical waste. In Turkey, municipal solid waste is not incinerated in the incineration plants. The activity data is available for clinical waste after 1995 and for industrial and hazardous waste after 1999. The default Tier 1 methodology in the 2006 IPCC Guidelines is used for estimating CO_2, CH_4 and N_2O emissions in Turkey. CO_2, CH_4 and N_2O emissions as CO_2 equivalents are given in Table 8.5 for waste incineration.

8.5 GHG emissions from waste incineration

(Gg CO_2 eq.)

	CO_2	CH_4	N_2O	Total
1995	0.233	0.036	0.004	0.273
1996	2.203	0.342	0.039	2.583
1997	3.909	0.606	0.069	4.584
1998	4.907	0.761	0.086	5.754
1999	10.827	1.119	0.200	12.147
2000	28.463	2.758	0.528	31.750
2001	27.782	2.646	0.516	30.944
2002	21.589	2.230	0.398	24.217
2003	31.469	2.973	0.585	35.028
2004	27.468	2.685	0.509	30.662
2005	36.496	3.402	0.679	40.578
2006	44.885	4.076	0.837	49.799
2007	38.465	3.616	0.716	42.797
2008	40.960	3.894	0.761	45.616
2009	40.346	3.581	0.754	44.681
2010	39.941	3.649	0.745	44.334
2011	54.424	4.872	1.017	60.313

The major GHG emissions from waste incineration are CO_2 emissions, which represent 90.2% of total emissions from this sector in 2011, followed by CH_4 and N_2O as 8.1% and 1.7%, respectively.

Uncertainties and time-series consistency: The activity data for this category are gathered from the waste incineration plants. Uncertainties in the emission factor and production data are determined by TurkStat experts. After, CH_4 and N_2O emissions are calculated; they are converted to the CO_2 equivalent by multiplying the global warming potential. The approach to produce quantitative uncertainty estimates is used as described in IPCC Good Practice Guidance 2000 for determining uncertainties of that category in total emissions. The combine uncertainties in emission factors and activity data are given in annex 7 in detail.

8.6 Time series consistency of emission factor for (6.C)

Source category	Gas	Comments on time series consistency
6.C	CO_2, CH_4, N_2O	All EFs are constant over the time series after 1995

Source-specific QA/QC and verification: The IPCC Good Practice Guidance is used for the quality assurance and quality control (QA/QC) procedures of National greenhouse gases emission inventory. Emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Recalculation: There is recalculation in waste incineration (6.C) for the period of 1995-2010.

8.4 Other (6.D)

There are no other activities to be considered under this category.

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ANNEX 1

A1. KEY CATEGORIES

According to the IPCC Good Practice Guidance, a key source category is one that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of direct greenhouse gases in terms of the absolute level of emissions. The results of this study has shown that;

- 5. LULUCF (CO_2),
- 1.A.1.a Public electricity and heat production (CO_2),
- 2.A.1 Cement production (mineral products) (CO_2),
- 1.A.3.b Road transportation (CO_2),
- 1.A.4.b Residential usage of natural gas, hard coal, lignite, LPG (CO_2),
- 6.A.1 Solid waste disposal (managed landfill) (CH_4),
- 2.C.1 Iron and steel production (CO_2),
- 4.A Enteric fermentation (CH_4),
- 1.A.4.c Agriculture/Forestry/Fisheries (CO_2),
- 6.A.2 Solid waste disposal (unmanaged landfill) (CH_4),
- 1.A.2.f Other industries (CO_2),
- 1.A.2.f Cement production (CO_2),
- 2.F Emission of HFCs (HFC-134a),
- 1.A.2.a Iron and steel (CO_2),
- 4.D.1.1 Agricultural soil (synthetic fertilizer) (N_2O),
- 2.A.2 Lime production (mineral products) (CO_2),
- 1.A.2.c Chemicals (CO_2),
- 1.A.3.a Civil aviation (CO_2),
- 1.A.1.b Petroleum refining (CO_2),
- 4.B Manure management (N_2O),
- 1.A.3.d Navigation (CO_2),
- 6.B.2 Domestic and commercial wastewater handling (CH_4), (N_2O),

- 4.D.1.2 Agricultural soil (animal manure applied) (N_2O),
- 1.A.2.f Fertilizer (CO_2),
- 1.B.1.a.2 Mining (surface) (CH_4)

are determined as key sources in 2011.

The key source categories were determined by using Tier 1 level and trend assessment.

The contribution of each source category to the total national inventory level is calculated according to Equation A1.1.

$$L_{x,t} = E_{x,t} / E_t * 100 \quad \text{(A1.1)}$$

where,

$L_{x,t}$: Level assessment for source x in year t
$E_{x,t}$: Emission estimate of source category x in year t
E_t : Total inventory estimate in year t

After the necessary level assessment are computed, key source categories are those that summed together in descending order of magnitude, add up to over %95 of the total cumulative of level assessment. The following spreadsheet can be used for the key source categories.

A1.1 Tier 1 key source categories

Source category	Fuel	Gas	2011 Emission	Level Assessment (contribution)	Cumulative Total (%)
Example (1.A.1.a)	Fuel Oil	CO_2	Input Data		
			Gg	%	
			$\Sigma(E_{x,t})$		100

A1.2 Key source categories (including LULUCF)

2011 KSA (with LULUCF)						
CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
5. LULUCF		CO2	-43640.3	43640.3	9.4	9.4
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CO2	49179.3	49179.3	10.6	19.9
1.A.1.a. Public Electricity and Heat Production	Lignite	CO2	42433.7	42433.7	9.1	29.0
2.A.1. Cement Production (Mineral Products)		CO2	28234.0	28234.0	6.1	35.1
1.A.3.b. Road Transportation	Gas / Diesel oil	CO2	27538.3	27538.3	5.9	41.0
1.A.4.b. Residential	Natural Gas	CO2	21616.2	21616.2	4.6	45.6
6.A.1. Solid Waste Disposal (Managed)		CH4	21348.4	21348.4	4.6	50.2
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CO2	20848.5	20848.5	4.5	54.7
2.C.1. Iron and Steel Production		CO2	17882.8	17882.8	3.8	58.5
4.A. Enteric Fermentation		CH4	17305.4	17305.4	3.7	62.2

A1.2 Key source categories (including LULUCF) (cont.)

CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
1.A.4.b. Residential	Hard Coal	CO2	16073.4	16073.4	3.4	65.7
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CO2	15283.4	15283.4	3.3	69.0
1.A.4.b. Residential	Lignite	CO2	10840.6	10840.6	2.3	71.3
6.A.2.1. Solid Waste Disposal (Unmanaged)		CH4	10825.0	10825.0	2.3	73.6
1.A.2.f. Other Industries	Natural Gas	CO2	10136.5	10136.5	2.2	75.8
1.A.3.b. Road Transportation	LPG	CO2	8322.2	8322.2	1.8	77.6
1.A.2.f. Cement Production	Lignite	CO2	6738.6	6738.6	1.4	79.0
1.A.2.f. Cement Production	Petroleum Coke	CO2	6557.5	6557.5	1.4	80.4
1.A.3.b. Road Transportation	Gasoline	CO2	5606.4	5606.4	1.2	81.6
2.F. Emission of HFCs		HFC-134a	5308.3	5308.3	1.1	82.8
1.A.2.f. Cement Production	Hard Coal	CO2	5165.3	5165.3	1.1	83.9
1.A.2.a. Iron and Steel	Natural Gas	CO2	4334.6	4334.6	0.9	84.8
4.D.1.1. Agricultural Soil (Synthetic Fertilizer)		N2O	3904.0	3904.0	0.8	85.6
2.A.2. Lime Production (Mineral Products)		CO2	3741.8	3741.8	0.8	86.4
1.A.2.f. Other Industries	Lignite	CO2	3624.5	3624.5	0.8	87.2
1.A.2.a. Iron and Steel	Hard Coal	CO2	3619.1	3619.1	0.8	88.0
1.A.2.f. Other Industries	Gas / Diesel oil	CO2	3514.2	3514.2	0.8	88.7
1.A.2.c. Chemicals	Natural Gas	CO2	3343.6	3343.6	0.7	89.5
1.A.3.a. Civil Aviation	Jet Kerosene	CO2	3330.6	3330.6	0.7	90.2
1.A.1.b. Petroleum Refining	Refinery Gas	CO2	2936.2	2936.2	0.6	90.8
1.A.4.b. Residential	LPG	CO2	2808.6	2808.6	0.6	91.4
1.A.1.b. Petroleum Refining	Natural Gas	CO2	2560.1	2560.1	0.5	92.0
4.B. Manure Management		N2O	2555.5	2555.5	0.5	92.5
1.A.3.d. Navigation	Gas / Diesel oil	CO2	2227.3	2227.3	0.5	93.0
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CO2	2139.2	2139.2	0.5	93.4
6.B.2. Domestic and Commercial Wastewater Handling		CH4	2035.5	2035.5	0.4	93.9
6.B.2. Domestic and Commercial Wastewater Handling		N2O	1857.4	1857.4	0.4	94.3
4.D.1.2. Agricultural Soil (Animal Manure Applied)		N2O	1578.9	1578.9	0.3	94.6
1.A.2.f. Fertilizer	Natural Gas	CO2	1445.1	1445.1	0.3	94.9
1.B.1.a.2. Mining (Surface)		CH4	1343.5	1343.5	0.3	95.2
4.B. Manure Management		CH4	1323.8	1323.8	0.3	95.5
1.A.2.f. Sugar	Lignite	CO2	1207.9	1207.9	0.3	95.8
4.D.1.4. Agricultural Soil (Crop Residue)		N2O	1198.5	1198.5	0.3	96.0
1.A.4.b. Residential	Hard Coal	CH4	1092.3	1092.3	0.2	96.3
1.A.2.c. Chemicals	Residual Fuel Oil	CO2	1076.2	1076.2	0.2	96.5
1.A.2.f. Other Industries	Petroleum Coke	CO2	1052.6	1052.6	0.2	96.7
2.F. Emission of SF6		SF6	950.2	950.2	0.2	96.9
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CO2	869.4	869.4	0.2	97.1
1.A.2.c. Chemicals	LPG	CO2	741.2	741.2	0.2	97.3
1.B.1.a.1. Mining (underground)		CH4	711.5	711.5	0.2	97.4
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CO2	693.3	693.3	0.1	97.6
1.A.4.b. Residential	Lignite	CH4	688.6	688.6	0.1	97.7
1.A.4.b. Residential	Residual Fuel Oil	CO2	651.0	651.0	0.1	97.9
1.A.4.b. Residential	Wood	CH4	644.0	644.0	0.1	98.0
1.A.4.b. Residential	Asphaltite	CO2	567.9	567.9	0.1	98.1
1.A.2.b. Non-Ferrous Metals	Lignite	CO2	542.3	542.3	0.1	98.2
1.A.3.c. Railways	Gas / Diesel oil	CO2	480.3	480.3	0.1	98.3
1.A.2.f. Sugar	Natural Gas	CO2	446.5	446.5	0.1	98.4
1.A.2.f. Other Industries	Hard Coal	CO2	443.8	443.8	0.1	98.5
4.D.2. Pasture, Range and Padock Manure		N2O	435.6	435.6	0.1	98.6
1.A.2.f. Other Industries	Gasoline	CO2	424.5	424.5	0.1	98.7
1.A.2.b. Non-Ferrous Metals	Natural Gas	CO2	400.3	400.3	0.1	98.8
1.A.2.c. Chemicals	Lignite	CO2	398.3	398.3	0.1	98.9
1.A.2.c. Chemicals	Hard Coal	CO2	334.8	334.8	0.1	98.9
1.A.4.b. Residential	Waste of animal, plant	CH4	270.6	270.6	0.1	99.0
1.A.2.c. Chemicals	Second Fuel Coal	CO2	221.7	221.7	0.0	99.1
4.C.1.2.1. Rice Cultivation		CH4	208.7	208.7	0.0	99.1
1.B.2.a. Oil (fugitative)		CH4	206.1	206.1	0.0	99.1
4.F.1. Field Burning of Agricultural Residue		CH4	201.0	201.0	0.0	99.2
1.A.2.f. Cement Production	Natural Gas	CO2	194.7	194.7	0.0	99.2
1.A.2.f. Other Industries	Residual Fuel Oil	CO2	190.3	190.3	0.0	99.3
1.A.1.a. Public Electricity and Heat Production	Lignite	N2O	185.3	185.3	0.0	99.3
1.A.3.d. Navigation	Residual Fuel Oil	CO2	170.3	170.3	0.0	99.3
1.A.2.f. Other Industries	Asphaltite	CO2	155.3	155.3	0.0	99.4
1.A.2.f. Sugar	Residual Fuel Oil	CO2	141.4	141.4	0.0	99.4
1.A.2.a. Iron and Steel	Lignite	CO2	128.2	128.2	0.0	99.4
1.A.4.b. Residential	Wood	N2O	126.8	126.8	0.0	99.5
1.A.2.f. Sugar	Second Fuel Coal	CO2	111.7	111.7	0.0	99.5
1.B.2.c. Venting and Flaring (fugitative)		CO2	106.4	106.4	0.0	99.5
1.A.2.c. Chemicals	Gas / Diesel oil	CO2	98.1	98.1	0.0	99.5
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	N2O	89.6	89.6	0.0	99.6

A1.2 Key source categories (including LULUCF) (cont.)

CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
2.B.5. Other Chemicals Production (Chemical Industry)		CH4	88.6	88.6	0.0	99.6
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CO2	82.1	82.1	0.0	99.6
1.A.4.b. Residential	Hard Coal	N2O	75.2	75.2	0.0	99.6
1.A.4.b. Residential	Gas / Diesel oil	CO2	72.2	72.2	0.0	99.6
1.A.2.f. Cement Production	Residual Fuel Oil	CO2	69.7	69.7	0.0	99.6
1.A.3.b. Road Transportation	Gas / Diesel oil	N2O	69.2	69.2	0.0	99.6
1.A.3.b. Road Transportation	LPG	CH4	64.5	64.5	0.0	99.7
1.B.2.b. Natural Gas (fugitative)		CH4	63.7	63.7	0.0	99.7
4.F.1. Field Burning of Agricultural Residue		N2O	60.8	60.8	0.0	99.7
6.C. Waste Incineration		CO2	54.4	54.4	0.0	99.7
1.A.4.b. Residential	Waste of animal, plant	N2O	53.3	53.3	0.0	99.7
1.A.2.f. Sugar	Hard Coal	CO2	53.3	53.3	0.0	99.7
1.A.2.b. Non-Ferrous Metals	Hard Coal	CO2	48.6	48.6	0.0	99.7
1.A.4.b. Residential	Lignite	N2O	47.4	47.4	0.0	99.7
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CO2	47.2	47.2	0.0	99.8
1.B.2.c. Venting and Flaring (fugitative)		CH4	46.6	46.6	0.0	99.8
1.A.2.a. Iron and Steel	Gas / Diesel oil	CO2	46.1	46.1	0.0	99.8
1.A.4.b. Residential	Natural Gas	CH4	41.4	41.4	0.0	99.8
4.D.3.2. Nitrogen Leaching and Runoff (4.d.3.2)		N2O	40.6	40.6	0.0	99.8
1.A.3.b. Road Transportation	Gas / Diesel oil	CH4	39.0	39.0	0.0	99.8
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	N2O	38.8	38.8	0.0	99.8
1.A.4.b. Residential	Asphaltite	CH4	38.6	38.6	0.0	99.8
1.A.1.a. Public Electricity and Heat Production	Natural Gas	N2O	36.0	36.0	0.0	99.8
1.A.3.a. Civil Aviation	Jet Kerosene	N2O	36.0	36.0	0.0	99.8
1.A.3.b. Road Transportation	Gasoline	CH4	34.0	34.0	0.0	99.8
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CO2	30.8	30.8	0.0	99.8
1.A.2.f. Cement Production	Petroleum Coke	N2O	30.7	30.7	0.0	99.9
1.A.2.f. Cement Production	Lignite	N2O	29.5	29.5	0.0	99.9
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CO2	28.9	28.9	0.0	99.9
1.A.2.a. Iron and Steel	Naphta	CO2	28.8	28.8	0.0	99.9
1.A.2.c. Chemicals	Gasoline	CO2	26.7	26.7	0.0	99.9
1.A.2.a. Iron and Steel	Residual Fuel Oil	CO2	26.3	26.3	0.0	99.9
1.A.2.f. Cement Production	Hard Coal	N2O	24.2	24.2	0.0	99.9
1.B.2.a. Oil (fugitative)		CO2	23.9	23.9	0.0	99.9
1.A.2.f. Cement Production	Gasoline	CO2	23.0	23.0	0.0	99.9
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CH4	21.9	21.9	0.0	99.9
4.D.1.3. Agricultural Soil (N-Fixing Crops)		N2O	19.7	19.7	0.0	99.9
1.A.2.f. Other Industries	Natural Gas	CH4	19.1	19.1	0.0	99.9
1.A.2.f. Other Industries	Second Fuel Coal	CO2	18.7	18.7	0.0	99.9
1.A.2.f. Cement Production	Gas / Diesel oil	CO2	17.3	17.3	0.0	99.9
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CH4	17.0	17.0	0.0	99.9
1.A.2.a. Iron and Steel	Hard Coal	N2O	16.9	16.9	0.0	99.9
1.A.2.f. Fertilizer	Residual Fuel Oil	CO2	16.2	16.2	0.0	99.9
1.A.2.f. Other Industries	Lignite	N2O	15.9	15.9	0.0	99.9
1.A.3.b. Road Transportation	Gasoline	N2O	15.0	15.0	0.0	99.9
1.A.2.f. Cement Production	Petroleum Coke	CH4	14.9	14.9	0.0	99.9
1.A.2.f. Cement Production	Lignite	CH4	14.3	14.3	0.0	99.9
1.A.4.b. Residential	Natural Gas	N2O	12.2	12.2	0.0	99.9
1.A.2.f. Cement Production	Hard Coal	CH4	11.7	11.7	0.0	99.9
1.A.1.a. Public Electricity and Heat Production	LPG	CO2	10.2	10.2	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Hard Coal	N2O	9.9	9.9	0.0	100.0
1.A.2.a. Iron and Steel	LPG	CO2	9.7	9.7	0.0	100.0
1.A.4.b. Residential	LPG	CH4	9.4	9.4	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Lignite	CH4	9.0	9.0	0.0	100.0
1.A.2.f. Other Industries	Gas / Diesel oil	N2O	8.9	8.9	0.0	100.0
1.A.4.b. Residential	LPG	N2O	8.4	8.4	0.0	100.0
1.A.2.a. Iron and Steel	Hard Coal	CH4	8.2	8.2	0.0	100.0
1.A.2.a. Iron and Steel	Natural Gas	CH4	8.2	8.2	0.0	100.0
1.A.2.a. Iron and Steel	Petroleum Coke	CO2	7.7	7.7	0.0	100.0
1.A.2.f. Other Industries	Lignite	CH4	7.7	7.7	0.0	100.0
1.A.1.b. Petroleum Refining	Refinery Gas	N2O	7.5	7.5	0.0	100.0
1.A.2.f. Sugar	Gasoline	CO2	6.3	6.3	0.0	100.0
1.A.2.c. Chemicals	Natural Gas	CH4	6.3	6.3	0.0	100.0
1.A.2.f. Other Industries	Natural Gas	N2O	5.6	5.6	0.0	100.0
1.A.3.d. Navigation	Gas / Diesel oil	N2O	5.6	5.6	0.0	100.0
1.A.2.f. Sugar	Lignite	N2O	5.3	5.3	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CO2	5.0	5.0	0.0	100.0
1.A.2.f. Other Industries	Petroleum Coke	N2O	4.9	4.9	0.0	100.0
6.C. Waste Incineration		CH4	4.9	4.9	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CH4	4.3	4.3	0.0	100.0
1.A.2.f. Sugar	Gas / Diesel oil	CO2	3.9	3.9	0.0	100.0

A1.2 Key source categories (including LULUCF) (cont.)

CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
1.A.3.d. Navigation	Gas / Diesel oil	CH4	3.2	3.2	0.0	100.0
1.A.2.f. Fertilizer	Natural Gas	CH4	2.7	2.7	0.0	100.0
1.A.4.b. Residential	Asphaltite	N2O	2.7	2.7	0.0	100.0
1.A.2.c. Chemicals	Residual Fuel Oil	N2O	2.6	2.6	0.0	100.0
1.A.2.f. Sugar	Lignite	CH4	2.6	2.6	0.0	100.0
1.A.1.b. Petroleum Refining	Refinery Gas	CH4	2.5	2.5	0.0	100.0
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CO2	2.4	2.4	0.0	100.0
1.A.2.a. Iron and Steel	Natural Gas	N2O	2.4	2.4	0.0	100.0
1.A.2.f. Other Industries	Petroleum Coke	CH4	2.4	2.4	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Lignite	N2O	2.4	2.4	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	N2O	2.4	2.4	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Biofuel	N2O	2.3	2.3	0.0	100.0
1.A.2.c. Chemicals	LPG	N2O	2.2	2.2	0.0	100.0
1.A.2.f. Other Industries	Hard Coal	N2O	2.1	2.1	0.0	100.0
1.A.2.f. Other Industries	Gas / Diesel oil	CH4	2.0	2.0	0.0	100.0
1.A.2.f. Fertilizer	Gas / Diesel oil	CO2	2.0	2.0	0.0	100.0
1.A.2.c. Chemicals	Natural Gas	N2O	1.9	1.9	0.0	100.0
1.A.4.b. Residential	Residual Fuel Oil	CH4	1.8	1.8	0.0	100.0
1.A.2.c. Chemicals	Lignite	N2O	1.7	1.7	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Asphaltite	N2O	1.6	1.6	0.0	100.0
1.A.4.b. Residential	Residual Fuel Oil	N2O	1.6	1.6	0.0	100.0
1.A.2.c. Chemicals	Hard Coal	N2O	1.6	1.6	0.0	100.0
1.A.2.f. Other Industries	Waste of animal, plant	N2O	1.6	1.6	0.0	100.0
1.A.1.b. Petroleum Refining	Natural Gas	N2O	1.4	1.4	0.0	100.0
1.B.2.b. Natural Gas (fugitative)		CO2	1.3	1.3	0.0	100.0
1.A.3.c. Railways	Gas / Diesel oil	N2O	1.2	1.2	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Biofuel	CH4	1.2	1.2	0.0	100.0
1.A.2.f. Other Industries	Gasoline	N2O	1.2	1.2	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Lignite	CH4	1.1	1.1	0.0	100.0
1.A.2.c. Chemicals	Second Fuel Coal	N2O	1.0	1.0	0.0	100.0
6.C. Waste Incineration		N2O	1.0	1.0	0.0	100.0
1.A.2.f. Other Industries	Hard Coal	CH4	1.0	1.0	0.0	100.0
1.A.3.a. Civil Aviation	Jet Kerosene	CH4	1.0	1.0	0.0	100.0
1.A.1.b. Petroleum Refining	Natural Gas	CH4	1.0	1.0	0.0	100.0
1.A.2.c. Chemicals	Lignite	CH4	0.8	0.8	0.0	100.0
1.A.2.f. Sugar	Natural Gas	CH4	0.8	0.8	0.0	100.0
1.A.2.f. Fertilizer	Natural Gas	N2O	0.8	0.8	0.0	100.0
1.A.2.f. Other Industries	Waste of animal, plant	CH4	0.8	0.8	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CH4	0.8	0.8	0.0	100.0
1.A.2.c. Chemicals	Hard Coal	CH4	0.8	0.8	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Natural Gas	CH4	0.8	0.8	0.0	100.0
1.A.2.f. Other Industries	Asphaltite	N2O	0.7	0.7	0.0	100.0
1.A.3.c. Railways	Gas / Diesel oil	CH4	0.7	0.7	0.0	100.0
4.D.3.1. Atmospheric deposition		N2O	0.6	0.6	0.0	100.0
1.A.2.c. Chemicals	Residual Fuel Oil	CH4	0.6	0.6	0.0	100.0
1.A.2.a. Iron and Steel	Lignite	N2O	0.6	0.6	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CH4	0.5	0.5	0.0	100.0
1.A.2.f. Sugar	Second Fuel Coal	N2O	0.5	0.5	0.0	100.0
1.B.2.c. Venting and Flaring (fugitative)		N2O	0.5	0.5	0.0	100.0
1.A.2.c. Chemicals	Second Fuel Coal	CH4	0.5	0.5	0.0	100.0
1.A.2.c. Chemicals	LPG	CH4	0.5	0.5	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CH4	0.5	0.5	0.0	100.0
1.A.2.f. Other Industries	Residual Fuel Oil	N2O	0.5	0.5	0.0	100.0
1.A.1.b. Petroleum Refining	Gasoline	CO2	0.4	0.4	0.0	100.0
1.A.3.d. Navigation	Residual Fuel Oil	N2O	0.4	0.4	0.0	100.0
1.A.2.f. Cement Production	Natural Gas	CH4	0.4	0.4	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CH4	0.4	0.4	0.0	100.0
1.A.2.f. Other Industries	Asphaltite	CH4	0.4	0.4	0.0	100.0
1.A.2.f. Sugar	Residual Fuel Oil	N2O	0.3	0.3	0.0	100.0
1.A.3.b. Road Transportation	LPG	N2O	0.3	0.3	0.0	100.0
1.A.2.a. Iron and Steel	Lignite	CH4	0.3	0.3	0.0	100.0
1.A.2.f. Other Industries	Gasoline	CH4	0.3	0.3	0.0	100.0
1.A.2.f. Sugar	Second Fuel Coal	CH4	0.3	0.3	0.0	100.0
1.A.2.f. Sugar	Hard Coal	N2O	0.2	0.2	0.0	100.0
1.A.2.c. Chemicals	Gas / Diesel oil	N2O	0.2	0.2	0.0	100.0
1.A.2.f. Sugar	Natural Gas	N2O	0.2	0.2	0.0	100.0
1.A.3.d. Navigation	Residual Fuel Oil	CH4	0.2	0.2	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Hard Coal	N2O	0.2	0.2	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Natural Gas	N2O	0.2	0.2	0.0	100.0
1.A.4.b. Residential	Gas / Diesel oil	CH4	0.2	0.2	0.0	100.0
1.A.4.b. Residential	Gas / Diesel oil	N2O	0.2	0.2	0.0	100.0

A1.2 Key source categories (including LULUCF) (cont.)

CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
1.A.2.f. Cement Production	Naphta	CO2	0.2	0.2	0.0	100.0
1.A.2.f. Cement Production	Residual Fuel Oil	N2O	0.2	0.2	0.0	100.0
1.A.2.f. Cement Production	LPG	CO2	0.2	0.2	0.0	100.0
1.A.3.b. Road Transportation	Biofuel	N2O	0.1	0.1	0.0	100.0
1.A.2.a. Iron and Steel	Gasoline	CO2	0.1	0.1	0.0	100.0
1.A.2.f. Sugar	LPG	CO2	0.1	0.1	0.0	100.0
1.A.2.f. Sugar	Hard Coal	CH4	0.1	0.1	0.0	100.0
1.A.2.a. Iron and Steel	Gas / Diesel oil	N2O	0.1	0.1	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Hard Coal	CH4	0.1	0.1	0.0	100.0
1.A.2.f. Cement Production	Natural Gas	N2O	0.1	0.1	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	N2O	0.1	0.1	0.0	100.0
1.A.2.f. Other Industries	Residual Fuel Oil	CH4	0.1	0.1	0.0	100.0
1.A.1.b. Petroleum Refining	Petroleum & Other	CO2	0.1	0.1	0.0	100.0
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CH4	0.1	0.1	0.0	100.0
1.A.2.f. Other Industries	Second Fuel Coal	N2O	0.1	0.1	0.0	100.0
1.A.3.b. Road Transportation	Biofuel	CH4	0.1	0.1	0.0	100.0
1.A.2.f. Sugar	Residual Fuel Oil	CH4	0.1	0.1	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	N2O	0.1	0.1	0.0	100.0
1.A.2.a. Iron and Steel	Naphta	N2O	0.1	0.1	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	N2O	0.1	0.1	0.0	100.0
1.A.2.c. Chemicals	Gasoline	N2O	0.1	0.1	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Naphta	N2O	0.1	0.1	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	N2O	0.1	0.1	0.0	100.0
1.A.2.a. Iron and Steel	Residual Fuel Oil	N2O	0.1	0.1	0.0	100.0
1.A.2.f. Cement Production	Gasoline	N2O	0.1	0.1	0.0	100.0
1.A.2.c. Chemicals	Gas / Diesel oil	CH4	0.1	0.1	0.0	100.0
1.A.2.f. Sugar	Naphta	CO2	0.1	0.1	0.0	100.0
1.B.2.a. Oil (fugitative)		N2O	0.1	0.1	0.0	100.0
1.A.2.f. Cement Production	Gas / Diesel oil	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Second Fuel Coal	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Residual Fuel Oil	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Petroleum Coke	N2O	0.0	0.0	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	LPG	N2O	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	N2O	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Wood	N2O	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Petroleum Coke	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Gasoline	N2O	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Naphta	CH4	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.2.c. Chemicals	Gasoline	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.5.a. Other (Stationary)		N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Gasoline	CH4	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Wood	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Gas / Diesel oil	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.5.a. Other (Stationary)		CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	LPG	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Gas / Diesel oil	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Waste of animal, plant	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	LPG	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Gas / Diesel oil	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Gasoline	CH4	0.0	0.0	0.0	100.0
1.A.1.a. Public Electricity and Heat Production	Naphta	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Wood	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Waste of animal, plant	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Wood	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Gasoline	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Gas / Diesel oil	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	LPG	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Naphta	N2O	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Gasoline	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Gasoline	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	LPG	N2O	0.0	0.0	0.0	100.0

A1.2 Key source categories (including LULUCF) (cont.)

CATEGORY	FUEL	GAS	EMISSION	ABS (EMIS)	CONTRIBUTION (%)	COMMUTATIVE CONTRIBUTION
1.A.1.b. Petroleum Refining	Petroleum & Other	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Naphta	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	LPG	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Naphta	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Petroleum & Other	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Gasoline	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	LPG	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Sugar	Naphta	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	LPG	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	LPG	CH4	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Hard Coal	CO2	0.0	0.0	0.0	100.0
1.A.3.d. Navigation	Hard Coal	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Lignite	CO2	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Lignite	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Asphaltite	CO2	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Second Fuel Coal	CO2	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Second Fuel Coal	CO2	0.0	0.0	0.0	100.0
1.A.4.b. Residential	Second Fuel Coal	CO2	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CO2	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CO2	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Residual Fuel Oil	CO2	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	LPG	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	LPG	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Refinery Gas	CO2	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Naphta	CO2	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Hard Coal	CH4	0.0	0.0	0.0	100.0
1.A.3.d. Navigation	Hard Coal	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Lignite	CH4	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Lignite	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Asphaltite	CH4	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Second Fuel Coal	CH4	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Second Fuel Coal	CH4	0.0	0.0	0.0	100.0
1.A.4.b. Residential	Second Fuel Coal	CH4	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Residual Fuel Oil	CH4	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	LPG	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	LPG	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Refinery Gas	CH4	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Naphta	CH4	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Hard Coal	N2O	0.0	0.0	0.0	100.0
1.A.3.d. Navigation	Hard Coal	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Lignite	N2O	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Lignite	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Cement Production	Asphaltite	N2O	0.0	0.0	0.0	100.0
1.A.2.a. Iron and Steel	Second Fuel Coal	N2O	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Second Fuel Coal	N2O	0.0	0.0	0.0	100.0
1.A.4.b. Residential	Second Fuel Coal	N2O	0.0	0.0	0.0	100.0
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	N2O	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	Residual Fuel Oil	N2O	0.0	0.0	0.0	100.0
1.A.3.c. Railways	Residual Fuel Oil	N2O	0.0	0.0	0.0	100.0
1.A.1.b. Petroleum Refining	LPG	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	LPG	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Other Industries	Refinery Gas	N2O	0.0	0.0	0.0	100.0
1.A.2.f. Fertilizer	Naphta	N2O	0.0	0.0	0.0	100.0
2.C.3. Aluminium Production		CO2	-	0.0	0.0	100.0
2.B.1. Ammonia Production		CO2	-	0.0	0.0	100.0
2.B.4.2. Carbide Production		CO2	-	0.0	0.0	100.0
2.B.2. Nitric Acid Production (Chemical Industry)		N2O	-	0.0	0.0	100.0
2.C.3. Aluminium Production		CF4	-	0.0	0.0	100.0
2.C.3. Aluminium Production		C2F6	-	0.0	0.0	100.0
2.A.4.1. Soda Ash Production and Use (Mineral Products)		CO2	-	0.0	0.0	100.0
1.A.3.b. Road Transportation	Natural Gas	CO2	-	0.0	0.0	100.0
1.A.3.b. Road Transportation	Natural Gas	CH4	-	0.0	0.0	100.0
1.A.3.b. Road Transportation	Natural Gas	N2O	-	0.0	0.0	100.0
2.C.2. Ferroalloys Production		CO2	-	0.0	0.0	100.0
2.A.3. Limestone and Dolomite Use (Mineral Products)		CO2	-	0.0	0.0	100.0
			422415.82			

A1.3 Key source categories (excluding LULUCF)

2011 KSA (without LULUCF)						
CATEGORY	**FUEL**	**GAS**	**EMISSION**	**ABS (EMIS)**	**CONTRIBUTION (%)**	**COMMUTATIVE CONTRIBUTION**
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CO2	49179.3	49179.3	11.6	11.6
1.A.1.a. Public Electricity and Heat Production	Lignite	CO2	42433.7	42433.7	10.0	21.7
2.A.1. Cement Production (Mineral Products)		CO2	28234.0	28234.0	6.7	28.4
1.A.3.b. Road Transportation	Gas / Diesel oil	CO2	27538.3	27538.3	6.5	34.9
1.A.4.b. Residential	Natural Gas	CO2	21616.2	21616.2	5.1	40.0
6.A.1. Solid Waste Disposal (Managed)		CH4	21348.4	21348.4	5.1	45.1
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CO2	20848.5	20848.5	4.9	50.0
2.C.1. Iron and Steel Production		CO2	17882.8	17882.8	4.2	54.2
4.A. Enteric Fermentation		CH4	17305.4	17305.4	4.1	58.3
1.A.4.b. Residential	Hard Coal	CO2	16073.4	16073.4	3.8	62.1
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CO2	15283.4	15283.4	3.6	65.8
1.A.4.b. Residential	Lignite	CO2	10840.6	10840.6	2.6	68.3
6.A.2.1. Solid Waste Disposal (Unmanaged)		CH4	10825.0	10825.0	2.6	70.9
1.A.2.f. Other Industries	Natural Gas	CO2	10136.5	10136.5	2.4	73.3
1.A.3.b. Road Transportation	LPG	CO2	8322.2	8322.2	2.0	75.2
1.A.2.f. Cement Production	Lignite	CO2	6738.6	6738.6	1.6	76.8
1.A.2.f. Cement Production	Petroleum Coke	CO2	6557.5	6557.5	1.6	78.4
1.A.3.b. Road Transportation	Gasoline	CO2	5606.4	5606.4	1.3	79.7
2.F. Emission of HFCs		HFC-134a	5308.3	5308.3	1.3	81.0
1.A.2.f. Cement Production	Hard Coal	CO2	5165.3	5165.3	1.2	82.2
1.A.2.a. Iron and Steel	Natural Gas	CO2	4334.6	4334.6	1.0	83.2
4.D.1.1. Agricultural Soil (Synthetic Fertilizer)		N2O	3904.0	3904.0	0.9	84.2
2.A.2. Lime Production (Mineral Products)		CO2	3741.8	3741.8	0.9	85.0
1.A.2.f. Other Industries	Lignite	CO2	3624.5	3624.5	0.9	85.9
1.A.2.a. Iron and Steel	Hard Coal	CO2	3619.1	3619.1	0.9	86.8
1.A.2.f. Other Industries	Gas / Diesel oil	CO2	3514.2	3514.2	0.8	87.6
1.A.2.c. Chemicals	Natural Gas	CO2	3343.6	3343.6	0.8	88.4
1.A.3.a. Civil Aviation	Jet Kerosene	CO2	3330.6	3330.6	0.8	89.2
1.A.1.b. Petroleum Refining	Refinery Gas	CO2	2936.2	2936.2	0.7	89.9
1.A.4.b. Residential	LPG	CO2	2808.6	2808.6	0.7	90.5
1.A.1.b. Petroleum Refining	Natural Gas	CO2	2560.1	2560.1	0.6	91.1
4.B. Manure Management		N2O	2555.5	2555.5	0.6	91.7
1.A.3.d. Navigation	Gas / Diesel oil	CO2	2227.3	2227.3	0.5	92.3
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CO2	2139.2	2139.2	0.5	92.8
6.B.2. Domestic and Commercial Wastewater Handling		CH4	2035.5	2035.5	0.5	93.3
6.B.2. Domestic and Commercial Wastewater Handling		N2O	1857.4	1857.4	0.4	93.7
4.D.1.2. Agricultural Soil (Animal Manure Applied)		N2O	1578.9	1578.9	0.4	94.1
1.A.2.f. Fertilizer	Natural Gas	CO2	1445.1	1445.1	0.3	94.4
1.B.1.a.2. Mining (Surface)		CH4	1343.5	1343.5	0.3	94.7
4.B. Manure Management		CH4	1323.8	1323.8	0.3	95.0
1.A.2.f. Sugar	Lignite	CO2	1207.9	1207.9	0.3	95.3

ANNEX 2

A2. METHODOLOGY

Turkey's greenhouse gas emission inventory is in accordance with the IPCC Guidelines. The emission factors are given in the following Table A2.1.

