Greenhouse Gas Emissions in Republic of Bulgaria 1988-2005. National Inventory Report 2005

Submission 2007

Hr. Vassilev, Ch. Christov, V. Hristova, B. Neshev

National Inventory Report prepared for submission in accordance with the UN Framework Convention on Climate Change (UNFCCC) [including electronic Excel spreadsheet files containing Common Reporting Format (CRF) data for 1988-2005]

This study has been performed by order and for the account of the Bulgaria Ministry of Environment and Water within the framework of Energy Institute contract No. 1017/22.12.2006, project title “GHG Inventory of Bulgaria for 2005 under UNFCCC with National Report”.

The Report and the CRF tables have been received approval of the Expert Environmental Council of the Executive Environmental Agency to the Ministry of Environment and Water.

ABBREVIATION'S LIST 3
EXECUTIVE SUMMARY 4
P.1. Background Information on the GHG Inventories and Climate Change 4
P.2. National GHG Emissions Trends 6
P.3 Overview of Sources and Sink Category Emission Estimates and Trends 10
P.4. Other Information 17
Chapter 1. Introduction 24
1.1. Background Information on GHG Inventories and Climate Change 24
1.2. A description of the Institutional Arrangement for Inventory Preparation 27
1.3. Brief Description of the Inventory Preparation Process 28
1.4. Brief General Description of Methodologies and Data Sources Used 28
1.5. Brief Description of Key Categories 33
1.6. Information on the QA/QC Plan Including Verification and Treatment of Confidentiality Issues 34
1.7. General Uncertainty Evaluation 34
1.8. General Assessment of Inventory Completeness 39
Chapter 2. Overall GHG Emission Trends 40
2.1. Aggregated GHG Emission Trends 40
2.2. GHG Emission Trends by Gas 44
2.3. GHG Emission Trends by Source Categories 50
2.4. Emissions Trends of GHG-Precursors and SOx 51
Chapter 3. Energy 56
3.1. General Description 56
3.2. Fuel Combustion 59
3.3. Fugitive Methane Emissions from Coal Mining and Systems for Gas and Oil Extraction and Distribution 83
Chapter 4. Industrial Processes 89
4.1. General Sector Description 89
4.2. Mineral Products 92
4.3. Chemical Industry 93
4.4. Metal Production 94
4.5. Halocarbon and SF_6 Production 95
4.6. Halocarbon and SF_6 Consumption 95
4.7. Other industrial Processes 97
Chapter 5. Solvent Use 98
5.1. General Description 98
5.2. NMVOCs Emissions from Solvent Use 98
Chapter 6. Agriculture 100
6.1. General Description 100
6.2. Enteric Fermentation 102
6.3. Manure Management 103
6.4. Rice Cultivation 105
6.5. N_2O Emissions from Agricultural Soils 105
6.6. Field Burning of Agricultural Residues 108
Chapter 7. Land-Use Change and Forestry 109
7.1. General Description 109
7.2. CO_2 Sinks from Forestry 110
Chapter 8. Waste 114
8.1. General Description 114
8.2. Solid Waste Disposal 114

8.3. Wastewater Handling 116
8.4. Waste Incineration..... 117
Chapter 9. Other (Sector 7 from CRF)..... 119
Chapter 10. Recalculation of GHG Emissions and Improvements..... 120
10.1. Prerequisites and Assumptions During the Recalculations..... 120
10.2. Introducing Improvements for GHG Emissions Levels..... 121
10.3. Introduction of Improvements in the GHG Emissions Trends 124
10.4. Recalculation, Inventory Revisions and Planned Improvements..... 124
REFERENCES..... 127
Annex 1: Key Sources of GHG Emissions A1
Annex 2: Methodology and Data for Assessment of CO_2 Emissions From Fuel Combustion.. A11
Annex 3: Methodology for Calculation of GHG Emissions for Some Sources and Sinks..... A14
Annex 4: CO_2 Reference Approach and Comparison with Sectoral Approach..... A33
Annex 5: Assessment of Completeness of Inventories A38
Annex 6: Additional Information to be Considered as Part of NIR Submission. A47
Annex 7: Some CRF Tables..... A48

ABBREVIATION'S LIST

CH_4	Methane
CO	Carbon oxide
CO_2	Carbon dioxide
CO_2-eq.	Carbon dioxide-equivalent
CORINAIR	The Atmospheric Emission Inventory for Europe
CRF	Common Reporting Format
DOC	Degradable Organic Content
EEA	Executive Environmental Agency
EI	Energy Institute
EUROSTAT	European Statistical Organisation
FAO	Food and Agriculture Organisation
GHG	Greenhouse Gas
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
IEA	International Energy Agency
IPCC	Intergovernmental Panel of Climate Change
KP	Kyoto Protocol
LPG	Liquid Petroleum Gas
LULUCF	Land Use and Land Use Change and Forestry
MAF	Ministry of Agriculture and Forestry
MEE	Ministry of Economy and Energy
MIA	Ministry of Internal Affairs
MoEW	Ministry of Environment and Water
MOI	Ministry of Interior
MSW	Municipal Solid Waste
N_2O	Nitrous oxide
NC	National Communications
NFPS	National Forest policy and strategy
NIR	National Inventory Report
NMVOCs	Non-Methane Volatile Organic Compounds
NOx	Nitrogen oxide
NAP	Nuclear Power Plant
NSI	National Statistical Institute
OECD	Organization for Economic Cooperation and Development
PFC	Perfluorocarbons
QA/QC	Systems for Quality Assessment and Quality Control
QMS	Quality Management System
RA	Reference Approach
RCD	Road Control Department
SA	Sectoral Approach
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEEC	Superior Expert Ecological Council at MoEW
SF_6	Sulphur hexafluoride
SOx	Sulphur oxide
SWDS	Solid Waste Disposal Site
TPP	Thermo Power Plant
UNFCCC	UN Framework Convention on Climate Change

EXECUTIVE SUMMARY

P.1. Background Information on the GHG Inventories and Climate Change

This report represents the annual GHG Inventory in Bulgaria for 2005.

The Inventory is prepared according to the UNFCCC Guideline approved by the Subsidiary Body for Scientific and Technological Appliance on The 21st session on 06-14.12.2004 in Buenos Aires.

The rules and the structure of the National GHG Inventory Report are formed by this Guideline.

The Inventory should be prepared in a way that ensures Transparency, Consistency, Comparativeness, Completeness and Accuracy. These qualities of the Inventory are elements of the "Good Practices", pointed out in the IPCC Good Practice Guidance, 2000.

That is the reason why the current report presents:

- GHG emissions trends for the period 1988-2005;
- Methods and data for assessment of the uncertainty of the annual GHG emissions and trends;
- Key sources of the GHG emissions according to the methods from type Tier 1 and Tier 2,
- Assessment of the system of Appliance and Control of the Quality.

Tables with data and GHG emissions are applied in the report, formatted according to the Common Reporting Format (CRF) for reporting the annual inventory.

The full set of CRF tables (including for the sector Land use change and Forestry) and the text of the National Report as PDF-file are in the Internet page of MoEW (www.moew.government.bg) and on the Internet page of the Energy Institute (www.eninbg.com).

UNFCCC and Protocol from Kyoto

The Parliament of Bulgaria ratified the UN Framework Convention on Climate Change in March 1995.

The Convention separates the countries in two main groups: the first one is the group of countries listed in the Annex 1 (so-called Annex I Countries) and the second one is of these countries outside of this Annex 1. Countries of Annex I are the industrial countries which are members of the Organization for Economic Cooperation and Development (OECD) and countries with economy in transition (Russia, Baltic countries, Ukraine and Central and East Europe Countries). Bulgaria is a part of the group of countries with economy in transition.

The Kyoto Protocol (KP) was approved on the Third session of the Conference of the Parties in December 1997 in Kyoto, Japan. Bulgaria ratified it on August 15th, 2002. After its ratification by the Russian Federation in November 2004, the Kyoto Protocol entered into force on February 16th 2005.

With Kyoto Protocol, the Parties to the Convention assumed the obligation not only to stabilize the GHG emissions, but also to reduce them with a certain rate regarding the base year for each country.

Report Requirements: UNFCCC and IPCC

Annex 1 Countries to the Convention must report annual GHG Inventory, which includes data for the GHG emissions for the base year and at least 1 year before the current Inventory.

The UNFCCC Guidance describes the GHG emission sources, methodologies for their calculation and the content of the reported materials on the Inventory. For this purpose, the Revised IPCC Guidance, 1996 and the Good Practice Guidance, 2000 for formatting and reporting the results from the GHG emission calculation are used.

Key Sources of GHG emissions

In defining the key sources of GHG emissions, the IPCC/OECD methodology, proposed in the Good Practice Guidance for GHG Inventories, 2000 is used.

The determination of the key sources according to the method type Tier 1 treats the national total annual emissions as well as the total trend for annual emissions.

The results from applying *Tier 1 method* in its two varieties (quantitative assessment of the participation in the total emissions and assessment of the trend of each source toward the total emission trend) are presented in details in ***Annex 1*** of this report. From the total 41 emission sources, the key emission sources are 20 based on the quantitative assessment and 18 sources according to the trend assessment and for the two types of assessment they give 95 % of the total quantity of the GHG emissions expressed in CO_2-eq.

According to the *method of type Tier 2*, the assessment of the key sources is made by accounting the uncertainty of each source. The uncertainty is regarded as the combined uncertainty of the data (fuels, products, etc.) and the emission factors.

Because of the applying of the two approaches for assessment of the key sources a list of total 25 sources, which are subject of the following assessments and analysis, is created. Only 11 of them are defined as key sources and they participate in all the applied methods and types of assessment (in quantity and trend).

Description of the Institutional Arrangement for Inventory Preparation

The activities for the preparation of the GHG Inventory in Bulgaria is coordinated and managed at a state level by the Ministry of Environment and Waters.

Executive Environmental Agency (EEA) is a subsidiary body of the MoEW. It coordinates all the activities connected with the collection of the data for fuels and other sources of GHG emissions. EEA is the main body responsible for the Inventory data collection, which is aggregated at a national level, by the following state bodies:

- National Statistical Institute (NSI);
- Department for road control in the Ministry of Internal Affairs;
- Department “Statistics” within the Ministry of Agriculture and Forests;
- Ministry of Economy and Energy;
- National Forest’s Management within MAF;
- Executive Agency for soil resources within MAF;

- National Bureau on vegetable protection;
- Energy Efficiency Agency.

In the GHG Inventory are used data received directly from the large emitters from the energy and industry. These data are generalized by Executive Environmental Agency and by the organization, which prepares the Inventory – Energy Institute (EI).

The Energy Institute Joint Stock Company is an executer of the current Inventory. It completes all the activities on the contracting basis according to the Law of Public Orders.

The EI is a scientific and consultant organization with significant experience in researching and resolving the problems of climate change. All the GHG Inventory according to the IPCC methodology from 1988 until now is elaborated by the team of EI.

Organization of the National Inventory Report

In the organization of the Inventory Report of Bulgaria for the year 2005 and in the National Report the following improvements are made in comparison with the previous National Report from 2004:

- The last version of the CRF-reporter for the inventory reporting is applied completely.
- CRF tables are prepared for all years in which the GHG Inventory is elaborated in the period of 1988–2004 including 1989;

National Inventory Report starts with *Chapter 1* – Introduction, which includes general information for the process of elaboration of the GHG Inventory in Bulgaria, description of the key sources of GHG emissions, assessment of the methods, sources and emission factors as well as the uncertainty in their determination.

In *Chapter 2* the GHG trends by type of sources and gases are analyzed.

Chapters 3–9 provide information in detail of the GHG emissions from the different sectors of the economy and services.

The final *Chapter 10* presents information and results from GHG emissions recalculations done for the period 1988-2004.

There are seven appendixes in the report, which give detailed assessment of the used data, and the received results. Part of the tables from the Common Reporting Format – CRF and the tables from LULUCF - format is applied.

P.2. National GHG Emissions Trends

The GHG Inventory for the year 2005 revealed that the overall GHG emissions expressed in CO_2-eq. are 69 994.88 Gg not taking into account the sequestration in sector Land use Change and Forestry(LUCF). The net emissions (including the sequestration from LUCF) are 62 607.6 Gg.

Table ES.1 represents the emission trends of the basic GHG, the overall emissions (not taking into account the LUCF) and the relative share of the overall emissions to the emissions from the base year 1988 referred to as 100 %.

The analysis of the **Table ES.1** reveals that in 2005 the CO_2 emissions form the largest share of 78.99 % from the overall GHG emissions expressed in CO_2-eq.; the CH_4 emissions are second with 14.7 % and the N_2O emissions with a 6.96 % share stand in the third place.

There can be seen that in the year 2005 the overall GHG emissions expressed in CO_2-eq. registered a growth. The emissions for the year 2005 are 52.8 % in comparison to the base year 1988 and they registered an increase of 1.3 % in comparison to the previous year 2004.

Summary of emission trend per gas, CO_2-eq., Gg

Table ES.1

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2 with LUCF	93,659	93,411	80,089	61,119	54,351	56,879	55,038	58,815	58,471	56,177	48,315	43,768	41,487	42,632	40,939	46,804	45,298	47,982
CO_2 excluding LUCF	98,792	99,040	86,246	68,755	61,763	64,354	62,340	66,340	64,988	63,049	55,176	50,968	50,463	52,099	49,257	53,860	53,264	54,978
CH_4	21,759	21,544	19,915	18,522	17,319	15,969	15,015	14,921	14,244	13,269	12,743	11,995	11,708	10,723	10,668	11,335	11,222	10,260
N_2O	12,061	11,239	10,450	7,793	6,377	5,671	5,805	5,838	5,757	5,404	4,402	4,476	4,918	4,577	4,454	4,446	4,394	4,366
HFCs								2.95	109.30	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs								NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO
SF_6								1.26	1.31	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
Total	**132,613**	**131,823**	**116,611**	**95,070**	**85,459**	**85,994**	**83,159**	**87,102**	**85,099**	**81,912**	**72,900**	**67,544**	**67,188**	**67,499**	**64,470**	**69,764**	**69,100**	**69,994.88**
Index (1988 = 100)																		
Index CO_2 excluding LUCF	100	100.25	87.30	69.60	62.52	65.14	63.10	67.15	65.78	63.82	55.85	51.59	51.08	52.74	49.86	54.52	53.91	55.65
Index CH_4	100	99.01	91.52	85.12	79.59	73.39	69.00	68.57	65.46	60.98	58.57	55.13	53.81	49.28	49.03	52.09	51.57	47.15
Index N_2O	100	93.18	86.64	64.61	52.87	47.01	48.13	48.40	47.73	44.81	36.50	37.11	40.78	37.95	36.93	36.86	36.43	36.20
Index [group of six]	**100**	**99.40**	**87.93**	**71.69**	**64.44**	**64.85**	**62.71**	**65.68**	**64.17**	**61.77**	**54.97**	**50.93**	**50.67**	**50.90**	**48.62**	**52.61**	**52.11**	**52.78**
Index (1995 = 100)																		
Index HFCs								100	3,705	6,378	19,547	3,485	3,255	3,305	3,037	4,088	7,366	13,113
Index PFCs								NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO
Index SF_6								100	104	139	145	149	177	181	199	200	292	350

In **Table ES.2** are presented shares of the overall GHG emissions by sectors for the period 1988-2005. The percentage was calculated out of the overall emissions without taking into account the CO_2 sequestration.

Sector contribution in aggregated emissions, %

Table ES.2

Sector/ year	1988	1989	1990	1991	1992	1993	1994	1995	1996
Energy	71.39	71.89	69.86	69.18	69.83	72.29	71.06	71.15	71.51
Industrial processes	7.97	8.07	8.48	7.44	6.94	6.81	8.52	10.29	10.37
Agriculture	10.98	10.45	11.11	11.07	9.98	8.31	7.93	6.81	6.70
Forestry	-3.87	-4.27	-5.28	-8.03	-8.67	-8.69	-8.78	-8.64	-7.67
Waste	9.67	9.59	10.55	12.31	13.25	12.59	12.49	11.74	11.42
Sector/ year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Energy	72.25	74.14	72.44	71.81	73.85	73.52	73.91	73.55	74.98
Industrial processes	9.83	6.88	7.43	8.92	8.84	8.27	8.47	8.54	8.82
Agriculture	6.84	7.34	8.40	8.04	6.74	7.55	6.94	7.38	6.90
Forestry	-8.41	-9.49	-10.68	-13.38	-14.05	-12.92	-10.13	-11.56	-10.05
Waste	11.08	11.65	11.73	11.23	10.57	10.66	10.69	10.53	9.30

The analyses of the **Table ES.2** show that the Energy sector forms the largest share of the overall emissions in 2005 – 74.5 %. Second in share is sector Industrial Process – 8.8 %, and in the third place stands the sector Waste with almost the same share.

In **Figure ES.1** is presented the trend of the aggregated GHG emissions by sectors in compliance with the IPCC classification.

Figure ES.1

The uncertainty of the trend of the aggregated GHG emissions according to the method from type Tier 1 is about 3.5 %. The uncertainty of the level of the overall emissions is considerably larger and it is about 12.7 %. This fact shows that the accounting of the emissions in the base year 1988

leads to a reduction of the uncertainty indexes only in comparison to the emission's accounting of the current year.

P.3 Overview of Sources and Sink Category Emission Estimates and Trends

In **Table ES.3** are presented the CO_2 emission trends from IPCC sectors for the period 1988- 2005.

Energy Sector

The Bulgarian Energy sector has key position in the national economy. It is the source of over 74 % of the aggregated GHG emissions for the last inventory 2004.

In the year 2005 the decrease in general CO_2 emissions compared with the basis year 1988 is 45 %. This decrease is conditioned in the great value from the decrease in Industry – 57.9 %, in Transport – 41.2 % and especially in residential sector – 81 %. Least decrease is in Energy – 31 %, which is due to the structure of electric power units in production and significant electricity production from nuclear energy.

In comparison with the preceding 2004, in the present year is shown a little growth in CO_2 emissions by 3.3 %. That note, that the tendency of liveliness in economy and increase of the energy efficiency are supporting for the third year in a row.

The analyses of **Table ES.3** show that the *Energy industries* have the largest share. Only the Energy industry registered an increase in the relative share regarding the base year 1988 – from 47.6 % to 59.4 % in 2005. This share has decreased: in the *Processing Industry* – from 27.3 % to 20.8 % and mostly in the *Public and Residential sector* – from 9.8 to 3.4 %.

The trend of *Transport* sector shows steady growth in the last five years, as in 2005 the emissions increased by 9.4 % compared to 2004 and they form 16.3 % of the overall emissions of CO_2 in the sector. The fluctuations in bigger degree are in relation in with the change in liquid fuel price as well as the process of restructure and renovation of the car park.

In sub-sector *Other sectors* (Services, Residential, Agriculture and Forestry) the general tendency varies as well.

The CO_2 emissions from non-energy use of fuels are accustomed to be reported in this sector and not in sector Industrial Processes.

Fugitive emissions of methane from mining and systems for extraction and distribution of oil and natural gas are part of the Energy sector as well.

The Coal Mining in Bulgaria is concentrated mainly in mines Maritza East basin where lignite coals are extracted in surface mines.

Petroleum and natural gas extraction is in a small scale – less than 1 % from the total consumption in the country. Due to its geographical position, Bulgaria is natural energy centre in the region and because of that reason; the transit flows of the natural gas are significant. They are over three times higher than the country's overall consumption.

Industrial Processes

The emissions from Industrial processes comprise emissions of all the main GHGs and GHG-precursors. A special attention is paid to the emissions of F-gases.

For all the categories of sources in this sector, there is a stable trend for emission's reduction from 1988 until 1998-1999, after that begins a stable growth especially for CO_2.

In the current year, there was registered growth by 4.3 % of the total emissions from the sector compared to the year 2004. Detailed analyze of GHG emissions should be implemented in Chapter 4 of the report.

In **Figure ES.2** are presented the emission trends for CO_2 for the main sub-sectors.

Figure ES.2

The analyses of the **Figure ES.2** show that the emission fluctuations follow the economical changes in the country. During the period under review, the following factors had the greatest influence on the macroeconomic level:

- Changes on the International market;
- Privatization of the state property;
- Others.

Solvent Use

The IPCC Guidelines do not provide methodology for estimating emissions of NMVOCs, which are the main GHG-precursor emissions source in this sector. Therefore, for the purpose of GHG inventories in Bulgaria a simplified method for estimating the emissions of NMVOCs is used. It includes data from the GHG estimation after the CORINAIR methodology.

The N_2O emissions are not estimated in the Inventories of Bulgaria due to the lack of data for the use substances for anaesthesia, production of medicines, aerosol packages, etc.

Agriculture

The general reduction of GHG emissions from Agriculture for the period from the year 1988 is 67 %. All emission categories of the sector decreased on the average with the same percents.

In the present year, a reduction of sector emissions is observed toward the year 2004 with 5.4 %. There are fluctuations around one average level of 4.8 millions of tons. A detailed analyze of GHG emissions in sector is implemented in Chapter 6 of the report.

In **Figure ES.3** the methane emission trends are presented and they form 41 % of the overall sectors emission expressed in CO_2-eq.

There is a stable trend in emission's increase from 2001 up to now. Nevertheless, the drop related to the base year 1988 stands a very large one – above 65 %.

The *N_2O emissions* from the sector are also large in volume. The most significant portion is released from agricultural soils. For the year 2005 it constituted over 86 %, and for the entire period (1988-2004) this share remains in the range of 83 – 88 %. The N_2O emissions from manure management and field burning of agricultural residues are one magnitude lower and they both total up to 13 – 14 % of the overall N_2O emissions from this sector.

As a general, the N_2O emissions in 2005, expressed in CO_2-eq., are about 43 % higher than the CH_4 emissions, expressed in CO_2-eq.

Land Use Change and Forestry

Due to the great diversity and complicity of CO_2 sequestration and emitting, in the Revised IPCC Guidelines are defined several categories:

– Changes in Forest and Other Woody Biomass Stocks;

– Forest and Grassland Conversion;

– Abandonment of Managed Lands;

– CO_2 Emissions and Removals from Soil;

– Other.

Figure ES.3

In the GHG Inventory for the year 2005, as well as for the previous years is estimated the net CO_2 removal from category Land Use Change and Forestry. CO_2 emissions or removal of CO_2 from rest of the above categories were determined in accordance to the new structure of the sector, which is proposed by the Good Practice Guidance in this sector.

The forests in Bulgaria are from the temperate zone. They are mainly two types of forests – broad-leaved and coniferous. The area of the forests in Bulgaria is around 30 % from the total territory of the country. The varied relief suggests the existence of huge forest areas at the mountain and hilly regions of Central and South Bulgaria.

The woody reserves of the Bulgarian forests is more than 530 millions m^3 with average annual growth of around 13-14 millions m^3. For the year 2005 the cut is in the range of 7.05 millions m^3.

Waste

The GHG emissions from the Waste sector result from the process of accumulation, disposal and management of solid wastes from the households and industry and industrial wastewater handling.

In 2005 too the emissions from solid waste disposal head the first place of methane sources in Bulgaria and the fifth place from all GHG emission sources in the country.

The trend analysis shows, that the CH_4 emissions from solid waste disposal have a stable trend of reduction and remain relatively stable during the last three years.

The CH_4 emissions from wastewater and sludge are significantly smaller and have a trend, which does not vary to such a degree as it is for the solid waste trend.

Others (CRF sector 7)

According to the IPCC classification, this sector is assigned to represent all the GHG emission sources, which for some reason can not be included in the sectors mentioned above.

There are no such specified sources in Bulgaria, which can be reported in this sector.

International Bunkers

GHG emissions from fuel combustion for international transportation are determined following the methodology proposed in IPCC Guidelines – Section Mobile Combustion of the Energy sector. During the preparation of the Bulgaria Inventory, the emissions from International bunkers are separated in two categories:

- GHG emissions from international marine;
- GHG emissions from international aviation.

The GHG emissions from international bunkers in the year 2005 are decreased with 52 % compared to the year 1988. The main reason for this difference is the liquidation of the navy for ocean fishing after the year 1999.

Trends of the GHG - Precursors and SOx

In the **Figure ES.4** are shown the variations of the trends of the emissions of GHG – precursors.

The emissions of GHG-precursors and SOx are reported only for Energy and Industrial Processes sectors in the Bulgarian inventories. In Solvent Use are released only emissions of NMVOCs. In the Field Burning of Agricultural Residues category of the Agricultural sector are emitted NOx and CO, which are also accounted.

Figure ES.4

The analyses of the **Figure ES.4** reveal slight variations within some years of the period when a certain increase compared to the previous was registered.