A2.1 Emission factors used for national emission inventory

Sector	Gas	Unit	Emission Factor
Energy			
Hard Coal	CO_2	tC/TJ	25.8
Lignite	CO_2	tC/TJ	27.6
Asphalt	CO_2	tC/TJ	25.8
Secondary Fuel Coal	CO_2	tC/TJ	25.8
Petroleum Coke	CO_2	tC/TJ	25.8
Petroleum	CO_2	tC/TJ	20.0
Natural Gases	CO_2	tC/TJ	15.3
Jet Kerosene	CO_2	tC/TJ	19.5
Energy - Electricity Production			
Hard Coal	CH_4	KG/TJ	1.0
Lignite	CH_4	KG/TJ	1.0
Asphalt	CH_4	KG/TJ	1.0
Secondary Fuel Coal	CH_4	KG/TJ	1.0
Petroleum Coke	CH_4	KG/TJ	1.0
Petroleum	CH_4	KG/TJ	3.0
Natural Gas	CH_4	KG/TJ	1.0
Energy - Industry			
Hard Coal	CH_4	KG/TJ	10.0
Lignite	CH_4	KG/TJ	10.0
Asphalt	CH_4	KG/TJ	10.0
Secondary Fuel Coal	CH_4	KG/TJ	10.0
Petroleum Coke	CH_4	KG/TJ	10.0
Petroleum	CH_4	KG/TJ	2.0
Natural Gas	CH_4	KG/TJ	5.0
Energy - Other			
Hard Coal	CH_4	KG/TJ	300.0
Lignite	CH_4	KG/TJ	300.0
Asphalt	CH_4	KG/TJ	300.0
Secondary Fuel Coal	CH_4	KG/TJ	300.0
Petroleum Coke	CH_4	KG/TJ	300.0
Petroleum (Residential)	CH_4	KG/TJ	10.0
Petroleum (Agriculture)	CH_4	KG/TJ	5.0
Natural Gas	CH_4	KG/TJ	5.0
Biomass (Residential)	CH_4	KG/TJ	300.0
Energy - Transport			
Hard Coal	CH_4	KG/TJ	10.0
Lignite	CH_4	KG/TJ	10.0
Asphalt	CH_4	KG/TJ	10.0
Secondary Fuel Coal	CH_4	KG/TJ	10.0
Petroleum Coke	CH_4	KG/TJ	10.0
Petroleum	CH_4	KG/TJ	5.0
Natural Gas	CH_4	KG/TJ	50.0
Jet Kerosene	CH_4	KG/TJ	0.5
Fuel-oil	CH_4	KG/TJ	5.0
Diesel	CH_4	KG/TJ	5.0
Gasoline	CH_4	KG/TJ	20.0
Energy - Electricity Production			
Hard Coal	N_2O	KG/TJ	1.4
Lignite	N_2O	KG/TJ	1.4
Asphalt	N_2O	KG/TJ	1.4
Secondary Fuel Coal	N_2O	KG/TJ	1.4
Petroleum Coke	N_2O	KG/TJ	1.4
Petroleum	N_2O	KG/TJ	0.6
Natural Gas	N_2O	KG/TJ	0.1
Energy - Industry			
Hard Coal	N_2O	KG/TJ	1.4
Lignite	N_2O	KG/TJ	1.4
Asphalt	N_2O	KG/TJ	1.4
Secondary Fuel Coal	N_2O	KG/TJ	1.4
Petroleum Coke	N_2O	KG/TJ	1.4
Petroleum	N_2O	KG/TJ	0.6
Energy - Industry			
Natural Gas	N_2O	KG/TJ	0.1
Energy - Other			
Hard Coal	N_2O	KG/TJ	1.4
Lignite	N_2O	KG/TJ	1.4
Asphalt	N_2O	KG/TJ	1.4
Secondary Fuel Coal	N_2O	KG/TJ	1.4
Petroleum Coke	N_2O	KG/TJ	1.4
Petroleum (Residential)	N_2O	KG/TJ	0.6
Petroleum (Agriculture)	N_2O	KG/TJ	0.6
Natural Gas	N_2O	KG/TJ	0.1
Biomass (Residential)	N_2O	KG/TJ	4.0
Energy - Transport			
Hard Coal	N_2O	KG/TJ	1.4
Lignite	N_2O	KG/TJ	1.4
Asphalt	N_2O	KG/TJ	1.4
Secondary Fuel Coal	N_2O	KG/TJ	1.4
Petroleum Coke	N_2O	KG/TJ	1.4
Petroleum	N_2O	KG/TJ	0.6
Natural Gas	N_2O	KG/TJ	0.1
Jet Kerosene	N_2O	KG/TJ	2.0
Fuel-oil	N_2O	KG/TJ	0.6
Diesel	N_2O	KG/TJ	0.6
Gasoline	N_2O	KG/TJ	0.6
Energy - Electricity Production			
Hard Coal	NO_x	KG/TJ	300.0
Lignite	NO_x	KG/TJ	300.0
Asphalt	NO_x	KG/TJ	300.0
Secondary Fuel Coal	NO_x	KG/TJ	300.0
Petroleum Coke	NO_x	KG/TJ	300.0
Petroleum	NO_x	KG/TJ	200.0
Natural Gas	NO_x	KG/TJ	150.0
Energy - Industry			
Hard Coal	NO_x	KG/TJ	300.0
Lignite	NO_x	KG/TJ	300.0
Asphalt	NO_x	KG/TJ	300.0
Secondary Fuel Coal	NO_x	KG/TJ	300.0
Petroleum Coke	NO_x	KG/TJ	300.0
Petroleum	NO_x	KG/TJ	200.0
Natural Gas	NO_x	KG/TJ	150.0
Energy - Other			
Hard Coal	NO_x	KG/TJ	100.0
Lignite	NO_x	KG/TJ	100.0
Asphalt	NO_x	KG/TJ	100.0
Secondary Fuel Coal	NO_x	KG/TJ	100.0
Petroleum Coke	NO_x	KG/TJ	100.0
Petroleum (Residential)	NO_x	KG/TJ	100.0
Petroleum (Agriculture)	NO_x	KG/TJ	1,200.0
Natural Gas	NO_x	KG/TJ	50.0
Biomass (Residential)	NO_x	KG/TJ	100.0
Energy - Transport			
Hard Coal	NO_x	KG/TJ	300.0
Lignite	NO_x	KG/TJ	300.0
Asphalt	NO_x	KG/TJ	300.0
Secondary Fuel Coal	NO_x	KG/TJ	300.0
Petroleum Coke	NO_x	KG/TJ	300.0
Natural Gas	NO_x	KG/TJ	600.0
Jet Kerosene	NO_x	KG/TJ	300.0
Fuel-oil (Railway)	NO_x	KG/TJ	1,200.0
Diesel (Railway)	NO_x	KG/TJ	1,200.0
Gasoline	NO_x	KG/TJ	600.0
Fuel-oil (Navigation)	NO_x	KG/TJ	1,500.0

A2.1 Emission factors used for national emission inventory (cont.)

Sector	Gas	Unit	Emission Factor
Energy - Transport			
Diesel (Navigation)	NO_X	KG/TJ	1 500.0
Fuel-oil (Road Trans.)	NO_X	KG/TJ	800.0
Diesel (Road Trans.)	NO_X	KG/TJ	800.0
Energy - Electricity Production			
Hard Coal	CO	KG/TJ	20.0
Lignite	CO	KG/TJ	20.0
Asphalt	CO	KG/TJ	20.0
Secondary Fuel Coal	CO	KG/TJ	20.0
Petroleum Coke	CO	KG/TJ	20.0
Petroleum	CO	KG/TJ	15.0
Natural Gas	CO	KG/TJ	20.0
Energy - Industry			
Hard Coal	CO	KG/TJ	150.0
Lignite	CO	KG/TJ	150.0
Asphalt	CO	KG/TJ	150.0
Secondary Fuel Coal	CO	KG/TJ	150.0
Petroleum Coke	CO	KG/TJ	150.0
Petroleum	CO	KG/TJ	10.0
Natural Gas	CO	KG/TJ	30.0
Energy - Other			
Hard Coal	CO	KG/TJ	2 000.0
Lignite	CO	KG/TJ	2 000.0
Asphalt	CO	KG/TJ	2 000.0
Secondary Fuel Coal	CO	KG/TJ	2 000.0
Petroleum Coke	CO	KG/TJ	2 000.0
Petroleum (Residential)	CO	KG/TJ	20.0
Petroleum (Agriculture)	CO	KG/TJ	1 000.0
Natural Gas	CO	KG/TJ	50.0
Biomass (Residential)	CO	KG/TJ	5 000.0
Energy - Transport			
Hard Coal	CO	KG/TJ	150.0
Lignite	CO	KG/TJ	150.0
Asphalt	CO	KG/TJ	150.0
Secondary Fuel Coal	CO	KG/TJ	150.0
Petroleum Coke	CO	KG/TJ	150.0
Petroleum	CO	KG/TJ	1 000.0
Natural Gas	CO	KG/TJ	400.0
Jet Kerosene	CO	KG/TJ	100.0
Fuel-oil	CO	KG/TJ	1 000.0
Diesel	CO	KG/TJ	1 000.0
Gasoline	CO	KG/TJ	8 000.0
Energy - Electricity Production			
Hard Coal	NMVOC	KG/TJ	5.0
Lignite	NMVOC	KG/TJ	5.0
Asphalt	NMVOC	KG/TJ	5.0
Secondary Fuel Coal	NMVOC	KG/TJ	5.0
Petroleum Coke	NMVOC	KG/TJ	5.0
Petroleum	NMVOC	KG/TJ	5.0
Natural Gas	NMVOC	KG/TJ	5.0
Energy - Industry			
Hard Coal	NMVOC	KG/TJ	20.0
Lignite	NMVOC	KG/TJ	20.0
Asphalt	NMVOC	KG/TJ	20.0
Secondary Fuel Coal	NMVOC	KG/TJ	20.0
Petroleum Coke	NMVOC	KG/TJ	20.0
Petroleum	NMVOC	KG/TJ	5.0
Natural Gas	NMVOC	KG/TJ	5.0
Energy - Other			
Hard Coal	NMVOC	KG/TJ	200.0
Lignite	NMVOC	KG/TJ	200.0
Asphalt	NMVOC	KG/TJ	200.0
Secondary Fuel Coal	NMVOC	KG/TJ	200.0
Petroleum Coke	NMVOC	KG/TJ	200.0
Petroleum (Residential)	NMVOC	KG/TJ	5.0
Petroleum (Agriculture)	NMVOC	KG/TJ	200.0
Natural Gas	NMVOC	KG/TJ	5.0
Biomass (Residential)	NMVOC	KG/TJ	600.0

Sector	Gas	Unit	Emission Factor
Energy - Transport			
Hard Coal	NMVOC	KG/TJ	20.0
Lignite	NMVOC	KG/TJ	20.0
Asphalt	NMVOC	KG/TJ	20.0
Secondary Fuel Coal	NMVOC	KG/TJ	20.0
Petroleum Coke	NMVOC	KG/TJ	20.0
Petroleum	NMVOC	KG/TJ	200.0
Natural Gas	NMVOC	KG/TJ	5.0
Jet Kerosene	NMVOC	KG/TJ	50.0
Fuel-oil	NMVOC	KG/TJ	200.0
Diesel	NMVOC	KG/TJ	200.0
Gasoline	NMVOC	KG/TJ	1 500.0
Energy - Fugitive Emission			
Coal Mining			
Underground mining	CH_4	m^3/tonnes	17.5
Surface mining	CH_4	m^3/tonnes	1.2
Industrial Processes			
Cement Production			
Clinker (CKD is 1,02)	CO_2	tonne CO_2/tonne	0.51
Lime Production			
CaO Production	CO_2	Kg CO_2/tonne	0.75
Limestone and Dolomite Use			
Limestone	CO_2	Kg CO_2/tonne	440*f
Dolomite	CO_2	Kg CO_2/tonne	477*f
Note: f is the fractional purity, which is taken as 1			
Soda Ash Production and Use			
Soda ash use (Na_2CO_3)	CO_2	Kg CO_2/tonne	415.0
Road Paving with Asphalt			
Asphalt plant	NO_X	Kg/tonne	0.084
Asphalt plant	SO_2	Kg/tonne	0.120
Asphalt plant	CO	Kg/tonne	0.035
Asphalt plant	NMVOC	Kg/tonne	0.023
Road Surface	MNVOC	Kg/tonne	320
Asphalt Roofing Production			
Asphalt Roofing	MNVOC	Kg/tonne	0.16
Asphalt Roofing	CO	Kg/tonne	0.0095
Ammonia Production			
NH_3	CO_2	tonne CO_2/tonne	1.6
Nitric Acid Production			
Nitric Acid	N_20	Kg/tonne	19.0
Nitric Acid	NO_X	Kg/tonne	12.0
Nitric Acid	NH_3	G/tonne	10.0
Calcium Carbid Production			
Limestone	CO_2	Kg/tonne	760.0
Production of Other Chemicals			
Carbon Black	CH_4	g/Kg	11.0
Ethylene	CH_4	g/Kg	1.0
Styrene	CH_4	g/Kg	4.0
Methanol	CH_4	g/Kg	2.0
Coke	CH_4	g/Kg	0.5
Carbon Black	SO_2	Kg/tonne	3.1
Sulfuric Acid	SO2	Kg/tonne	17.5
Carbon Black	NO_X	Kg/tonne	0.4
Acrylonitrite	NMVOC	Kg/tonne	1.0
Etylene	NMVOC	Kg/tonne	1.4
Propylene	NMVOC	Kg/tonne	1.4
Carbon Black	NMVOC	Kg/tonne	40.0
Formaldehyde	NMVOC	Kg/tonne	5.0
Phtalic anthydride	NMVOC	Kg/tonne	6.0
Polypropylene	NMVOC	Kg/tonne	12.0
Polystyrene	NMVOC	Kg/tonne	5.4
Polyethene-low density	NMVOC	Kg/tonne	3.0
Polyethene-high density	NMVOC	Kg/tonne	6.4
Polyvinylchloride	NMVOC	Kg/tonne	8.5
Styrene	NMVOC	Kg/tonne	18.0
Styrene butadiene	NMVOC	Kg/tonne	5.8
Carbon Black	CO	Kg/tonne	10.0

A2.1 Emission factors used for national emission inventory (cont.)

Sector	Gas	Unit	Emission Factor
Iron and Steel			
Iron production-Pig Iron Tap.	NMVOC	g/tonne	20.0
Iron production-Blast Fur.	NMVOC	g/tonne	100.0
Steel Production	NMVOC	g/tonne	30.0
Iron production-Pig Iron Tap.	CO	g/tonne	112.0
Iron production-Blast Fur.	CO	g/tonne	1,330.0
Steel Production	CO	g/tonne	1.0
Iron production	NO_X	g/tonne	76.0
Steel Production	NO_X	g/tonne	40.0
Aluminium			
Aluminium Production	CO_2	tonne/tonne	1.8
Aluminium Production	NO_X	Kg/tonne	2.15
Aluminium Production	CO	Kg/tonne	135.0
Pulp and Paper			
Pulp and paper production	NOX	Kg/tonne	1.5
Pulp and paper production	VOC	Kg/tonne	3.7
Pulp and paper production	CO	Kg/tonne	5.6
Alcoholic Beverages			
Wine	NMVOC	Kg/liter	0.08
Beer	NMVOC	Kg/liter	0.035
Spirits (unspecified)	NMVOC	Kg/liter	15.0
Whiskey	NMVOC	Kg/liter	15.0
Bread making and other food			
Meat, fish and poultry	NMVOC	Kg/tonne	0.3
Sugar	NMVOC	Kg/tonne	10.0
Margarine-solid cooking fats	NMVOC	Kg/tonne	10.0
Cakes, biscuits, bre.cereals	NMVOC	Kg/tonne	1.0
Bread	NMVOC	Kg/tonne	8.0
Animal feed	NMVOC	Kg/tonne	1.0
Agriculture			
Enteric Fermentation			
Dairy Cattle	CH_4	Kg/head/year	68.5
Other Cattle	CH_4	Kg/head/year	56.0
Buffalo	CH_4	Kg/head/year	55.0
Sheep	CH_4	Kg/head/year	5.0
Goats	CH_4	Kg/head/year	5.0
Camels	CH_4	Kg/head/year	46.0
Horse	CH_4	Kg/head/year	18.0
Swine	CH_4	Kg/head/year	1.0
Mules&Donkeys	CH_4	Kg/head/year	10.0
Manure Mangement			
Dairy Cattle (C.R. Temp.)	CH_4	Kg/head/year	16.0
Other Cattle (C.R. Temp.)	CH_4	Kg/head/year	1.0
Buffalo (Clim.R. Temp.)	CH_4	Kg/head/year	2.0
Sheep (Clim.R. Temp.)	CH_4	Kg/head/year	0.16
Goats (Clim.R. Temp.)	CH_4	Kg/head/year	0.17
Camels (Clim.R. Temp.)	CH_4	Kg/head/year	1.9
Horse (Clim.R. Temp.)	CH_4	Kg/head/year	1.6
Mules&Dankeys (C.R.Temp.)	CH_4	Kg/head/year	0.9
Swine (Clim.R. Temp.)	CH_4	Kg/head/year	4.0
Poultry (Clim.R. Temp.)	CH_4	Kg/head/year	0.018
Rice Cultivation			
Rice	CH_4	g/m^2	20.0
Note: Integrated emission factor (arithmetic mean)			
Agricultural Burning			
Wheat, Barley, Maize, Oat, Rye	CH_4	Emission Ratios*	0.05
Wheat, Barley, Maize, Oat, Rye	CO	Emission Ratios*	0.06
Wheat, Barley, Maize, Oat, Rye	N_2O	Emission Ratios*	0.007
Wheat, Barley, Maize, Oat, Rye	NO_X	Emission Ratios*	0.121
Note: Dry Matter fraction (arithmetic mean)			

Direct N_2O Manure	N Excretion/animal kg N/head/year	Waste manage type (%)
Dairy Cattle	82.581	0.003
Other Cattle	45.088	0.006
Buffalo	44.384	0.007
Sheep	13.502	0.000
Goats	16.494	0.002
Camels	33.266	0.000
Horse	37.869	0.002
Swine	6.800	0.007
Mules&Dankeys	37.869	0.002
Poultry	-	-
Chicken	0.409	0.001
Duck&Gees	0.818	0.000
Turkey	1.837	0.001

Indirect N_2O Manure	Fraction of Total N lost	Emission Factor
Dairy Cattle	0.2096	0.01
Other Cattle	0.15975	0.01
Buffalo	0.132	0.01
Sheep	0	0.01
Goats	0	0.01
Camels	0	0.01
Horse	0.05	0.01
Swine	0.150225	0.01
Mules&Dankeys	0.05	0.01
Poultry	-	-
Chicken	0.2375	0.01
Duck&Gees	0	0.01
Turkey	0.2375	0.01

Fr. of manure used as fertilizer	Fr. of Total N lost (CS)
Dairy Cattle	0.8
Other Cattle	0.5
Buffalo	0.5
Sheep	0.0
Goats	0.0
Camels	0.0
Horse	0.1
Swine	0.0
Mules&Dankeys	0.1
Poultry	-
Chicken	0.2
Duck&Gees	0.0
Turkey	0.2

Crop Residue Burning	Residue/Crop	Dry matter	% Burned
Wheat	1.30	0.83	0.10
Barley	1.20	0.83	0.10
Maize	1.00	0.40	0.10
Oat	1.30	0.83	0.10
Rye	1.60	0.83	0.10

Nitrogen Fixation	Dry Matter Fraction	% 100=1	$Frac_{NCRBF}$ (EF) (kg N/kg)
Peas	0.91	0.10	0.03
Lentil (Red)	0.91	0.10	0.03
Lentil (Green)	0.91	0.06	0.03
Chick Peas	0.91	0.12	0.03
Soya	0.91	0.03	0.03
Dry Bean	0.90	0.08	0.03

EF for synthetic N applied as fertilizers is 0,01 kg N_2O/kg N

A2.1 Emission factors used for national emission inventory (cont.)

Crop residues	Dry matter fraction	Above ground residue DM relationship with DM yield: Slop	Intercept	Above ground residue N	Below residue/ above biomass	Below ground residue N	Combustion factor	Area burnt	Renewal fraction	Fraction removed
Major crop types										
Grains	0,88	1,09	0,88	0,01	0,22	0,01	0,80	0,10	1,00	0,50
Beans & Pulses (N fix)	0,91	1,13	0,85	0,01	0,19	0,01	0,80	0,10	1,00	0,50
Beans & Pulses (non-N fix)	0,91	1,13	0,85	0,01	0,19	0,01	0,80	0,10	1,00	0,50
Tubers	0,22	0,10	1,06	0,02	0,20	0,01	0,80	0,00	1,00	1,00
Root crops and Other	0,94	1,07	1,54	0,02	0,20	0,01	0,80	0,00	1,00	1,00
N-fixing forages	0,90	0,30	0,00	0,03	0,40	0,02	0,80	0,00	1,00	1,00
Non-N-fixing forages	0,90	0,30	0,00	0,02	0,54	0,01	0,80	0,00	1,00	1,00
Perennial grasses	0,90	0,30	0,00	0,02	0,80	0,01	0,80	0,00	1,00	1,00
Grass-clover mixtures	0,90	0,30	0,00	0,03	0,80	0,02	0,80	0,00	1,00	1,00
Individual Crops										
Maize	0,87	1,03	0,61	0,01	0,22	0,01	0,80	0,10	1,00	0,50
Wheat	0,89	1,51	0,52	0,01	0,24	0,01	0,80	0,10	1,00	0,50
Winter wheat	0,89	1,61	0,40	0,01	0,23	0,01	0,80	-	-	-
Spring wheat	0,89	1,29	0,75	0,01	0,28	0,01	0,80	-	-	-
Rice	0,89	0,95	2,46	0,01	0,16	0,00	0,80	0,10	1,00	0,50
Barley	0,89	0,98	0,59	0,01	0,22	0,01	0,80	0,10	1,00	0,50
Oats	0,89	0,91	0,89	0,01	0,25	0,01	0,80	0,10	1,00	0,50
Millet	0,90	1,43	0,14	0,01	0,00	0,00	0,80	0,10	1,00	0,50
Sorghum	0,89	0,88	1,33	0,01	0,00	0,01	0,80	0,10	1,00	0,50
Soyabean	0,91	0,93	1,35	0,01	0,19	0,01	0,80	0,10	1,00	0,50
Dry bean	0,90	0,36	0,68	0,01	0,00	0,01	0,80	0,10	1,00	0,50
Potato	0,22	0,10	1,06	0,02	0,20	0,01	0,80	0,00	1,00	1,00
Peanut (w/pod)	0,94	1,07	1,54	0,02	0,00	0,00	0,80	-	-	-
Alfalfa	0,90	0,29	0,00	0,03	0,40	0,02	0,80	0,10	1,00	0,50
Non-legume hay	0,90	0,18	0,00	0,15	0,54	0,01	0,80			

CH_4 emission from waste disposal sites

*= (MSWT*MSWF*MCF*DOC*D*	*Collected*	*Gg/year*	-
MSWT	*Collected*	*Gg/year*	-
MSWF	*Fraction*	-	*1.0*
MCF (Uncont. Landfill)	*Corr. Fact.*	-	*0.6*
MCF (Cont. Landfill)	*Corr. Fact.*	-	*1.0*
DOC	*Deg.Org.C*	-	*0.15*
DOCF	*Fraction*	-	*0.77*
F	*Fra.in land.*	-	*0.5*
R	*Recovered*	*Gg/year*	-
OX	*Oxi. Fact.*	-	*0.0*

Wastewater

Annual Protein Consumption (FAO) (kg/person/year)	36.83
Fraction of Nitrogen in Protein (kg N/kg)	0.16
Factor Non-consumed Protein added to WW	1.40
Factor for industrial and commercial co-discharged protein into the server system	1.25
Nitrogen removed with sludge (kg N/year)	0.00
Domestic WW EF (kg N_2O-N/kg	0.01

Wastewater

Domestic Wastewater	BOD g/person/day	EF	
Organics in Wastewater	38.0		1.0
	kg CH4/kg BOD		
	urban		rural
	0.06		0.21

Note: Weighted CH_4 Efs (kg CH_4/kg COD) is taken as 0.03

Solvent and Other Product Use

Paint (Vehicle Production)	Gas	Unit	EF
Small	NMVOC	Kg/car	12.3
Medium	NMVOC	Kg/car	21.95
Large	NMVOC	Kg/car	31.6
Chemical Products Manufacture and Processing			
Cosmetics and toiletries	NMVOC	Kg/person	0.23
DIY/Buildings	NMVOC	Kg/Household	0.49
Household Products	NMVOC	Kg/Household	0.46
Car Care Products	NMVOC	Kg/Car	0.97

Waste Incineration

CF (industrial waste)	CO_2	(fraction)	0.50
FCF (industrial waste)	CO_2	(fraction)	0.90
OF (industrial waste)	CO_2	(fraction)	1.00
CF (clinical waste)	CO_2	(fraction)	0.60
FCF (clinical waste)	CO_2	(fraction)	0.40
OF (clinical waste)	CO_2	(fraction)	1.00
EF (industrial, clinical waste)	CH_4	kg CH_4/Gg Wet Waste	6500
EF (industrial waste)	N_2O	kg N_2O/Gg Wet Waste	100
EF (clinical waste)	N_2O	kg N_2O/Gg Wet Waste	50

The EF for new sectors added to the inventory

Sector	Gas	Unit	Emission Factor
Fugitative Emissions			
Well Drilling	CO_2	ktonne/m^3	0.000100
Well Testing	CO_2	ktonne/m^3	0.009000
Well Servicing	CO_2	ktonne/m^3	0.000002
Gas Production (1)	CO_2	ktonne/m^3	0.000082
Gas Production (2)	CO_2	ktonne/m^3	0.001200
Gas processing (1)	CO_2	ktonne/m^3	0.000320
Gas processing (2)	CO_2	ktonne/m^3	0.001800
Gas transmission&storage(1)	CO_2	ktonne/m^3	0.000001
Gas transmission&storage(2)	CO_2	ktonne/m^3	0.000003
Gas transmission&storage(3)	CO_2	ktonne/m^3	0.000000
Oil Production	CO_2	ktonne/m^3	0.000260
Oil Production	CO_2	ktonne/m^3	0.000000
Oil Production	CO_2	ktonne/m^3	0.000095
Oil Production	CO_2	ktonne/m^3	0.041000
Oil transport	CO_2	ktonne/m^3	0.000000
Tanker, trucks, rail cars	CO_2	ktonne/m^3	0.000002
Well Drilling	CH_4	ktonne/m^3	0.000033
Well Testing	CH_4	ktonne/m^3	0.000051
Well Servicing	CH_4	ktonne/m^3	0.000110
Gas Production (1)	CH_4	ktonne/m^3	0.002300
Gas Production (2)	CH_4	ktonne/m^3	0.000001
Gas processing (1)	CH_4	ktonne/m^3	0.001030
Gas processing (2)	CH_4	ktonne/m^3	0.000001
Gas transmission&storage(1)	CH_4	ktonne/m^3	0.000480
Gas transmission&storage(2)	CH_4	ktonne/m^3	0.000320
Gas transmission&storage(3)	CH_4	ktonne/m^3	0.000025
Oil Production	CH_4	ktonne/m^3	0.003600
Oil Production	CH_4	ktonne/m^3	0.000001
Oil Production	CH_4	ktonne/m^3	0.000720
Oil Production	CH_4	ktonne/m^3	0.000025
Oil transport	CH_4	ktonne/m^3	0.000005
Tanker, trucks, rail cars	CH_4	ktonne/m^3	0.000025
Oil Refining	CH_4	ktonne/m^3	0.000041
Well Testing	N_2O	ktonne/m^3	0.000000
Gas Production - Flaring	N_2O	ktonne/m^3	0.000000
Gas processing - Flaring	N_2O	ktonne/m^3	0.000000
Oil Production	N_2O	ktonne/m^3	0.000001
Well Drilling	NMVOC	ktonne/m^3	0.000001
Well Testing	NMVOC	ktonne/m^3	0.000012
Well Servicing	NMVOC	ktonne/m^3	0.000017
Gas Production (1)	NMVOC	ktonne/m^3	0.000550
Gas Production (2)	NMVOC	ktonne/m^3	0.000001
Gas processing (1)	NMVOC	ktonne/m^3	0.000470
Gas processing (2)	NMVOC	ktonne/m^3	0.000001
Gas transmission&storage(1)	NMVOC	ktonne/m^3	0.000007
Gas transmission&storage(2)	NMVOC	ktonne/m^3	0.000005
Gas transmission&storage(3)	NMVOC	ktonne/m^3	0.000000
Oil Production	NMVOC	ktonne/m^3	0.004500
Oil Production (1)	NMVOC	ktonne/m^3	0.000430
Oil Production (2)	NMVOC	ktonne/m^3	0.000021
Oil transport	NMVOC	ktonne/m^3	0.000054
Tanker, trucks, rail cars	NMVOC	ktonne/m^3	0.000250
Oil Refining	NMVOC	ktonne/m^3	0.001300
Post Mining activities			
Underground	CH_4	m^3/tonne	2.5
Surface Mining	CH_4	m^3/tonne	0.1
Agriculture - Indirect losses			
Leaching & Run-off	N_2O	kg N_2O-N/kg N input	0.0075
Atmospheric Deposition	N_2O	kg N_2O-N/kg N input	0.0100
Agriculture - Pasture, Range, Paddock			
Cattle, Poultry and Pigs	N_2O	kg N_2O-N/kg N input	0.02
Sheep and Other	N_2O	kg N_2O-N/kg N input	0.01

Note:

Gas Production (1) - Production
Gas Production (2) - Exploration
Gas processing (1) - Processing
Gas processing (2) - Flaring
Gas transmission and storage (1) - Transmission
Gas transmission and storage (2) - Venting
Gas transmission and storage (3) - Storage
Oil Production (1) - Venting
Oil Production (2) - Flaring
Tanker, trucks, rail cars - Venting

ANNEX 3

A3. QUALITY ASSURANCE AND QUALITY CONTROL

Programmed period for the Turkish Statistical System has been launched with The Official Statistics Programme, prepared based on the Statistics Law of Turkey (No 5429) dated 18th of November 2005. The Official Statistics Programme has been prepared for a 5-year-period. After approved by Council of Ministers, it is published in the Official Gazette and come into force. Within the context of the Programme, responsible and related institutions are clearly defined, data compilation methodology and the publication periodicity/schedule of official statistics are specified. Turkish Statistical Institute (TurkStat) is the responsible agency for compiling the National Greenhouse Gases Inventory, according to the Official Statistical Programme.

Quality Assurance and Quality Control (QA/QC) plan of Turkey is under preparation. Negotiations on the draft plan is almost completed. IPCC Good Practice Guidance is used in preparation of QA/QC procedures of national greenhouse gas emission inventory. TurkStat is designated to be responsible for the national inventory of greenhouse gases in Turkey. The inventory is prepared as a joint work by TurkStat, Ministry of Food, Agriculture and Husbandry, Ministry of Environment and Urbanization, Ministry of Forest and Water Affairs, Ministry of Transport, Maritime Affairs and Communications and Ministry of Energy and Natural Resources. Based on the roles of the Ministries defined in the Programme emissions from related sub-source categories are estimated and related NIR sections are prepared by responsible organizations and combined by TurkStat. Then, QA/QC is being processed. For the quality control purposes, GHGs emissions estimated by using Tier 2 approach are compared with emissions estimated by using Tier 1 approach. If the difference between the emission values obtained by both methods is less than 5%, then it is considered as appropriate. In addition, emission trends are analysed. If there is a high fluctuation in the series then activity data and emission calculation re-examined.

Emission inventory calculations are archived in electronic format as Excel. The emissions are calculated in Excel by keeping the activity data and emission factors used in the calculations in the Excel spreadsheets. TurkStat has been working on the establishment of the Emission Inventory Portal. The portal is planned to have three components. First component is the database, including activity data, EF, and calculation sheets. Almost 95% of database is completed. The database is designed in such a way that when activity data is loaded emissions

will be estimated and key source/trend/uncertainty analysis etc. will be performed in the database system. The second component is the web base data collection. It is not completed yet. All responsible organizations involved in the emission inventory will enter their activity data to the system via internet with password. Finally the third component is the documentation and archiving system. It is not also completed.

Quality control of the inventory are made by the experts on emission factors and activity data. Data integrity is checked to ensure the consistency and completeness. All materials and documents are archived on the process of inventory preparation.

Draft QA/QC Plan of Turkey is prepared. This plan will be implemented following the approval of Climate Change Coordination Board.

ANNEX 4

A4. REFERENCE and SECTORAL APPROACH

A4.1 Reference Approach

The Reference Approach is the method for determining the CO_2 emissions from combustion of total domestic fuels. Therefore, first step in this approach is to calculate the apparent fuel consumption. This is done using the following formula:

extraction + imports - exports - change (increase/decrease) in stocks (A4.1)

In the equation (A4.1), each fuel emission is presented in units of Gg. The conversion to energy units - TJ is done using conversion factors provided in the IPCC Guidelines. A national conversion factor is applied only for lignite, hard coal and petroleum products. For each year average conversion factor are changing according to the quality and/or quantity of those fuels as seen in Table A4.1.

A4.1 Conversion factors (Reference Approach)

(TJ/Gg)

	1990	1995	2000	2005	2007	2008	2009	2010	2011
Hard coal	31.43	28.92	26.79	26.98	25.42	26.13	26.09	25.35	26.60
Lignite	8.91	8.47	8.14	6.9	7.78	8.35	8.67	9.30	9.30
Petroleum	44.08	43.98	43.52	43.43	43.39	43.27	42.88	43.14	43.98

Country specific emission factors are used for comparative estimation of CO_2 emissions. The differences tend to be less than 10% except for 2008, which was around 11%. The main reason was the reference approach uses data on crude oil, lignite and hard coal as the average "calorific values" and "carbon content". However sectoral approach uses the individual "calorific values" and "carbon content" in each sector. The annual differences could be seen from Table A4.2.

A4.2 Comparison of CO_2 from fuel combustion (Sectoral and Reference Approach difference)

(%)

1990	1995	2000	2005	2007	2008	2009	2010	2011
10.54	4.7	2.58	6.75	7.2	10.89	9.03	4.8	8.11

A4.2 Sectoral Approach

The Sectoral Approach requires detail fuel consumption data in each sectors. The biggest advantage of this method is the possibility of analyzing sectoral emissions. The calculations by using sectoral approach results in more accurate estimation, since the calorific values and carbon content are specific for each type of consumed fuel.

The GHG emissions from fuel combustion are released from two types of sources: stationary and mobile. The stationary sources include the industrial processes, energy production, services, agriculture and residential sector. The mobile sources include transport and other motor vehicles. All these sources grouped according to the IPCC categories reflected in CRF tables. The GHG emissions are estimated by grouping the fuel types into 4 categories - liquid, solid, gaseous and biomass.

The GHGs emissions in the energy sector are the main key sources in the inventory. The GHGs emissions in the energy sector are the main key sources in the inventory. However The heat content of fuels for each plant shows a great variations in source category 1.A.1.a. The average NCV are given in the Table A4.3.

A4.3 Average NCVs of fuels

Fuels	NCV	Unit	Fuels	NCV	Unit
Natural Gas	8250	(kcal/Sm^3)	Coke	7200	(kcal/kg)
Fuel oil	9600	(kcal/kg)	Petroleum Coke	7600	(kcal/kg)
Hard Coal	6100	(kcal/kg)	Wood	3000	(kcal/kg)
Lignite	2200	(kcal/kg)	Animal and Vegetal		
LPG	10527	(kcal/Sm^3)	Waste	2300	(kcal/kg)
Asphaltite	4300	(kcal/kg)	Crude Oil	10500	(kcal/kg)

Emissions from International Bunkers has been included in the inventory since 2008.

ANNEX 5

A5. COMPLETENESS

The following sources are not estimated owing to the reasons listed below;

A5.1 GHGs and sources not considered in emission inventory

GHG	Sector	Source/sink category	Explanation
CH4	1 Energy	1.B.1.B Solid Fuel Transformation	The methodology is not clear
CH4	1 Energy	1.B.2.A.5 Distribution of oil products	The methodology is not clear
CO2	1 Energy	1.B.2.A.5 Distribution of oil products	The methodology is not clear
CH4	1 Energy	1.B.2.B.4 Distribution	The methodology is not clear
CO2	1 Energy	1.B.2.B.4 Distribution	The methodology is not clear
CH4	1 Energy	1.B.2.C.1.3 Combined	The methodology is not clear
CO2	1 Energy	1.B.2.C.1.3 Combined	The methodology is not clear
CH4	1 Energy	1.B.2.C.2.3 Combined	The methodology is not clear
CO2	1 Energy	1.B.2.C.2.3 Combined	The methodology is not clear
N2O	1 Energy	1.B.2.C.2.3 Combined	The methodology is not clear
SF6	2 Industrial Processes	2.C.4 Aluminium and Magnesium Foundries	There is no activity data
SF6	2 Industrial Processes	2.C.4.1 Aluminium Foundries	There is no activity data
HFCs	2 Industrial Processes	2.F.1 Refrigeration and Air Conditioning Equipment	There is no activity data
PFCs	2 Industrial Processes	2.F.1 Refrigeration and Air Conditioning Equipment	There is no activity data
SF6	2 Industrial Processes	2.F.1 Refrigeration and Air Conditioning Equipment	There is no activity data
SF6	2 Industrial Processes	2.F.3 Fire Extinguishers	There is no activity data
HFCs	2 Industrial Processes	2.F.4 Aerosols/ Metered Dose Inhalers	There is no activity data
PFCs	2 Industrial Processes	2.F.4 Aerosols/ Metered Dose Inhalers	There is no activity data
SF6	2 Industrial Processes	2.F.4 Aerosols/ Metered Dose Inhalers	There is no activity data
HFCs	2 Industrial Processes	2.F.5 Solvents	There is no activity data
PFCs	2 Industrial Processes	2.F.5 Solvents	There is no activity data
SF6	2 Industrial Processes	2.F.5 Solvents	There is no activity data
HFCs	2 Industrial Processes	2.F.6 Other applications using ODS substitutes	There is no activity data
PFCs	2 Industrial Processes	2.F.6 Other applications using ODS substitutes	There is no activity data
SF6	2 Industrial Processes	2.F.6 Other applications using ODS substitutes	There is no activity data
HFCs	2 Industrial Processes	2.F.7 Semiconductor Manufacture	There is no activity data
PFCs	2 Industrial Processes	2.F.7 Semiconductor Manufacture	There is no activity data
SF6	2 Industrial Processes	2.F.7 Semiconductor Manufacture	There is no activity data
SF6	2 Industrial Processes	2.F.P2.2 In products	There is no activity data
SF6	2 Industrial Processes	2.F.P3.1 In bulk	There is no activity data
CO2	3 Solvent and Other Product Use	3.A Paint Application	There is no activity data
CO2	3 Solvent and Other Product Use	3.B Degreasing and Dry Cleaning	There is no activity data
N2O	3 Solvent and Other Product Use	3.B Degreasing and Dry Cleaning	There is no activity data
CO2	3 Solvent and Other Product Use	3.C Chemical Products, Manufacture and Processing	There is no activity data
N2O	3 Solvent and Other Product Use	3.D.1 Use of N2O for Anaesthesia	There is no activity data
N2O	3 Solvent and Other Product Use	3.D.2 Fire Extinguishers	There is no activity data
N2O	3 Solvent and Other Product Use	3.D.3 N2O from Aerosol Cans	There is no activity data
N2O	3 Solvent and Other Product Use	3.D.4 Other Use of N2O	There is no activity data
Carbon	5 LULUCF	5.A.1 Forest Land remaining Forest Land	-
CH4	5 LULUCF	5.A.2 Land converted to Forest Land	-
CO2	5 LULUCF	5.A.2 Land converted to Forest Land	-
N2O	5 LULUCF	5.A.2 Land converted to Forest Land	-
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	-
Carbon	5 LULUCF	5.B.1 Cropland remaining Cropland	The methodology will be revised
CO2	5 LULUCF	5.B.1 Cropland remaining Cropland	The methodology will be revised
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	-
N2O	5 LULUCF	5.B.2.2 Grassland converted to Cropland	-
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	-
N2O	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	-
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	-
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	-
N2O	5 LULUCF	5.B.2.5 Other Land converted to Cropland	-

A5.1 GHGs and sources not considered in emission inventory (cont.)

GHG	Sector	Source/sink category	Explanation
Carbon	5 LULUCF	5.C.1 Grassland remaining Grassland	The database is not adequate to differentiate grasslans type
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	-
Carbon	5 LULUCF	5.C.2.5 Other Land converted to Grassland	The methodology and activity data will be revised.
Carbon	5 LULUCF	5.D.1 Wetlands remaining Wetlands	-
Carbon	5 LULUCF	5.D.2.1 Forest Land converted to Wetlands	-
Carbon	5 LULUCF	5.D.2.2 Cropland converted to Wetlands	-
Carbon	5 LULUCF	5.D.2.3 Grassland converted to Wetlands	-
Carbon	5 LULUCF	5.E.1 Settlements remaining Settlements	-
Carbon	5 LULUCF	5.E.2.1 Forest Land converted to Settlements	
Carbon	5 LULUCF	5.E.2.2 Cropland converted to Settlements	
Carbon	5 LULUCF	5.E.2.3 Grassland converted to Settlements	
CO2	5 LULUCF	5.G Harvested Wood Products	A harvested wood products database has not been established yet
CH4	6 Waste	6.B.1 Industrial Wastewater	There is no activity data
N2O	6 Waste	6.B.1 Industrial Wastewater	There is no activity data

ANNEX 6

A6. TREND ANALYSIS

One of the major component part of the inventories is the determination of chnges from base year in national emission.