Summary of emission trend per source category and gas, Gg CO_2-eq.

Table ES.3

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1. All energy (combustion and fugitive)	**94,666**	**94,763**	**81,466**	**65,771**	**59,674**	**62,163**	**59,091**	**61,974**	**60,773**	**59,044**	**53,617**	**48,853**	**48,178**	**49,773**	**47,328**	**51,469**	**50,662**	**52,186**
1A. Energy: fuel combustion	91,396	91,459	79,257	63,824	57,666	60,150	57,121	59,869	58,698	57,188	51,751	47,233	46,384	48,014	45,603	49,752	48,867	50,451
CO_2:1. Energy industries	43,217	43,690	39,601	37,106	33,862	34,092	30,945	31,572	30,652	30,936	27,502	25,760	26,216	29,036	26,466	28,330	28,298	29,642
CO_2:2. Industry	24,755	25,215	21,821	14,758	12,093	13,296	15,032	18,023	17,499	17,691	14,217	12,283	11,868	10,788	10,198	11,533	10,818	10,421
CO_2:3. Transport	13,814	13,245	10,864	6,525	6,435	7,444	6,547	6,845	6,559	5,285	6,478	6,215	5,889	6,024	6,329	7,111	7,415	8,115
CO_2:4. Other sectors	8,940	8,639	5,381	4,086	4,610	4,117	3,325	2,621	3,238	2,678	2,989	2,491	1,896	1,638	2,074	2,206	1,758	1,700
CO_2:5. Other	NO	NO	1,006	882	196	733	810	315	261	112	49	NO	NO	NO	NO	NO	NO	NO
CH_4	162.18	167.60	145.39	107.63	109.26	108.62	111.58	122.41	120.49	113.68	152.67	152.15	171.94	163.31	186.82	188.34	196.33	190.76
N_2O	507.99	502.77	438.37	359.60	359.31	359.73	351.55	370.56	369.98	371.57	362.96	330.82	342.35	365.06	350.06	383.43	381.56	381.34
B. Fugitive fuel emissions	**3,271**	**3,304**	**2,209**	**1,947**	**2,007**	**2,013**	**1,970**	**2,106**	**2,074**	**1,857**	**1,866**	**1,620**	**1,794**	**1,759**	**1,725**	**1,717**	**1,795**	**1,735**
CH_4	3,271	3,304	2,209	1,947	2,007	2,013	1,970	2,106	2,074	1,857	1,866	1,620	1,794	1,759	1,725	1,717	1,795	1,735
N_2O	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Industrial Processes (ISIC)	**10,570**	**10,638**	**9,893**	**7,071**	**5,933**	**5,857**	**7,087**	**8,959**	**8,811**	**8,034**	**4,972**	**5,009**	**5,982**	**5,959**	**5,326**	**5,897**	**5,881**	**6,138**
CO_2	8,066	8,252	7,574	5,398	4,566	4,673	5,681	6,964	6,780	6,346	3,941	4,218	4,594	4,613	4,191	4,679	4,975	5,099
CH_4	81.66	81.75	63.46	46.44	43.97	51.35	67.50	73.92	68.64	73.67	63.31	58.17	73.81	50.90	46.08	58.54	47.67	46.33
N_2O	2,422	2,305	2,255	1,626	1,324	1,133	1,338	1,921	1,962	1,614	968	732	1,314	1,295	1,089	1,159	858	992
HFCs								62.16	109.30	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs																		
SF_6								1.26	1.31	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
3. Solvent and Other Product Use	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**
4. Agriculture	**14,559**	**13,778**	**12,953**	**10,529**	**8,525**	**7,150**	**6,591**	**5,935**	**5,696**	**5,591**	**5,309**	**5,666**	**5,394**	**4,541**	**4,859**	**4,833**	**5,081**	**4,804**
CH_4 Enteric fermentation	4,049	3,939	3,784	3,486	2,887	2,251	1,893	1,791	1,730	1,669	1,717	1,742	1,665	1,306	1,448	1,502	1,490	1,414
CH_4 Manure management	1,524	1,535	1,501	1,319	1,073	859	729	725	664	587	623	636	569	405	471	512	505	478
CH_4 Rice cultivation	119.25	115.38	89.56	69.38	38.27	26.38	6.99	11.67	22.04	32.09	33.86	11.98	30.20	32.96	44.25	47.73	48.20	39.61
CH_4 Field Burning of Agricultural Residues	46.35	55.78	46.25	48.74	34.06	27.84	29.43	30.69	16.93	28.12	24.96	27.36	24.15	27.32	31.55	19.01	33.80	27.10
N_2O Manure Management	1,056	1,057	1,030	921	760	606	510	496	461	422	452	467	429	321	368	395	390	369
N_2O Agricultural soils	7,750	7,057	6,488	4,668	3,722	3,372	3,415	2,872	2,797	2,845	2,452	2,773	2,671	2,442	2,488	2,352	2,604	2,468
N_2O Field Burning of Agricultural Residues	15.10	18.51	13.98	16.49	10.99	7.63	7.95	9.31	5.51	7.97	7.05	8.38	6.26	6.33	8.16	5.94	9.55	7.53
5. Land-Use Change and Forestry	**-5,133**	**-5,629**	**-6,157**	**-7,636**	**-7,412**	**-7,476**	**-7,302**	**-7,524**	**-6,517**	**-6,872**	**-6,860**	**-7,200**	**-8,976**	**-9,467**	**-8,318**	**-7,056**	**-7,965**	**-6,996**
CO_2	-5,133	-5,629	-6,157	-7,636	-7,412	-7,476	-7,302	-7,524	-6,517	-6,872	-6,860	-7,200	-8,976	-9,467	-8,318	-7,056	-7,965	-6,996
6. Waste	**12,817**	**12,644**	**12,300**	**11,700**	**11,327**	**10,824**	**10,390**	**10,230**	**9,708**	**9,053**	**8,422**	**7,912**	**7,536**	**7,127**	**6,865**	**7,441**	**7,255**	**6,475**
CO_2	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
CH_4	12,507	12,345	12,076	11,498	11,126	10,631	10,207	10,061	9,548	8,910	8,263	7,747	7,381	6,979	6,714	7,290	7,105	6,328
N_2O	310.49	298.59	223.66	201.68	201.27	192.26	182.59	168.88	160.79	143.16	159.77	164.45	155.57	148.29	150.55	151.14	149.94	147.08
7. Other (please specify)																		
NATIONAL TOTAL EMISSIONS	**132,613**	**131,823**	**116,611**	**95,070**	**85,459**	**85,994**	**83,159**	**87,102**	**85,099**	**81,912**	**72,900**	**67,544**	**67,188**	**67,499**	**64,470**	**69,764**	**69,100**	**69,995**
International bunker	**1,727**	**1,727**	**1,774**	**1,206**	**1,446**	**1,590**	**1,490**	**1,439**	**1,210**	**1,529**	**1,521**	**345**	**477**	**702**	**739**	**925**	**775**	**826**

P.4. Other Information

Differences with the National Inventory

In general, the results in line with the IPCC Methodology differ from the results of the National Inventory made according to the CORINAIR Methodology of the European Union. This mainly concerns the GHG emission- Precursors.

The reasons for the differences have methodological and structural character. There are certain differences in the size of the input data that are used for the calculation of the emissions from combustion and technological processes. In contrast to the CORINAIR methodology, the IPCC Methodology does not account CO_2 emissions from the biomass combustion because the net emissions from biomass are zero.

Uncertainty Assessment

The uncertainty assessment of the GHG Inventory is made following the methodology from the Good Practice Guidance.

The overall uncertainty of the GHG Inventory is becoming by combining the emission sources uncertainty and the emission factors uncertainty.

The overall uncertainty assessments for the 2005 Inventory, as well as the trend uncertainty in relation to the base year 1988 were made after the Tier 1 method.

The following data for determination of the uncertainties are used:

- Available normative statistical difference in the overall energy balance of the country;
- Examples of the assessments proposed by the Good Practice Guidance;
- Expert assessment of Bulgarian and Foreign specialists for the activities in Agriculture Sector, Waste Management, etc;

In **Table ES.4** are presented in percentages the calculated uncertainties of the overall national GHG emissions for the year 2005 and the overall emission trend uncertainty to the base year until the year 2005.

Uncertainty in total GHG emissions, %

Table ES.4

Uncertainty	Uncertainty NIR 2006	Uncertainty NIR 2007
Uncertainty in total GHG emissions	12.46	12.70
Overall uncertainty into the trend in total GHG emissions	3.208	3.47

The contribution of each emission source to the overall **level** uncertainty of the total emissions for the year 2005 provides a possibility for the sources to be set in order. In this manner, the emissions with the largest contribution can be defined. In **Table ES.5** are presented the first ten sources with the largest contribution.

Key sources with the maximum contribution to uncertainty of summary GHG emissions in 2005

Table ES.5

IPCC	IPCC sources	GHG	Uncertainty (p.u. of national summary GHG emissions in 2005)
6A	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	0.21
4D	Indirect N_2O Emissions from Agriculture Soils	N_2O	0.16
4D	Direct N_2O Emissions from Agriculture Soils	N_2O	0.10
1A1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	0.08
1B2	Fugitive Emissions from Coal Mining and Handling	CH_4	0.08
2B	N_2O Emissions from Nitric Acid Production	N_2O	0.07
4D	N_2O Emissions from Animal Production	N_2O	0.05
4B	N_2O Emissions from Manure Management	N_2O	0.04
4A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	0.03
1A2	N_2O Emissions from Stationary Combustion	N_2O	0.02
	TOTAL		**0.84**

In **Table ES.6** are presented the first ten sources with the largest contribution to the trend assessment uncertainty of the overall GHG emissions for the period 1988-2005.

Key sources with the maximum contribution to uncertainty of GHG emissions summary trend in 1988-2005

Table ES.6

IPCC	IPCC sources	GHG	Uncertainty (p.u. of the trend of total emissions for 1988-2005)
4D	Indirect N_2O Emissions from Agriculture Soils	N_2O	0.29
4D	Direct N_2O Emissions from Agriculture Soils	N_2O	0.16
1A1	CO_2 Emissions from Stationary Combustion- Energy Industries,Coal	CO_2	0.08
4D	N_2O Emissions from Animal Production	N_2O	0.07
2B	N_2O Emissions from Nitric Acid Production	N_2O	0.05
4B	N_2O Emissions from Manure Management	N_2O	0.05
1A2	CO_2 Emissions from Stationary Combustion – Oil	CO_2	0.04
2E	New gases	PFC, HFC, SF_6	0.04
4A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	0.03
6B	Emissions from Wastewater Handling	CH_4	0.03
	TOTAL		**0.85**

Total evaluation of the completeness of the inventory

In the GHG Inventory for the 2005 are included all the sectors given in Revised IPCC Guidance, 1996 with the exception of:

- CO_2 emissions from Solid Waste combustion;
- F-gases emissions from aerosol preparation use, fire-extinguishers, etc.;
- N_2O emissions from Solvent Use.

The emissions mentioned above exist, but there are no elaborated methodologies for their determination and for the quality collection of the input data.

Recalculations and Improvements

The GHG Inventory recalculation for the period 1988-2004 was carried out by assumptions and preconditions for each sector and source category and GHG sinks in compliance with the structure of Revised IPCC Guidelines, 1996. The changes can be generalized in the following groups:

A. Changes in the methodology of modelling the processes, activities and emission factors;

B. Changes in the structure of the fuel's data and GHG emitters activities;

- **Energy sector**:

  - Stationary processes of fuel combustion in Energy, Industry, Public sector, Household, Agriculture and Forestry;
  - Transport.
  - Fugitive emissions – from liquid fuels and natural gas.

- **Industrial Processes:**

  - Main GHG emissions and their precursors from technical processes in Industry (minerals, chemistry);
  - Emissions of F- gases – PFC, HFC and SF_6.

- **Waste**

  - Solid Waste disposal

In **Table ES.7** are presented the differences between the Inventories based on recalculations in the National Inventory Report 2004 (Submission 2006) and the current report (Submission 2007).

Differences between NIR 2007 and NIR 2006 for 1988-2004 due to recalculation, %

Table ES.7

Gas/Sector	Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Energy	*NIR-2007 versus NIR- 2006, %*																	
CO_2		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
CH_4		1.5		1.8	2.0	1.9	1.8	2.0	2.1	2.4	2.9	4.7	5.3	6.1	6.0	7.2	7.4	7.6
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.9	2.1	2.6	3.2	3.2	3.0
Indusstrial Prosseses																		
CO_2		6.5		14.6	17.7	17.0	18.8	23.3	29.7	29.5	27.9	9.3	5.7	6.5	5.4	4.0	1.1	3.2
CH_4		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solvent and Other Product Use																		
NMVOCs		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.3	0.0	0.0	0.0	0.0	0.0	0.0
Agriculture																		
CH_4		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4
Land-Use Change and Forestry																		
CO_2 sink		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste																		
CH_4		-1.2		10.7	21.9	23.2	28.1	30.3	32.8	39.2	58.0	69.4	63.4	53.1	49.1	44.3	33.9	23.0
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL without LUCF																		
CO_2-eq-without F-gases		0.3		1.9	3.2	3.4	3.7	4.4	5.0	5.3	6.1	6.2	5.2	4.6	4.1	3.8	3.0	2.4
CO_2-eq- total		0.2		1.9	3.1	3.3	3.7	4.3	4.9	5.2	6.1	6.1	5.1	4.6	4.1	3.8	3.0	2.4
CO_2		0.5		1.1	1.2	1.1	1.2	1.8	2.5	2.4	2.2	1.4	0.5	0.6	0.5	0.4	0.1	0.3
CH_4		-0.5		6.5	12.8	14.1	17.4	19.2	20.4	23.8	33.4	37.5	34.8	29.6	28.9	25.8	21.1	14.9
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.0

Recalculation of the Base Year 1988

In the preceding NIR 2006 the main admissions and requirements about preparing the inventory for the base year 1988 were described in detail.

In the current inventory, the base year 1988 was recalculated only on the basis of the changes, shown above.

Total GHG emissions

The total aggregated emissions of Bulgaria for the year 1988 are 132 612.57 Gg CO_2-eq. (not taking into account the CO_2 sequestration in forests). The difference in comparison with the preliminary assessment is growth by 0.02 %.

The share of CO_2 is 74.5 %, the share of CH_4 is 16.4 % and the N_2O – 9.1 % all expressed in CO_2–eq. from the overall emissions.

The allocation of the aggregated emissions through sectors (without LUCF) is as follows:

- Energy industries – 32.8 %;
- Industry – combustible processes - 18.7 %;
- Transport – 10.5 %;
- Households and services – 6.8 %;
- Industrial processes – 8 %;
- Agriculture – 11 %;
- Waste – 9.7 %.

CO_2 emissions

The largest ***CO_2 emission*** source is Energy sector – 90 726 Gg or 68.4 % of the overall GHG emissions in Bulgaria (not taking into account the sink from forests).

In sector Industrial Processes ***CO_2 emissions*** are increased with 6.5 % because of revalue GHG emissions from clinker and ammonia output.

CH_4 emissions

The overall ***CH_4 emissions*** are 1 036 Gg, which indicates a minimum decrease with 0.5 %, compared to the previous inventory. This decrease is mainly on the account of the emissions from solid waste.

N_2O emissions

The overall ***N_2O emissions*** are 38.9 Gg. This quantity has not changed compared to the previous inventory.

GHG inventory for 1989

In the present report are submitted the results from the GHG inventory for 1989. It is intermediate between the base year and 1990, which is a base year for the most countries in the world. A main difficulty for the later inclusion of 1989 in the time series is the lack of energy balance for it. NSI prepares energy balances from 1990. Because of this, an energy balance on the basis of available material balances had to be prepared.

The total GHG emissions in CO_2-eq. in 1989 are 131 940.7 Gg. This shows a decrease of 0.5 % compared to the base year. The allocation of the emissions by sectors is rather close to the one from 1988.

In all trend tables and in the analyses of the emission tables (by sectors and by gases) are included the concrete values for 1989. The results are consistent.

Recalculation of the GHG Inventories for the Period of 1990-2004

The change of the GHG emissions due to the recalculation is different in certain years. Only methane GHG is changes.

- CH_4- from 1.8 to 7.6 %;

Results form Revisions of GHG Inventories

The GHG Inventories in Bulgaria are object of check-ups and revisions by local and international teams.

Up to now the GHG Inventories of Bulgaria were object of the following international check-ups and revisions:

- Revision in country from international team of UNFCCC Secretariat – September 2003;
- Part for Bulgaria in the Synthetic Assessment Report of UNFCCC for the 1999-2001 Inventory;
- Desk Review for the 2002 Inventory, November 2004;
- Second Centralized review of Inventories for the year 2003 in Bonn, Germany, October 2005.

The results of these examinations indicated some omissions in inventories, which were removed. Some of them are as follows:

- Including the additional information in National Inventory Report;
- Comparison between the inventory data and the relevant data from international organizations.

In this report the recommendations and notes from the last inventory revision 2003 are shown, namely:

a. Concerning with more description in details of the fuels quantities and processes – sources of GHG emissions in the base year 1988;

b. Concerning applying of methods of type Tier 2 for assessment of emissions from waste management in depots;

c. creating a methodology for evaluation of the over-ground biomass in forests and CO_2 absorption by soils.

Planned Improvements

The general element of the planned improvements in the GHG inventories for Bulgaria is the National System for Assessment of Anthropogenic GHG Emissions. The development of this system started in 2005 with a project for preliminary investigation of the main principles, structures and rules for its setting-up.

After some delay connected with a revaluation of the necessary resources and structures of the system, at the end of 2006 was decided open tender under the Public Procurement Law procedure should be performed to select the developer of this system. It is expected that it will develop as an element of the system for monitoring of the emissions of air pollutants. In the latest years, this system works properly by coordination and management at a national level by Executive Environmental Agency.

CHAPTER 1. INTRODUCTION

The Republic of Bulgaria joined the UN Framework Convention on Climate Change (UNFCCC), which took part in Rio de Janeiro in 1992. The Parliament ratified the UNFCCC in March 1995.

As an Annex I Party to the Convention, Bulgaria is committed to conduct annual inventories on greenhouse gas (GHG) emissions by sources and removals by sinks, using the GHG inventory methodology, approved by the UNFCCC.

The inventories issuance started with the country base year – 1988. The first inventories covered the period 1988-1994 as a part of the international project "Country Study to Address Climate Change".

1.1. Background Information on GHG Inventories and Climate Change

This Report documents the annual GHG inventory in Bulgaria for 2005, which has been prepared in conformity with UNFCCC Guidelines, adopted at the 21^{-st} session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), on 06-14.12 2004 in Buenos Aires. The Guidelines set up the structure of National GHG Inventory Report, prepared in compliance with the Revised 1996 IPCC Guidelines, and the IPCC Good Practice Guidance for National GHG Inventories, 2000.

According to the UNFCCC Guidelines, the inventory should have features, which are also elements of the "good practice", and provide

- Transparency;
- Consistency;
- Comparability;
- Completeness;
- Accuracy.

In view of that, this Report presented also the GHG emission trends for the period 1988-2005. The following are described as well:

1. Methods and indices for uncertainty assessment of the annual GHG emissions and trends;
2. Key GHG emission sources according to methods of the type Tier 1 and Tier 2, specified in the Good Practice Guidance;
3. Assessment of the quality assurance and control system.

Tables with GHG data and emissions generated by the software of UNFCCC-CRF reporter, which automates the process of making and printing the CRF-tables for the Common Reporting Format (CRF) for reporting the annual inventories, are attached to the Report. These tables were completed for the whole period 1988-2005.

The full set of CRF Tables and the text of the National report as a PDF – file, have been uploaded on the web page of MoEW (www.moew.government.bg) and the Energy Institute (www.eninbg.com).

1.1.1. Greenhouse Gases and Climate Change: Global Warming Potential (GWP).

The main greenhouse gases to be reported pursuant to UNFCCC are as follows:

- Carbon dioxide - CO_2;
- Methane - CH_4;
- Nitrous oxide - N_2O;
- Hydrofluorocarbons – HFCs;
- Perfluorocarbons – PFCs;

- Sulphur hexafluoride - SF_6.

Each of these gases has a different warming effect. As an example, the gases HFCs, PFCs and SF_6 (so called F-gases) have much greater warming effect, in some cases over one hundred times, compared to methane, nitrous oxide and carbon dioxide.

Because of that, a common assessment criterion for the effect of each GHG on the atmosphere warming should be introduced. This criterion is the so-called Global Warming Potential (GWP), representing GHG emissions as CO_2-eq. emissions. It allows totalling the effect of all GHGs, adjusted to a common base.

For defining of GWP, the Parties to the Convention and Kyoto Protocol accept values, over a time horizon of 100 years, as mentioned in the IPCC Second Assessment Report of 1999.

Other gases have indirect warming effect to the atmosphere (as NOx, CO and NMVOCs), or cooling effect as SOx. These gases are precursors of the greenhouse gas – troposphere ozone, and are subject of regional control protocols. They do not have global effect on the climate changes as the main GHG. That is why in the National Inventory Report only the total GHGs emissions – precursors, as well as the total SOx emissions were reported.

1.1.2. UNFCCC and the Kyoto Protocol

The UN Framework Convention on Climate Change is proposed for signing by the world commonwealth at the World Summit in 1992 in Rio de Janeiro. Bulgaria participated in that international forum and joined the Convention.

The Parliament ratified the UNFCCC in March 1995.

The Convention set as an ultimate objective the stabilization of the atmospheric GHGs concentration at levels, not allowing dangerous anthropogenic effects on the climate system. These levels must be achieved for a period, allowing the ecosystems to adapt in a natural way to the climate change.

The Convention divided the Parties into two main groups: those, listed in Annex 1 (known as Annex I Parties), and those, not listed in this Annex I. The Annex I Parties amount to 41. These are the industrial countries of the world, members of the Organization for Economic Cooperation and Development (OECD), and the countries with economy in transition (Russia, Baltic countries, Ukraine and the Central and East European countries). Bulgaria is a part of the group of the East European countries with economy in transition.

The Kyoto Protocol (KP) is adopted at the III^{-rd} Session of the Conference of the Parties to the Convention in December 1997, in Kyoto, Japan. KP is ratified by Bulgaria on 15.08.2002. After Russia ratified the KP in November 2004, it entered into force on 16 February 2005.

With the KP, the Parties to the Convention took the commitment not only to stabilize the GHGs emissions, but also to reduce them by percentage, defined with respect to the base year of each Party. Bulgaria took the commitment to reduce the GHGs emissions from its base year, 1988, by 8 % for the first commitment period pursuant to the Protocol (2008-2012).

1.1.3. Requirements to the Reports: UNFCCC and IPCC

Annex I Parties to the Convention should report the annual GHG inventory, where should be included data for the GHG emissions of the base year and at least one year, preceding the current inventory.

Since 2000, the annual inventories were subject of technical checks. Further to the above mentioned, the Annex I Parties should submit also National Communications on Climate Change, where an overall picture of the activity on Climate change is given and measures and policies

regarding reduction of GHG emissions for a certain prognosticated period are indicated. Bulgaria submitted its IV-th National communication in August 2006.

UNFCCC

The UNFCCC Guidelines describes the GHG emission sources, the methods of their calculation and the content of the inventory reports. For obtaining, the results from GHGs emissions' calculations, the Revised 1996 IPCC Guidelines, the 2000 IPCC Good Practice Guidance and Good Practice Guidance for LULUCF, should be used in general.

The tables of the Common Reporting Format (CRF) and the National inventory report are the two main documents, which report the annual consecutive inventories to Secretariat to the Convention. The Parties are obliged to publish the inventories on a paper carrier or in e-format on an Internet web page.

IPCC

The IPCC methodology uses the concept of application of methods with a different complexity, describing the processes for estimating the input data, emission factors and GHG emissions. The complexity level of the method is indicated by Tier X, as the higher "X" is, the more complex the method is. For example:

- Tier 1 is the simplest method, requiring minimum data and no-complex processes models;
- Tier 2 is more complex and requires more input data and more complex models;
- Tier 3 is the most accurate method.

It is necessary to have a reasonable and balanced combination of the method accuracy with the type and accuracy of the results obtained, as well as with the capabilities of the Party to provide the relevant information data and resources. The regulation of this balance is covered by the Good Practice Guidance, which gives the ways for optimal combining of results' accuracy and the capabilities of those, who prepare the inventory. The leading concept of this combination is the rule for using methods that are more accurate for the key sources of GHG emissions, on a first place.

1.1.4. Differences with the National Inventory

UNFCCC uses certain definitions regarding the structure of the emissions, which have to be included in the total emissions of the country.

As a whole, the results obtained by the IPCC methods differ from the results of the National inventory, which is carried out in compliance with the method CORINAIR of EU. It concerns mostly the GHG emissions – precursors.

The reasons for that difference have both methodical and structural origin. There are also certain differences in the quantity of the input data, used for calculating the emissions of combustible and technological processes. Unlike the CORINAIR methodology, IPCC methodology does not take into account the CO_2 emissions from biomass combustion, because the net biomass emissions are zero. In the last several inventories, a process of decrease in these differences observes, mainly because of removal of differences in data and emission factors. It could be claimed that the differences have decreased more than twice, compared to Inventory 2000.

1.1.5. Organization of the National Inventory Report

The organization of the inventory report for Bulgaria, 2005, and the corresponding National report have been improved compared to the preceding National report, 2004, as follows:

- A new inventory of GHG for 1989 has been prepared. All the changes in the data and parameters, used in the current inventory for 2005, ware applied for it. The

specific characteristic of this new inventory has been analyzed. In sectors Energy, Industrial processes and Wastes ware made considerable changes of data, emission factors and methods, which ware introduced in p.10 - “Recalculations” of this report.

- Additional electronic tables have been prepared through the CRF reporter, for evaluation of the temporary series of input data, GHG emissions and analysis of the actual emission factors, which appear as a result of concrete calculations

1.2. A description of the Institutional Arrangement for Inventory Preparation

All activities on preparation of GHG inventories in Bulgaria are coordinated and managed on a state level by the Ministry of Environment and Water.

1.2.1. Data Sources for GHG Inventory

The Executive Environment Agency (EEA) is a subsidiary authority to the Ministry of Environment and Water. It coordinates all activities, related to collecting data on fuels and other sources of GHG emissions. EEA is the core body for collecting inventory data, aggregated on a national level by the following state authorities:

- National Statistical Institute (NSI);
- Road Control Department (RCD) within the Ministry of Internal Affairs;
- Statistics Department within Ministry of Agriculture and Forestry (MAF);
- Ministry of Economy and Energy;
- Ministry of Environment and Water;
- Forestry Department within MAF;
- Soil Resource Executive Agency within MAF;
- National Service for Plant Protection, Quarantine and Agro chemistry;
- Energy Efficiency Agency.

The NSI plays a special role in data collection system for the inventory. Data for energy and material balances of the country, as well as major part of the calculations on the national inventory under the CORINAIR methodology are prepared in NSI. All data, related to solid waste and waste water, is also collected there.

NSI uses up-to-date statistical methods and procedures for data summarizing and structuring, harmonized with the provisions and methods of EUROSTAT.

The GHG inventory used data, received directly from large GHG emissions sources in the energy sector and the industry. This data is summarized by EEA and the organization, preparing the inventory - Energy Institute (EI).

1.2.2. National Inventory Report and CRF Tables

MoEW is responsible to the Secretariat to the UNFCCC for the annual GHG inventory report. The Ministry, together with EEA, organizes preparation of the inventory. All activities, related to the calculations of GHG emissions, drawing up and structuring of the results and analyses in the National Inventory Report are assigned to an independent organization. The last one prepares the necessary materials, submits them for review by independent experts and reports to the High Expert Council of MoEW.

The Energy Institute (EI) – a private joint - stock company, implemented the present inventory. All the work is carried out on a contract base, in compliance with Law on Public Procurement Orders.

EI is a scientific and consulting organization with large experience in climate change research. Since 1988 to the present, the EI team has prepared all GHG inventories made under the IPCC methods. The same team has prepared the four National communications on climate change. Significant part of EI activities are related to GHG emissions analyses and forecast models and methods development, analysis and assessment of policies and measures on reduction of GHG emissions, as well as a scientific R & D, relevant to Kyoto mechanisms.

1.3. Brief Description of the Inventory Preparation Process

The GHG inventory represents a process, covering the following main activities:

- Collecting, processing and assessment of input data on used fuels,produced output, materials and other GHG emission sources;
- Selection and application of emission factors for estimating the emissions;
- Determination of the basic (key) GHG emission sources and assessment of the results uncertainty.

Each year during inventory, some changes occur that affect directly the activities above enlisted. Important inventory stage is the process of data transformation into a form, suitable for CRF Tables format. During this process, aggregation of the fuels by type is made (solid, liquid and gaseous), and further data is added, regarding parameters and indices, specifying the systems for transportation and distribution of oil and natural gas, the systems for fertilizer processing, etc. These activities are just a part of additional data, filled in the CRF Tables.

The organization and management of the inventory process in Bulgaria should be boosted and significantly improved after introducing the National assessment system of the GHG anthropogenic emissions. This system is at a stage of starting a procedure for assigning to a particular contractor according to the Public Procurement Act for selection of a contractor of preliminary research, which will start up to middle of 2006.

1.4. Brief General Description of Methodologies and Data Sources Used

The GHG inventory for the year 2005 was carried out in compliance with the 1996 Revised IPCC Guidelines, at closer abidance to the Good Practice Guidance recommendations.

The basic source for emission factors for current inventory was again the local practice, IPCC Revised Guidelines and the Good Practice Guidelines. Some data from the CORINAIR methodology is also used.

The specific Bulgarian circumstances for many activities were recognized, applying relevant parameters and emission factors. It concerned particularly the emission factors in the sectors Energy, Agriculture, some industrial processes and particularly the road transport. The transport data is obtained based on scientific and practical research, considering the specifics of the motor fleet in the country. Due to the significant changes of the motor fleet during the past 6-7 years, and as a result of the renovation trend, all emission factors have to be revised in the near future, in accordance with the adopted motor vehicles categories (cars, buses, trucks).

Table 1.1 shows the methods and the emission factors applied, according to the adopted designations in the IPCC methodology, as follows:

<u>Methods applied</u>

D – IPCC standard method;

T 1, 2, 3 – methods of the type Tier 1, 2, 3;

NO – such method/emission factor not available;

RA – reference method;

NE – no estimation available.

Emission factors applied

D – standard IPCC emission factor;

C – by CORINAIR;

CS – specific for the country.

CRF Summary table 3 with methods and emission factors applied

Table 1.1

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O	
	Method applied	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**
1. Energy	**T1,T2**	**CS,D**	**T1,T2**	**CS,D**	**T1,T2**	**CS,D**
A. Fuel Combustion	T1,T2	CS,D	T1,T2	CS,D	T1,T2	CS,D
1. Energy Industries	T2	CS	T2	CS	T2	D
2. Manufacturing Industries and Construction	T2	CS	T2	CS	T2	D
3. Transport	T1,T2	CS,D	T1,T2	CS,D	T1,T2	CS,D
4. Other Sectors	T2	CS	T2	CS	T2	D
5. Other	NA	NA	T1	D	T1	D
B. Fugitive Emissions from Fuels	NA	NA	T1	D	NA	NA
1. Solid Fuels	NA	NA	T1	D	NA	NA
2. Oil and Natural Gas	NA	NA	T1	D	NA	NA
2. Industrial Processes	**D,T1,T2**	**CS,D**	**D**	**CR,D**	**D**	**D**
A. Mineral Products	D,T1,T2	D	NA	NA	NA	NA
B. Chemical Industry	D,T1	CS,D	D	CR	D	D
C. Metal Production	D	CS	D	D	NA	NA
D. Other Production	NA	NA				
E. Production of Halocarbons and SF6						
F. Consumption of Halocarbons and SF6						
G. Other	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**NA**	**NA**			**NA**	**NA**
4. Agriculture			**D,T1,T2**	**CS,D**	**D**	**CS,D**
A. Enteric Fermentation			T1	D		
B. Manure Management			T1,T2	CS,D	D	D
C. Rice Cultivation			D	CS		
D. Agricultural Soils			NA	NA	D	D
E. Prescribed Burning of Savannas			NA	NA	NA	NA
F. Field Burning of Agricultural Residues			D	CS,D	D	CS,D
G. Other			NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**T1**	**CS**	**NA**	**NA**	**NA**	**NA**
A. Forest Land	T1	CS	NA	NA	NA	NA
B. Cropland	T1	CS	NA	NA	NA	NA
C. Grassland	T1	CS	NA	NA	NA	NA
D. Wetlands	NA	NA	NA	NA	NA	NA
E. Settlements	NA	NA	NA	NA	NA	NA
F. Other Land	NA	NA	NA	NA	NA	NA
G. Other	NA	NA	NA	NA	NA	NA
6. Waste						
A. Solid Waste Disposal on Land	NA	NA	T2	CS,D		
B. Waste-water Handling			D	CS,D	D	D
C. Waste Incineration	NA	NA	NA	NA	NA	NA
D. Other	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	**HFCs**		**PFCs**		**SF6**	
	Method applied	**Emission factor**	**Method applied**	**Emission factor**	**Method applied**	**Emission factor**
2. Industrial Processes	**NA**	**NA**	**NA**	**NA**	**D**	**D**
A. Mineral Products						
B. Chemical Industry					NA	NA
C. Metal Production	NA	NA	NA	NA	NA	NA
D. Other Production						
E. Production of Halocarbons and SF6	NA	NA	NA	NA	NA	NA
F. Consumption of Halocarbons and SF6	NA	NA	NA	NA	D	D
G. Other	NA	NA	NA	NA	NA	NA
7. Other (as specified in Summary 1.A)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Carbon Dioxide Emissions

The CO_2 emissions are derived by combustion of fuels in the energy sector, transport and households. Data from the energy balance of the country is used for their calculation, as the balance

summarizes on the national level the production, the input and the output, the distribution and the end consumption of the energy sources.

Parameters, specified in the Revised IPCC Guidelines, are used for estimation of the carbon stocks in the products, which is not CO_2 emission source, because of the lack of concrete data for the fuels, utilized in Bulgaria.

Because of the fact, that the combustion of solid waste is not spread in the country (for power production or for the purpose of liquidation), the corresponding CO_2 emissions are not reported.

Carbon Dioxide Sequestration

For the time being, Bulgaria reports on CO_2 sequestration from forestry only (category 5.A from sector Land-Use Change and Forestry). Data for C sequestration from forestry is based on:

- Area of forestry used;
- Average annual forest growth by species (in m^3/ha/year);
- Annual felling (in m^3/year).

Estimation of the average annual forest biomass growth is made based on data from forestry inventory, which is made each five years according to a methodology, approved by the forestry authorities. For estimation of the biomass dry content, a common conversion factor of 0.6 for both forestry types, coniferous and deciduous, is used.

There is an absorbing of CO_2 in the areas of agricultural crops, meadows and all roadside and village plantations. In the present inventory, the amassed quantities of carbon in these areas are reported in the new LULUCF common table format that is prepared for the first time in this inventory.

Methane

CH_4 emissions from fuel combustions are estimated by data from the energy balance and the emission factors, as methods of the type Tier 2 are applied.

CH_4 emissions from road transport are estimated with emission factors, specified for the various motor vehicle categories. The main restrictions in this case are the quantities of used fuels, indicated in the general energy balance of the country.

Fugitive CH_4 emissions from coal mining and the systems for extraction and distribution of oil and natural gas are estimated, as a rule, by standard emission factors, specified in IPCC Guidance. Complete revision of the emission factors was carried out with the present inventory, especially for the systems for distribution of oil and natural gas. The emission factors were replaced by data, indicated in Good Practice Guidance.

Methane emissions from agriculture are estimated by method of the type Tier 1, excluding the manure handling emissions of cattle's and swine, where method of the type Tier 2 is used.

Methane emissions from solid waste disposal sites are estimated by the Tier 2 method, specified in IPCC Guidance. Using of methods with higher accuracy became possible after NSI provided long enough historical series of values of the time series for disposed household solid waste.

In the last revision of the 2003 inventory, it is recommended that a method of the type Tier 2 be used. It is made for the first time in the current inventory and the inventories for all the years from the time series including the 1989 inventory.

Nitrous Oxide

N_2O emissions from fuel combustions are estimated by data from the general energy balance of the country and emission factors, specific for the country. The emissions from road transport are estimated based on the fuels used from the various motor vehicle categories, and specific emission factors, defined for each category. Those emission factors have been defined by experimental-analytic method for the period until 1995, and have not been changed since then.

N_2O emissions from chemicals output include the nitric acid production only. For the time being, there is no data available on emissions from utilization of solvents and for anaesthesia.

N_2O emissions from agriculture soils are estimated in full accordance with the IPCC methodology. These emissions include all necessary sources, such as synthetic and natural fertilizers, crop residues, animal waste from pastures and indirect emissions from release of ammonia and NOx in the atmosphere, as well as due to drainage (leaching) of underground water.

Consumed proteins are calculated based on the statistical data for the foodstuffs, consumed by humans. N_2O emissions are estimated on the proteins from the human waste, structured in sector Waste.

F- gases

There is no production of F- gases from the PFC, HFC and SF_6 groups in Bulgaria. Data on F- gases consumption is limited and allows just general assessments of the potential emissions of HFC and SF_6.

During the last years, large-scale inquiries were initiated for data collection regarding the available SF_6 quantities in the electrical equipment of the electric power system of the country. It resulted in reliable data for the fugitive SF_6 emissions during equipment operation for the period 1995 -2004.

Original Data Sources for the Inventory

The original data sources on GHG are as follows:

- data on used fuels: general energy balance of Bulgaria, prepared by NSI;
- data on consumed households biomass: MAF statistics and NSI energy balance;
- vehicles number, types and models – MIA – Department of the road control;
- Industrial output – companies' reports summarized in the material balances of NSI; independent companies' reports etc.
- SF_6 fugitive emissions: reports from the units of the Ministry of Economy and Energy (MEE); reports of factory power-plants to companies;
- number of farming animals and plant crops: "Agro statistics" Department within MAF;
- quantity of used synthetic fertilizers: National Service for Plant Protection, Quarantine and Agro chemistry within MAF;
- land-use change and forestry: National Forestry Administration within MAF;
- Disposal of solid waste and quantity of waste water: "Ecology" Department of NSI and "Waste" Department within MoEW.

Certain portion of the above-mentioned data is available on the web pages of NSI, MEE and MAF.

1.5. Brief Description of Key Categories

Determination of the basic (key) GHG emission sources was made on the IPCC/OECD methodology, included in Good Practice Guidance in the national GHG inventories, 2000.

The key source list is not changed in size, compared to the NIR 2006. One new key source was added: *CO_2 from ammonia production* and one source was get out- *N_2O emissions from animal production*.

Results of applying the method Tier 1 in its ***two varieties*** (quantitative assessment of the share in the overall emissions, and trend assessment for each source compared to the overall emission trend) are given on ***Annex 1*** of this report. There are 20 key sources by quantitative assessment and by trend assessment, of total 41 emissions sources, as for the two types of assessments they amount to 95 % of the total quantity of GHG emissions, expressed in CO_2-eq.

According to method of the type Tier 2, assessment of the key sources is made by identifying the uncertainty of each source. In this case “uncertainty" means the combined uncertainty of the assessment, which is a mean quadratic assessment of the uncertainty of the data (fuels, products, etc.) and of the emission factors.

Key sources assessment results, made by methods of the type Tier 1 and Tier 2 are presented in **Table 1.2.**

List of key source identified by IPCC Tier 1 and 2 level and trend assessments

Table 1.2

IPCC	*B*	*A*	*Key(L,T)*	*Tier 1*	*Tier 2*
	Gas	*Key source category*			
ENERGY SECTOR					
1A1	CO_2	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	Key(L,T)	L,T	L,T
1A3	CO_2	Mobile Combustion- road transportation	Key(L,T)	L,T	L,T
1A2	CO_2	CO_2 Emissions from Stationary Combustion- Manufacturing Industries, Coal	Key(L,T)	L,T	L
1A2	CO_2	CO_2 Emissions from Stationary Combustion – Gas	Key(L,T)	L,T	L
1A2	CO_2	CO_2 Emissions from Stationary Combustion – Oil	Key(L,T)	L,T	L,T
1A	CO_2	CO_2 Emissions from Stationary Combustion- Other Sectors, Coal	Key(L,T)	L,T	T
1B	CH_4	Fugitive Emissions from Coal Mining and Handling	Key(L,T)	L	L,T
1A3	CO_2	Mobile Combustion-other transportation	Key(L,T)	L,T	T
1B	CH_4	Fugitive Emissions from Oil and natural gas	Key(L)	L	L
1A1	N_2O	N_2O Emissions from Stationary Combustion	Key(L,T)	-	L,T
INDUSTRIAL PROCESES					
2A	CO_2	CO_2 Emissions from Cement Production	Key(L,T)	L,T	L,T
2A	CO_2	CO_2 from Lime Production	Key(L,T)	L,T	-
2B	CO_2	CO_2 Emissions from Ammonia Production	Key(L,T)	L,T	-
2C	CO_2	CO_2 Emissions from Steel Production	Key(L)	L	-
2B	N_2O	N_2O Emissions from Nitric Acid Production	Key(L,T)	L,T	L,T
2B	CO_2	CO_2 from non-energy use of fuels-gas	Key(L,T)	L,T	-
-		F-gases	Key(L,T)	T	L,T
AGRICULTURAL SECTOR					
4A	CH_4	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	Key(L,T)	L,T	L,T
4B	CH_4	CH_4 Emissions from Manure Management	Key(L,T)	T	L,T
4D	N_2O	Direct N_2O Emissions from Agriculture Soils	Key(L,T)	L,T	L,T
4D	N_2O	N_2O Emissions from Animal Production	Key(L,T)	T	L,T
4B	N_2O	N_2O Emissions from Manure Management	Key(L,T)	-	L,T
4D	N_2O	Indirect N_2O Emissions from Agriculture Soils	Key(L,T)	L,T	L,T
WASTE SECTOR					
6A	CH_4	CH_4 Emissions from Solid Waste Disposal Sites	Key(L)	L	L
6B	CH_4	Emissions from Wastewater Handling	Key(L,T)	L,T	L,T

The method of the type Tier 2 gives preponderance to sources with higher uncertainty. This results to a certain alteration of the results, as far as the proper classification of large GHG emitters is concerned, which have relatively low degree of uncertainty in their determination. (see ***Annex 1***).

As a result of applying the two approaches for assessment of key sources, a list of total 25 sources is formed, which take part in the key source assessment. Only 11 of all these are registered as key sources, included in all methods and kinds of assessment (by quantity and trend).

1.6. Information on the QA/QC Plan Including Verification and Treatment of Confidentiality Issues

Drawing up the GHG inventory is an aggregate of activities, subject of quality assessment and quality control.

The systems for quality assessment and quality control (QA/QC) are part of working procedures in the Bulgarian companies and organizations, and are subject of international quality control certification.

Issues on quality management of the following two stages of preparing the inventory will be discussed herein: preparation of initial data and calculation of the GHG emissions; and compiling of original CRF Tables and the National Inventory Report.

Quality Management of the Sources of Initial Data

Each organization – data source, solves the quality management issues in accordance with its internal rules and provisions. With some of the sources as NSI, MOI, etc., those rules follow strictly the international practices. For example, quality assessment/quality control procedures with NSI have been harmonized with the relevant instructions and provisions of EUROSTAT.

Some of the large enterprises – GHG emission sources, have well arranged and effective quality management systems. Most of them have introduced quality management systems based on ISO 9001:2000 standard.

Quality Management of the National Inventory Report and the CRF Tables

The final results of the inventory are reported in the National Inventory Report and the CRF Tables. These two documents are subject of control from the Quality Management System (QMS), which has been introduced in the Energy Institute. This system is certified on ISO 9001:2000 standard,.

The QMS contains all rules and procedures for management and control of the entire inventory process. Furthermore, specific checks are to be made at different stages, thus additionally verifying the data, received by the original sources.

Together with development of National monitoring system for air pollutants including GHG emissions would be assessed the anthropogenic GHG emissions (requirement of Art. 5 of the Kyoto Protocol). The development of the system will started in 2006.

1.7. General Uncertainty Evaluation

As a whole, the uncertainty assessment of the GHG inventories follows the methodology of Good Practice Guidance.

It is known that the overall uncertainty is closely related to the GHG emission sources data uncertainty (fuels, activities, processes, etc.) and to the emission factor uncertainty.

The uncertainty of the GHG ***emission sources*** can be defined during data collection and processing, and it is a part of procedures, applied by the statistical agencies and organizations. Different criteria for uncertainty assessment are used, for example as statistical subtraction, on basis on differences between the production, import, export and consumption of fuels, through expert assessments, etc.

The uncertainty of the ***emission factors*** depends on the origin of the factors applied. In case the emission factors result from direct periodical measurements, the uncertainty is determined by the relevant methodology, related to the measuring methods and apparatuses.

The overall uncertainty of the GHG inventory is determined by combining the emission sources uncertainty and the emission factors uncertainty.

Two rules are applied in this process:

- Rule A – combination of the uncertainties by summing;
- Rule B – combination of the uncertainties by multiplying.

Since the GHG inventories are sums of products of emission sources, multiplied by emission factors, the two rules above can be used for determining the overall uncertainty of the inventory.

Rules A and B represent the foundation of the Tier 1 method, recommended in the Good Practice Guidance.

The overall uncertainty assessments for the 2004 GHG inventory, as well as the trend uncertainty compared to the base year (1988), are made by the Tier 1 method.

The necessary uncertainties for all the emission sources (key and non-key) and emission factors are presented in **Table 1.3**.

Following data are used for assessment of uncertainties:

- the standard statistical subtraction, which is bound to the general energy balance of the country;
- exemplary assessments, proposed by the Good Practice Guidance;
- expert assessments of local and foreign experts on agriculture activities, waste management, etc.;
- reference data and information for inventories in the Netherlands, Slovakia, Canada, Austria, etc.

Calculations on the uncertainty of each emission source (key or non-key), are given in **Table 1.4.**

Uncertainty Calculation and Reporting (level assessment), %

Table 1.3

ID	IPCC source category	Gas	Activity data uncertainty	Emission factor uncertainty
1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	5	7
2	Mobile Combustion- road transportation	CO_2	3	5
3	CO_2 Emissions from Stationary Combustion- Manufacturing Industries, Coal	CO_2	5	7
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	5	5
5	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	20	100
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	5	5
7	CO_2 Emissions from Steel Production	CO_2	3	10
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	2	50
9	CO_2 Emissions from Cement Production	CO_2	3	30
10	CO_2 Emissions from Stationary Combustion- Other Sectors, Coal	CO_2	5	7
11	Emissions from Wastewater Handling	CH_4	30	80
12	Fugitive Emissions from Coal Mining and Handling	CH_4	10	200
13	Direct N_2O Emissions from Agriculture Soils	N_2O	3	250
14	CO_2 from Lime Production	CO_2	5	15
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	3	500
16	N_2O Emissions from Nitric Acid Production	N_2O	10	200
17	Mobile Combustion-other transportation	CO_2	5	5
18	Non-energy fuel use- gas	CO_2	5	5
19	Fugitive Emissions from Oil and Gas Operations	CH_4	5	50
20	N_2O Emissions from Animal Production	N_2O	3	250
21	CH_4 Emissions from Manure Management	CH_4	2	50
22	CO_2 from Ammonia Production	CO_2	5	20
23	N_2O Emissions from Manure Management	N_2O	2	300
24	N_2O Emissions from Stationary Combustion	N_2O	5	200
25	Emissions from Wastewater Handling	N_2O	30	100
26	CO_2 from Soda Ash Production	CO_2	5	20
27	CO_2 Emissions from Industrial Processes - others	CO_2	5	20
28	Mobile Combustion-Railways	CO_2	3	5
29	Non-energy fuel use- liquid	CO_2	5	5
30	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	5	20
31	Non-energy fuel use- solid	CO_2	5	20
32	CH_4 Emissions from Rice Production	CH_4	25	80
33	CH_4 Emissions from Industrial Processes - metal production	CH_4	5	20
34	Mobile Combustion-road transportation	N_2O	3	40
35	New gases	PFC, HFC	10	50
36	CH_4 Emissions from Stationary Combustion	CH_4	5	50
37	CH_4 Emissions from Agricultural Residue Burning	CH_4	25	50
38	Mobile Combustion-road transportation	CH_4	3	40
39	N_2O Emissions from Agricultural Residue Burning	N_2O	25	200
40	CO_2 Emissions from limestone and dolomite use	CO_2	5	15
41	Total others		5	20

The calculations for the uncertainty of every source of emissions (key source or not) are given in **Table 1.4.** Here combined uncertainty means the mean quadratic value of the uncertainties for every source and for every emission factor, given in **Table 1.3.**

Tier 1 Uncertainty Calculation and Reporting (level assessment), Gg CO_2-eq.