In the Following Table A6.1., the annual trend analysis compared to year 1990 are given.

$$T_x^t = L_x^t * [((E_x^t - E_x^o)/ E_x^t) - ((E^t_{tot} – E^o_{tot})/ E^t_{tot})] \qquad (A6.1)$$

x: the category

t: year

o: base year

tot: total emission

T: trend assessment (%)

L: emission contribution (%)

E: emission (unit)

A6.1 Trend analysis

2011 VS. 1990 TREND ANALYSIS									
CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CO2	49179.3	11.6	5403.3	3.9144	12.4%	12.4%	89.0%
1.A.1.a. Public Electricity and Heat Production	Lignite	CO2	42433.7	10.0	20538.5	0.3810	1.2%	1.2%	51.6%
2.A.1. Cement Production (Mineral Products)		CO2	28234.0	6.7	10534.9	0.4877	1.5%	1.5%	62.7%
1.A.3.b. Road Transportation	Gas / Diesel oil	CO2	27538.3	6.5	15742.6	0.8187	2.6%	2.6%	42.8%
1.A.4.b. Residential	Natural Gas	CO2	21616.2	5.1	106.7	2.2575	7.1%	7.1%	99.5%
6.A.1. Solid Waste Disposal (Managed)		CH4	21348.4	5.1	NA	-	-	-	-
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CO2	20848.5	4.9	0.0	2.2017	7.0%	7.0%	100.0%
2.C.1. Iron and Steel Production		CO2	17882.8	4.2	IE	-	-	-	-
4.A. Enteric Fermentation		CH4	17305.4	4.1	18955.6	2.6599	8.4%	8.4%	-9.5%
1.A.4.b. Residential	Hard Coal	CO2	16073.4	3.8	3936.8	0.7654	2.4%	2.4%	75.5%
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CO2	15283.4	3.6	5795.4	0.2420	0.8%	0.8%	62.1%
1.A.4.b. Residential	Lignite	CO2	10840.6	2.6	9496.2	1.1033	3.5%	3.5%	12.4%
6.A.2.1. Solid Waste Disposal (Unmanaged)		CH4	10825.0	2.6	6386.5	0.3687	1.2%	1.2%	41.0%
1.A.2.f. Other Industries	Natural Gas	CO2	10136.5	2.4	669.9	0.9119	2.9%	2.9%	93.4%
1.A.3.b. Road Transportation	LPG	CO2	8322.2	2.0	0.0	0.8789	2.8%	2.8%	100.0%
1.A.2.f. Cement Production	Lignite	CO2	6738.6	1.6	2422.2	0.1382	0.4%	0.4%	64.1%
1.A.2.f. Cement Production	Petroleum Coke	CO2	6557.5	1.6	929.2	0.4725	1.5%	1.5%	85.8%
1.A.3.b. Road Transportation	Gasoline	CO2	5606.4	1.3	8293.3	1.3712	4.3%	4.3%	-47.9%
2.F. Emission of HFCs		HFC-134a	5308.3	1.3	NA	-	-	-	-
1.A.2.f. Cement Production	Hard Coal	CO2	5165.3	1.2	2619.9	0.0747	0.2%	0.2%	49.3%
1.A.2.a. Iron and Steel	Natural Gas	CO2	4334.6	1.0	0.0	0.4577	1.4%	1.4%	100.0%
4.D.1.1. Agricultural Soil (Synthetic Fertilizer)		N2O	3904.0	0.9	3719.0	0.4681	1.5%	1.5%	4.7%
2.A.2. Lime Production (Mineral Products)		CO2	3741.8	0.9	3084.8	0.3351	1.1%	1.1%	17.6%
1.A.2.f. Other Industries	Lignite	CO2	3624.5	0.9	5022.2	0.8062	2.5%	2.5%	-38.6%
1.A.2.a. Iron and Steel	Hard Coal	CO2	3619.1	0.9	0.0	0.3822	1.2%	1.2%	100.0%
1.A.2.f. Other Industries	Gas / Diesel oil	CO2	3514.2	0.8	302.2	0.2996	0.9%	0.9%	91.4%
1.A.2.c. Chemicals	Natural Gas	CO2	3343.6	0.8	0.0	0.3531	1.1%	1.1%	100.0%
1.A.3.a. Civil Aviation	Jet Kerosene	CO2	3330.6	0.8	904.6	0.1376	0.4%	0.4%	72.8%
1.A.1.b. Petroleum Refining	Refinery Gas	CO2	2936.2	0.7	1402.9	0.0220	0.1%	0.1%	52.2%
1.A.4.b. Residential	LPG	CO2	2808.6	0.7	4596.4	0.7915	2.5%	2.5%	-63.7%
1.A.1.b. Petroleum Refining	Natural Gas	CO2	2560.1	0.6	0.0	0.2704	0.9%	0.9%	100.0%
4.B. Manure Management		N2O	2555.5	0.6	2497.3	0.3213	1.0%	1.0%	2.3%
1.A.3.d. Navigation	Gas / Diesel oil	CO2	2227.3	0.5	219.1	0.1833	0.6%	0.6%	90.2%
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CO2	2139.2	0.5	846.3	0.0255	0.1%	0.1%	60.4%
6.B.2. Domestic and Commercial Wastewater Handling		CH4	2035.5	0.5	1950.7	0.2468	0.8%	0.8%	4.2%
6.B.2. Domestic and Commercial Wastewater Handling		N2O	1857.4	0.4	1384.5	0.1316	0.4%	0.4%	25.5%
4.D.1.2. Agricultural Soil (Animal Manure Applied)		N2O	1578.9	0.4	1679.8	0.2309	0.7%	0.7%	-6.4%

A6.1 Trend analysis (cont.)

CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.2.f. Fertilizer	Natural Gas	CO2	1445.1	0.3	1035.3	0.0925	0.3%	0.3%	28.4%
1.B.1.a.2. Mining (Surface)		CH4	1343.5	0.3	817.3	0.0516	0.2%	0.2%	39.2%
4.B. Manure Management		CH4	1323.8	0.3	1428.8	0.1984	0.6%	0.6%	-7.9%
1.A.2.f. Sugar	Lignite	CO2	1207.9	0.3	1752.8	0.2874	0.9%	0.9%	-45.1%
4.D.1.4. Agricultural Soil (Crop Residue)		N2O	1198.5	0.3	1115.2	0.1374	0.4%	0.4%	7.0%
1.A.4.b. Residential	Hard Coal	CH4	1092.3	0.3	261.3	0.0535	0.2%	0.2%	76.1%
1.A.2.c. Chemicals	Residual Fuel Oil	CO2	1076.2	0.3	2006.3	0.3613	1.1%	1.1%	-86.4%
1.A.2.f. Other Industries	Petroleum Coke	CO2	1052.6	0.2	0.0	0.1112	0.4%	0.4%	100.0%
2.F. Emission of SF6		SF6	950.2	0.2	NA	-	-	-	-
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CO2	869.4	0.2	3469.5	0.7295	2.3%	2.3%	-299.1%
1.A.2.c. Chemicals	LPG	CO2	741.2	0.2	0.0	0.0783	0.2%	0.2%	100.0%
1.B.1.a.1. Mining (underground)		CH4	711.5	0.2	772.4	0.1077	0.3%	0.3%	-8.6%
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CO2	693.3	0.2	0.0	0.0732	0.2%	0.2%	100.0%
1.A.4.b. Residential	Lignite	CH4	688.6	0.2	589.3	0.0668	0.2%	0.2%	14.4%
1.A.4.b. Residential	Residual Fuel Oil	CO2	651.0	0.2	3616.6	0.7874	2.5%	2.5%	-455.5%
1.A.4.b. Residential	Wood	CH4	644.0	0.2	1414.1	0.2667	0.8%	0.8%	-119.6%
1.A.4.b. Residential	Asphaltite	CO2	567.9	0.1	399.8	0.0347	0.1%	0.1%	29.6%
1.A.2.b. Non-Ferrous Metals	Lignite	CO2	542.3	0.1	57.5	0.0437	0.1%	0.1%	89.4%
1.A.3.c. Railways	Gas / Diesel oil	CO2	480.3	0.1	405.2	0.0452	0.1%	0.1%	15.6%
1.A.2.f. Sugar	Natural Gas	CO2	446.5	0.1	0.0	0.0472	0.1%	0.1%	100.0%
1.A.2.f. Other Industries	Hard Coal	CO2	443.8	0.1	1250.6	0.2492	0.8%	0.8%	-181.8%
4.D.2. Pasture, Range and Padock Manure		N2O	435.6	0.1	565.0	0.0878	0.3%	0.3%	-29.7%
1.A.2.f. Other Industries	Gasoline	CO2	424.5	0.1	0.0	0.0448	0.1%	0.1%	100.0%
1.A.2.b. Non-Ferrous Metals	Natural Gas	CO2	400.3	0.1	0.0	0.0423	0.1%	0.1%	100.0%
1.A.2.c. Chemicals	Lignite	CO2	398.3	0.1	507.4	0.0781	0.2%	0.2%	-27.4%
1.A.2.c. Chemicals	Hard Coal	CO2	334.8	0.1	0.0	0.0354	0.1%	0.1%	100.0%
1.A.4.b. Residential	Waste of animal, plant	CH4	270.6	0.1	487.2	0.0867	0.3%	0.3%	-80.0%
1.A.2.c. Chemicals	Second Fuel Coal	CO2	221.7	0.1	0.0	0.0234	0.1%	0.1%	100.0%
4.C.1.2.1. Rice Cultivation		CH4	208.7	0.0	111.3	0.0043	0.0%	0.0%	46.7%
1.B.2.a. Oil (fugitative)		CH4	206.1	0.0	314.7	0.0527	0.2%	0.2%	-52.7%
4.F.1. Field Burning of Agricultural Residue		CH4	201.0	0.0	181.8	0.0218	0.1%	0.1%	9.5%
1.A.2.f. Cement Production	Natural Gas	CO2	194.7	0.0	2.1	0.0201	0.1%	0.1%	98.9%
1.A.2.f. Other Industries	Residual Fuel Oil	CO2	190.3	0.0	4344.0	1.0083	3.2%	3.2%	-2183.2%
1.A.1.a. Public Electricity and Heat Production	Lignite	N2O	185.3	0.0	90.4	0.0018	0.0%	0.0%	51.2%
1.A.3.d. Navigation	Residual Fuel Oil	CO2	170.3	0.0	275.3	0.0472	0.1%	0.1%	-61.7%
1.A.2.f. Other Industries	Asphaltite	CO2	155.3	0.0	24.7	0.0105	0.0%	0.0%	84.1%
1.A.2.f. Sugar	Residual Fuel Oil	CO2	141.4	0.0	413.4	0.0829	0.3%	0.3%	-192.4%
1.A.2.a. Iron and Steel	Lignite	CO2	128.2	0.0	0.0	0.0135	0.0%	0.0%	100.0%
1.A.4.b. Residential	Wood	N2O	126.8	0.0	278.3	0.0525	0.2%	0.2%	-119.6%
1.A.2.f. Sugar	Second Fuel Coal	CO2	111.7	0.0	147.6	0.0231	0.1%	0.1%	-32.1%
1.B.2.c. Venting and Flaring (fugitative)		CO2	106.4	0.0	160.8	0.0268	0.1%	0.1%	-51.0%
1.A.2.c. Chemicals	Gas / Diesel oil	CO2	98.1	0.0	0.0	0.0104	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	N2O	89.6	0.0	0.0	0.0095	0.0%	0.0%	100.0%
2.B.5. Other Chemicals Production (Chemical Industry)		CH4	88.6	0.0	49.4	0.0023	0.0%	0.0%	44.3%
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CO2	82.1	0.0	NA	-	-	-	-
1.A.4.b. Residential	Hard Coal	N2O	75.2	0.0	18.0	0.0037	0.0%	0.0%	76.1%
1.A.4.b. Residential	Gas / Diesel oil	CO2	72.2	0.0	603.2	0.1352	0.4%	0.4%	-734.9%
1.A.2.f. Cement Production	Residual Fuel Oil	CO2	69.7	0.0	1519.9	0.3525	1.1%	1.1%	-2080.9%
1.A.3.b. Road Transportation	Gas / Diesel oil	N2O	69.2	0.0	157.9	0.0301	0.1%	0.1%	-128.4%
1.A.3.b. Road Transportation	LPG	CH4	64.5	0.0	0.0	0.0068	0.0%	0.0%	100.0%
1.B.2.b. Natural Gas (fugitative)		CH4	63.7	0.0	17.1	0.0027	0.0%	0.0%	73.2%
4.F.1. Field Burning of Agricultural Residue		N2O	60.8	0.0	54.2	0.0064	0.0%	0.0%	10.8%
6.C. Waste Incineration		CO2	54.4	0.0	NA	-	-	-	-
1.A.4.b. Residential	Waste of animal, plant	N2O	53.3	0.0	95.9	0.0171	0.1%	0.1%	-80.0%
1.A.2.f. Sugar	Hard Coal	CO2	53.3	0.0	245.3	0.0524	0.2%	0.2%	-360.6%
1.A.2.b. Non-Ferrous Metals	Hard Coal	CO2	48.6	0.0	0.0	0.0051	0.0%	0.0%	100.0%
1.A.4.b. Residential	Lignite	N2O	47.4	0.0	40.6	0.0046	0.0%	0.0%	14.4%
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CO2	47.2	0.0	0.0	0.0050	0.0%	0.0%	100.0%
1.B.2.c. Venting and Flaring (fugitative)		CH4	46.6	0.0	64.5	0.0104	0.0%	0.0%	-38.3%
1.A.2.a. Iron and Steel	Gas / Diesel oil	CO2	46.1	0.0	19.5	0.0003	0.0%	0.0%	57.8%
1.A.4.b. Residential	Natural Gas	CH4	41.4	0.0	0.2	0.0043	0.0%	0.0%	99.5%
4.D.3.2. Nitrogen Leaching and Runoff (4.d.3.2)		N2O	40.6	0.0	45.3	0.0064	0.0%	0.0%	-11.6%
1.A.3.b. Road Transportation	Gas / Diesel oil	CH4	39.0	0.0	20.9	0.0008	0.0%	0.0%	46.5%
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	N2O	38.8	0.0	14.8	0.0006	0.0%	0.0%	61.7%
1.A.4.b. Residential	Asphaltite	CH4	38.6	0.0	26.5	0.0022	0.0%	0.0%	31.2%
1.A.1.a. Public Electricity and Heat Production	Natural Gas	N2O	36.0	0.0	3.0	0.0031	0.0%	0.0%	91.6%
1.A.3.a. Civil Aviation	Jet Kerosene	N2O	36.0	0.0	9.1	0.0017	0.0%	0.0%	74.8%
1.A.3.b. Road Transportation	Gasoline	CH4	34.0	0.0	47.0	0.0075	0.0%	0.0%	-38.4%
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CO2	30.8	0.0	739.9	0.1719	0.5%	0.5%	-2303.5%
1.A.2.f. Cement Production	Petroleum Coke	N2O	30.7	0.0	4.4	0.0022	0.0%	0.0%	85.6%
1.A.2.f. Cement Production	Lignite	N2O	29.5	0.0	10.7	0.0006	0.0%	0.0%	63.6%

A6.1 Trend analysis (cont.)

CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CO2	28.9	0.0	43.4	0.0072	0.0%	0.0%	-50.5%
1.A.2.a. Iron and Steel	Naphta	CO2	28.8	0.0	0.0	0.0030	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	Gasoline	CO2	26.7	0.0	0.0	0.0028	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Residual Fuel Oil	CO2	26.3	0.0	1777.3	0.4180	1.3%	1.3%	-6649.2%
1.A.2.f. Cement Production	Hard Coal	N2O	24.2	0.0	12.4	0.0004	0.0%	0.0%	48.6%
1.B.2.a. Oil (fugitative)		CO2	23.9	0.0	36.5	0.0061	0.0%	0.0%	-52.7%
1.A.2.f. Cement Production	Gasoline	CO2	23.0	0.0	0.0	0.0024	0.0%	0.0%	100.0%
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CH4	21.9	0.0	8.4	0.0003	0.0%	0.0%	61.7%
4.D.1.3. Agricultural Soil (N-Fixing Crops)		N2O	19.7	0.0	33.8	0.0059	0.0%	0.0%	-71.9%
1.A.2.f. Other Industries	Natural Gas	CH4	19.1	0.0	1.3	0.0017	0.0%	0.0%	93.3%
1.A.2.f. Other Industries	Second Fuel Coal	CO2	18.7	0.0	520.5	0.1212	0.4%	0.4%	-2684.9%
1.A.2.f. Cement Production	Gas / Diesel oil	CO2	17.3	0.0	78.4	0.0167	0.1%	0.1%	-354.2%
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CH4	17.0	0.0	2.0	0.0013	0.0%	0.0%	88.0%
1.A.2.a. Iron and Steel	Hard Coal	N2O	16.9	0.0	0.0	0.0018	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	Residual Fuel Oil	CO2	16.2	0.0	0.0	0.0017	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Lignite	N2O	15.9	0.0	22.3	0.0036	0.0%	0.0%	-40.3%
1.A.3.b. Road Transportation	Gasoline	N2O	15.0	0.0	88.9	0.0195	0.1%	0.1%	-491.0%
1.A.2.f. Cement Production	Petroleum Coke	CH4	14.9	0.0	2.1	0.0011	0.0%	0.0%	85.6%
1.A.2.f. Cement Production	Lignite	CH4	14.3	0.0	5.2	0.0003	0.0%	0.0%	63.6%
1.A.4.b. Residential	Natural Gas	N2O	12.2	0.0	0.1	0.0013	0.0%	0.0%	99.5%
1.A.2.f. Cement Production	Hard Coal	CH4	11.7	0.0	6.0	0.0002	0.0%	0.0%	48.6%
1.A.1.a. Public Electricity and Heat Production	LPG	CO2	10.2	0.0	0.0	0.0011	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Hard Coal	N2O	9.9	0.0	4.0	0.0001	0.0%	0.0%	59.8%
1.A.2.a. Iron and Steel	LPG	CO2	9.7	0.0	0.0	0.0010	0.0%	0.0%	100.0%
1.A.4.b. Residential	LPG	CH4	9.4	0.0	15.1	0.0026	0.0%	0.0%	-59.9%
1.A.1.a. Public Electricity and Heat Production	Lignite	CH4	9.0	0.0	4.4	0.0001	0.0%	0.0%	51.2%
1.A.2.f. Other Industries	Gas / Diesel oil	N2O	8.9	0.0	0.8	0.0008	0.0%	0.0%	91.3%
1.A.4.b. Residential	LPG	N2O	8.4	0.0	13.4	0.0023	0.0%	0.0%	-59.9%
1.A.2.a. Iron and Steel	Hard Coal	CH4	8.2	0.0	0.0	0.0009	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Natural Gas	CH4	8.2	0.0	0.0	0.0009	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Petroleum Coke	CO2	7.7	0.0	0.0	0.0008	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Lignite	CH4	7.7	0.0	10.8	0.0017	0.0%	0.0%	-40.3%
1.A.1.b. Petroleum Refining	Refinery Gas	N2O	7.5	0.0	3.7	0.0001	0.0%	0.0%	50.6%
1.A.2.f. Sugar	Gasoline	CO2	6.3	0.0	0.0	0.0007	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	Natural Gas	CH4	6.3	0.0	0.0	0.0007	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Natural Gas	N2O	5.6	0.0	0.4	0.0005	0.0%	0.0%	93.3%
1.A.3.d. Navigation	Gas / Diesel oil	N2O	5.6	0.0	0.6	0.0005	0.0%	0.0%	90.1%
1.A.2.f. Sugar	Lignite	N2O	5.3	0.0	7.8	0.0013	0.0%	0.0%	-47.0%
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CO2	5.0	0.0	67.7	0.0155	0.0%	0.0%	-1250.7%
1.A.2.f. Other Industries	Petroleum Coke	N2O	4.9	0.0	0.0	0.0005	0.0%	0.0%	100.0%
6.C. Waste Incineration		CH4	4.9	0.0	NA	-	-	-	-
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CH4	4.3	0.0	0.0	0.0005	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Gas / Diesel oil	CO2	3.9	0.0	0.0	0.0004	0.0%	0.0%	100.0%
1.A.3.d. Navigation	Gas / Diesel oil	CH4	3.2	0.0	0.3	0.0003	0.0%	0.0%	90.1%
1.A.2.f. Fertilizer	Natural Gas	CH4	2.7	0.0	2.0	0.0002	0.0%	0.0%	27.4%
1.A.4.b. Residential	Asphaltite	N2O	2.7	0.0	1.8	0.0002	0.0%	0.0%	31.2%
1.A.2.c. Chemicals	Residual Fuel Oil	N2O	2.6	0.0	5.1	0.0009	0.0%	0.0%	-94.5%
1.A.2.f. Sugar	Lignite	CH4	2.6	0.0	3.8	0.0006	0.0%	0.0%	-47.0%
1.A.1.b. Petroleum Refining	Refinery Gas	CH4	2.5	0.0	1.3	0.0000	0.0%	0.0%	50.6%
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CO2	2.4	0.0	5.6	0.0011	0.0%	0.0%	-132.8%
1.A.2.a. Iron and Steel	Natural Gas	N2O	2.4	0.0	0.0	0.0003	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Petroleum Coke	CH4	2.4	0.0	0.0	0.0003	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Lignite	N2O	2.4	0.0	0.3	0.0002	0.0%	0.0%	89.0%
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	N2O	2.4	0.0	8.5	0.0018	0.0%	0.0%	-257.6%
1.A.1.a. Public Electricity and Heat Production	Biofuel	N2O	2.3	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	LPG	N2O	2.2	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Hard Coal	N2O	2.1	0.0	5.9	0.0012	0.0%	0.0%	-185.4%
1.A.2.f. Other Industries	Gas / Diesel oil	CH4	2.0	0.0	0.2	0.0002	0.0%	0.0%	91.3%
1.A.2.f. Fertilizer	Gas / Diesel oil	CO2	2.0	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	Natural Gas	N2O	1.9	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.4.b. Residential	Residual Fuel Oil	CH4	1.8	0.0	9.7	0.0021	0.0%	0.0%	-442.7%
1.A.2.c. Chemicals	Lignite	N2O	1.7	0.0	2.3	0.0004	0.0%	0.0%	-32.9%
1.A.1.a. Public Electricity and Heat Production	Asphaltite	N2O	1.6	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.4.b. Residential	Residual Fuel Oil	N2O	1.6	0.0	8.6	0.0019	0.0%	0.0%	-442.7%
1.A.2.c. Chemicals	Hard Coal	N2O	1.6	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Waste of animal, plant	N2O	1.6	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Natural Gas	N2O	1.4	0.0	0.0	0.0002	0.0%	0.0%	100.0%
1.B.2.b. Natural Gas (fugitative)		CO2	1.3	0.0	0.3	0.0001	0.0%	0.0%	73.2%
1.A.3.c. Railways	Gas / Diesel oil	N2O	1.2	0.0	2.9	0.0006	0.0%	0.0%	-143.5%
1.A.1.a. Public Electricity and Heat Production	Biofuel	CH4	1.2	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Gasoline	N2O	1.2	0.0	0.0	0.0001	0.0%	0.0%	100.0%