Table 1.4

No.	IPCC source category	Gas	1988 Gg CO_2-eq.	2005 Gg CO_2-eq.	Comb. uncertainty %	Combined uncertainty as % of total nat. emissions in 2005	Uncertainty into the trend in total nat. emissions, %
1	CO_2 Emissions from Stationary Combustion- Energy Industries,Coal	CO_2	31,318	26,083.7	8.6	3.2	1.5
2	Mobile Combustion- road transportation	CO_2	7,747	7,177.6	5.8	0.6	0.3
3	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	10,662	5,675.4	102.0	8.3	1.2
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	10,259	5,129.6	7.1	0.5	0.3
5	CO_2 Emissions from Stationary Combustion- Manufacturing Industries,Coal	CO_2	9,272	4,349.1	8.6	0.5	0.2
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	19,685	4,066.4	7.1	0.4	0.3
7	CO_2 Emissions from Cement Production	CO_2	2,006	1,551.8	30.1	0.7	0.1
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	4,049	1,414.1	50.0	1.0	0.3
9	CO_2 Emissions from Steel Production	CO_2	2,360	1,376.3	10.4	0.2	0.0
10	CO_2 Emissions from Stationary Combustion- Other Sectors,Coal	CO_2	4,953	1,190.3	8.6	0.1	0.1
11	Fugitive Emissions from Coal Mining and Handling	CH_4	1,992	1,106.7	200.2	3.2	0.1
12	Direct N_2O Emissions from Agriculture Soils	N_2O	3,273	1,076.4	250.0	3.8	1.2
13	CO_2 from Lime Production	CO_2	1,118	996.1	15.8	0.2	0.1
14	N_2O Emissions from Nitric Acid Production	N_2O	2,422	992.2	200.2	2.8	0.4
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	2,825	875.0	500.0	6.3	2.3
16	Non-energy fuel use- gas	CO_2	990	830.5	7.1	0.1	0.0
17	Mobile Combustion-other transportation	CO_2	3,998	723.9	7.1	0.1	0.1
18	Emissions from Wastewater Handling	CH_4	1,845	653.0	85.4	0.8	0.3
19	Fugitive Emissions from Oil and Gas Operations	CH_4	1,279	628.7	50.2	0.5	0.0
20	CO_2 from Ammonia Production	CO_2	1,652	596.9	20.6	0.2	0.1
21	N_2O Emissions from Animal Production	N_2O	1,524	517.0	250.0	1.8	0.5
22	CH_4 Emissions from Manure Management	CH_4	1,662	477.8	20.6	0.1	0.1
23	New gases	PFC, HFC, SF_6	0	391.3	104.4	0.6	0.3
24	N_2O Emissions from Manure Management	N_2O	1,056	369.4	300.0	1.6	0.4
25	CO_2 from Limestone and Dolomit use	CO_2	458	313.8	15.8	0.1	0.0
26	N_2O Emissions from Stationary Combustion	N_2O	396	308.8	200.1	0.9	0.2
27	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	85	192.1	20.6	0.1	0.0
28	Emissions from Wastewater Handling	N_2O	310	147.1	20.6	0.0	0.0
29	CO_2 from Soda Ash Production	CO_2	233	146.5	20.6	0.0	0.0
30	CH_4 Emissions from Stationary Combustion	CH_4	100	130.3	50.2	0.1	0.0
31	Mobile Combustion-Railways	CO_2	368	93.9	7.1	0.0	0.0
32	CO_2 Emissions from Industrial Processes - others	CO_2	27	91.6	5.8	0.0	0.0
33	Non-energy fuel use- liquid	CO_2	354	68.3	20.6	0.0	0.0
34	Mobile Combustion-road transportation	N_2O	48	56.9	51.0	0.0	0.0
35	Non-energy fuel use- solid	CO_2	80	45.7	83.8	0.1	0.0
36	CH_4 Emissions from Industrial Processes - metal production	CH_4	73	42.6	100.0	0.1	0.0
37	CH_4 Emissions from Rice Production	CH_4	119	39.6	20.6	0.0	0.0
38	Mobile Combustion-road transportation	CH_4	54	27.6	40.1	0.0	0.0
39	CH_4 Emissions from Agricultural Residue Burning	CH_4	46	27.1	55.9	0.0	0.0
40	N_2O Emissions from Agricultural Residue Burning	N_2O	15	7.5	201.6	0.0	0.0
41	Total others		1,898	6.1	20.6	0.0	0.2
	Overall uncerainty in the year					**12.697**	**3.469**

Results for every source are given in **Table 1.4.** as follows:

– combined uncertainty as a part of overall emissions for 2005;

It means that for every source has been calculated MCUi =(EMi/EM_{total})x CUi, where MCUi – measured combined uncertainty, EMi- source emissions for 2005, EM_{total} – total country emissions for 2005, CNi – combined uncertainty of the i-th source.

– uncertainty of the overall emissions trend for 2005;

It means that for every source has been calculated HTi – overall emissions trend uncertainty brought in by the i-th source. This uncertainty calculates in column M of Table 6.1 of p.6.3.2 of the Good Practice Guidance (GPG)

The calculated uncertainties, in %, of the overall national GHG emissions for the year 2005 (row 7, column H in Table 6.1 of the GPG), and the overall emission trend related to the base inventory year until 2005 (row 7, column M in Table 6.1.) are given in **Table 1.5**. The relevant data for the previous inventories for 2003 and 2004 are given for comparison (NDI 2005 and NDI 2006).

Uncertainty in total GHG emissions, %

Table 1.5

Uncertainty	Uncertainty NIR 2005	Uncertainty NIR 2006	Uncertainty NIR 2007
Uncertainty in total GHG emissions	13.00	12.46	12.70
Overall uncertainty into the trend in total GHG emissions	3.381	3.208	3.47

The contribution of each source to the general uncertainty of summary GHG emissions' **level** for 2004, allows to arrange the sources and to identify the highest contribution sources. This was made within the frames of Tier 2 from ***Annex 1***. The first ten sources with highest contribution are shown in **Table 1.6**.

Key sources with the maximum contribution to uncertainty of summary GHG emissions in 2005

Table 1.6

IPCC	IPCC sources	GHG	Uncertainty (part of national summary GHG emissions in 2005)
6A	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	0.21
4D	Indirect N_2O Emissions from Agriculture Soils	N_2O	0.16
4D	Direct N_2O Emissions from Agriculture Soils	N_2O	0.10
1A1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	0.08
1B2	Fugitive Emissions from Coal Mining and Handling	CH_4	0.08
2B	N_2O Emissions from Nitric Acid Production	N_2O	0.07
4D	N_2O Emissions from Animal Production	N_2O	0.05
4B	N_2O Emissions from Manure Management	N_2O	0.04
4A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	0.03
1A2	N_2O Emissions from Stationary Combustion	N_2O	0.02
	TOTAL		**0.84**

The first ten sources with highest contribution to the uncertainty of GHG summary trend emissions for the period 1988-2005, are shown in **Table 1.7**.

Key sources with the maximum contribution to uncertainty of GHG emissions summary trend in 1988-2005

Table 1.7

IPCC	IPCC sources	GHG	Uncertainty (part of the trend of total emissions for 1988-2005)
4D	Indirect N_2O Emissions from Agriculture Soils	N_2O	0.29
4D	Direct N_2O Emissions from Agriculture Soils	N_2O	0.16
1A1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	0.08
4D	N_2O Emissions from Animal Production	N_2O	0.07
2B	N_2O Emissions from Nitric Acid Production	N_2O	0.05
4B	N_2O Emissions from Manure Management	N_2O	0.05
1A2	CO_2 Emissions from Stationary Combustion – Oil	CO_2	0.04
2E	New gases	PFC, HFC, SF_6	0.04
4A	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	0.03
6B	Emissions from Wastewater Handling	CH_4	0.03
	TOTAL		**0.85**

Analysis of the above two tables showed that the highest contribution to the uncertainty of GHG summary emissions belongs to the sectors agriculture, waste and stationary combustion processes.

1.8. General Assessment of Inventory Completeness

GHG inventory for 2005 covered all sectors, included in IPCC Good Practice Guidance, 1996, excluding:

- F-gases emissions from utilization of aerosols, fire-extinguishers, etc.;
- N_2O emissions from utilization of solvents.

The above-mentioned emissions exist; however, there is no methodology for their determination and efficient input data collection developed.

Additional information about the inventory completeness is given in ***Annex 5.***

CHAPTER 2. OVERALL GHG EMISSION TRENDS

2.1. Aggregated GHG Emission Trends

GHG emission inventory for 2005 showed that the overall GHG emissions in CO_2–eq. amounted to 69 994.88 Gg, without reporting of sequestration from sector Land-Use Change and Forestry (LUCF). The net emissions (without reporting of sequestration from LUCF) were 62 998.84 Gg.

In **Table 2.1** are given emission trends of the main GHG, the summary emissions (without reporting of LUCF) and the overall emissions share of the emissions from the base year 1988, assumed as 100 %.

Analysis of **Table 2.1** shows, that in 2005, CO_2 emissions headed the list with the biggest share – 78.99 % of the overall GHG emissions, expressed in CO_2-eq., CH_4 emissions ranked the second place with 14.7 %, and N_2O emissions ranked the third place with 6.9 %. This distribution has undergone some changes compared to the base 1988, as it is shown in **Figure 2.1**.

Summary of emission trends per gas, Gg

Table 2.1

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2 with LUCF	93,659	93,411	80,089	61,119	54,351	56,879	55,038	58,815	58,471	56,177	48,315	43,768	41,487	42,632	40,939	46,804	45,298	47,982
CO_2 excluding LUCF	98,792	99,040	86,246	68,755	61,763	64,354	62,340	66,340	64,988	63,049	55,176	50,968	50,463	52,099	49,257	53,860	53,264	54,978
CH_4	21,759	21,544	19,915	18,522	17,319	15,969	15,015	14,921	14,244	13,269	12,743	11,995	11,708	10,723	10,668	11,335	11,222	10,260
N_2O	12,061	11,239	10,450	7,793	6,377	5,671	5,805	5,838	5,757	5,404	4,402	4,476	4,918	4,577	4,454	4,446	4,394	4,366
HFCs								2.95	109.30	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs								NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO
SF_6								1.26	1.31	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
Total	**132,613**	**131,823**	**116,611**	**95,070**	**85,459**	**85,994**	**83,159**	**87,102**	**85,099**	**81,912**	**72,900**	**67,544**	**67,188**	**67,499**	**64,470**	**69,764**	**69,100**	**69,994.88**
Index (1988 = 100)																		
Index CO_2 excluding LUCF	100	100.25	87.30	69.60	62.52	65.14	63.10	67.15	65.78	63.82	55.85	51.59	51.08	52.74	49.86	54.52	53.91	55.65
Index CH_4	100	99.01	91.52	85.12	79.59	73.39	69.00	68.57	65.46	60.98	58.57	55.13	53.81	49.28	49.03	52.09	51.57	47.15
Index N_2O	100	93.18	86.64	64.61	52.87	47.01	48.13	48.40	47.73	44.81	36.50	37.11	40.78	37.95	36.93	36.86	36.43	36.20
Index [group of six]	**100**	**99.40**	**87.93**	**71.69**	**64.44**	**64.85**	**62.71**	**65.68**	**64.17**	**61.77**	**54.97**	**50.93**	**50.67**	**50.90**	**48.62**	**52.61**	**52.11**	**52.78**
Index (1995 = 100)																		
Index HFCs								100	3,705	6,378	19,547	3,485	3,255	3,305	3,037	4,088	7,366	13,113
Index PFCs								NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO	NA,NE, NO
Index SF_6								100	104	139	145	149	177	181	199	200	292	350

Figure 2.1

Figure 2.2 shows the change in the overall emissions for the period 1988-2005.

Figure 2.2

It can be seen that in 2005, the total GHG emissions in CO_2-eq., indicated a little increase. 2005 emissions were 52.78 % from the emissions in the base year, 1988, and increase compared to the preceding 2004 by 0.67 %. Detailed GHG emission trends by types of gases and source categories are given in ***Annex 7***.

Table 2.2 shows the overall emissions by sectors for the period 1988-2005, in CO_2-eq. The quantities of CO_2, sequestrated by forestry, are also included.

Aggregated GHG emissions by sector, Gg, CO_2-eq.

Table 2.2

Sector/ year	1988	1989	1990	1991	1992	1993	1994	1995	1996
Energy	94,666.4	94,763.2	81,465.8	65,770.7	59,673.5	62,163.4	59,091.2	61,974.5	60,772.5
Industrial processes	10,569.8	10,638.0	9,892.5	7,070.6	5,933.3	5,856.8	7,086.9	8,958.8	8,811.3
Agriculture	14,559.0	13,778.4	12,953.2	10,528.8	8,524.8	7,150.1	6,591.2	5,935.3	5,696.1
Forestry	-5,132.6	-5,629.3	-6,157.0	-7,635.7	-7,412.0	-7,475.8	-7,301.7	-7,524.5	-6,517.5
Waste	12,817.4	12,643.6	12,299.5	11,699.8	11,327.2	10,823.6	10,390.0	10,229.6	9,708.4
Total (without LUCF)	132,613	131,823	116,611	95,070	85,459	85,994	83,159	87,098	84,988
Sector/ year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Energy	59,044.4	53,616.9	48,852.6	48,177.6	49,772.7	47,328.4	51,469.4	50,661.9	52,186.3
Industrial processes	8,034.4	4,972.4	5,008.8	5,982.1	5,959.1	5,325.5	5,897.4	5,880.6	6,137.8
Agriculture	5,590.8	5,309.4	5,666.1	5,394.1	4,540.7	4,859.3	4,832.7	5,081.0	4,804.0
Forestry	-6,871.5	-6,860.5	-7,199.8	-8,976.2	-9,467.1	-8,318.1	-7,056.0	-7,965.2	-6,996.0
Waste	9,052.8	8,422.5	7,911.6	7,536.3	7,127.1	6,865.0	7,441.2	7,255.4	6,475.4
Total (without LUCF)	81,722	72,321	67,439	67,090	67,400	64,378	69,641	68,879	69,604

Table 2.3 shows the shares in percentage of the overall GHG emissions by sectors for the period 1988-2005. This percent is calculated on the overall emissions, excluding CO_2 sequestration by forestry.

Sector contribution in aggregated emissions, %

Table 2.3

Sector/ year	1988	1989	1990	1991	1992	1993	1994	1995	1996
Energy	71.39	71.89	69.86	69.18	69.83	72.29	71.06	71.15	71.51
Industrial processes	7.97	8.07	8.48	7.44	6.94	6.81	8.52	10.29	10.37
Agriculture	10.98	10.45	11.11	11.07	9.98	8.31	7.93	6.81	6.70
Forestry	-3.87	-4.27	-5.28	-8.03	-8.67	-8.69	-8.78	-8.64	-7.67
Waste	9.67	9.59	10.55	12.31	13.25	12.59	12.49	11.74	11.42
Sector/ year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Energy	72.25	74.14	72.44	71.81	73.85	73.52	73.91	73.55	74.98
Industrial processes	9.83	6.88	7.43	8.92	8.84	8.27	8.47	8.54	8.82
Agriculture	6.84	7.34	8.40	8.04	6.74	7.55	6.94	7.38	6.90
Forestry	-8.41	-9.49	-10.68	-13.38	-14.05	-12.92	-10.13	-11.56	-10.05
Waste	11.08	11.65	11.73	11.23	10.57	10.66	10.69	10.53	9.30

Analysis of **Table 2.3** shows that sector Energy, where GHG emissions come from fuel combustion, headed the list in 2005 with the biggest share – 74.6 %. Sector Industrial processes ranked the second place with 9.33 % and sector Waste ranked the third place with 9.25 %.

Figure 2.3 shows the aggregated GHG emissions by sectors according to the IPCC classification.

Figure 2.3

The aggregated GHG emission trend's uncertainty, according to the method Tier 1, was 3.5 %. The level (quantity) uncertainty of the overall emissions was much larger and achieved about 12.7 %. The last thing indicates that reporting the emissions in the base 1988 leads to lowering the uncertainty parameters compared to the reporting of emissions of the current year.

2.2. GHG Emission Trends by Gas

Table 2.4 shows the **<u>CO_2 emission</u>** trends by IPCC sectors.

Reduction of the CO_2 overall emissions in 2005 compared to the base 1988 was 47.2 %. That reduction was conditioned mostly by the reduction in industry – 58 %, in transport - 41 %, and especially in households - 81 %. The lowest reduction was in the Energy sector - 31 %, due to the structure of the electrical production facilities, including the significant output of electrical power, produced in the Nuclear Power Plant – almost 11 % more than 2004.

Compare to previous 2004 year, CO_2 emissions in current year have a growth of 3.2 %. That means the liveliness trend in economy and energy efficiency are observed for a third year in a row.

Table 2.5 shows the **CH_4 emission** trends by IPCC sectors.

Reduction of the CH_4 overall emissions in 2005 compared to the base 1988 was 52.8 %. That reduction is conditioned mostly by the reduction in agriculture – 66 %, in fugitive emissions from coal mining and gas and oil systems - 47 %, and particularly in the solid waste - 47 %. The reduction in the wastewater treatment is essential - 65 %. The indicated reductions describe best the processes of changes and restructuring of the agricultural production.

Compared to the preceding 2004, a growth of CH_4 emissions can be seen in the current year, as follows: overall reduction of 8.4 %, 5.7 % reduction in agriculture and 11 % reduction in wastes.

CO_2 emissions and sinks per IPCC sector 1988- 2005, Gg

Table 2.4

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TOTAL NET NAT. EMISSIONS Incl. LUCF	**93,659**	**93,411**	**80,089**	**61,119**	**54,351**	**56,879**	**55,038**	**58,815**	**58,471**	**56,177**	**48,315**	**43,768**	**41,487**	**42,632**	**40,939**	**46,804**	**45,298**	**47,982**
TOTAL NET NAT. EMISSIONS Excl. LUCF	**98,792**	**99,040**	**86,246**	**68,755**	**61,763**	**64,354**	**62,340**	**66,340**	**64,988**	**63,049**	**55,176**	**50,968**	**50,463**	**52,099**	**49,257**	**53,860**	**53,264**	**54,978**
1. All energy (combustion and fugitive)	**90,726**	**90,789**	**78,673**	**63,357**	**57,197**	**59,682**	**56,658**	**59,376**	**58,208**	**56,703**	**51,235**	**46,750**	**45,869**	**47,486**	**45,066**	**49,180**	**48,289**	**49,879**
A. Fuel combustion total	90,726	90,789	78,673	63,357	57,197	59,682	56,658	59,376	58,208	56,703	51,235	46,750	45,869	47,486	45,066	49,180	48,289	49,879
1a Electricity and heat production	43,217	43,690	37,939	35,823	32,882	32,969	29,830	30,350	29,470	29,929	26,458	24,499	24,881	27,805	25,201	27,264	27,043	27,263
1bc Other transformation	NO	NO	1,662	1,283	981	1,122	1,115	1,222	1,181	1,007	1,044	1,262	1,334	1,231	1,265	1,066	1,254	2,380
2. Manufacturing Industries and Construction	24,755	25,215	21,821	14,758	12,093	13,296	15,032	18,023	17,499	17,691	14,217	12,283	11,868	10,788	10,198	11,533	10,818	10,421
3. Transport	13,814	13,245	10,864	6,525	6,435	7,444	6,547	6,845	6,559	5,285	6,478	6,215	5,889	6,024	6,329	7,111	7,415	8,115
4a Commercial/Institutional	1,068	773	172	124	107	114	96	64	114	46	288	503	330	574	388	287	200	224
4b Residential	6,654	6,609	4,787	3,633	4,354	3,890	2,962	2,456	3,095	2,632	2,544	1,795	1,362	884	1,511	1,741	1,354	1,241
4c Agriculture/Forestry/Fishing	1,219	1,256	422	330	149	114	267	102	28	0	157	194	204	180	174	178	204	235
5. Other	NO	NO	1,006	882	196	733	810	315	261	112	49	NO	NO	NO	NO	NO	NO	NO
B. Fugitive fuel emissions	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
1. Solid fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Crude oil and natural gas	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
2. Industrial Processes (ISIC)	**8,066**	**8,252**	**7,574**	**5,398**	**4,566**	**4,673**	**5,681**	**6,964**	**6,780**	**6,346**	**3,941**	**4,218**	**4,594**	**4,613**	**4,191**	**4,679**	**4,975**	**5,099**
3. Solvent and Other Product Use	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**	**NE,NO**
5. Land-Use Change and Forestry	**-5,133**	**-5,629**	**-6,157**	**-7,636**	**-7,412**	**-7,476**	**-7,302**	**-7,524**	**-6,517**	**-6,872**	**-6,860**	**-7,200**	**-8,976**	**-9,467**	**-8,318**	**-7,056**	**-7,965**	**-6,996**
6. Waste	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**
7. Other (please specify)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
International bunker	**1,718**	**1,719**	**1,766**	**1,198**	**1,438**	**1,583**	**1,483**	**1,432**	**1,204**	**1,520**	**1,512**	**345**	**475**	**699**	**735**	**921**	**772**	**822**
CO_2 Marine	969	987	874	878	873	844	850	882	732	1,092	1,022	26	205	306	336	436	366	349
CO_2 Aviation	749	892	892	320	565	739	632	549	472	428	490	319	270	393	399	485	405	473

CH_4 emissions per IPCC sector 1988- 2005, Gg

Table 2.5

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TOTAL NET NATIONAL EMISSIONS	**1,036**	**1,026**	**948**	**882**	**825**	**760**	**715**	**711**	**678**	**632**	**607**	**571**	**558**	**511**	**508**	**540**	**534**	**489**
1. All energy (combustion and fugitive)	**163**	**165**	**112**	**98**	**101**	**101**	**99**	**106**	**105**	**94**	**96**	**84**	**94**	**92**	**91**	**91**	**95**	**92**
A. Fuel combustion total	7.7	8.0	6.9	5.1	5.2	5.2	5.3	5.8	5.7	5.4	7.3	7.2	8.2	7.8	8.9	9.0	9.3	9.1
1. Energy	0.8	0.8	0.9	0.7	0.7	0.6	0.5	0.6	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.5
2. Industry	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2
3. Transport	3.0	3.1	2.9	1.4	1.7	1.9	1.9	2.0	1.7	1.3	1.4	1.5	1.4	1.3	1.4	1.4	1.3	1.4
4. Other sectors	1.7	1.6	1.1	0.8	1.0	0.9	1.0	1.3	1.6	1.6	3.5	3.5	4.7	4.4	5.3	5.6	5.8	5.5
4a Comercial/Institutional	0.3	1.2	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.1	0.2	0.1	0.2
4b Residential	1.2	1.2	1.0	0.7	0.9	0.8	0.9	1.3	1.5	1.6	3.1	3.1	4.4	4.3	5.1	5.3	5.6	5.3
4c Agriculture/Forestry/Fishing	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1
5. Other	1.7	1.9	1.6	1.8	1.6	1.5	1.6	1.6	1.6	1.7	1.5	1.6	1.4	1.4	1.6	1.3	1.6	1.5
B. Fugitive fuel emissions	155.7	157.3	105.2	92.7	95.6	95.9	93.8	100.3	98.8	88.4	88.9	77.1	85.4	83.7	82.2	81.8	85.5	82.6
1. Solid fuels	94.8	92.6	75.8	65.1	71.5	71.4	66.7	69.2	67.3	60.7	63.7	56.0	57.1	57.7	58.5	57.5	58.7	52.7
2. Crude oil and natural gas	60.9	64.8	29.4	27.6	24.1	24.5	27.1	31.1	31.4	27.7	25.1	21.1	28.3	26.0	23.7	24.2	26.8	29.9
2. Industrial Processes (ISIC)	**3.9**	**3.9**	**3.0**	**2.2**	**2.1**	**2.4**	**3.2**	**3.5**	**3.3**	**3.5**	**3.0**	**2.8**	**3.5**	**2.4**	**2.2**	**2.8**	**2.3**	**2.2**
3. Solvent and Other Product Use																		
4. Agriculture	**273.23**	**268.83**	**258.13**	**234.43**	**192.02**	**150.67**	**126.58**	**121.81**	**115.83**	**110.27**	**114.21**	**115.13**	**108.95**	**84.37**	**95.00**	**99.07**	**98.90**	**93.27**
A. Enteric Fermentation	192.8	187.6	180.2	166.0	137.5	107.2	90.1	85.3	82.4	79.5	81.8	83.0	79.3	62.2	69.0	71.5	70.9	67.3
B. Manure Management	72.6	73.1	71.5	62.8	51.1	40.9	34.7	34.5	31.6	27.9	29.6	30.3	27.1	19.3	22.4	24.4	24.1	22.8
C. Rice Cultivation	5.7	5.5	4.3	3.3	1.8	1.3	0.3	0.6	1.0	1.5	1.6	0.6	1.4	1.6	2.1	2.3	2.3	1.9
D. Agricultural Soils	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
F. Field Burning of Agricultural Residues	2.2	2.7	2.2	2.3	1.6	1.3	1.4	1.5	0.8	1.3	1.2	1.3	1.1	1.3	1.5	0.9	1.6	1.3
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land-Use Change and Forestry	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**	**IE,NE NO**
6. Waste	**595.57**	**587.86**	**575.04**	**547.53**	**529.81**	**506.25**	**486.07**	**479.08**	**454.65**	**424.27**	**393.46**	**368.91**	**351.46**	**332.32**	**319.74**	**347.15**	**338.35**	**301.35**
A. Solid Waste Disposal on Land	507.7	510.5	508.5	495.9	482.6	466.1	448.8	429.7	407.8	384.5	359.1	338.8	323.2	309.4	297.9	288.7	279.6	270.3
B. Wastewater Handling	87.9	77.4	66.5	51.7	47.3	40.1	37.3	49.3	46.9	39.8	34.3	30.1	28.3	22.9	21.8	58.5	58.7	31.1
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other (please specify)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Table 2.6 shows the N_2O emission trends by IPCC sectors.

The overall N_2O emission reduction in 2005, compared to the base 1988, was 63.7 %. That reduction is conditioned mostly by the reduction in the industrial processes - 59 %, and particularly in the agriculture – 67.7 %. The indicated reductions describe best the processes of fertilizers and manure handling, and the reduction of plant crops.

Compared to the preceding 2004, a reduction of N_2O emissions can be seen in the current year as follows: overall reduction of 0.7 %, same level in energy sector, 14.3 % growth in industrial processes, and 5.1 % reduction in agriculture. Main factor for the reduction in the agriculture is the reduced yields of plant crops.

The growth in the Industrial sector is due to the increased output of nitric acid during the current year.

N_2O emissions per IPCC sector 1988- 2005, Gg

Table 2.6

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TOTAL NET NATIONAL EMISSIONS	**38.91**	**36.25**	**33.71**	**25.14**	**20.57**	**18.29**	**18.73**	**18.83**	**18.57**	**17.43**	**14.20**	**14.44**	**15.87**	**14.77**	**14.37**	**14.34**	**14.17**	**14.08**
1. All energy (combustion and fugitive)	**1.64**	**1.62**	**1.41**	**1.16**	**1.16**	**1.16**	**1.13**	**1.20**	**1.19**	**1.20**	**1.17**	**1.07**	**1.10**	**1.18**	**1.13**	**1.24**	**1.23**	**1.23**
A. Fuel combustion total	1.64	1.62	1.41	1.16	1.16	1.16	1.13	1.20	1.19	1.20	1.17	1.07	1.10	1.18	1.13	1.24	1.23	1.23
1a Electricity and heat production	0.97	1.00	0.80	0.79	0.81	0.80	0.79	0.83	0.82	0.85	0.80	0.72	0.75	0.83	0.74	0.82	0.81	0.79
1bc Other transformation	NO	NO	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2. Industry	0.14	0.13	0.21	0.09	0.08	0.08	0.10	0.11	0.11	0.13	0.09	0.07	0.07	0.07	0.07	0.08	0.07	0.06
3. Transport	0.33	0.31	0.25	0.15	0.14	0.17	0.14	0.14	0.14	0.12	0.13	0.13	0.13	0.14	0.15	0.17	0.18	0.20
4. Other Sectors	0.16	0.15	0.10	0.07	0.08	0.07	0.06	0.06	0.08	0.07	0.11	0.10	0.12	0.11	0.13	0.14	0.14	0.13
5. Other	0.03	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B. Fugitive fuel emissions	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
1. Solid fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Crude oil and natural gas	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
2. Industrial Processes (ISIC)	**7.81**	**7.43**	**7.28**	**5.25**	**4.27**	**3.65**	**4.32**	**6.20**	**6.33**	**5.21**	**3.12**	**2.36**	**4.24**	**4.18**	**3.51**	**3.74**	**2.77**	**3.20**
3. Solvent and Other Product Use	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**
4. Agriculture	**28.46**	**26.24**	**24.30**	**18.08**	**14.49**	**12.86**	**12.69**	**10.89**	**10.53**	**10.56**	**9.39**	**10.48**	**10.02**	**8.93**	**9.24**	**8.88**	**9.69**	**9.18**
A. Enteric Fermentation																		
B. Manure Management	3.41	3.41	3.32	2.97	2.45	1.96	1.64	1.60	1.49	1.36	1.46	1.51	1.38	1.03	1.19	1.27	1.26	1.19
C. Rice Cultivation																		
D. Agricultural Soils	25.00	22.77	20.93	15.06	12.01	10.88	11.02	9.27	9.02	9.18	7.91	8.95	8.61	7.88	8.03	7.59	8.40	7.96
E. Prescribed Burning of Savannas																		
F. Field Burning of Agricultural Residues	0.05	0.06	0.05	0.05	0.04	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.02
G. Other																		
5. Land-Use Change and Forestry	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**	**NE**
6. Waste	**1.00**	**0.96**	**0.72**	**0.65**	**0.65**	**0.62**	**0.59**	**0.54**	**0.52**	**0.46**	**0.52**	**0.53**	**0.50**	**0.48**	**0.49**	**0.49**	**0.48**	**0.47**
7. Other																		

Table 2.7 shows the actual emissions **of F-gases.**

In 2005 there is almost no change of the overall F-gases emissions, compared to the base 1995. In contrast to the previous inventories, current emissions of PFCs are not included, because there is not production of primary aluminum in the country. There is casting of aluminum products, which is classified as production of secondary aluminum.

Actual emissions of HFCs, PFCs, SF_6- Gg CO_2-eq.

Table 2.7

New gases,Gg	1988	1989	1990	1991	1992	1993	1994	1995	1996
HFCs- total								2.95	
PFCs-total									
SF_6-use									
Total HFCs/PFCs/SF_6								2.95	
HFCs- potential								62.16	109.3
PFCs-potential									
SF6-potential									
New gases,Gg	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
HFCs- total									
PFCs-total									
SF_6-use	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
Total HFCs/PFCs/SF_6	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
HFCs- potential	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs-potential									
SF6-potential				29.4	2.39	2.39	6.36		0.956

2.3. GHG Emission Trends by Source Categories

Table 2.8 shows the GHG aggregated emission trends by IPCC sectors. Obviously, sector Energy had the biggest contribution to the overall emissions, expressed in CO_2-eq. Sector Industrial processes (especially after 2000) and sectors Waste and Agriculture followed it.

Energy

A steady trend towards emission reduction in this sector has been observed since 1988. The highest reduction was in the public sector (including households) - 81 %, industry - 58 %, and transport - 41 %, and the lowest in the power engineering - 31 %.

Compared to the preceding 2004, a growth of emissions of all categories in the energy sector can be seen in 2005, except for industry and fugitive emissions from coal production, petrol and gas. Chapter 3 of this Report contains a more detailed analysis of GHG emissions in the sector.

Industrial Processes

A steady trend towards emission reduction in this sector is observed since 1988. The highest reduction was with N_2O - 59 %, CH_4 – 43.9 % and with CO_2 it was 36.8 %. The reporting of the

potential emissions of HFCs in the new gases leads to an increase compared to the base year for them 1995 with more than five times.

Compared to the preceding 2004, a growth of 4.4 % of the overall emissions of the sector can be seen in 2005. This growth is due to the increase of emissions of CO_2 because of the changed emission factor in ammonia production. Chapter 4 of this Report contains a more detailed analysis of GHG emissions in the sector.

Agriculture

The overall emission reduction in the sector has amounted to 67 % since 1988. Emissions of all categories in this sector reduced at the rate of the same percent.

Compared to 2004, a reduction of emissions in the sector can be seen in 2005 by 5.5 %. It breaks the trend of stable annual growth after 2000. Chapter 6 of this Report contains a more detailed analysis of GHG emissions in the sector.

Land-Use Change and Forestry

In this sector for the first time Bulgaria reports emissions of carbon absorbing from the agricultural soil, pastures and meadows and the forest soil are reported. These emissions are calculated by means of developed new method for inventory of the GHG emissions from this sector.

The annual CO_2 sequestration was about 7 - 9 million tones for the period after 1988. Chapter 7 of this Report contains a more detailed analysis of GHG emissions in the sector.

Waste

The total sector emission reduction from the base year until now was 49.5 %. This reduction described best the emission reduction from solid waste, which was about 58 %.

During the current year, the wastewater emissions from the sector ware reduced by 10.7 %. It is due to the change of the method from Tier 1 to Tier. Chapter 8 of this Report contains a more detailed analysis of GHG emissions in the sector.

International Bunkering

International bunkering emissions of marine and air transport are reported separately from the overall emissions of the country. Compared to the base year, their reduction was by 52 %.

2.4. Emissions Trends of GHG-Precursors and SOx

Table 2.9 shows the GHG-precursors aggregated emission trends. As a whole, the emissions from all gases decreased in the period after the base 1988.

Summary of emission trend per source category and gas, Gg CO_2-eq.

Table 2.8

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1. All energy (combustion and fugitive)	**94,666**	**94,763**	**81,466**	**65,771**	**59,674**	**62,163**	**59,091**	**61,974**	**60,773**	**59,044**	**53,617**	**48,853**	**48,178**	**49,773**	**47,328**	**51,469**	**50,662**	**52,186**
1A. Energy: fuel combustion	91,396	91,459	79,257	63,824	57,666	60,150	57,121	59,869	58,698	57,188	51,751	47,233	46,384	48,014	45,603	49,752	48,867	50,451
CO_2:1. Energy industries	43,217	43,690	39,601	37,106	33,862	34,092	30,945	31,572	30,652	30,936	27,502	25,760	26,216	29,036	26,466	28,330	28,298	29,642
CO_2:2. Industry	24,755	25,215	21,821	14,758	12,093	13,296	15,032	18,023	17,499	17,691	14,217	12,283	11,868	10,788	10,198	11,533	10,818	10,421
CO_2:3. Transport	13,814	13,245	10,864	6,525	6,435	7,444	6,547	6,845	6,559	5,285	6,478	6,215	5,889	6,024	6,329	7,111	7,415	8,115
CO_2:4. Other sectors	8,940	8,639	5,381	4,086	4,610	4,117	3,325	2,621	3,238	2,678	2,989	2,491	1,896	1,638	2,074	2,206	1,758	1,700
CO_2:5. Other	NO	NO	1,006	882	196	733	810	315	261	112	49	NO	NO	NO	NO	NO	NO	NO
CH_4	162.18	167.60	145.39	107.63	109.26	108.62	111.58	122.41	120.49	113.68	152.67	152.15	171.94	163.31	186.82	188.34	196.33	190.76
N_2O	507.99	502.77	438.37	359.60	359.31	359.73	351.55	370.56	369.98	371.57	362.96	330.82	342.35	365.06	350.06	383.43	381.56	381.34
B. Fugitive fuel emissions	**3,271**	**3,304**	**2,209**	**1,947**	**2,007**	**2,013**	**1,970**	**2,106**	**2,074**	**1,857**	**1,866**	**1,620**	**1,794**	**1,759**	**1,725**	**1,717**	**1,795**	**1,735**
CH_4	3,271	3,304	2,209	1,947	2,007	2,013	1,970	2,106	2,074	1,857	1,866	1,620	1,794	1,759	1,725	1,717	1,795	1,735
N_2O	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Industrial Processes (ISIC)	**10,570**	**10,638**	**9,893**	**7,071**	**5,933**	**5,857**	**7,087**	**8,959**	**8,811**	**8,034**	**4,972**	**5,009**	**5,982**	**5,959**	**5,326**	**5,897**	**5,881**	**6,138**
CO_2	8,066	8,252	7,574	5,398	4,566	4,673	5,681	6,964	6,780	6,346	3,941	4,218	4,594	4,613	4,191	4,679	4,975	5,099
CH_4	81.66	81.75	63.46	46.44	43.97	51.35	67.50	73.92	68.64	73.67	63.31	58.17	73.81	50.90	46.08	58.54	47.67	46.33
N_2O	2,422	2,305	2,255	1,626	1,324	1,133	1,338	1,921	1,962	1,614	968	732	1,314	1,295	1,089	1,159	858	992
HFCs								62.16	109.30	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs																		
SF_6								1.26	1.31	1.75	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42
3. Solvent and Other Product Use	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**	**NA,NE NO**
4. Agriculture	**14,559**	**13,778**	**12,953**	**10,529**	**8,525**	**7,150**	**6,591**	**5,935**	**5,696**	**5,591**	**5,309**	**5,666**	**5,394**	**4,541**	**4,859**	**4,833**	**5,081**	**4,804**
CH_4 Enteric fermentation	4,049	3,939	3,784	3,486	2,887	2,251	1,893	1,791	1,730	1,669	1,717	1,742	1,665	1,306	1,448	1,502	1,490	1,414
CH_4 Manure management	1,524	1,535	1,501	1,319	1,073	859	729	725	664	587	623	636	569	405	471	512	505	478
CH_4 Rice cultivation	119.25	115.38	89.56	69.38	38.27	26.38	6.99	11.67	22.04	32.09	33.86	11.98	30.20	32.96	44.25	47.73	48.20	39.61
CH_4 Field Burning of Agricultural Residues	46.35	55.78	46.25	48.74	34.06	27.84	29.43	30.69	16.93	28.12	24.96	27.36	24.15	27.32	31.55	19.01	33.80	27.10
N_2O Manure Management	1,056	1,057	1,030	921	760	606	510	496	461	422	452	467	429	321	368	395	390	369
N_2O Agricultural soils	7,750	7,057	6,488	4,668	3,722	3,372	3,415	2,872	2,797	2,845	2,452	2,773	2,671	2,442	2,488	2,352	2,604	2,468
N_2O Field Burning of Agricultural Residues	15.10	18.51	13.98	16.49	10.99	7.63	7.95	9.31	5.51	7.97	7.05	8.38	6.26	6.33	8.16	5.94	9.55	7.53
5. Land-Use Change and Forestry	**-5,133**	**-5,629**	**-6,157**	**-7,636**	**-7,412**	**-7,476**	**-7,302**	**-7,524**	**-6,517**	**-6,872**	**-6,860**	**-7,200**	**-8,976**	**-9,467**	**-8,318**	**-7,056**	**-7,965**	**-6,996**
CO_2	-5,133	-5,629	-6,157	-7,636	-7,412	-7,476	-7,302	-7,524	-6,517	-6,872	-6,860	-7,200	-8,976	-9,467	-8,318	-7,056	-7,965	-6,996
6. Waste	**12,817**	**12,644**	**12,300**	**11,700**	**11,327**	**10,824**	**10,390**	**10,230**	**9,708**	**9,053**	**8,422**	**7,912**	**7,536**	**7,127**	**6,865**	**7,441**	**7,255**	**6,475**
CO_2	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
CH_4	12,507	12,345	12,076	11,498	11,126	10,631	10,207	10,061	9,548	8,910	8,263	7,747	7,381	6,979	6,714	7,290	7,105	6,328
N_2O	310.49	298.59	223.66	201.68	201.27	192.26	182.59	168.88	160.79	143.16	159.77	164.45	155.57	148.29	150.55	151.14	149.94	147.08
7. Other (please specify)																		
NATIONAL TOTAL EMISSIONS	**132,613**	**131,823**	**116,611**	**95,070**	**85,459**	**85,994**	**83,159**	**87,102**	**85,099**	**81,912**	**72,900**	**67,544**	**67,188**	**67,499**	**64,470**	**69,764**	**69,100**	**69,995**
International bunker	**1,727**	**1,727**	**1,774**	**1,206**	**1,446**	**1,590**	**1,490**	**1,439**	**1,210**	**1,529**	**1,521**	**345**	**477**	**702**	**739**	**925**	**775**	**826**

Trend in emissions of ozone and aerosol precursors, 1988-2004, Gg

Table 2.9

Compound	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Emissions in Gg																		
Total NOx	284.87	283.44	242.26	179.36	161.96	165.34	146.12	151.45	144.89	140.62	135.75	123.40	127.77	137.60	134.41	146.63	136.79	149.57
Total CO	884.51	916.74	789.67	571.62	609.05	634.05	607.55	644.37	609.81	531.04	640.93	618.00	634.83	583.00	677.93	654.03	673.83	646.20
Total NMVOC	128.99	127.12	117.48	76.92	78.53	86.37	86.67	94.45	87.00	72.47	87.50	78.29	78.90	81.80	87.41	85.63	95.53	102.83
Total SOx	1,781	1,800	1,517	1,313	1,291	1,279	1,262	1,300	1,311	1,311	1,192	1,056	1,045	1,096	983	1,043	998	957
Index (1988 = 100)																		
Idex total NOx	100	99	85	63	57	58	51	53	51	49	48	43	45	48	47	51	48	53
Idex total CO	100	104	89	65	69	72	69	73	69	60	72	70	72	66	77	74	76	73
Idex total NMVOC	100	99	91	60	61	67	67	73	67	56	68	61	61	63	68	66	74	80
Idex total SOx	100	101	85	74	72	72	71	73	74	74	67	59	59	62	55	59	56	54

Figure 2.4 shows changes of GHG-precursors emission trends.

Figure 2.4

Analysis of **Figure 2.4** shows a trend towards stable emissions in the period after 1999.The biggest are the fluctuations in SOx emissions, where desulphurisation plant have significant influence.

NOx Emissions

Overall NOx emissions for the country in 2005 were 149.6 Gg. Compared to 2004, an increase of the emissions by 9.3 % could be seen.

Sector Energy was a main source of NOx emissions in Bulgaria. It emitted 93 % of the overall NOx emissions in 2005. The main part of emissions in this sector came from sub-sectors Energy industries and Transport – over 80 % of the emissions in the sector in total.

CO Emissions

Overall CO emissions for the country in 2005 were 646.2 Gg. Compared to 2004, a reduction by 4.1 % could be seen.

Sector Energy was a main source of CO emissions in Bulgaria, and it emitted 95 % of the overall emissions in the country, including 45 % from the Public sub-sector. The emissions from this sector are bigger than sub-sector Transport because of the increase of the emission factor from household biomass combustion. In the last inventory this factor was corrected in conformity with the IPCC data, which brought to increase of the emissions almost seven times more than NIR 2006

Sector Agriculture covers 4.2 % from the total CO emissions in Bulgaria. They are 20 % less than the level in 2004 because of the more unfavorable climate conditions in food and other crop production.

NMVOCs Emissions

The NMVOC emitters for Bulgaria were sectors: Energy, Industrial processes and Solvent use.

Overall emissions for the country in 2005 were 102.8 Gg. The emissions' increase, compared to 2004, was 7.6 %.

Sector Energy was a main source of NMVOC emissions in Bulgaria, and it emitted 57.8 Gg in 2005. This is 56.2 % of the overall NMVOC emissions in the country. Almost 2/3 of them come from sub-sector Transport.

Sector Solvent use was the second largest NMVOC emission source in Bulgaria, with 29.5 % of the overall emissions in the country.

SO_x Emissions

The SO_x emitters for Bulgaria were sectors: Energy and Industrial processes.

Overall emissions in 2005 were 956.58 Gg. The emissions' drop, compared to 2004, was 4.1 %.

Sector Energy was a main source of SO_x emissions in Bulgaria. It emitted over 97 % of the overall SO_x emissions in 2005. The main part of emissions in this sector came from sub-sector Energy industries – 819 Gg in 2005.

The second largest SO_x emission source was sub-sector Manufacturing industries and construction, with 7.2 %, and on third place – sector Other sectors, with 3.8 %.

CHAPTER 3. ENERGY

3.1. General Description

In accordance to the IPCC classification, the Energy sector comprises of emissions resulting from end-use fuel combustion as well as fugitive emissions from extraction, transmission and distribution of solid, liquid and gaseous fuels are also included in this sector.

Combustion processes' emissions are divided to the following sub-sectors according to the IPCC structure:

- Energy industries;
- Manufacturing industries and construction;
- Transport;
- Other sectors (Services, Households, Agriculture and Forestry);
- Other.

The *fugitive* emissions are:

- coal mining;
- extraction, transportation and distribution of petrol products and natural gas.

The Energy sector in Bulgaria holds a key position in the national economy. It was the source of over 74 % of the aggregated GHG emissions for the last inventory 2005.

Table 3.1 shows CO_2 emission trends of the above sub-sectors for the period 1988-2005.

The analysis of **Table 3.1** shows that the *Energy industries* kept the largest share - over 45 % of the overall emissions in this sector. It was the only sector, where an increase of the relative share compared to the base 1988, can be observed – from 45.6 % up to 56.7 % in 2005. For all other sectors this share decreased: *manufacturing industries* from 26 down to 20 %, *transport* from 14.6 up to 15.5 %, and especially in the *public sector and households* – from 9.4 down to 3.2 %. The last figure can be assumed as a positive result from the reduced direct fuel combustion in the households, which led to an overall GHG emission and air pollutants' reduction.

The emissions growth in the energy industries, compared to the preceding year, can be observed only in *energy and transport*.

The trend of *Transport sector* shows increase with 9.4 % in 2005 compared to the previous year. Despite the fluctuations resulted from variations of liquid fuel prices, and from restructuring and renovation of the vehicles after 2000 as well, there is a stable tendency for growth of emissions.

The overall trend in sub-sector *Other sectors* (Services, Households, Agriculture and Forestry) displayed fluctuations as well.

CO_2 emissions from biomass combustion are not taken into account because these were not included in the net GHG overall emissions.

Emissions from Sector Energy are assessed by data from the National energy balance of the country. This balance summarized all balances of companies and other large GHG sources at national level. The methodology of GHG emission calculation is presented in ***Annex 2*** to this Report.

CO_2 emissions from non-energy use of fuels are reported in this sector and not in sector Industrial Process because they belong exactly to this sector.

The fugitive emissions from coal mining, from extraction, transmission and distribution of petrol products and natural gas are also part of this sector.

The coal mining in Bulgaria is concentrated mainly in Maritza Iztok Mines, where lignite is mined in surface mines. These mines produce about 40 % of the electrical power in the country. Brown and black coal mining has significantly less share.

Extraction of petrol products and natural gas in the country reported for less that 1 % of the overall consumption. Due to its geographic location, a significant natural gas transits run across Bulgaria. They were about 3 times larger than the overall consumption of the country and lead to the corresponding increase of methane fugitive emissions.

Trends in greenhouse gas emissions from Energy sector, Gg CO_2-eq.

Table 3.1

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1. All energy (combustion and fugitive)	**94,666**	**94,763**	**81,466**	**65,771**	**59,674**	**62,163**	**59,091**	**61,974**	**60,773**	**59,044**	**53,617**	**48,853**	**48,178**	**49,773**	**47,328**	**51,469**	**50,662**	**52,186**
1A. Energy: fuel combustion	91,396	91,459	79,257	63,824	57,666	60,150	57,121	59,869	58,698	57,188	51,751	47,233	46,384	48,014	45,603	49,752	48,867	50,451
CO_2:1. Energy industries	43,217	43,690	39,601	37,106	33,862	34,092	30,945	31,572	30,652	30,936	27,502	25,760	26,216	29,036	26,466	28,330	28,298	29,642
CO_2:2. Industry	24,755	25,215	21,821	14,758	12,093	13,296	15,032	18,023	17,499	17,691	14,217	12,283	11,868	10,788	10,198	11,533	10,818	10,421
CO_2:3. Transport	13,814	13,245	10,864	6,525	6,435	7,444	6,547	6,845	6,559	5,285	6,478	6,215	5,889	6,024	6,329	7,111	7,415	8,115
CO_2:4. Other sectors	8,940	8,639	5,381	4,086	4,610	4,117	3,325	2,621	3,238	2,678	2,989	2,491	1,896	1,638	2,074	2,206	1,758	1,700
CO_2:5. Other	NO	NO	1,006	882	196	733	810	315	261	112	49	NO	NO	NO	NO	NO	NO	NO
CH_4	162	168	145	108	109	109	112	122	120	114	153	152	172	163	187	188	196	191
N_2O	508	503	438	360	359	360	352	371	370	372	363	331	342	365	350	383	382	381
1B2. Fugitive fuel emissions	**3,271**	**3,304**	**2,209**	**1,947**	**2,007**	**2,013**	**1,970**	**2,106**	**2,074**	**1,857**	**1,866**	**1,620**	**1,794**	**1,759**	**1,725**	**1,717**	**1,795**	**1,735**
CH_4	3,271	3,304	2,209	1,947	2,007	2,013	1,970	2,106	2,074	1,857	1,866	1,620	1,794	1,759	1,725	1,717	1,795	1,735
N_2O	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE

Key Sources

Table 3.2 shows the basic (key) and non-key GHG sources in sector Energy.