A6.1 Trend analysis (cont.)

CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.2.b. Non-Ferrous Metals	Lignite	CH4	1.1	0.0	0.1	0.0001	0.0%	0.0%	89.0%
1.A.2.c. Chemicals	Second Fuel Coal	N2O	1.0	0.0	0.0	0.0001	0.0%	0.0%	100.0%
6.C. Waste Incineration		N2O	1.0	0.0	NA	-	-	-	-
1.A.2.f. Other Industries	Hard Coal	CH4	1.0	0.0	2.9	0.0006	0.0%	0.0%	-185.4%
1.A.3.a. Civil Aviation	Jet Kerosene	CH4	1.0	0.0	1.3	0.0002	0.0%	0.0%	-33.5%
1.A.1.b. Petroleum Refining	Natural Gas	CH4	1.0	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	Lignite	CH4	0.8	0.0	1.1	0.0002	0.0%	0.0%	-32.9%
1.A.2.f. Sugar	Natural Gas	CH4	0.8	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	Natural Gas	N2O	0.8	0.0	0.6	0.0001	0.0%	0.0%	27.4%
1.A.2.f. Other Industries	Waste of animal, plant	CH4	0.8	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CH4	0.8	0.0	2.9	0.0006	0.0%	0.0%	-277.3%
1.A.2.c. Chemicals	Hard Coal	CH4	0.8	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Natural Gas	CH4	0.8	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Asphaltite	N2O	0.7	0.0	0.1	0.0000	0.0%	0.0%	83.9%
1.A.3.c. Railways	Gas / Diesel oil	CH4	0.7	0.0	0.6	0.0001	0.0%	0.0%	6.5%
4.D.3.1. Atmospheric deposition		N2O	0.6	0.0	0.6	0.0001	0.0%	0.0%	4.5%
1.A.2.c. Chemicals	Residual Fuel Oil	CH4	0.6	0.0	1.1	0.0002	0.0%	0.0%	-94.5%
1.A.2.a. Iron and Steel	Lignite	N2O	0.6	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CH4	0.5	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Second Fuel Coal	N2O	0.5	0.0	0.7	0.0001	0.0%	0.0%	-33.8%
1.B.2.c. Venting and Flaring (fugitative)		N2O	0.5	0.0	0.8	0.0001	0.0%	0.0%	-50.0%
1.A.2.c. Chemicals	Second Fuel Coal	CH4	0.5	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	LPG	CH4	0.5	0.0	0.0	0.0001	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CH4	0.5	0.0	0.2	0.0000	0.0%	0.0%	60.1%
1.A.2.f. Other Industries	Residual Fuel Oil	N2O	0.5	0.0	10.7	0.0025	0.0%	0.0%	-2212.3%
1.A.1.b. Petroleum Refining	Gasoline	CO2	0.4	0.0	1.9	0.0004	0.0%	0.0%	-340.1%
1.A.3.d. Navigation	Residual Fuel Oil	N2O	0.4	0.0	0.7	0.0001	0.0%	0.0%	-62.5%
1.A.2.f. Cement Production	Natural Gas	CH4	0.4	0.0	0.0	0.0000	0.0%	0.0%	98.9%
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CH4	0.4	0.0	NA	-	-	-	-
1.A.2.f. Other Industries	Asphaltite	CH4	0.4	0.0	0.1	0.0000	0.0%	0.0%	83.9%
1.A.2.f. Sugar	Residual Fuel Oil	N2O	0.3	0.0	1.0	0.0002	0.0%	0.0%	-196.1%
1.A.3.b. Road Transportation	LPG	N2O	0.3	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Lignite	CH4	0.3	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Gasoline	CH4	0.3	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Second Fuel Coal	CH4	0.3	0.0	0.3	0.0001	0.0%	0.0%	-33.8%
1.A.2.f. Sugar	Hard Coal	N2O	0.2	0.0	1.2	0.0002	0.0%	0.0%	-366.5%
1.A.2.c. Chemicals	Gas / Diesel oil	N2O	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Natural Gas	N2O	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.3.d. Navigation	Residual Fuel Oil	CH4	0.2	0.0	0.4	0.0001	0.0%	0.0%	-62.7%
1.A.2.b. Non-Ferrous Metals	Hard Coal	N2O	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Natural Gas	N2O	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.4.b. Residential	Gas / Diesel oil	CH4	0.2	0.0	1.7	0.0004	0.0%	0.0%	-715.6%
1.A.4.b. Residential	Gas / Diesel oil	N2O	0.2	0.0	1.5	0.0003	0.0%	0.0%	-715.6%
1.A.2.f. Cement Production	Naphta	CO2	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Residual Fuel Oil	N2O	0.2	0.0	3.7	0.0009	0.0%	0.0%	-2108.7%
1.A.2.f. Cement Production	LPG	CO2	0.2	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.3.b. Road Transportation	Biofuel	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Gasoline	CO2	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	LPG	CO2	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Hard Coal	CH4	0.1	0.0	0.6	0.0001	0.0%	0.0%	-366.5%
1.A.2.a. Iron and Steel	Gas / Diesel oil	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	57.4%
1.A.2.b. Non-Ferrous Metals	Hard Coal	CH4	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Natural Gas	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	98.9%
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	N2O	0.1	0.0	NA	-	-	-	-
1.A.2.f. Other Industries	Residual Fuel Oil	CH4	0.1	0.0	2.4	0.0006	0.0%	0.0%	-2212.3%
1.A.1.b. Petroleum Refining	Petroleum & Other	CO2	0.1	0.0	2.6	0.0006	0.0%	0.0%	-2563.1%
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CH4	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Second Fuel Coal	N2O	0.1	0.0	2.5	0.0006	0.0%	0.0%	-2720.4%
1.A.3.b. Road Transportation	Biofuel	CH4	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Residual Fuel Oil	CH4	0.1	0.0	0.2	0.0000	0.0%	0.0%	-196.1%
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	N2O	0.1	0.0	1.9	0.0004	0.0%	0.0%	-2400.0%
1.A.2.a. Iron and Steel	Naphta	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	N2O	0.1	0.0	0.1	0.0000	0.0%	0.0%	-56.5%
1.A.2.c. Chemicals	Gasoline	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Naphta	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	N2O	0.1	0.0	0.2	0.0000	0.0%	0.0%	-164.1%
1.A.2.a. Iron and Steel	Residual Fuel Oil	N2O	0.1	0.0	4.4	0.0010	0.0%	0.0%	-6716.6%
1.A.2.f. Cement Production	Gasoline	N2O	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.c. Chemicals	Gas / Diesel oil	CH4	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Naphta	CO2	0.1	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.B.2.a. Oil (fugitative)		N2O	0.1	0.0	0.1	0.0000	0.0%	0.0%	-52.7%

A6.1 Trend analysis (cont.)

CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.2.f. Cement Production	Gas / Diesel oil	N2O	0.0	0.0	0.2	0.0000	0.0%	0.0%	-360.0%
1.A.2.f. Other Industries	Second Fuel Coal	CH4	0.0	0.0	1.2	0.0003	0.0%	0.0%	-2720.4%
1.A.2.f. Fertilizer	Residual Fuel Oil	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Residual Fuel Oil	CH4	0.0	0.0	0.8	0.0002	0.0%	0.0%	-2108.7%
1.A.2.a. Iron and Steel	Petroleum Coke	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CH4	0.0	0.0	0.1	0.0000	0.0%	0.0%	-76.0%
1.A.2.a. Iron and Steel	LPG	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	57.4%
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Wood	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Petroleum Coke	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Gasoline	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CH4	0.0	0.0	0.4	0.0001	0.0%	0.0%	-2400.0%
1.A.2.a. Iron and Steel	Naphta	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	-56.5%
1.A.2.c. Chemicals	Gasoline	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	Residual Fuel Oil	CH4	0.0	0.0	1.0	0.0002	0.0%	0.0%	-6716.6%
1.A.5.a. Other (Stationary)		N2O	0.0	0.0	NA	-	-	-	-
1.A.2.f. Cement Production	Gasoline	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.b. Non-Ferrous Metals	Wood	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Gas / Diesel oil	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	-360.0%
1.A.5.a. Other (Stationary)		CH4	0.0	0.0	NA	-	-	-	-
1.A.2.f. Fertilizer	Residual Fuel Oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.a. Iron and Steel	LPG	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Gas / Diesel oil	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	-140.5%
1.A.2.f. Sugar	Waste of animal, plant	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	LPG	CO2	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	Gas / Diesel oil	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Gasoline	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.a. Public Electricity and Heat Production	Naphta	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Other Industries	Wood	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Waste of animal, plant	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	-140.5%
1.A.2.f. Other Industries	Wood	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Gasoline	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	-354.7%
1.A.2.f. Fertilizer	Gas / Diesel oil	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	LPG	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Naphta	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Gasoline	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	-354.7%
1.A.2.a. Iron and Steel	Gasoline	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	LPG	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Petroleum & Other	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	-2651.5%
1.A.2.f. Sugar	Naphta	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	LPG	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Cement Production	Naphta	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.1.b. Petroleum Refining	Petroleum & Other	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	-2651.5%
1.A.2.a. Iron and Steel	Gasoline	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	LPG	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Sugar	Naphta	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	LPG	N2O	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.2.f. Fertilizer	LPG	CH4	0.0	0.0	0.0	0.0000	0.0%	0.0%	100.0%
1.A.3.c. Railways	Hard Coal	CO2	0.0	0.0	29.3	-	-	-	-
1.A.3.d. Navigation	Hard Coal	CO2	0.0	0.0	3.1	-	-	-	-
1.A.2.f. Fertilizer	Lignite	CO2	0.0	0.0	626.1	-	-	-	-
1.A.3.c. Railways	Lignite	CO2	0.0	0.0	21.6	-	-	-	-
1.A.2.f. Cement Production	Asphaltite	CO2	0.0	0.0	62.6	-	-	-	-
1.A.2.a. Iron and Steel	Second Fuel Coal	CO2	0.0	0.0	7605.2	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CO2	0.0	0.0	70.5	-	-	-	-
1.A.2.f. Fertilizer	Second Fuel Coal	CO2	0.0	0.0	2.7	-	-	-	-
1.A.4.b. Residential	Second Fuel Coal	CO2	0.0	0.0	650.0	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CO2	0.0	0.0	99.3	-	-	-	-
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CO2	0.0	0.0	2276.2	-	-	-	-
1.A.3.c. Railways	Residual Fuel Oil	CO2	0.0	0.0	60.6	-	-	-	-
1.A.1.b. Petroleum Refining	LPG	CO2	0.0	0.0	0.1	-	-	-	-
1.A.2.f. Other Industries	LPG	CO2	0.0	0.0	133.8	-	-	-	-
1.A.2.f. Other Industries	Refinery Gas	CO2	0.0	0.0	1.1	-	-	-	-
1.A.2.f. Fertilizer	Naphta	CO2	0.0	0.0	478.0	-	-	-	-
1.A.3.c. Railways	Hard Coal	CH4	0.0	0.0	0.1	-	-	-	-
1.A.3.d. Navigation	Hard Coal	CH4	0.0	0.0	0.0	-	-	-	-

A6.1 Trend analysis (cont.)

CATEGORY	FUEL	GAS	EMISSION 2011	CONT. (%)	EMISSION 1990	TREND ASSES.	CONT.	CUMULATIVE TOTAL	TREND
1.A.2.f. Fertilizer	Lignite	CH4	0.0	0.0	1.3	-	-	-	-
1.A.3.c. Railways	Lignite	CH4	0.0	0.0	0.1	-	-	-	-
1.A.2.f. Cement Production	Asphaltite	CH4	0.0	0.0	0.1	-	-	-	-
1.A.2.a. Iron and Steel	Second Fuel Coal	CH4	0.0	0.0	17.4	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CH4	0.0	0.0	0.2	-	-	-	-
1.A.2.f. Fertilizer	Second Fuel Coal	CH4	0.0	0.0	0.0	-	-	-	-
1.A.4.b. Residential	Second Fuel Coal	CH4	0.0	0.0	43.2	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CH4	0.0	0.0	0.2	-	-	-	-
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CH4	0.0	0.0	1.9	-	-	-	-
1.A.3.c. Railways	Residual Fuel Oil	CH4	0.0	0.0	0.1	-	-	-	-
1.A.1.b. Petroleum Refining	LPG	CH4	0.0	0.0	0.0	-	-	-	-
1.A.2.f. Other Industries	LPG	CH4	0.0	0.0	0.1	-	-	-	-
1.A.2.f. Other Industries	Refinery Gas	CH4	0.0	0.0	0.0	-	-	-	-
1.A.2.f. Fertilizer	Naphta	CH4	0.0	0.0	0.3	-	-	-	-
1.A.3.c. Railways	Hard Coal	N2O	0.0	0.0	0.4	-	-	-	-
1.A.3.d. Navigation	Hard Coal	N2O	0.0	0.0	0.0	-	-	-	-
1.A.2.f. Fertilizer	Lignite	N2O	0.0	0.0	2.8	-	-	-	-
1.A.3.c. Railways	Lignite	N2O	0.0	0.0	0.3	-	-	-	-
1.A.2.f. Cement Production	Asphaltite	N2O	0.0	0.0	0.3	-	-	-	-
1.A.2.a. Iron and Steel	Second Fuel Coal	N2O	0.0	0.0	36.0	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	N2O	0.0	0.0	0.3	-	-	-	-
1.A.2.f. Fertilizer	Second Fuel Coal	N2O	0.0	0.0	0.0	-	-	-	-
1.A.4.b. Residential	Second Fuel Coal	N2O	0.0	0.0	3.0	-	-	-	-
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	N2O	0.0	0.0	0.5	-	-	-	-
1.A.1.b. Petroleum Refining	Residual Fuel Oil	N2O	0.0	0.0	5.7	-	-	-	-
1.A.3.c. Railways	Residual Fuel Oil	N2O	0.0	0.0	0.4	-	-	-	-
1.A.1.b. Petroleum Refining	LPG	N2O	0.0	0.0	0.0	-	-	-	-
1.A.2.f. Other Industries	LPG	N2O	0.0	0.0	0.4	-	-	-	-
1.A.2.f. Other Industries	Refinery Gas	N2O	0.0	0.0	0.0	-	-	-	-
1.A.2.f. Fertilizer	Naphta	N2O	0.0	0.0	1.2	-	-	-	-
2.C.3. Aluminium Production		CO2	-	-	109.6	-	-	-	-
2.B.1. Ammonia Production		CO2	-	-	713.5	-	-	-	-
2.B.4.2. Carbide Production		CO2	-	-	112.2	-	-	-	-
2.B.2. Nitric Acid Production (Chemical Industry)		N2O	-	-	128.1	-	-	-	-
2.C.3. Aluminium Production		CF4	-	-	568.0	-	-	-	-
2.C.3. Aluminium Production		C2F6	-	-	35.5	-	-	-	-
2.A.4.1. Soda Ash Production and Use (Mineral Products)		CO2	-	-	106.3	-	-	-	-
1.A.3.b. Road Transportation	Natural Gas	CO2	-	-	-	-	-	-	-
1.A.3.b. Road Transportation	Natural Gas	CH4	-	-	-	-	-	-	-
1.A.3.b. Road Transportation	Natural Gas	N2O	-	-	-	-	-	-	-
2.C.2. Ferroalloys Production		CO2	-	-	-	-	-	-	-
2.A.3. Limestone and Dolomite Use (Mineral Products)		CO2	-	-	-	-	-	-	-
TOTAL			422416		188434	31.63	100.0%		

ANNEX 7

A7. UNCERTAINTY ANALYSIS

Uncertainties are calculated by multiplying by sectoral uncertainty values after conversion to the CO_2 equivalent according to the global warming potential equivalent of the direct GHG emissions and sinks of CO_2, N_2O, CH_4, HFCs, PFCs and SF_6. Quantitative estimates of the uncertainties in the emissions are calculated using direct expert judgement. It can be concluded that the total uncertainty is 5.2% according to the high uncertain data of LULUCF. The general procedure for uncertainty analysis is:

- Uncertainties of each activity are allocated by using emission factor and activity rate uncertainties.
- A calculation is set up to estimate the emission of each CO_2, CH_4, N_2O, HFCs and SF_6 gases.
- The uncertainties used for the industrial processes data are estimated from the statistical difference between supply and demand.
- The uncertainties for sectorial energy usage are estimated by MENR experts.
- The uncertainties of agricultural activities are estimated by TurkStat experts.
- The uncertainties of transport sectors are estimated by MTMAC experts.

The highest combined uncertainties are seen in the industrial processes (especially chemical productions), burning of agricultural residue, waste, coal mining and fuel combustion (basically the usage of hard coal in electricity production and residential areas).