Key sources in Energy sector (Methods Tier 1 and Tier 2)

Table 3.2

IN	IPCC Source category	Key sources
1	CO_2 Emissions from Stationary Combustion- Energy Industries,Coal	Yes
2	CO_2 Emissions from Stationary Combustion- Manufacturing Industries,Coal	Yes
3	CO_2 Emissions from Stationary Combustion – Gas	Yes
4	CO_2 Emissions from Stationary Combustion – Oil	Yes
5	N_2O Emissions from Stationary Combustion	Yes
6	CO_2 Emissions from Stationary Combustion- Other Sectors,Coal	Yes
7	CH_4 Emissions from Stationary Combustion	No
8	CO_2 Emissions from Non-energy fuel use- gas	Yes
9	CO_2 Emissions from Non-energy fuel use- oil	No
10	CO_2 Emissions from Non-energy fuel use- solid	No
11	CO_2 Emissions from Mobile Combustion- road transportation	Yes
12	CO_2 Emissions from Mobile Combustion-other transportation	Yes
13	CH_4 Emissions from Mobile Combustion- road transportation	No
14	CO_2 Emissions from Mobile Combustion- Railways	No
15	N_2O Emissions from Mobile Combustion- road transportation	No
16	Fugitive Emissions from Coal Mining and Handling	Yes
17	Fugitive Emissions from Oil and Gas Operations	Yes

CO_2 Emissions from Biomass

The biomass fuels in Bulgaria have been used mainly in the public sector, households and the agriculture, for the purposes of heat production, hot water and cooking. Biomass means firewood, wood processing waste, and waste biomass from forestry.

Table 3.3 shows CO_2 emissions at biomass combustion in the different sector categories.

Analysis of **Table 3.3** displayed a steady trend of biomass consumption growth since 1988 to the present. CO_2 emissions increased 2-3 times in 2005 compared to 1988. This growth was realized mainly in households, which held the largest share, namely 71 % from the overall CO_2 emissions from biomass in 2005. The household emissions share is doubled compared to the base 1988.

3.2. Fuel Combustion

CO_2 emissions are calculated following the two methods, given below:

- "Top - down" (Reference approach) which deals with the apparent fuel consumption, taking into account the carbon flows into and of the country and stock changes;
- "Bottom - up" (Sectoral approach) which deals with the fuel consumption by sectors, sources and technology types that emit GHG.

Fuel combustion emissions are given in **Table 3.4.** The reduction trend of main GHG emissions was kept until 2000. Then emission fluctuations can be seen, with trend towards growth. CO_2 emissions in 2005 are reduced by 45 %, compared to 1988. The corresponding reduction of CH_4 emissions was 43.9 %, and of N_2O emissions by 25 %.

The uncertainty assessment of GHG emissions from fuel combustion is on the basis of the uncertainties of fuel quantities and the emission factors for stationary and mobile combustion

processes. These uncertainties are estimated at about 6-9 % for CO_2 emissions, 50-100 % for CH_4 emissions and 100-200 % for N_2O emissions.

Electrical power and heat production had the biggest share of CO_2 emissions from fuel combustion – 59.3 %. *Manufacturing industries* ranked the second place by 21 %, followed by transport – 16 %.

CH_4 and N_2O emissions were considerably lower than CO_2 emissions, as their overall share in the total emissions (in CO_2-eq.) from fuel combustion was less than5 %.

The Energy balance of the country contains all primary and secondary fuels, used for energy needs and for non-energy consumption.

The help of conversion factors made fuel conversion from natural units into energy units, specific for the country. Database for the annual GHG inventory included both natural and energy units, by means of which the current conversion factors were determined. These factors are elements of the input data control system. The GHG emissions are calculated by the following base equation according to sectoral approach:

$$\textit{Emissions} = \sum(EF_{abc} * Source_{abc}),$$

where:
EF – emission factor [kg/TJ]
Source = Energy flow [TJ]
a – fuel type
b – sector type (sub-sector or group)
c – technology type

Organic CO_2 emissions (Gg) reported as "CO_2 from biomass" (from CRF 1A combustion)

Table 3.3

	1988	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
A. Fuel Combustion	**1,344**	**1,437**	**1,152**	**1,129**	**1,120**	**1,014**	**1,120**	**1,246**	**1,373**	**1,434**	**2,199**	**2,209**	**2,705**	**2,638**	**3,108**	**3,131**	**3,391**	**3,146**
1.A.1 Energy Industries	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1.A.2 Manufacturing Industries and Construction	54.66	52.39	56.02	36.55	42.93	21.55	25.47	26.56	22.95	17.28	95.05	100.48	118.44	177.28	191.74	241.62	259.64	190.46
1A.3 Transport	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.A.4 Other Sectors	572.44	567.99	413.02	323.64	408.93	360.83	422.77	555.64	667.98	684.74	1,444	1,442	1,984	1,873	2,244	2,348	2,435	2,331
a Commercial/Institutional	68.48	65.06	17.01	13.48	15.02	10.56	11.55	11.43	5.67	7.83	94.23	51.39	36.54	33.12	30.06	48.78	33.75	51.03
b Residential	467.91	467.57	365.32	290.23	367.95	346.73	397.36	540.85	662.31	676.91	1,346	1,349	1,893	1,834	2,205	2,288	2,388	2,260
c Agriculture/Forestry/Fishing	36.04	35.36	30.69	19.93	25.95	3.54	13.85	3.36	0.00	0.00	3.78	42.48	54.99	5.85	9.09	11.88	12.78	19.98
1.A.5 Other	716.84	816.76	683.06	769.02	667.66	631.39	671.31	663.92	681.71	731.69	660.27	666.11	602.49	588.31	672.17	541.14	696.55	625.02

Emissions and sinks for Energy sector 1988-2005, Gg

Table 3.4

IPCC Sector	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CO_2																		
1. All energy (combustion and fugitive)	**90,726**	**90,789**	**78,673**	**63,357**	**57,197**	**59,682**	**56,658**	**59,376**	**58,208**	**56,703**	**51,235**	**46,750**	**45,869**	**47,486**	**45,066**	**49,180**	**48,289**	**49,879**
A. Fuel combustion total	90,726	90,789	78,673	63,357	57,197	59,682	56,658	59,376	58,208	56,703	51,235	46,750	45,869	47,486	45,066	49,180	48,289	49,879
1. Energy	43,217	43,690	39,601	37,106	33,862	34,092	30,945	31,572	30,652	30,936	27,502	25,760	26,216	29,036	26,466	28,330	28,298	29,642
2. Industry	24,755	25,215	21,821	14,758	12,093	13,296	15,032	18,023	17,499	17,691	14,217	12,283	11,868	10,788	10,198	11,533	10,818	10,421
3. Transport	13,814	13,245	10,864	6,525	6,435	7,444	6,547	6,845	6,559	5,285	6,478	6,215	5,889	6,024	6,329	7,111	7,415	8,115
4a Comercial/Institutional	1,068	773	172	124	107	114	96	64	114	46	288	503	330	574	388	287	200	224
4b Residential	6,654	6,609	4,787	3,633	4,354	3,890	2,962	2,456	3,095	2,632	2,544	1,795	1,362	884	1,511	1,741	1,354	1,241
4c Agriculture/Forestry/Fishing	1,219	1,256	422	330	149	114	267	102	28	0	157	194	204	180	174	178	204	235
5. Other	NO	NO	1,006	882	196	733	810	315	261	112	49	NO	NO	NO	NO	NO	NO	NO
B. Fugitive fuel emissions	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO	NA,NE NO
CH_4																		
1. All energy (combustion and fugitive)	**163.5**	**165.3**	**112.1**	**97.8**	**100.8**	**101.0**	**99.1**	**106.1**	**104.5**	**93.8**	**96.1**	**84.4**	**93.6**	**91.5**	**91.0**	**90.7**	**94.8**	**91.7**
A. Fuel combustion total	7.7	8.0	6.9	5.1	5.2	5.2	5.3	5.8	5.7	5.4	7.3	7.2	8.2	7.8	8.9	9.0	9.3	9.1
1. Energy	0.8	0.8	0.9	0.7	0.7	0.6	0.5	0.6	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.4	0.5
2. Industry	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
3. Transport	3.0	3.1	2.9	1.4	1.7	1.9	1.9	2.0	1.7	1.3	1.4	1.5	1.4	1.3	1.4	1.4	1.3	1.4
4. Other sectors	1.7	1.6	1.1	0.8	1.0	0.9	1.0	1.3	1.6	1.6	3.5	3.5	4.7	4.4	5.3	5.6	5.8	5.5
4a Comercial/Institutional	0.3	0.3	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.4	0.2	0.2	0.1	0.1	0.2	0.1	0.2
4b Residential	1.2	1.2	1.0	0.7	0.9	0.8	0.9	1.3	1.5	1.6	3.1	3.1	4.4	4.3	5.1	5.3	5.6	5.3
4c Agriculture/Forestry/Fishing	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1
5. Other	1.7	1.9	1.6	1.8	1.6	1.5	1.6	1.6	1.6	1.7	1.5	1.6	1.4	1.4	1.6	1.3	1.6	1.5
B. Fugitive fuel emissions	155.7	157.3	105.2	92.7	95.6	95.9	93.8	100.3	98.8	88.4	88.9	77.1	85.4	83.7	82.2	81.8	85.5	82.6
1. Solid fuels	94.8	92.6	75.8	65.1	71.5	71.4	66.7	69.2	67.3	60.7	63.7	56.0	57.1	57.7	58.5	57.5	58.7	52.7
2. Crude oil and natural gas	60.9	64.8	29.4	27.6	24.1	24.5	27.1	31.1	31.4	27.7	25.1	21.1	28.3	26.0	23.7	24.2	26.8	29.9
N_2O																		
1. All energy (combustion and fugitive)	**1.64**	**1.62**	**1.41**	**1.16**	**1.16**	**1.16**	**1.13**	**1.20**	**1.19**	**1.20**	**1.17**	**1.07**	**1.10**	**1.18**	**1.13**	**1.24**	**1.23**	**1.23**
A. Fuel combustion total	1.64	1.62	1.41	1.16	1.16	1.16	1.13	1.20	1.19	1.20	1.17	1.07	1.10	1.18	1.13	1.24	1.23	1.23
1. Energy	0.97	1.00	0.80	0.79	0.82	0.80	0.79	0.84	0.83	0.85	0.80	0.73	0.76	0.83	0.75	0.82	0.81	0.80
2. Industry	0.14	0.13	0.21	0.09	0.08	0.08	0.10	0.11	0.11	0.13	0.09	0.07	0.07	0.07	0.07	0.08	0.07	0.06
3. Transport	0.33	0.31	0.25	0.15	0.14	0.17	0.14	0.14	0.14	0.12	0.13	0.13	0.13	0.14	0.15	0.17	0.18	0.20
4. Other Sectors	0.16	0.15	0.10	0.07	0.08	0.07	0.06	0.06	0.08	0.07	0.11	0.10	0.12	0.11	0.13	0.14	0.14	0.13
5. Other	0.03	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
B. Fugitive fuel emissions	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE

3.2.1. Energy Industries

Description of Source Categories

Sub-sector Energy industries included the groups:

- Public Electricity and Heat Production;
- Petroleum Refining;
- Solid fuels Production and Other Energy Industries.

The aggregation level for sub-sector Energy industries was the fuel type and the power plant type – only for electricity production, co-generation and for heat production. Based on data, specific for the country, as well as data from IPCC Guidance, summary emission factors were determined for the main GHG - CO_2, CH_4 and N_2O, for the GHG-precursors - CO, NO_x and NMVOC, and for the SOx. At the end of 2002, desulphurization facilities in TPP Maritza Iztok 2 started to operate, thus reducing the SOx emissions. **Table 3.5** shows the GHG emissions from sub-sector Energy industries.

The stationary combustion processes in the Energy industries (power engineering, petroleum refineries, solid fuels production and other energy industries) with **coal** were the largest GHG emission source in Bulgaria. This source emitted 26 084 Gg of CO_2 in 2005, which represented 37.3 % of the total GHG emissions, expressed in CO_2-eq.

Methodology

This emission source included the main power facilities in Bulgaria, combusting domestic low-caloric lignite, with high sulphur and ash content. CO_2 emissions were estimated by a method of the type Tier 2, using the data from the energy balance of the country. National emission factors were used for the main GHGs, obtained by measurement and analytical calculations for power plants in the complex Maritza Iztok, where domestic lignite is combusted. These emission factors are aggregated to fuel type and power plant type – electricity power plants, co-generation plants, auto-generator plants and heat plants. Using a method of the type Tier 2 meets the requirements of Good Practice Guidance because this source is included in the key source list – see **Table 3.2**.

The CO_2 emissions in 2005 are the same as in 2003. It was due to a stable structure of the power units after stopping of the two units in NPP Kozloduy, increased energy efficiency in industry and household and due to energy market conditions in the region. Indicator for that was the fact that the gross electricity consumption in the country increased by 3.8 %, and the export went up by 29 % - **Table 3.6.**

GHG emissions from the energy industries (1A1), Gg

Table 3.5

Gas/subsourse	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
a Public Electricity and Heat Production	43,217	43,690	37,939	35,823	32,882	32,969	29,830	30,350	29,470	29,929	26,458	24,499	24,881	27,805	25,201	27,264	27,043	27,263
b. Petroleum Refining	NO	NO	355.90	362.04	58.44	59.06	47.93	50.66	50.63	50.67	0.00	141.81	48.06	51.52	48.40	42.14	52.53	48.73
c. Manufacture of Solid Fuels and Other Energy Industries	NO	NO	1,306	921	922	1,063	1,067	1,171	1,131	957	1,044	1,120	1,286	1,179	1,217	1,024	1,202	2,331
CH_4																		
a Public Electricity and Heat Production	0.84	0.81	0.87	0.71	0.63	0.56	0.50	0.53	0.49	0.49	0.42	0.39	0.39	0.43	0.39	0.42	0.41	0.41
b. Petroleum Refining	NO	NO	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Manufacture of Solid Fuels and Other Energy Industries	NO	NO	0.04	0.03	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.04
N_2O																		
a Public Electricity and Heat Production	0.97	1.00	0.80	0.79	0.81	0.80	0.79	0.83	0.82	0.85	0.80	0.72	0.75	0.83	0.74	0.82	0.81	0.79
b. Petroleum Refining	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Manufacture of Solid Fuels and Other Energy Industries	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Gross production, import, export and gross consumption of electricity, millions kWh

Table 3.6

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Gross Production	**45,021**	**44,328**	**42,121**	**38,834**	**35,546**	**37,901**	**38,318**	**42,001**	**42,801**	**42,828**	**41,711**	**38,265**	**40,927**	**43,968**	**42,732**	**42,546**	**41,620**	**44,249**	**45,807**
Fossil fuel, non CHP	19,973	20,700	19,899	17,898	17,271	17,303	16,762	17,675	17,060	17,457	16,964	15,115	15,781	18,468	15,960	17,624	15,517	14,876	15,819
Nuclear	16,030	14,565	14,665	13,184	11,552	13,896	15,334	17,261	18,082	17,751	16,899	15,814	18,178	19,553	20,222	17,278	16,815	18,653	19,493
CHP and other	6,422	6,371	5,705	5,311	4,660	4,760	4,713	4,558	4,676	4,692	4,533	4,357	4,010	3,781	3,810	4,350	5,925	3,818	3,736
Hydro	2,596	2,691	1,852	2,441	2,063	1,941	1,509	2,506	2,984	2,928	3,315	2,979	2,958	2,166	2,741	3,294	3,363	4,761	4,620
Import	4,450	4,937	5,387	3,083	3,289	1,634	1,173	1,961	1,803	785	564	1,670	964	1,092	2,040	1,283	742	799	1,139
Export	304	548	1,597	959	584	1,518	1,245	2,121	2,252	4,335	4,211	3,627	5,584	8,017	8,335	6,772	6,620	8,380	8,882
Gross domestic use	**49,167**	**48,716**	**45,911**	**40,958**	**38,252**	**38,017**	**38,246**	**41,841**	**42,352**	**39,278**	**38,064**	**36,309**	**36,307**	**37,043**	**36,437**	**37,057**	**35,742**	**36,668**	**38,064**

Uncertainty and Consistency of Time Series

The uncertainty of this source category was 9 %.

The analysis of time series indicated a permanent reduction trend until 1998. In the next period emission increase started mainly due to the increased export and stopping of the two 440 MW units in NPP Kozloduy. Export increase revealed a great dynamics. In 1997 it doubled, compared to the preceding years. In 2001 export doubled again, thus reaching in natural units up to 8 335 GWh in 2002. After some decrease by about 20 % in 2003 and 2004, in the end of 2005 the level of 2002 is achieved again.

The fuels used by this emission source, taken from the energy balance, are aggregated by physical condition – solid, liquid and gaseous, for the purposes of the CRF Tables. Besides, the secondary gases, coke-oven gas and blast furnace gas, are added to the solid fuels, and dry gas from oil refining and petroleum coke was added to the liquid fuels.

3.2.2. Manufacturing Industries and Construction

Description of Source Categories

Sub-sector Manufacturing Industries and Construction included the groups:

- Ferrous metallurgy;
- Non-ferrous metallurgy;
- Chemical industry;
- Pulp and Paper production and printing industry;
- Food industry;
- Other.

The group Other included machinery construction, electrical engineering, light industry and auto-generating plants for combined production of electrical and thermal energy.

The aggregation level of sub-sector Manufacturing industries and construction was mainly the fuel type, as in some cases the type of combustion technology was reported as well. **Table 3.7** shows basic GHG emissions in the sub-sector categories.

Emissions from Manufacturing Industries and Construction (1A1), Gg

Table 3.7

Gas/subsourse	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
a. Iron and Steel	5,171	5,308	3,448	3,080	2,757	3,163	4,318	5,198	4,675	5,079	3,420	2,420	3,332	3,057	2,843	3,486	3,028	2,817
b. Non-Ferrous Metals	637	682	366	275	243	324	336	366	388	344	420	447	399	362	293	277	332	317
c. Chemicals	4,049	4,019	3,487	2,844	2,115	2,125	2,337	3,237	3,210	2,741	2,079	1,781	3,129	2,748	2,145	1,980	2,369	2,254
d. Pulp, Paper	196	128	61	121	72	24	29	33	30	8	274	201	191	138	362	280	221	220
e. Food Processing, Beverages and Tobacco	613	617	228	154	219	131	87	88	53	69	676	674	642	548	526	485	474	422
f. Other	14,089	14,461	14,231	8,284	6,688	7,528	7,926	9,102	9,143	9,450	7,348	6,760	4,175	3,935	4,029	5,025	4,393	4,391
CH_4																		
a. Iron and Steel	0.05	0.06	0.04	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
b. Non-Ferrous Metals	0.01	0.02	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01
c. Chemicals	0.07	0.06	0.05	0.03	0.02	0.03	0.03	0.04	0.04	0.03	0.02	0.02	0.05	0.06	0.05	0.06	0.07	0.06
d. Pulp, Paper	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
e. Food Processing, Beverages and Tobacco	0.02	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01
f. Other	0.41	0.42	0.25	0.23	0.19	0.21	0.21	0.25	0.25	0.23	0.20	0.19	0.11	0.10	0.09	0.11	0.11	0.09
N_2O																		
a. Iron and Steel	0.04	0.04	0.02	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01
b. Non-Ferrous Metals	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c. Chemicals	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01
d. Pulp, Paper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
e. Food Processing, Beverages and Tobacco	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
f. Other	0.08	0.06	0.17	0.06	0.05	0.05	0.06	0.06	0.06	0.08	0.06	0.04	0.03	0.03	0.03	0.04	0.03	0.03

CO_2 emissions from **coal** combustion in this sub-sector were a key source, ranked at **third place** in key source list, and were responsible for 6 % of the total GHG emissions of Bulgaria in 2005. The biggest share in these emissions had the other industries (machinery construction, electrical engineering, factory plants, etc.), ferrous metallurgy and the chemistry. These industry branches topped 90 % of the emissions in the sub-sector – see **Table 3.8.**

CO_2 emissions of non-energy fuel use are added to this sub-sector as well. Key sources were the emissions from non-energy use of natural gas.

The key source list included also two sources - CO_2 emissions from stationary combustion of liquid and gaseous fuels. In these key sources were included mainly the categories of this sub-sector and sub-sector Public Electricity and Heat Production, in a ratio of 52 to 48 % for the gaseous fuels, and 81 to 19 % for the liquid fuels.

Methodology

This emission source included the main power facilities in Bulgaria industry, combusting all basic types of fuels. CO_2 emissions are estimated by a method of the type Tier 2, using the data from the energy balance of the country, prepared by NSI. National emission factors are mainly used for the basic GHGs, as well as standard IPCC factors. Method of the type Tier 1 is applied for emissions from non-energy use of fuels. This method corresponds to the good practice only for non-energy emissions of solid and liquid fuels, which were not key sources – see **Table 3.2**.

Uncertainty and Consistency of Time Series

The uncertainty of this source category was 7 - 9 %.

The CO_2 emissions trends are shown on **Figure 3.1.**

Figure 3.1

The analysis of time series indicated a permanent reduction trend, with two minimums – in 1992 and in 2000. These two minimums reflected the economy crisis, related to the transition to market mechanisms of functioning and management, closing down a number of undertakings, and the change of the international markets of the country. Significant contribution to the emission reduction had the programs and measures for energy efficiency, as well as the technological renovation of branches such as food industry, machinery and electricity engineering, construction and others. There was a growth in the last four years, biggest in 2003, as it reflected surmounting of the crisis.

Table 3.9 shows the CO_2 emissions by basic types of fuels in the sub-sector.

CO_2 emissions from fuel use in the Manufacturing Industries and Construction, Gg

Table 3.8.

Gas/subsourse	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
a. Iron and Steel	5,171	5,308	3,448	3,080	2,757	3,163	4,318	5,198	4,675	5,079	3,420	2,420	3,332	3,057	2,843	3,486	3,028	2,817
feedstock	80	81	72	37	48	64	74	78	74	82	47	54	71	52	45	53	51	46
b. Non-Ferrous Metals	637	682	366	275	243	324	336	366	388	344	420	447	399	362	293	277	332	317
c. Chemicals	4,049	4,019	3,487	2,844	2,115	2,125	2,337	3,237	3,210	2,741	2,079	1,781	3,129	2,748	2,145	1,980	2,369	2,254
fuel combustion (Tier 1)	2,704	2,736	2,262	1,498	979	1,099	1,354	1,938	1,774	1,482	1,109	882	1,849	1,765	1,453	1,249	1,517	1,355
feedstock	1,344	1,282	1,225	1,346	1,135	1,027	983	1,299	1,436	1,259	969	899	1,280	984	692	730	852	899
d. Pulp, Paper	196	128	61	121	72	24	29	33	30	8	274	201	191	138	362	280	221	220
e. Food Processing, Beverages and Tobacco	613	617	228	154	219	131	87	88	53	69	676	674	642	548	526	485	474	422
f. Other	14,089	14,461	14,231	8,284	6,688	7,528	7,926	9,102	9,143	9,450	7,348	6,760	4,175	3,935	4,029	5,025	4,393	4,391
Total	**24,755**	**25,215**	**21,821**	**14,758**	**12,093**	**13,296**	**15,032**	**18,023**	**17,499**	**17,691**	**14,217**	**12,283**	**11,868**	**10,788**	**10,198**	**11,533**	**10,818**	**10,421**

CO_2 emissions by main fuels type in the Manufacturing Industries and Construction, Gg

Table 3.9

Gas/subsourse	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Totals	**24,809**	**25,268**	**21,877**	**14,794**	**12,136**	**13,318**	**15,058**	**18,050**	**17,522**	**17,709**	**14,312**	**12,383**	**11,987**	**10,965**	**10,390**	**11,775**	**11,077**	**10,611**
Liquid Fuels	7,740	7,939	2,075	3,596	2,577	2,280	2,350	3,326	3,015	3,424	4,540	4,107	3,415	3,008	3,240	3,495	3,219	2,944
Solid Fuels	9,353	9,697	14,277	6,087	5,066	6,083	7,542	8,627	8,469	9,832	5,719	5,242	5,033	4,863	4,504	5,398	4,905	4,395
Gaseous Fuels	7,661	7,580	5,469	5,074	4,451	4,933	5,139	6,070	6,015	4,435	3,959	2,934	3,420	2,917	2,455	2,641	2,693	3,082
Biomass	55	52	56	37	43	22	25	27	23	17	95	100	118	177	192	242	260	190
Other Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

The analysis of the table above indicated that solid fuels had the majority in the base year, and this has been kept during the whole inventory period. Reduction of overall emission level in 2005 is more than two times compared to the base year.

Table 3.10 shows CO_2 emissions of non-energy use of fuels. These emissions are reported by applying the Reference Approach, as well as for the Sectoral approach (start from NIR 2005).

Trends in CO_2 emissions by feedstock use of energy carriers according to the IPCC Reference Approach, Gg

Table 3.10

Gas/subsourse	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*
Totals	**11,835**	**12,106**	**12,363**	**10,300**	**9,128**	**8,622**	**8,666**	**10,824**	**10,966**
Liquid Fuels	354	297	206	105	102	123	100	454	452
Solid Fuels	80	81	72	37	48	64	74	78	74
Gaseous Fuels	11,401	11,729	12,085	10,158	8,978	8,435	8,493	10,293	10,440
Gas/subsourse	***1997***	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***
Totals	**8,722**	**7,921**	**6,362**	**6,765**	**6,007**	**5,375**	**5,602**	**5,571**	**6,292**
Liquid Fuels	415	438	330	336	50	60	74	76	68
Solid Fuels	82	47	54	71	52	45	53	51	46
Gaseous Fuels	8,225	7,436	5,978	6,358	5,905	5,271	5,475	5,444	6,178

Emission trend from **non-energy** use of fuels indicated significant reduction until 2003 and after that, there is an increase again at the cost of the non-energy use of the natural gas. The cause is the observed stir in the production of nitrous fertilizers. The structure of these fuels is also changed, as the share of gaseous fuels increased from 69 % in 1988 up to 88 % in 2005, and the share of liquid fuel emissions decreased from 25 % to 7 % accordingly. The share of emissions of solid materials remains practically the same- 5 - 6 % during the whole period from 1988 until now.

3.2.3. Transport

Description of Source Categories

Sub-sector Transport included the groups air, sea, road, inland waterway transport and other kinds of transport. The group Other transport included emission sources form agriculture and construction, such as agriculture machinery for land cultivation, wood processing machinery, construction machinery, etc. The last are so-called off-road machines. This type of machines is basically user of diesel fuel. Only a small part of them (tree cutters, mowers and others) uses avio gasoline or motor gasoline.

The aggregation level was by fuel type, vehicle type and dimensions (the engine volume for cars and the loading capacity for trucks). In this case the emission factors are expressed in natural units, i.e. g/kg of fuel. It did not concern LPG, for which the emission factor is expressed in energy units GJ.

Table 3.11 shows the GHG emission trends from mobile sources for the period 1988-2005.

Trends of greenhouse gas emissions from Transport sub sector, Gg

Table 3.11

Gas/sub-source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2	**13,814**	**13,245**	**10,864**	**6,525**	**6,435**	**7,444**	**6,547**	**6,845**	**6,559**	**5,285**	**6,478**	**6,215**	**5,889**	**6,024**	**6,329**	**7,111**	**7,415**	**8,115**
a Civil aviation	612	354	317	270	315	315	317	276	214	183	120	35	32	46	48	56	104	120
b.Road transport	7,747	8,060	7,586	4,418	4,646	5,751	4,976	5,390	5,306	4,016	5,154	5,327	5,016	5,197	5,496	6,281	6,562	7,178
c.Railways	368	347	334	223	175	178	132	114	121	1	131	120	122	106	97	89	89	94
d.Navigation	1,088	1,162	58	4	7	9	12	13	30	5	10	8	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
e.Other transport	3,998	3,322	2,569	1,610	1,293	1,192	1,109	1,053	888	1,079	1,064	724	720	675	688	685	659	724
CH_4	**2.98**	**3.08**	**2.72**	**1.30**	**1.60**	**1.80**	**1.78**	**1.93**	**1.58**	**1.16**	**1.28**	**1.32**	**1.17**	**0.97**	**1.06**	**1.05**	**0.93**	**0.98**
a Civil aviation	0.06	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
b.Road transport	2.55	2.68	2.41	1.09	1.44	1.65	1.63	1.79	1.46	1.03	1.14	1.22	1.06	0.87	0.95	0.94	0.84	0.87
c.Railways	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
d.Navigation	0.08	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
e.Other transport	0.26	0.25	0.28	0.18	0.14	0.13	0.13	0.12	0.10	0.12	0.12	0.10	0.10	0.09	0.09	0.09	0.09	0.09
N_2O	**0.33**	**0.37**	**0.25**	**0.15**	**0.14**	**0.17**	**0.14**	**0.14**	**0.14**	**0.12**	**0.13**	**0.13**	**0.13**	**0.14**	**0.15**	**0.17**	**0.18**	**0.20**
a Civil aviation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
b.Road transport	0.16	0.16	0.15	0.09	0.09	0.12	0.10	0.10	0.11	0.08	0.10	0.11	0.11	0.12	0.13	0.15	0.16	0.18
c.Railways	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d.Navigation	0.03	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
e.Other transport	0.13	0.11	0.09	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02

CO_2 emissions from **road transport** were key source of GHG emissions. This source ranked second place in key source list (estimated by method Tier 1 – with emission level assessment). These emissions were 10 % of the overall country emissions in 2005. Another key source was the CO_2 emissions from **other transport**, with 1 % share in the overall emissions. The rest GHG emission sources are not key sources.

The *road transport* was the largest emission source of main GHG in sub-sector Transport - 89 % of the CO_2 emissions, 91 % of methane emissions, and 86 % of N_2O emissions.

CO_2 emissions from the other kinds of transport were significantly less (about two times), compared to the road transport. Off-road emissions were about one time less than the road transport.

The *avian transport* emissions were spitted between domestic and international transport based on expert assessment. The overall quantities of the used kerosene used were indicated in the energy balance of the country. It was assumed that 80 % of kerosene was used for international transport and the relevant emissions were reported in international bunkering.

After 2000, there was no navigation on the Danube and the Black sea for the purposes of domestic passenger transport and because of that no fuels were reported. Only fuels for international transport were indicated.

Table 3.12 shows GHG-precursors emissions with the highest values in this sub-sector – for CO and NMVOC from the corresponding overall emissions of the country, and on second place for NOx, following the Energy sector.

The main GHG emissions from the source increased by approx. 9.5 % in 2005 compared to the preceding year. This was due to increased diesel fuel consumption in the road transport.

Table 3.13 shows the trend of fuel quantities, used by the road transport. It shows a stable growth after 1997.

GHG-precursors emissions from Mobile sources, Gg

Table 3.12

year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
NOx	115.6	114.6	97.8	57.6	51.7	56.0	48.9	49.4	45.3	41.8	48.4	45.2	47.3	48.1	51.5	56.2	50.6	60.5
CO	454.4	468.7	434.8	216.0	260.4	304.0	296.9	327.6	267.5	190.0	241.0	239.0	221.3	202.2	220.0	221.7	205.5	218.4
NMVOCs	67.1	70.2	66.3	34.2	39.1	45.9	44.0	48.2	40.6	29.9	39.3	38.5	36.4	34.6	37.4	38.5	36.9	38.0
SO_2	57.8	49.3	18.0	10.5	9.6	11.0	9.1	8.8	9.4	7.8	8.3	8.0	7.1	7.3	7.5	8.8	9.5	10.5

Fuels for Road Transportation, TJ

Table 3.13

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Gasoline	63,235	67,409	61,643	28,955	36,908	43,176	43,572	48,050	40,431	26,780	35,168	34,564	29,019	24,928	26,795	25,762	24,554	23,920
Diesel Oil	41,817	41,966	42,455	30,959	27,490	35,914	26,138	26,839	33,191	27,337	31,821	33,761	30,204	33,794	34,296	44,112	50,006	56,580
LPG	12	9	1	1	0	2	6	4	15	28	3,057	4,156	9,842	13,061	15,046	16,825	15,558	18,097
Total	**105,063**	**109,385**	**104,098**	**59,915**	**64,399**	**79,092**	**69,716**	**74,893**	**73,637**	**54,145**	**70,046**	**72,481**	**69,065**	**71,783**	**76,137**	**86,699**	**90,117**	**98,597**

Figure 3.2 shows the change in the fuel sales in 2005, compared to the base 1988. A clear trend towards increase of fuel sales can be seen, concerning the fuels that emit less air pollutants, including GHG. Obviously, the LPG consumption trend is remarkable. The volume of consumed LPG in road transportation is over the 18 % from total fuel road consumption in 2005.

Figure 3.2

The fuel sales, shown on **Figure 3.2** and **Table 3.13 and GHG emissions in Table 3.11** should be estimated on the basis of more than a double increase of number of automobiles (cars, trucks, buses) in 2005, compared to the base year.

Methodology

The CO_2 emissions are calculated according to the reported fuel consumption in the Energy Balance. The consumed fuels are apportioned for different vehicle types - cars, buses and trucks. A methodology is applied which helps to distribute; considering the number of vehicles, engine volume, loading capacity and the mileage. Data for the number of vehicles is provided by the Road Control Department within the Ministry of Interior (MOI).

The emissions are estimated after a method of the type Tier 2, with emission factors depending on the engine volume, loading capacity and the fuel type. The emission factors were based on measurements and studies of the motor fleet in the country. The characteristic features of these fleet vehicles have not changed significantly since the last GHG inventory, 2004. The indices retained nearly the same: high average age of the cars, (40 % from the cars are over 20 years old and only 10 % below 10 years), big share of old cars (Lada, Moskvich, Trabant, etc.), significant number of the imported second-hand cars (over 150 000 ones in the current year), relatively not a big share of the imported new cars. Nevertheless, a trend towards increase of the quantity of new cars was outlined which is deepening in the current year. In 2005 more new cars are imported which means a rise of nearly 30 % compared to 2004. There was also a growth of second-hand car sales.

Uncertainty and Consistency of Time Series

The uncertainty of this source category was 6-7 % for CO_2 emissions and 100 % for methane and N_2O emissions.

The CO_2 emission trends in transport formed uniform time series because for the whole period after the base 1988, there have been no changes in the methodology of calculation and collection of data for types of vehicles.

3.2.4. Other Sectors

Description of Source Categories

Sub-sector Other sectors included the groups:

- Commercial/institutional and services;
- Households;
- Agriculture and forestry.

These groups include only stationary sources, as the aggregation level was the type of the fuel and the combustion technology in the corresponding group (services, households, agriculture). The emission factors applied were combination of those standard values, recommended by the IPCC Guidance, and results from measurements and analytical studies, factors specific for the country.

Table 3.14 shows the main GHG emissions in the sub-sector.

The analysis of **Table 3.14** showed that the category **households** had a predominating role. More than 73 % of CO_2 emissions, 95 % of methane emissions and 96 % of N_2O emissions were emitted from this category.

The CO_2 emissions from stationary combustion processes – **other sectors, coal,** were key GHG emission source. This source ranked tenth place in key source list (estimated by method Tier 1 – with emission level assessment) and produced 2 % of the overall emissions of the country in 2005.

The consumption of fuels in the sub-sector **Households** was purposed on heat and hot water production, and cooking. These activities allow using of broad range of energy carriers and technologies, and due to that, they have a great potential for reduction of GHG emissions. A Bulgarian practice was a good example for that, showing a significant consumption of wood and wood waste in the households.

The CO_2 emissions form wood and wood waste combustion in 2005 were 2 260 Gg, which shows decrease by 5.6 % compared to the previous year. It brakes the trend of growth in the last ten years.

Methodology

The GHG emissions are calculated according to the reported fuel consumption in the Energy Balance. A method of the type Tier 2 is applied, with emission factors, estimated after IPCC and local measurements and analytical calculations as well.

Uncertainty and Consistency of Time Series

The uncertainty of this source category was 9 % for CO_2 emissions and 50 % for methane and N_2O emissions.

The CO_2 emission trends in the sector formed uniform time series because for the whole period after the base 1988, there have been no changes in the methodology of calculation and collection of data. It should be noticed that the impact of the seasonal temperature changes was not reported evidently. It did not affect significantly the emitted gases, because the heating standards have not been observed always, especially in some public buildings (schools, social facilities), and in the households as well. One of the main reasons is the high fuels and centralized district heating prices.

3.2.5. Other

The GHG emissions from the use of biomass for obtaining power were estimated in this category. However, the quantities of wood and wood waste, given in the Energy Balance, were not reported here (see p. 3.2.4 above).

The following was considered as a power source in this category:

- dry twigs and brushwood and other kinds of woody biomass;
- vegetal residues from grain, vineyards, etc.;
- used charcoal;
- sludge combustion.

CO_2 emissions from this source in 2005 were 625 Gg.

3.2.6. Comparison of the Sectoral Approach with the Reference Approach

The Reference approach (RA) is a method for estimating CO_2 combustion emissions by the help of limited input data. For this purpose the apparent consumption of fuels and the CO_2 emission factors of fuel combustion were needed. By the Reference approach were verified the results for CO_2 emissions, obtained with the Sectoral approach (SA). A detailed description of this method is given in ***Annex 4***.

Table 3.15 presents the CO_2 emissions, calculated by the Reference approach, and the emissions from fuel combustion, calculated by the Sectoral approach.

Comparison of the two approaches indicated difference 0.17 % for 2005.

Emission trend as per the two approaches for the period 1988-2005 is practically the same – reduction by -45 %. CO_2 emission reduction was biggest with the liquid fuels – 62 %, followed by gaseous, 45,6 % and solid fuels, 32 %.

Trends of greenhouse gas emissions form Other sectors, Gg

Table 3.14

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
4a Comercial/Institutional	1,068	773	172	124	107	114	96	64	114	46	288	503	330	574	388	287	200	224
4b Residential	6,654	6,609	4,787	3,633	4,354	3,890	2,962	2,456	3,095	2,632	2,544	1,795	1,362	884	1,511	1,741	1,354	1,241
4c Agriculture/Forestry/Fishing	1,219	1,256	422	330	149	114	267	102	28	0	157	194	204	180	174	178	204	235
CH_4																		
4a Comercial/Institutional	0.32	0.29	0.08	0.06	0.07	0.05	0.05	0.05	0.03	0.03	0.39	0.23	0.16	0.14	0.13	0.21	0.14	0.22
4b Residential	1.23	1.22	0.95	0.71	0.88	0.81	0.93	1.27	1.55	1.58	3.14	3.15	4.42	4.28	5.15	5.34	5.57	5.28
4c Agriculture/Forestry/Fishing	0.10	0.10	0.09	0.06	0.07	0.01	0.04	0.01	0.00	0.00	0.01	0.10	0.13	0.02	0.02	0.03	0.03	0.05
N_2O																		
4a Comercial/Institutional	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01
4b Residential	0.13	0.13	0.09	0.07	0.08	0.07	0.06	0.06	0.07	0.07	0.10	0.09	0.11	0.10	0.13	0.13	0.13	0.12
4c Agriculture/Forestry/Fishing	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Comparison of CO_2 emissions: Reference Approach (RA) versus National Approach (NA), Gg

Table 3.15

IPCC Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Reference Approach																		
Liquid Fuels	34,832	34,055	28,320	19,254	15,300	18,317	16,873	16,634	14,575	12,068	11,412	11,742	10,879	10,683	11,923	12,198	11,631	13,227
Solid Fuels	44,926	44,926	40,554	34,727	32,758	34,722	31,760	32,835	33,418	34,897	32,541	28,693	28,900	31,564	28,649	32,151	31,451	30,560
Gaseous Fuels	11,401	11,401	12,085	10,158	8,978	8,435	8,493	10,293	10,440	8,225	7,436	5,978	6,358	5,905	5,271	5,475	5,444	6,178
Total RA	**91,159**	**90,382**	**80,960**	**64,139**	**57,036**	**61,474**	**57,126**	**59,763**	**58,432**	**55,190**	**51,389**	**46,413**	**46,136**	**48,152**	**45,843**	**49,825**	**48,526**	**49,966**
National approach	90,726	90,789	78,673	63,357	57,197	59,682	56,658	59,376	58,208	56,703	51,235	46,750	45,869	47,486	45,066	49,180	48,289	49,879
Difference	***0.48***	***-0.45***	***2.91***	***1.23***	***-0.28***	***3.00***	***0.83***	***0.65***	***0.39***	***-2.67***	***0.30***	***-0.72***	***0.58***	***1.40***	***1.72***	***1.31***	***0.49***	***0.17***

3.2.7. Non-energy Use of Fuels

Description of Source Categories

CO_2 emissions from non-energy use of fuels were structured in sub-sector ***Manufacturing industries and construction*** of **Energy** sector. The fuels were used as raw materials mainly in Ferrous metallurgy and Chemistry. The overall share of these emission sources from the summary emissions of the country in 2005 was as low as 1.33 %, as this share was retained for the whole inventory period after the base year, 1988. Only the emissions from non-energy use of natural gas were key source, ranked at the eighteenth place in key source list.

The portion of carbon, which is stocked in products like asphalt, plastic, fertilizers, etc., was estimated by ratios, proposed by IPCC Guidance. There are no measurements in Bulgaria for estimation of ratios, specific for the country.

Methodology

CO_2 emissions from non-energy use of fuels were estimated by the emission factors applied in the Reference approach. As a whole, the emission calculation method was of type Tier 1.

Uncertainty and consistency of time series

The uncertainty of this source category was estimated by scientific information, based on assessments of international experts, and it amounted to 6-7 %.

The emission trends are shown in **Table 3.16** for the main types of fuels – liquid, solid and gaseous.

The overall emissions of Bulgaria from non-energy use of fuels in 2005 dropped down by 33.7 %, compared to the base year 1988.

3.2.8. International Bunkers

Description of source categories

The International Bunkers includes international air and sea transport.

The international transport of passengers and cargo uses fuel combustion, as GHG and pollutants in the atmosphere are emitted. These GHG emissions were also a subject of the inventory.

The GHG emissions from fuel combustion in international transport were estimated in compliance with the methods in the sector Mobile sources of Energy sector in the IPCC Guidance. The obtained GHG emission were not included in the summary emissions of the country, but reported separately in the relevant CRF tables.

In Bulgarian GHG inventories, international transport emissions were divided into two categories:

- GHG emissions from sea international transport;
- GHG emissions from air international transport.

Table 3.17 shows the fuels (in TJ) and CO_2 emissions for the period 1988-2005.

CO_2 emissions from non-energy use of fuels

Table 3.16

Fuels	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Liquid Fuels	354	297	206	105	102	123	100	454	452	415	438	330	336	50	60	74	76	68
Solid Fuels	80	81	72	37	48	64	74	78	74	82	47	54	71	52	45	53	51	46
Gaseous Fuels	990	986	1019	1241	1033	904	883	845	985	844	532	569	944	933	632	656	776	831
Total	**1,424**	**1,363**	**1,298**	**1,383**	**1,183**	**1,091**	**1,056**	**1,377**	**1,511**	**1,341**	**1,017**	**953**	**1,351**	**1,036**	**737**	**783**	**903**	**945**

International bunkers: energy consumption (TJ) and related CO_2 emissions (Gg) 1988-2005

Table 3.17

Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Energy consumption																		
Marine Bunkers	**12,439**	**12,646**	**11,295**	**11,430**	**11,049**	**10,589**	**10,664**	**10,684**	**9,240**	**13,624**	**12,812**	**333**	**2,696**	**4,017**	**4,416**	**5,723**	**4,813**	**4,589**
Gasoline	NO	NO	1.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	7,659	7,292	2,777	2,664	2,725	2,336	2,240	2,240	2,240	3,340	2,703	294	2,696	3,975	4,416	5,723	4,813	4,589
Residual Fuel Oil	4,780	5,354	8,517	8,766	8,324	8,253	8,424	8,444	7,000	10,284	10,109	39	NO	42	NO	NO	NO	NO
Aviation Bunkers	**10,602**	**10,344**	**12,638**	**4,536**	**8,004**	**10,464**	**8,958**	**7,782**	**6,686**	**6,056**	**6,938**	**4,522**	**3,822**	**5,571**	**5,654**	**6,870**	**5,741**	**6,696**
Jet Kerosene	10,602	10,344	12,377	4,446	7,967	10,427	8,892	7,731	6,668	6,031	6,896	4,522	3,822	5,571	5,654	6,870	5,741	6,696
Gasoline	NO	NO	260	90	37	36	66	51	18	25	42	NO	NO	NO	NO	NO	NO	NO
Total	***23,041***	***22,990***	***23,933***	***15,966***	***19,053***	***21,053***	***19,622***	***18,466***	***15,926***	***19,680***	***19,750***	***4,855***	***6,518***	***9,588***	***10,070***	***12,594***	***10,554***	***11,285***
CO_2 Emissions																		
Marine Bunkers	**969**	**987**	**874**	**878**	**873**	**844**	**850**	**882**	**732**	**1,092**	**1,022**	**26**	**205**	**306**	**336**	**436**	**366**	**349**
Gasoline	NO	NO	0.1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	583.2	555.3	208.3	199.8	204.4	177.9	170.5	200.9	173.7	262.0	206.2	22.4	205.3	302.4	336.2	435.8	366.4	349.4
Residual Fuel Oil	385.8	432.1	665.5	678.3	668.7	666.1	679.9	681.4	557.9	829.9	815.8	3.2	NO	3.4	NO	NO	NO	NO
Aviation Bunkers	**749**	**731**	**892**	**320**	**565**	**739**	**632**	**549**	**472**	**428**	**490**	**319**	**270**	**393**	**399**	**485**	**405**	**473**
Jet Kerosene	749	731	874	314	562	736	628	546	471	426	487	319	270	393	399	485	405	473
Gasoline	NO	NO	18	6	3	3	5	4	1	2	3	NO	NO	NO	NO	NO	NO	NO
Total	***1,718***	***1,719***	***1,766***	***1,198***	***1,438***	***1,583***	***1,483***	***1,432***	***1,204***	***1,520***	***1,512***	***345***	***475***	***699***	***735***	***921***	***772***	***822***

The international marine bunkering emissions in 2005 dropped by 64 % compared to 1988, while the air bunkering emissions dropped less, i.e. by 36.8 %. The main reason for that was the liquidation of the deep-sea fishery fleet after 1999.

Methodology

The GHG emissions were estimated, using the data from the Energy Balance of the country. The fuel quantities for sea and air transport were specified in the balance. Certain complications resulted from the fuel data for air transport, since the last was separated by domestic and international transport. That is why the fuels for international transport were determined by expertise.

During the international transport, the main GHG are emitted - CO_2, CH_4 and N_2O, GHG-precursors NO, CO, NMVOCs, as well as SOx. The GHG emissions were estimated by Tier 1 method with the emission factors determined based on the experimental and analytical studies, taking into account the country specific conditions (type and size of ships and airplanes, value of cargo, destinations etc.).

Table 3.18 shows the trends of main GHG and GHG precursors emissions.