Uncertainty estimates are an essential element of a complete emissions inventory. Uncertainties of the inventories are, mainly derived from measured data. However, it is not practical to measure every sources in this way. Expert judgement in this way minimise the risk of bias and it discusses how to combine uncertainties in emission factors and activity data to estimate source category and total uncertainties in inventories. Once the uncertainties in the source categories have been determined, they may be combined to provide uncertainty estimates for the entire inventory. The following Table A7.1 is used for calculating Tier 1 uncertainty analysis of the emission inventory.

A7.1 Tier 1 uncertainty calculation

A	B	C	D	E	F	G	H	I
Source Category	**Fuel**	**Gas**	**1990 Emission**	**2011 Emission**	**Activity Data Uncert. (%)**	**Emission Factor Uncert. (%)**	**Combined Uncertainty**	**Combined uncertainty of total national emissions in year 2011 (%)**
			Input Data	Input Data	Input Data	Input Data	$\sqrt{F^2+G^2}$	$\frac{H*E}{\sum E}$
			(Gg CO_2 eq.)	(Gg CO_2 eq.)	%	%	%	& Total Uncertainty
Example (1.A.1.a)	Hard coal	CO_2						
				$\sum D$	$\sum E$			$\sqrt{\sum I^2}$

A7.2 Uncertainty analysis

CATEGORY	FUEL	GAS	2011	Activity data Unc. (%)	Emis fact. Unc. (%)	Combined Unc. (%)	Combined uncertainty as % of total national emissions in year 2011
5. LULUCF		CO2	-43640.3	40.0	10.0	41.2	-4.75040
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CO2	49179.3	0.0	3.0	3.0	0.38951
1.A.1.a. Public Electricity and Heat Production	Lignite	CO2	42433.7	5.3	3.0	6.1	0.68227
2.A.1. Cement Production (Mineral Products)		CO2	28234.0	0.0	5.0	5.0	0.37270
1.A.3.b. Road Transportation	Gas / Diesel oil	CO2	27538.3	0.0	5.0	5.0	0.36352
1.A.4.b. Residential	Natural Gas	CO2	21616.2	0.0	3.0	3.0	0.17121
6.A.1. Solid Waste Disposal (Managed)		CH4	21348.4	15.00	19.0	24.2	1.36437
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CO2	20848.5	7.00	3.0	7.6	0.41919
2.C.1. Iron and Steel Production		CO2	17882.8	0.00	1.0	1.0	0.04721
4.A. Enteric Fermentation		CH4	17305.4	6.30	1.0	6.4	0.29144
1.A.4.b. Residential	Hard Coal	CO2	16073.4	7.0	3.0	7.6	0.32318
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CO2	15283.4	0.0	5.0	5.0	0.20175
1.A.4.b. Residential	Lignite	CO2	10840.6	5.3	3.0	6.1	0.17430
6.A.2.1. Solid Waste Disposal (Unmanaged)		CH4	10825.0	15.00	19.0	24.2	0.69182
1.A.2.f. Other Industries	Natural Gas	CO2	10136.5	0.0	3.0	3.0	0.08028
1.A.3.b. Road Transportation	LPG	CO2	8322.2	2.5	5.0	5.6	0.12282
1.A.2.f. Cement Production	Lignite	CO2	6738.6	5.3	3.0	6.1	0.10835
1.A.2.f. Cement Production	Petroleum Coke	CO2	6557.5	0.0	3.0	3.0	0.05194
1.A.3.b. Road Transportation	Gasoline	CO2	5606.4	3.0	3.0	4.2	0.06280
2.F. Emission of HFCs		HFC-134a	5308.3	40.00	20.0	44.7	0.62674
1.A.2.f. Cement Production	Hard Coal	CO2	5165.3	7.0	3.0	7.6	0.10386
1.A.2.a. Iron and Steel	Natural Gas	CO2	4334.6	0.0	3.0	3.0	0.03433
4.D.1.1. Agricultural Soil (Synthetic Fertilizer)		N2O	3904.0	1.00	9.0	9.1	0.09333
2.A.2. Lime Production (Mineral Products)		CO2	3741.8	15.0	1.0	15.0	0.14851
1.A.2.f. Other Industries	Lignite	CO2	3624.5	5.3	3.0	6.1	0.05828
1.A.2.a. Iron and Steel	Hard Coal	CO2	3619.1	7.0	3.0	7.6	0.07277
1.A.2.f. Other Industries	Gas / Diesel oil	CO2	3514.2	0.0	5.0	5.0	0.04639
1.A.2.c. Chemicals	Natural Gas	CO2	3343.6	0.0	3.0	3.0	0.02648
1.A.3.a. Civil Aviation	Jet Kerosene	CO2	3330.6	0.0	3.0	3.0	0.02638
1.A.1.b. Petroleum Refining	Refinery Gas	CO2	2936.2	0.00	3.0	3.0	0.02326
1.A.4.b. Residential	LPG	CO2	2808.6	2.5	5.0	5.6	0.04145
1.A.1.b. Petroleum Refining	Natural Gas	CO2	2560.1	0.0	3.0	3.0	0.02028
4.B. Manure Management		N2O	2555.5	1.00	9.0	9.1	0.06109
1.A.3.d. Navigation	Gas / Diesel oil	CO2	2227.3	0.0	5.0	5.0	0.02940
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CO2	2139.2	7.0	3.0	7.6	0.04301
6.B.2. Domestic and Commercial Wastewater Handling		CH4	2035.5	15.00	19.0	24.2	0.13009
6.B.2. Domestic and Commercial Wastewater Handling		N2O	1857.4	15.00	19.0	24.2	0.11871
4.D.1.2. Agricultural Soil (Animal Manure Applied)		N2O	1578.9	1.00	9.0	9.1	0.03775
1.A.2.f. Fertilizer	Natural Gas	CO2	1445.1	0.0	3.0	3.0	0.01145
1.B.1.a.2. Mining (Surface)		CH4	1343.5	5.00	20.0	20.6	0.07312
4.B. Manure Management		CH4	1323.8	6.30	1.0	6.4	0.02229
1.A.2.f. Sugar	Lignite	CO2	1207.9	5.3	3.0	6.1	0.01942
4.D.1.4. Agricultural Soil (Crop Residue)		N2O	1198.5	1.00	9.0	9.1	0.02865
1.A.4.b. Residential	Hard Coal	CH4	1092.3	7.0	16.0	17.5	0.05036
1.A.2.c. Chemicals	Residual Fuel Oil	CO2	1076.2	2.50	3.0	3.9	0.01110
1.A.2.f. Other Industries	Petroleum Coke	CO2	1052.6	0.0	3.0	3.0	0.00834
2.F. Emission of SF6		SF6	950.2	40.00	20.0	44.7	0.11219
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CO2	869.4	2.50	3.0	3.9	0.00896
1.A.2.c. Chemicals	LPG	CO2	741.2	2.5	5.0	5.6	0.01094
1.B.1.a.1. Mining (underground)		CH4	711.5	5.00	20.0	20.6	0.03872
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CO2	693.3	20.0	20.0	28.3	0.05177
1.A.4.b. Residential	Lignite	CH4	688.6	5.3	16.0	16.9	0.03064
1.A.4.b. Residential	Residual Fuel Oil	CO2	651.0	2.50	3.0	3.9	0.00671
1.A.4.b. Residential	Wood	CH4	644.0	16.00	16.0	22.6	0.03847
1.A.4.b. Residential	Asphaltite	CO2	567.9	20.0	20.0	28.3	0.04241
1.A.2.b. Non-Ferrous Metals	Lignite	CO2	542.3	5.3	3.0	6.1	0.00872
1.A.3.c. Railways	Gas / Diesel oil	CO2	480.3	0.0	5.0	5.0	0.00634
1.A.2.f. Sugar	Natural Gas	CO2	446.5	0.0	3.0	3.0	0.00354
1.A.2.f. Other Industries	Hard Coal	CO2	443.8	7.0	3.0	7.6	0.00892
4.D.2. Pasture, Range and Padock Manure		N2O	435.6	6.30	1.0	6.4	0.00734
1.A.2.f. Other Industries	Gasoline	CO2	424.5	3.0	3.0	4.2	0.00475
1.A.2.b. Non-Ferrous Metals	Natural Gas	CO2	400.3	0.0	3.0	3.0	0.00317
1.A.2.c. Chemicals	Lignite	CO2	398.3	5.3	3.0	6.1	0.00640
1.A.2.c. Chemicals	Hard Coal	CO2	334.8	7.0	3.0	7.6	0.00673
1.A.4.b. Residential	Waste of animal, plant	CH4	270.6	0.00	16.0	16.0	0.01143
1.A.2.c. Chemicals	Second Fuel Coal	CO2	221.7	7.00	3.0	7.6	0.00446
4.C.1.2.1. Rice Cultivation		CH4	208.7	10.00	20.0	22.4	0.01232
1.B.2.a. Oil (fugitative)		CH4	206.1	2.5	16.0	16.2	0.00881
4.F.1. Field Burning of Agricultural Residue		CH4	201.0	25.00	14.0	28.7	0.01521
1.A.2.f. Cement Production	Natural Gas	CO2	194.7	0.0	3.0	3.0	0.00154
1.A.2.f. Other Industries	Residual Fuel Oil	CO2	190.3	2.50	3.0	3.9	0.00196
1.A.1.a. Public Electricity and Heat Production	Lignite	N2O	185.3	5.3	20.0	20.7	0.01012
1.A.3.d. Navigation	Residual Fuel Oil	CO2	170.3	2.50	3.0	3.9	0.00176

A7.2 Uncertainty analysis (cont.)

CATEGORY	FUEL	GAS	2011	Activity data Unc. (%)	Emis fact. Unc. (%)	Combined Unc. (%)	Combined uncertainty as % of total national emissions in year 2011
1.A.2.f. Other Industries	Asphaltite	CO2	155.3	20.0	20.0	28.3	0.01159
1.A.2.f. Sugar	Residual Fuel Oil	CO2	141.4	2.50	3.0	3.9	0.00146
1.A.2.a. Iron and Steel	Lignite	CO2	128.2	5.3	3.0	6.1	0.00206
1.A.4.b. Residential	Wood	N2O	126.8	45.00	45.0	63.6	0.02130
1.A.2.f. Sugar	Second Fuel Coal	CO2	111.7	7.00	3.0	7.6	0.00225
1.B.2.c. Venting and Flaring (fugitative)		CO2	106.4	1.0	3.0	3.2	0.00089
1.A.2.c. Chemicals	Gas / Diesel oil	CO2	98.1	0.0	5.0	5.0	0.00130
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	N2O	89.6	7.00	20.0	21.2	0.00501
2.B.5. Other Chemicals Production (Chemical Industry)		CH4	88.6	60.00	1.0	60.0	0.01404
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CO2	82.1	10.0	10.0	14.1	0.00307
1.A.4.b. Residential	Hard Coal	N2O	75.2	7.0	20.0	21.2	0.00421
1.A.4.b. Residential	Gas / Diesel oil	CO2	72.2	0.0	5.0	5.0	0.00095
1.A.2.f. Cement Production	Residual Fuel Oil	CO2	69.7	2.50	3.0	3.9	0.00072
1.A.3.b. Road Transportation	Gas / Diesel oil	N2O	69.2	0.0	5.0	5.0	0.00091
1.A.3.b. Road Transportation	LPG	CH4	64.5	2.5	10.0	10.3	0.00176
1.B.2.b. Natural Gas (fugitative)		CH4	63.7	0.0	16.0	16.0	0.00269
4.F.1. Field Burning of Agricultural Residue		N2O	60.8	25.00	20.0	32.0	0.00514
6.C. Waste Incineration		CO2	54.4	16.0	16.0	22.6	0.00325
1.A.4.b. Residential	Waste of animal, plant	N2O	53.3	45.00	45.0	63.6	0.00895
1.A.2.f. Sugar	Hard Coal	CO2	53.3	7.0	3.0	7.6	0.00107
1.A.2.b. Non-Ferrous Metals	Hard Coal	CO2	48.6	7.0	3.0	7.6	0.00098
1.A.4.b. Residential	Lignite	N2O	47.4	5.3	20.0	20.7	0.00259
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CO2	47.2	0.0	3.0	3.0	0.00037
1.B.2.c. Venting and Flaring (fugitative)		CH4	46.6	1.0	16.0	16.0	0.00197
1.A.2.a. Iron and Steel	Gas / Diesel oil	CO2	46.1	0.0	5.0	5.0	0.00061
1.A.4.b. Residential	Natural Gas	CH4	41.4	0.0	16.0	16.0	0.00175
4.D.3.2. Nitrogen Leaching and Runoff (4.d.3.2)		N2O	40.6	5.0	5.0	7.1	0.00076
1.A.3.b. Road Transportation	Gas / Diesel oil	CH4	39.0	0.0	5.0	5.0	0.00052
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	N2O	38.8	0.0	5.0	5.0	0.00051
1.A.4.b. Residential	Asphaltite	CH4	38.6	20.0	20.0	28.3	0.00288
1.A.1.a. Public Electricity and Heat Production	Natural Gas	N2O	36.0	0.0	20.0	20.0	0.00190
1.A.3.a. Civil Aviation	Jet Kerosene	N2O	36.0	0.0	10.0	10.0	0.00095
1.A.3.b. Road Transportation	Gasoline	CH4	34.0	10.0	10.0	14.1	0.00127
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CO2	30.8	2.50	3.0	3.9	0.00032
1.A.2.f. Cement Production	Petroleum Coke	N2O	30.7	0.0	20.0	20.0	0.00162
1.A.2.f. Cement Production	Lignite	N2O	29.5	5.3	20.0	20.7	0.00161
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CO2	28.9	0.0	5.0	5.0	0.00038
1.A.2.a. Iron and Steel	Naphta	CO2	28.8	2.5	3.0	3.9	0.00030
1.A.2.c. Chemicals	Gasoline	CO2	26.7	3.0	3.0	4.2	0.00030
1.A.2.a. Iron and Steel	Residual Fuel Oil	CO2	26.3	2.50	3.0	3.9	0.00027
1.A.2.f. Cement Production	Hard Coal	N2O	24.2	7.0	20.0	21.2	0.00135
1.B.2.a. Oil (fugitative)		CO2	23.9	2.5	3.0	3.9	0.00025
1.A.2.f. Cement Production	Gasoline	CO2	23.0	3.0	3.0	4.2	0.00026
1.A.4.c. Agriculture/Forestry/Fisheries	Gas / Diesel oil	CH4	21.9	0.0	5.0	5.0	0.00029
4.D.1.3. Agricultural Soil (N-Fixing Crops)		N2O	19.7	1.00	9.0	9.1	0.00047
1.A.2.f. Other Industries	Natural Gas	CH4	19.1	0.0	16.0	16.0	0.00081
1.A.2.f. Other Industries	Second Fuel Coal	CO2	18.7	7.00	3.0	7.6	0.00038
1.A.2.f. Cement Production	Gas / Diesel oil	CO2	17.3	0.0	5.0	5.0	0.00023
1.A.1.a. Public Electricity and Heat Production	Natural Gas	CH4	17.0	0.0	16.0	16.0	0.00072
1.A.2.a. Iron and Steel	Hard Coal	N2O	16.9	7.0	20.0	21.2	0.00095
1.A.2.f. Fertilizer	Residual Fuel Oil	CO2	16.2	2.50	3.0	3.9	0.00017
1.A.2.f. Other Industries	Lignite	N2O	15.9	5.3	20.0	20.7	0.00087
1.A.3.b. Road Transportation	Gasoline	N2O	15.0	16.0	16.0	22.6	0.00090
1.A.2.f. Cement Production	Petroleum Coke	CH4	14.9	0.0	16.0	16.0	0.00063
1.A.2.f. Cement Production	Lignite	CH4	14.3	5.3	16.0	16.9	0.00063
1.A.4.b. Residential	Natural Gas	N2O	12.2	0.0	20.0	20.0	0.00065
1.A.2.f. Cement Production	Hard Coal	CH4	11.7	7.0	16.0	17.5	0.00054
1.A.1.a. Public Electricity and Heat Production	LPG	CO2	10.2	2.5	5.0	5.6	0.00015
1.A.1.a. Public Electricity and Heat Production	Hard Coal	N2O	9.9	7.0	20.0	21.2	0.00055
1.A.2.a. Iron and Steel	LPG	CO2	9.7	2.5	5.0	5.6	0.00014
1.A.4.b. Residential	LPG	CH4	9.4	2.5	10.0	10.3	0.00026
1.A.1.a. Public Electricity and Heat Production	Lignite	CH4	9.0	5.3	16.0	16.9	0.00040
1.A.2.f. Other Industries	Gas / Diesel oil	N2O	8.9	0.0	5.0	5.0	0.00012
1.A.4.b. Residential	LPG	N2O	8.4	2.5	16.0	16.2	0.00036
1.A.2.a. Iron and Steel	Hard Coal	CH4	8.2	7.0	16.0	17.5	0.00038
1.A.2.a. Iron and Steel	Natural Gas	CH4	8.2	0.0	16.0	16.0	0.00034
1.A.2.a. Iron and Steel	Petroleum Coke	CO2	7.7	0.0	3.0	3.0	0.00006
1.A.2.f. Other Industries	Lignite	CH4	7.7	5.3	16.0	16.9	0.00034
1.A.1.b. Petroleum Refining	Refinery Gas	N2O	7.5	0.00	16.0	16.0	0.00032
1.A.2.f. Sugar	Gasoline	CO2	6.3	3.0	3.0	4.2	0.00007
1.A.2.c. Chemicals	Natural Gas	CH4	6.3	0.0	16.0	16.0	0.00027
1.A.2.f. Other Industries	Natural Gas	N2O	5.6	0.0	20.0	20.0	0.00030
1.A.3.d. Navigation	Gas / Diesel oil	N2O	5.6	0.0	5.0	5.0	0.00007

A7.2 Uncertainty analysis (cont.)

CATEGORY	FUEL	GAS	2011	Activity data Unc. (%)	Emis fact. Unc. (%)	Combined Unc. (%)	Combined uncertainty as % of total national emissions in year 2011
1.A.2.f. Sugar	Lignite	N2O	5.3	5.3	20.0	20.7	0.00029
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CO2	5.0	0.0	5.0	5.0	0.00007
1.A.2.f. Other Industries	Petroleum Coke	N2O	4.9	0.0	20.0	20.0	0.00026
6.C. Waste Incineration		CH4	4.9	16.00	16.0	22.6	0.00029
1.A.1.a. Public Electricity and Heat Production	Second Fuel Coal	CH4	4.3			0.0	0.00000
1.A.2.f. Sugar	Gas / Diesel oil	CO2	3.9	0.0	5.0	5.0	0.00005
1.A.3.d. Navigation	Gas / Diesel oil	CH4	3.2	0.0	5.0	5.0	0.00004
1.A.2.f. Fertilizer	Natural Gas	CH4	2.7	0.0	16.0	16.0	0.00011
1.A.4.b. Residential	Asphaltite	N2O	2.7	20.0	20.0	28.3	0.00020
1.A.2.c. Chemicals	Residual Fuel Oil	N2O	2.6	2.50	16.0	16.2	0.00011
1.A.2.f. Sugar	Lignite	CH4	2.6	5.3	16.0	16.9	0.00011
1.A.1.b. Petroleum Refining	Refinery Gas	CH4	2.5	0.00	10.0	10.0	0.00007
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CO2	2.4	0.0	5.0	5.0	0.00003
1.A.2.a. Iron and Steel	Natural Gas	N2O	2.4	0.0	20.0	20.0	0.00013
1.A.2.f. Other Industries	Petroleum Coke	CH4	2.4	0.0	16.0	16.0	0.00010
1.A.2.b. Non-Ferrous Metals	Lignite	N2O	2.4	5.3	20.0	20.7	0.00013
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	N2O	2.4	2.50	16.0	16.2	0.00010
1.A.1.a. Public Electricity and Heat Production	Biofuel	N2O	2.3	16.0	16.0	22.6	0.00014
1.A.2.c. Chemicals	LPG	N2O	2.2	2.5	16.0	16.2	0.00009
1.A.2.f. Other Industries	Hard Coal	N2O	2.1	7.0	20.0	21.2	0.00012
1.A.2.f. Other Industries	Gas / Diesel oil	CH4	2.0	0.0	5.0	5.0	0.00003
1.A.2.f. Fertilizer	Gas / Diesel oil	CO2	2.0	0.0	5.0	5.0	0.00003
1.A.2.c. Chemicals	Natural Gas	N2O	1.9	0.0	20.0	20.0	0.00010
1.A.4.b. Residential	Residual Fuel Oil	CH4	1.8	2.50	10.0	10.3	0.00005
1.A.2.c. Chemicals	Lignite	N2O	1.7	5.3	20.0	20.7	0.00010
1.A.1.a. Public Electricity and Heat Production	Asphaltite	N2O	1.6	20.0	20.0	28.3	0.00012
1.A.4.b. Residential	Residual Fuel Oil	N2O	1.6	2.50	16.0	16.2	0.00007
1.A.2.c. Chemicals	Hard Coal	N2O	1.6	7.0	20.0	21.2	0.00009
1.A.2.f. Other Industries	Waste of animal, plant	N2O	1.6	45.00	45.0	63.6	0.00026
1.A.1.b. Petroleum Refining	Natural Gas	N2O	1.4	0.0	20.0	20.0	0.00008
1.B.2.b. Natural Gas (fugitative)		CO2	1.3	0.0	3.0	3.0	0.00001
1.A.3.c. Railways	Gas / Diesel oil	N2O	1.2	0.0	5.0	5.0	0.00002
1.A.1.a. Public Electricity and Heat Production	Biofuel	CH4	1.2	16.0	16.0	22.6	0.00007
1.A.2.f. Other Industries	Gasoline	N2O	1.2	16.0	16.0	22.6	0.00007
1.A.2.b. Non-Ferrous Metals	Lignite	CH4	1.1	5.3	16.0	16.9	0.00005
1.A.2.c. Chemicals	Second Fuel Coal	N2O	1.0	7.00	20.0	21.2	0.00006
6.C. Waste Incineration		N2O	1.0	16.0	16.0	22.6	0.00006
1.A.2.f. Other Industries	Hard Coal	CH4	1.0	7.0	16.0	17.5	0.00005
1.A.3.a. Civil Aviation	Jet Kerosene	CH4	1.0	0.0	10.0	10.0	0.00003
1.A.1.b. Petroleum Refining	Natural Gas	CH4	1.0	0.0	16.0	16.0	0.00004
1.A.2.c. Chemicals	Lignite	CH4	0.8	5.3	16.0	16.9	0.00004
1.A.2.f. Sugar	Natural Gas	CH4	0.8	0.0	16.0	16.0	0.00004
1.A.2.f. Fertilizer	Natural Gas	N2O	0.8	0.0	20.0	20.0	0.00004
1.A.2.f. Other Industries	Waste of animal, plant	CH4	0.8	0.00	16.0	16.0	0.00003
1.A.1.a. Public Electricity and Heat Production	Residual Fuel Oil	CH4	0.8	2.50	10.0	10.3	0.00002
1.A.2.c. Chemicals	Hard Coal	CH4	0.8	7.0	16.0	17.5	0.00003
1.A.2.b. Non-Ferrous Metals	Natural Gas	CH4	0.8	0.0	16.0	16.0	0.00003
1.A.2.f. Other Industries	Asphaltite	N2O	0.7	20.0	20.0	28.3	0.00005
1.A.3.c. Railways	Gas / Diesel oil	CH4	0.7	0.0	5.0	5.0	0.00001
4.D.3.1. Atmospheric deposition		N2O	0.6	5.0	5.0	7.1	0.00001
1.A.2.c. Chemicals	Residual Fuel Oil	CH4	0.6	2.50	10.0	10.3	0.00002
1.A.2.a. Iron and Steel	Lignite	N2O	0.6	5.3	20.0	20.7	0.00003
1.A.1.a. Public Electricity and Heat Production	Asphaltite	CH4	0.5	20.0	20.0	28.3	0.00004
1.A.2.f. Sugar	Second Fuel Coal	N2O	0.5	7.00	20.0	21.2	0.00003
1.B.2.c. Venting and Flaring (fugitative)		N2O	0.5	1.0	20.0	20.0	0.00003
1.A.2.c. Chemicals	Second Fuel Coal	CH4	0.5			0.0	0.00000
1.A.2.c. Chemicals	LPG	CH4	0.5	2.5	10.0	10.3	0.00001
1.A.1.a. Public Electricity and Heat Production	Hard Coal	CH4	0.5	7.0	16.0	17.5	0.00002
1.A.2.f. Other Industries	Residual Fuel Oil	N2O	0.5	2.50	16.0	16.2	0.00002
1.A.1.b. Petroleum Refining	Gasoline	CO2	0.4	3.0	3.0	4.2	0.00000
1.A.3.d. Navigation	Residual Fuel Oil	N2O	0.4	2.50	16.0	16.2	0.00002
1.A.2.f. Cement Production	Natural Gas	CH4	0.4	0.0	16.0	16.0	0.00002
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	CH4	0.4	16.0	16.0	22.6	0.00002
1.A.2.f. Other Industries	Asphaltite	CH4	0.4	20.0	20.0	28.3	0.00003
1.A.2.f. Sugar	Residual Fuel Oil	N2O	0.3	2.50	16.0	16.2	0.00001
1.A.3.b. Road Transportation	LPG	N2O	0.3	2.5	16.0	16.2	0.00001
1.A.2.a. Iron and Steel	Lignite	CH4	0.3	5.3	16.0	16.9	0.00001
1.A.2.f. Other Industries	Gasoline	CH4	0.3	10.0	10.0	14.1	0.00001
1.A.2.f. Sugar	Second Fuel Coal	CH4	0.3			0.0	0.00000
1.A.2.f. Sugar	Hard Coal	N2O	0.2	7.0	20.0	21.2	0.00001
1.A.2.c. Chemicals	Gas / Diesel oil	N2O	0.2	0.0	5.0	5.0	0.00000
1.A.2.f. Sugar	Natural Gas	N2O	0.2	0.0	20.0	20.0	0.00001
1.A.3.d. Navigation	Residual Fuel Oil	CH4	0.2	2.50	10.0	10.3	0.00001

A7.2 Uncertainty analysis (cont.)

CATEGORY	FUEL	GAS	2011	Activity data Unc. (%)	Emis fact. Unc. (%)	Combined Unc. (%)	Combined uncertainty as % of total national emissions in year 2011
1.A.2.b. Non-Ferrous Metals	Hard Coal	N2O	0.2	7.0	20.0	21.2	0.00001
1.A.2.b. Non-Ferrous Metals	Natural Gas	N2O	0.2	0.0	20.0	20.0	0.00001
1.A.4.b. Residential	Gas / Diesel oil	CH4	0.2	0.0	5.0	5.0	0.00000
1.A.4.b. Residential	Gas / Diesel oil	N2O	0.2	0.0	5.0	5.0	0.00000
1.A.2.f. Cement Production	Naphta	CO2	0.2	2.5	3.0	3.9	0.00000
1.A.2.f. Cement Production	Residual Fuel Oil	N2O	0.2	2.50	16.0	16.2	0.00001
1.A.2.f. Cement Production	LPG	CO2	0.2	2.5	5.0	5.6	0.00000
1.A.3.b. Road Transportation	Biofuel	N2O	0.1	16.0	16.0	22.6	0.00001
1.A.2.a. Iron and Steel	Gasoline	CO2	0.1	3.0	3.0	4.2	0.00000
1.A.2.f. Sugar	LPG	CO2	0.1	2.5	5.0	5.6	0.00000
1.A.2.f. Sugar	Hard Coal	CH4	0.1	7.0	16.0	17.5	0.00001
1.A.2.a. Iron and Steel	Gas / Diesel oil	N2O	0.1	0.0	5.0	5.0	0.00000
1.A.2.b. Non-Ferrous Metals	Hard Coal	CH4	0.1	7.0	16.0	17.5	0.00001
1.A.2.f. Cement Production	Natural Gas	N2O	0.1	0.0	20.0	20.0	0.00001
1.A.1.a. Public Electricity and Heat Production	Industrial Waste	N2O	0.1	45.0	45.0	63.6	0.00002
1.A.2.f. Other Industries	Residual Fuel Oil	CH4	0.1	2.50	10.0	10.3	0.00000
1.A.1.b. Petroleum Refining	Petroleum & Other	CO2	0.1	2.5	3.0	3.9	0.00000
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	CH4	0.1	0.0	16.0	16.0	0.00000
1.A.2.f. Other Industries	Second Fuel Coal	N2O	0.1	7.00	20.0	21.2	0.00000
1.A.3.b. Road Transportation	Biofuel	CH4	0.1	16.0	16.0	22.6	0.00000
1.A.2.f. Sugar	Residual Fuel Oil	CH4	0.1	2.50	10.0	10.3	0.00000
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	N2O	0.1	2.50	16.0	16.2	0.00000
1.A.2.a. Iron and Steel	Naphta	N2O	0.1	2.5	16.0	16.2	0.00000
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	N2O	0.1	0.0	5.0	5.0	0.00000
1.A.2.c. Chemicals	Gasoline	N2O	0.1	16.0	16.0	22.6	0.00000
1.A.1.a. Public Electricity and Heat Production	Naphta	N2O	0.1	2.5	16.0	16.2	0.00000
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	N2O	0.1	0.0	5.0	5.0	0.00000
1.A.2.a. Iron and Steel	Residual Fuel Oil	N2O	0.1	2.50	16.0	16.2	0.00000
1.A.2.f. Cement Production	Gasoline	N2O	0.1	16.0	16.0	22.6	0.00000
1.A.2.c. Chemicals	Gas / Diesel oil	CH4	0.1	0.0	5.0	5.0	0.00000
1.A.2.f. Sugar	Naphta	CO2	0.1	2.5	3.0	3.9	0.00000
1.B.2.a. Oil (fugitative)		N2O	0.1	2.5	20.0	20.2	0.00000
1.A.2.f. Cement Production	Gas / Diesel oil	N2O	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Other Industries	Second Fuel Coal	CH4	0.0			0.0	0.00000
1.A.2.f. Fertilizer	Residual Fuel Oil	N2O	0.0	2.50	16.0	16.2	0.00000
1.A.2.f. Cement Production	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.2.a. Iron and Steel	Petroleum Coke	N2O	0.0	0.0	20.0	20.0	0.00000
1.A.1.a. Public Electricity and Heat Production	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.2.a. Iron and Steel	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.a. Iron and Steel	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.4.c. Agriculture/Forestry/Fisheries	Natural Gas	N2O	0.0	0.0	20.0	20.0	0.00000
1.A.2.b. Non-Ferrous Metals	Wood	N2O	0.0	45.00	45.0	63.6	0.00000
1.A.2.a. Iron and Steel	Petroleum Coke	CH4	0.0	0.0	16.0	16.0	0.00000
1.A.2.f. Sugar	Gasoline	N2O	0.0	16.0	16.0	22.6	0.00000
1.A.2.b. Non-Ferrous Metals	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.2.a. Iron and Steel	Naphta	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.b. Non-Ferrous Metals	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.2.c. Chemicals	Gasoline	CH4	0.0	10.0	10.0	14.1	0.00000
1.A.2.a. Iron and Steel	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.5.a. Other (Stationary)		N2O	0.0	0.00	16.0	16.0	0.00000
1.A.2.f. Cement Production	Gasoline	CH4	0.0	10.0	10.0	14.1	0.00000
1.A.2.b. Non-Ferrous Metals	Wood	CH4	0.0	16.00	16.0	22.6	0.00000
1.A.2.f. Sugar	Gas / Diesel oil	N2O	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Cement Production	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.5.a. Other (Stationary)		CH4	0.0	0.00	20.0	20.0	0.00000
1.A.2.f. Fertilizer	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.2.a. Iron and Steel	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.1.b. Petroleum Refining	Gas / Diesel oil	N2O	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Sugar	Waste of animal, plant	N2O	0.0	45.00	45.0	63.6	0.00000
1.A.2.f. Fertilizer	LPG	CO2	0.0	2.5	5.0	5.6	0.00000
1.A.2.f. Fertilizer	Gas / Diesel oil	N2O	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Sugar	Gasoline	CH4	0.0	10.0	10.0	14.1	0.00000
1.A.1.a. Public Electricity and Heat Production	Naphta	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Other Industries	Wood	N2O	0.0	45.00	45.0	63.6	0.00000
1.A.2.f. Sugar	Waste of animal, plant	CH4	0.0	0.00	16.0	16.0	0.00000
1.A.2.f. Sugar	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.1.b. Petroleum Refining	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Other Industries	Wood	CH4	0.0	16.00	16.0	22.6	0.00000
1.A.1.b. Petroleum Refining	Gasoline	N2O	0.0	16.0	16.0	22.6	0.00000
1.A.2.f. Fertilizer	Gas / Diesel oil	CH4	0.0	0.0	5.0	5.0	0.00000
1.A.2.f. Cement Production	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.f. Cement Production	Naphta	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.1.b. Petroleum Refining	Gasoline	CH4	0.0	10.0	10.0	14.1	0.00000

A7.2 Uncertainty analysis (cont.)

CATEGORY	FUEL	GAS	2011	Activity data Unc. (%)	Emıs fact. Unc. (%)	Combıned Unc. (%)	Combined uncertainty as % of total national emissions in year 2011
1.A.2.a. Iron and Steel	Gasoline	N2O	0.0	16.0	16.0	22.6	0.00000
1.A.2.f. Sugar	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.1.b. Petroleum Refining	Petroleum & Other	N2O	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Sugar	Naphta	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.f. Cement Production	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Cement Production	Naphta	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.1.b. Petroleum Refining	Petroleum & Other	CH4	0.0	2.5	16.0	16.2	0.00000
1.A.2.a. Iron and Steel	Gasoline	CH4	0.0	10.0	10.0	14.1	0.00000
1.A.2.f. Sugar	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Sugar	Naphta	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Fertilizer	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.f. Fertilizer	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.3.c. Railways	Hard Coal	CO2	0.0	7.0	3.0	7.6	0.00000
1.A.3.d. Navigation	Hard Coal	CO2	0.0	7.0	3.0	7.6	0.00000
1.A.2.f. Fertilizer	Lignite	CO2	0.0	5.3	3.0	6.1	0.00000
1.A.3.c. Railways	Lignite	CO2	0.0	5.3	3.0	6.1	0.00000
1.A.2.f. Cement Production	Asphaltite	CO2	0.0	20.0	20.0	28.3	0.00000
1.A.2.a. Iron and Steel	Second Fuel Coal	CO2	0.0	7.00	3.0	7.6	0.00000
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CO2	0.0	7.00	3.0	7.6	0.00000
1.A.2.f. Fertilizer	Second Fuel Coal	CO2	0.0	7.00	3.0	7.6	0.00000
1.A.4.b. Residential	Second Fuel Coal	CO2	0.0	7.00	3.0	7.6	0.00000
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CO2	0.0	0.0	3.0	3.0	0.00000
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CO2	0.0	2.50	3.0	3.9	0.00000
1.A.3.c. Railways	Residual Fuel Oil	CO2	0.0	2.50	3.0	3.9	0.00000
1.A.1.b. Petroleum Refining	LPG	CO2	0.0	2.5	5.0	5.6	0.00000
1.A.2.f. Other Industries	LPG	CO2	0.0	2.5	5.0	5.6	0.00000
1.A.2.f. Other Industries	Refinery Gas	CO2	0.0	0.00	3.0	3.0	0.00000
1.A.2.f. Fertilizer	Naphta	CO2	0.0	2.5	3.0	3.9	0.00000
1.A.3.c. Railways	Hard Coal	CH4	0.0	7.0	16.0	17.5	0.00000
1.A.3.d. Navigation	Hard Coal	CH4	0.0	7.0	16.0	17.5	0.00000
1.A.2.f. Fertilizer	Lignite	CH4	0.0	5.3	16.0	16.9	0.00000
1.A.3.c. Railways	Lignite	CH4	0.0	5.3	16.0	16.9	0.00000
1.A.2.f. Cement Production	Asphaltite	CH4	0.0	20.0	20.0	28.3	0.00000
1.A.2.a. Iron and Steel	Second Fuel Coal	CH4	0.0			0.0	0.00000
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	CH4	0.0			0.0	0.00000
1.A.2.f. Fertilizer	Second Fuel Coal	CH4	0.0			0.0	0.00000
1.A.4.b. Residential	Second Fuel Coal	CH4	0.0			0.0	0.00000
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	CH4	0.0	0.0	16.0	16.0	0.00000
1.A.1.b. Petroleum Refining	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.3.c. Railways	Residual Fuel Oil	CH4	0.0	2.50	10.0	10.3	0.00000
1.A.1.b. Petroleum Refining	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Other Industries	LPG	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.2.f. Other Industries	Refinery Gas	CH4	0.0	0.00	10.0	10.0	0.00000
1.A.2.f. Fertilizer	Naphta	CH4	0.0	2.5	10.0	10.3	0.00000
1.A.3.c. Railways	Hard Coal	N2O	0.0	7.0	20.0	21.2	0.00000
1.A.3.d. Navigation	Hard Coal	N2O	0.0	7.0	20.0	21.2	0.00000
1.A.2.f. Fertilizer	Lignite	N2O	0.0	5.3	20.0	20.7	0.00000
1.A.3.c. Railways	Lignite	N2O	0.0	5.3	20.0	20.7	0.00000
1.A.2.f. Cement Production	Asphaltite	N2O	0.0	20.0	20.0	28.3	0.00000
1.A.2.a. Iron and Steel	Second Fuel Coal	N2O	0.0	7.00	20.0	21.2	0.00000
1.A.2.b. Non-Ferrous Metals	Second Fuel Coal	N2O	0.0	7.00	20.0	21.2	0.00000
1.A.2.f. Fertilizer	Second Fuel Coal	N2O	0.0	7.00	20.0	21.2	0.00000
1.A.4.b. Residential	Second Fuel Coal	N2O	0.0	7.00	20.0	21.2	0.00000
1.A.2.b. Non-Ferrous Metals	Petroleum Coke	N2O	0.0	0.0	20.0	20.0	0.00000
1.A.1.b. Petroleum Refining	Residual Fuel Oil	N2O	0.0	2.50	16.0	16.2	0.00000
1.A.3.c. Railways	Residual Fuel Oil	N2O	0.0	2.50	16.0	16.2	0.00000
1.A.1.b. Petroleum Refining	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.f. Other Industries	LPG	N2O	0.0	2.5	16.0	16.2	0.00000
1.A.2.f. Other Industries	Refinery Gas	N2O	0.0	0.00	16.0	16.0	0.00000
1.A.2.f. Fertilizer	Naphta	N2O	0.0	2.5	16.0	16.2	0.00000
2.C.3. Aluminium Production		CO2	C	0.00	1.0	1.0	-
2.B.1. Ammonia Production		CO2	C	24.00	1.0	24.0	-
2.B.4.2. Carbide Production		CO2	C	45.00	1.0	45.0	-
2.B.2. Nitric Acid Production (Chemical Industry)		N2O	C	9.00	1.0	9.1	-
2.C.3. Aluminium Production		CF4	C	0.00	1.0	1.0	-
2.C.3. Aluminium Production		C2F6	C	0.00	1.0	1.0	-
2.A.4.1. Soda Ash Production and Use (Mineral Products)		CO2	C	45.0	1.0	45.0	-
1.A.3.b. Road Transportation	Natural Gas	CO2	IE	0.0	3.0	3.0	-
1.A.3.b. Road Transportation	Natural Gas	CH4	IE	0.0	16.0	16.0	-
1.A.3.b. Road Transportation	Natural Gas	N2O	IE	0.0	20.0	20.0	-
2.C.2. Ferroalloys Production		CO2	IE	0.00	1.0	1.0	-
2.A.3. Limestone and Dolomite Use (Mineral Products)		CO2	IE	15.0	1.0	15.0	-
Total			378776				5.2