Trend in greenhouse gas emissions from International Bunkers 1988-2005, Gg

Table 3.18

Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CH_4																		
Marine Bunkers	*0.04*	*0.04*	*0.02*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.02*	*0.01*	*0.00*	*0.01*	*0.02*	*0.02*	*0.03*	*0.03*	*0.03*
Gasoline	NO	NO	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	0.04	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.01	0.02	0.02	0.03	0.03	0.03
Residual Fuel Oil	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Aviation Bunkers	*0.02*	*0.02*	*0.04*	*0.01*	*0.02*	*0.02*	*0.02*	*0.02*	*0.01*	*0.01*	*0.02*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Jet Kerosene	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Gasoline	NO	NO	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
Total	**0.06**	**0.06**	**0.06**	**0.03**	**0.03**	**0.04**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.04**	**0.04**
N_2O																		
Marine Bunkers	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.02*	*0.03*	*0.03*	*0.00*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Gasoline	NO	NO	0.00	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Residual Fuel Oil	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.00	NO	0.00	NO	NO	NO	NO
Aviation Bunkers	NO	NO	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	NO	NO	NO	NO	NO	NO	NO
Jet Kerosene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gasoline	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
Total	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
NOx																		
Marine Bunkers	*22.80*	*23.46*	*22.44*	*22.60*	*22.44*	*21.81*	*22.03*	*22.71*	*18.79*	*28.03*	*26.46*	*0.56*	*4.35*	*6.50*	*7.12*	*9.23*	*7.76*	*7.40*
Gasoline	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	12.35	11.76	4.41	4.23	4.33	3.77	3.61	4.25	3.68	5.55	4.37	0.47	4.35	6.40	7.12	9.23	7.76	7.40
Residual Fuel Oil	10.45	11.70	18.03	18.37	18.11	18.04	18.42	18.46	15.11	22.48	22.10	0.09	NO	0.09	NO	NO	NO	NO
Aviation Bunkers	*2.99*	*2.91*	*3.50*	*1.26*	*2.25*	*2.95*	*2.52*	*2.19*	*1.89*	*1.71*	*1.94*	*1.28*	*1.08*	*1.58*	*1.60*	*1.94*	*1.62*	*1.89*
Jet Kerosene	2.99	2.91	3.50	1.26	2.25	2.95	2.52	2.19	1.89	1.71	1.94	1.28	1.08	1.58	1.60	1.94	1.62	1.89
Gasoline	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total	**25.78**	**26.37**	**25.94**	**23.86**	**24.69**	**24.76**	**24.54**	**24.90**	**20.68**	**29.73**	**28.41**	**1.84**	**5.43**	**8.07**	**8.72**	**11.17**	**9.38**	**9.29**
CO																		
Marine Bunkers	*4.12*	*3.97*	*1.81*	*1.74*	*1.76*	*1.58*	*1.54*	*1.75*	*1.49*	*2.24*	*1.86*	*0.15*	*1.37*	*2.02*	*2.25*	*2.91*	*2.45*	*2.33*
Gasoline	NO	NO	0.02	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Gas/Diesel Oil	3.90	3.71	1.39	1.34	1.37	1.19	1.14	1.34	1.16	1.75	1.38	0.15	1.37	2.02	2.25	2.91	2.45	2.33

Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Residual Fuel Oil	0.23	0.26	0.39	0.40	0.40	0.39	0.40	0.40	0.33	0.49	0.48	0.00	NO	0.00	NO	NO	NO	NO
Aviation Bunkers	*1.24*	*1.21*	*7.45*	*2.59*	*1.77*	*2.06*	*2.56*	*2.08*	*1.18*	*1.27*	*1.77*	*0.53*	*0.45*	*0.65*	*0.66*	*0.80*	*0.67*	*0.78*
Jet Kerosene	1.24	1.21	1.44	0.52	0.93	1.22	1.04	0.90	0.78	0.70	0.80	0.53	0.45	0.65	0.66	0.80	0.67	0.78
Gasoline	NO	NO	6.01	2.07	0.84	0.84	1.52	1.18	0.41	0.57	0.97	NO	NO	NO	NO	NO	NO	NO
Total	**5.36**	**5.17**	**9.26**	**4.32**	**3.53**	**3.64**	**4.10**	**3.83**	**2.67**	**3.51**	**3.63**	**0.68**	**1.82**	**2.67**	**2.91**	**3.71**	**3.12**	**3.12**

In 2005 were emitted main GHG at the amount of 825.73 Gg CO_2-eq. The sea transport emitted 42 %, and the air transport - 58 %. After the big drop in 1999, all GHG emissions increased more than twice in 2005.

Uncertainty and consistency of time series

The uncertainty of this emission source category has never been estimated in Bulgarian inventory. As per scientific information, it is estimated to approx. 2 %, which was too optimistic estimation. Considering the uncertainty of the emission factors in the transport an estimation of 8 % is more realistic.

In 1999, a big drop of the data for sea bunkering fuels use is observed. This drop was due to the change of the statistical accounting in NSI and its harmonization in compliance with EUROSTAT.

3.3. Fugitive Methane Emissions from Coal Mining and Systems for Gas and Oil Extraction and Distribution

3.3.1. Description of Sources

The fugitive methane emissions from coal mining are one of the largest methane emission sources in Bulgaria. They are ranked 11-th place in key source list, with share more than 2 % of overall emissions for the country in 2005. The fugitive emissions from systems for gas and oil extraction and distribution are also key source (19 places) and had a share of approx. 1 % of overall GHG emissions.

Coal mining

The fugitive CH_4 emissions from coal mining were included in this category.

The coal in Bulgaria is mined in surface and underground mines. The main domestic resource – lignite, is mined in surface mines. in the complex Maritza Iztok. The yearly production is closely connected with the plans of electro energy production and amounts to 25-30 million tones. The local lignite has low caloricity – up to 1500 calories in kg., a high content of humidity and sulphur. The last provoked the necessity of building installation for desulphurization (the first started working at the end of 2002). As a result from the desulphurization, emissions of CO_2 are gained which are taken into account in the inventory.

Brown, black and anthracite coal is mined in underground mines. The basic yearly quantity amounts to 3 million tones for the last few years. In the base year, over 5 million tones of the same type of coal have been mined.

In Bulgaria considerable quantity of imported energy and coking coal are being used - over 4.5 million tones in the current year. At their transportation and processing no accidental methane emissions are observed.

Table 3.19 shows the fugitive methane emission trends in coal mining.

CH_4 fugitive emissions from coal mining and handling 1988-2005

Table 3.19

Coal Mining and Handling, kt	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Underground Mines	**5,180**	**4,992**	**3,848**	**3,220**	**3,600**	**3,682**	**3,328**	**3,381**	**3,198**	**2,779**	**2,993**	**2,712**	**2,719**	**2,756**	**2,860**	**2,695**	**2,844**	**2,490**
brown	4,984	4,799	3,705	3,092	3,352	3,419	3,155	3,187	3,060	2,677	2,902	2,590	2,602	2,646	2,766	2,644	2,811	2,481
black	131	130	100	86	203	222	144	170	119	88	78	122	118	98	83	43	33	9
anthracite	65	63	43	42	45	41	29	24	19	14	13	0	0	12	11	8	1	0
Surface Mines	**29,191**	**29,509**	**27,827**	**25,231**	**26,736**	**25,351**	**25,429**	**27,449**	**28,104**	**26,929**	**27,117**	**22,586**	**23,712**	**23,856**	**23,158**	**24,604**	**23,642**	**22,205**
lignite	29,191	29,509	27,827	25,231	26,736	25,351	25,429	27,449	28,104	26,929	27,117	22,586	23,712	23,856	23,158	24,604	23,642	22,205
CH_4 Emissions, Gg																		
Underground Mines	69.4	66.9	51.6	43.1	48.2	49.3	44.6	45.3	42.9	37.2	40.1	36.3	36.4	36.9	38.3	36.1	38.1	33.4
Surface Mines	25.4	25.7	24.2	22.0	23.3	22.1	22.1	23.9	24.5	23.5	23.6	19.7	20.7	20.8	20.2	21.4	20.6	19.3
Total	**94.8**	**92.6**	**75.8**	**65.1**	**71.5**	**71.4**	**66.7**	**69.2**	**67.3**	**60.7**	**63.7**	**56.0**	**57.1**	**57.7**	**58.5**	**57.5**	**58.7**	**52.7**

The fugitive methane emissions in 2005 were 1 106.7 Gg CO_2-eq. They marked a drop by 10 % compared to the preceding year, due to the decreased mining of brown coal.

The fugitive methane emissions from the underground mining were about 63 % of the emissions of this source, although the coal quantities from underground mining was less than 10.7 % of the overall coal mining in the country, expressed in natural (mass) units - tone.

Extraction, refining, transportation and distribution of oil and natural gas

This source included the CH_4 fugitive emissions from:

- Extraction of oil and natural gas;
- Supplies, transportation and refining of oil;
- Transport and distribution of natural gas in the country;
- Transit of natural gas for neighbouring countries;
- LPG supplies at the special gas stations.

Table 3.20 shows the trends of methane fugitive emissions from oil and gas systems.

Activity data and CH_4 fugitive emissions from oil and gas

Table 3.20

PJ	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Oil																		
Production	3.29	3.09	2.54	2.45	2.24	1.81	1.54	1.82	1.38	1.18	1.36	1.83	1.92	1.44	1.59	1.29	1.28	1.28
Transport	545.83	550.41	353.23	194.80	103.09	242.32	296.11	339.98	295.83	253.72	236.28	237.48	223.72	219.36	221.84	214.76	225.01	257.07
Refining / Storage	547.53	558.65	353.50	195.87	102.55	242.25	296.10	339.98	295.83	253.72	236.28	240.47	226.06	219.78	222.09	214.28	224.75	263.07
LPG- consumed	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.03	3.06	4.16	9.84	13.06	15.05	16.83	17.29	16.08
Natural Gas																		
Production	0.3	0.3	0.5	0.3	1.3	2.3	1.9	1.7	1.4	1.2	1.0	0.9	0.5	0.8	0.7	0.5	11.2	16.1
Transmission	246.6	330.8	336.5	330.7	321.3	327.8	328.8	381.3	384.4	384.5	390.1	464.8	520.7	539.6	552.9	558.1	552.2	621.4
Distribution	207.7	228.7	225.7	193.1	170.1	159.0	159.7	191.7	195.6	154.6	137.2	116.0	122.5	114.4	100.4	104.4	99.8	102.8
Venting /Flaring																		
Oil	551	562	356	198	105	244	298	342	297	255	238	242	228	221	224	216	226	264
Gas	0.7	0.6	0.9	0.7	2.5	4.6	3.8	3.3	2.8	2.4	1.9	1.8	1.0	1.5	1.4	1.1	22.3	32.2
Emissions CH_4, Gg	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Oil	**0.82**	**0.83**	**0.53**	**0.30**	**0.16**	**0.37**	**0.45**	**0.51**	**0.45**	**0.38**	**0.47**	**0.52**	**0.72**	**0.83**	**0.91**	**0.97**	**1.00**	**1.01**
Production	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Transport	0.41	0.41	0.26	0.15	0.08	0.18	0.22	0.25	0.22	0.19	0.18	0.18	0.17	0.16	0.17	0.16	0.17	0.19
Refining / Storage	0.41	0.42	0.26	0.15	0.08	0.18	0.22	0.25	0.22	0.19	0.18	0.18	0.17	0.16	0.17	0.16	0.17	0.20
LPG consumed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.16	0.38	0.50	0.58	0.64	0.66	0.62
Natural Gas	**60.06**	**63.90**	**28.85**	**27.27**	**23.88**	**24.04**	**26.57**	**30.50**	**30.97**	**27.31**	**24.65**	**20.59**	**27.60**	**25.19**	**22.73**	**23.26**	**25.58**	**28.63**
Production / Processing	0.03	0.03	0.04	0.03	0.11	0.19	0.16	0.14	0.12	0.10	0.08	0.08	0.04	0.06	0.06	0.04	0.93	1.35
Transmission	3.09	3.38	3.67	4.05	4.11	4.42	4.80	5.11	5.51	5.93	6.03	6.35	6.61	6.35	6.61	6.61	6.61	6.61
Distribution	NE	NE	NE	NE	0.03	0.03	0.03	0.03	0.03	0.04	0.06	0.12	0.19	0.31	0.43	0.56	0.78	0.98
Other Leakage	56.95	60.50	25.14	23.20	19.63	19.40	21.58	25.22	25.31	21.25	18.48	14.04	20.76	18.46	15.62	16.04	17.25	19.70
Venting /Flaring	**0.02**	**0.02**	**0.02**	**0.01**	**0.03**	**0.05**	**0.04**	**0.04**	**0.03**	**0.03**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**	**0.21**	**0.30**
Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01
Gas	0.01	0.01	0.01	0.01	0.02	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.20	0.30
Total	**60.90**	**64.75**	**29.40**	**27.58**	**24.07**	**24.46**	**27.06**	**31.05**	**31.45**	**27.72**	**25.14**	**21.13**	**28.33**	**26.04**	**23.66**	**24.24**	**26.79**	**29.94**

The CH_4 fugitive emissions, expressed in CO_2-eq. in 2005 were 628.74 Gg, or less than 1 % of the summary GHG emissions. The emission growth in 2005 was 11.6 %, compared to 2004, and it was mainly due to the new pipelines for distribution of natural gas in the country.

The extracted quantities of oil and gas in Bulgaria are very low and represent less than 1 % from the consumption of these fuels in the country.

The quantities of natural gas, imported and transited by the national gas system to neighbouring countries, were far more bigger that domestic consumption – about 3 times in 2005.

The methane fugitive emissions from the distribution gas networks in the industry and households were estimated by the quantities of natural gas in section Final energy consumption of the general energy balance of the country.

3.3.2. Methodology

The methane fugitive emissions from coal mining were estimated by method of the type Tier 1, as emission factors, given in IPCC Guidance, were used.

From the emission factors, given in IPCC Guidance, were chosen relevant values, considering that the underground mines have average depth not more than 400 m, and the surface mines for lignite have depth more than 25 m. According to the Good Practice Guidance, provided this is a key source, method that is more precise should be used. What is ahead is working out a methodology for more exact calculation of the underground mines emissions that will reach the level of Tier 2.

Applying of methods that are more precise is not possible at the present due to the limited data.

Calculation of CH_4 fugitive emissions from gas and oil systems was estimated by method of the type Tier 1.

Emission factors, given in Good Practice Guidance, are used for the 2005 inventory. They are estimated, as a rule, on a unit length of the pipelines, and they differed significantly from the standard parameters, specified in the Revised IPCC Guidance for the different regions of the world.

Table 3.21 shows the lengths of the natural gas distribution pipeline networks and their development since 1988.

Development of the natural gas distribution pipeline network, km

Table 3.21

Length of network	1988	1989	1990	1991	1992	1993	1994	1995	1996
Natural Gas - transit	265	280	300	350	375	400	450	475	605
Natural Gas - domestic transmission	969	1,070	1,169	1,269	1,269	1,369	1,469	1,569	1,600
Natural Gas - domestic distribution	0	0	0	0	50	50	50	50	50
Total	**1,234**	**1,350**	**1,469**	**1,619**	**1,694**	**1,819**	**1,969**	**2,094**	**2,255**
Length of network	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Natural Gas - transit	670	710	840	945	840	945	945	945	945
Natural Gas - domestic transmission	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Natural Gas - domestic distribution	60	100	200	300	500	700	911	1,260	1,577
Total	**2,430**	**2,510**	**2,740**	**2,945**	**3,040**	**3,345**	**3,556**	**3,905**	**4,222**

The data on crude oil and natural gas quantities was taken from the Energy balance of the country, where it was aggregated on a national level.

As it can be seen on **Table 3.20**, the broad use of LPG as a fuel for cars started in 1998, reaching almost 10 % from the overall fuel consumption in the country in 2005.

Besides the fugitive methane emissions, significant NMVOCs emissions from gasoline refuelling at gasoline stations, and from its delivery from refineries, as well as NOx, CO and NMVOCs emissions from burning the refinery flame torch, can bee seen. These emissions were structured and calculated in sector Industrial processes.

3.3.3. Uncertainty and Consistency of Time Series

The uncertainty of this emission source category was estimated as follows:

- 200 % for coal mining;
- 50 % for oil and natural gas systems.

The changes of the refined oil trends showed a reduction by 46 % in 1996, compared to 1988. In the next period the oil consumption was relatively steady, at levels about 220 PJ per annum, or approx. 5.4 million tones.

The natural gas consumption was reduced more than twice in 2005, compared to 1988. It was due to curtail industrial production from the fertilizers factories and it could not be compensated by the speed up gas consumption of households in the last years.

The quantities of transited natural gas had a steady growing trend. They increased about 10 times for the period 1988-2005.

CHAPTER 4. INDUSTRIAL PROCESSES

4.1. General Sector Description

GHG emissions from the Industrial Processes sector are obtained because of the industrial technological processes and/or material products consumption. With this type of emissions, no combustion processes are involved.

The industrial process emissions encompass emissions from all main GHGs and GHG-precursors. Special attention is paid to industrial emissions and emissions from F-gases usage.

GHG emissions are grouped in the following sub sectors according to industries:

- Mineral products;
- Chemical industry;
- Metal production;
- Other production;
- Production of Halocarbons (HFC's, PFC's) and SF_6;
- Consumption of Halocarbons and SF_6;
- Others.

In the Other production sub sector, emissions from the Food industry and Pulp and paper production are included.

In the Other sub sector, emissions from gasoline transportation, refuelling of vehicles with gasoline at petrol stations, and plastic and adhesive production have been included.

Halocarbons and sulphur hexafluoride - SF_6 emissions are differentiated in two separate sub sectors, due to their big variety as types of gases and very high global warming potential.

During the preparation of the national GHG inventory report for the year 2005 as well as for the preceding years, certain difficulties are encountered due to data confidentiality of some production processes and technologies. Therefore, the inventory report for 2005 overcomes those difficulties using NSI identified emission data according to the CORINAIR methodology.

GHG emissions trends are given in **Table 4.1**.

Trend in greenhouse gas emissions from Industrial Processes, Gg

Table 4.1

Gas/Subcategory	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
2A. Mineral Products	3,842	4,028	4,020	2,590	2,090	1,908	2,292	3,124	3,174	2,845	1,402	2,034	2,302	2,469	2,403	2,529	2,843	3,078
2B. Chemical Industry	1,751	1,750	1,717	1,415	1,163	1,126	1,263	1,524	1,512	1,248	673	481	813	725	464	492	610	623
2C. Metal Production	2,473	2,474	1,836	1,393	1,312	1,639	2,127	2,316	2,094	2,254	1,866	1,704	1,478	1,419	1,323	1,658	1,522	1,398
2D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2G. Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CH_4																		
2A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
2B. Chemical Industry	0.04	0.04	0.02	0.01	0.01	0.03	0.03	0.04	0.02	0.02	0.21	0.46	0.15	0.14	0.13	0.27	0.14	0.18
2C. Metal Production	3.49	3.52	2.76	2.05	1.94	2.25	3.00	3.29	3.04	3.29	2.62	2.23	3.37	2.28	2.06	2.51	2.13	2.03
2D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2G. Other (please specify)	0.36	0.33	0.25	0.14	0.14	0.17	0.18	0.20	0.20	0.20	0.18	0.07	NO	NO	NO	NO	NO	NO
N_2O																		
2B. Chemical Industry	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B2. Nitric Acid Production	7.81	7.43	7.28	5.25	4.27	3.65	4.32	6.20	6.33	5.21	3.12	2.36	4.24	4.18	3.51	3.74	2.77	3.20
F-gases																		
SF_6-Gg CO_2-eqv.								1.262	1.309	1.753	1.831	1.880	2.230	2.290	2.510	2.520	3.680	4.417

The main data source for the quantities of produced prime and raw materials and manufactured goods is the NSI.

The biggest share of the aggregated GHG emissions from sector Industrial Processes for 2005 has CO_2 – 83 %, followed by N_2O with 16 % and CH_4 with 0.8 % in CO_2–eq.

CO_2 emission trends for the main categories are given in **Figure 4.1**.

Figure 4.1

The analysis of **Figure 4.1** reveals that the emission fluctuations follow the changes of economic activity. Key factors on macroeconomic level were:

- Changes in international markets;
- Privatization of state property;
- Others.

It can be noted that during the period after the year 2000, certain stabilization of CO_2 emissions has been observed, and after 2002 - there is a tendency of an increase.

The following key sources are in the sector:

- CO_2 from cement production (ranked 7 with 2 % share);
- CO_2 from steel production (ranked 9 with more than 2 % share);
- CO_2 from quicklime production (ranked 13 with 1 % share);
- N_2O from nitric acid production (ranked 14 with 1 % share).
- CO_2 from ammonia production (ranked 20 with 1 % share).

The ranking above is from the list of main emission sources, prepared according to the Tier 1 method, with an estimation of the emission level. Non-key sources from this list are:

- CO_2 from soda ash production;
- CO_2 from the production of other products;
- CH_4 from metal production;
- CO_2 emissions from the use of limestone and dolomite;
- F- gases emissions.

GHG emissions are calculated following the default method according to the equation:

*Emissions = Production * Emission factor*,

where the *production* is in physical units (m^3, kg, m^2 etc.), the *emission factors* are in kg emissions per unit production.

The emissions factors, as a rule, are selected from the IPCC Guidelines but part of them are taken from the adapted in Bulgaria CORINAIR methodology (for the production of steel, ammonia, sinter and other).

4.2. Mineral Products

4.2.1. Source Description

Two key GHG sources contribute to the emissions in this sub sector, which are traditional in the economy of the country. These are the production of cement and lime.

CO_2 emissions from ***cement*** production are 1 551.8 Gg in the year 2005, which is 2 % of the aggregated GHG emissions. During the last five years, there has been a stabilization of the production with a tendency for slight increase. The increase of GHG emissions in 2005 is 12.7 %, compared to 2004.

CO_2 emissions from ***quick lime*** production are 996.1 Gg in the year 2005, which is more than 1 % of the aggregated GHG emissions. The increase of the CO_2 emissions in 2005 compared to 2004 is 4.2 %.

CO_2 emissions from ***soda ash production*** are 146.47 Gg in 2005. In 2005 the CO_2 emissions from the use of soda ash are about 29 % from the emissions at the production of this product.

The CO_2 emissions from glass production are included in the Other emission source of the sector.

4.2.2. Methodology

The Tier 2 method from the Good Practice Guidance is used when determining the emissions from ***cement*** production. As the CO_2 emissions are correlated with data from the produced clinker – emission factors and quantities, their specification is made based on the produced clinker.

The quantities of ***quick lime*** are given by the NSI and the emission factors are adopted by the IPCC Guidelines.

The CO_2 emission factors at use of limestone and dolomite are accepted according to the data from the Revised Guidelines of IPCC, 1996.

Data for the quantities of produced and used ***soda ash*** is confidential. Therefore, the determination of emissions follows a special methodology, coordinated with NSI.

4.2.3. Uncertainty and Consistency of Time Series

The uncertainty from emissions from the sub sector is within the 16-30 % range and the higher percentage relates for the cement production. For the non-key sources, the uncertainty is 20 %.

The CO_2 emission trends for Mineral products production is given in **Table 4.2.**

CO_2 emissions from Mineral products 1988-2005, Gg

Table 4.2

Years/Sources	1988	1989	1990	1991	1992	1993	1994	1995	1996
2A1. Cement Production	2,006	2,203	2,070	1,225	1,062	1,116	1,395	1,926	1,897
2A2. Lime Production	1,118	1,136	1,222	812	572	417	522	747	778
2A3. Limestone and Dolomite Use	458	409	482	340	314	284	244	261	296
2A4. Soda Ash	233	259	222	199	131	79	114	170	181
Soda Ash Production	107	112	101	87	50	25	44	77	84
Soda Ash Use	126	147	121	112	81	54	71	93	97
2A7. Other (please specify)	27	21	24	14	11	13	17	19	22
Glass Production	27	21	24	14	11	13	17	19	22
Desulphurized Emissions									
Total	**3,842**	**4,028**	**4,020**	**2,590**	**2,090**	**1,908**	**2,292**	**3,124**	**3,174**
Years/Sources	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
2A1. Cement Production	1,649	806	1,051	1,124	1,166	1,157	1,211	1,376	1,552
2A2. Lime Production	692	48	561	798	918	855	921	956	996
2A3. Limestone and Dolomite Use	309	376	312	255	246	233	205	297	314
2A4. Soda Ash	178	157	102	117	130	119	129	139	146
Soda Ash Production	84	79	67	90	109	100	106	111	113
Soda Ash Use	93	78	35	27	21	19	23	28	33
2A7. Other (please specify)	18	14	8	8	9	40	62	75	70
Glass Production	18	14	8	8	9	15	8	13	15
Desulphurized Emissions						24	54	61	55
Total	**2,845**	**1,402**	**2,034**	**2,302**	**2,469**	**2,403**	**2,529**	**2,843**	**3,078**

The analysis of **Table 4.2** shows a stable trend of the GHG emissions from the two main sources – cement and lime production..

4.3. Chemical Industry

4.3.1. Source Description

N_2O emissions from ***nitric acid*** production, expressed in CO_2-eq. were 992.2 Gg for the year 2005. The emission increase in 2005 is some 15.5 % compared to 2004, as the current level remains higher than the level in 1999.

CO_2 emissions from ***ammonia*** production were 596.92 Gg for the year 2005. The increase of emissions in 2005 is some 1.9 % compared to 2004 and the big fall after 1998 has overcome. Here we must point the big change in the level of these emissions because of the change of the emission factor. The new factor is increase by about 60 % and the emissions for the whole time series are recalculates. The reasons for this change of the emission factor are describe in Chapter 10 – Recalculations.

Non-energy emissions from the use of fuel in this sub sector are calculated and classified in the sub sector Chemistry of the Energy sector.

4.3.2. Methodology

Data for ***nitric acid*** production is confidential, due to which N_2O emissions are define based on a special methodology. The emission factors for the calculation of N_2O emission are from the IPCC Guidelines.

The quantity of produced ***ammonia*** is provided by NSI and the emission factor is determined with a model. Therefore, the emission factor in use is quite different from the standard value in the IPCC Guidelines.

4.3.3. Uncertainty and Consistency of Time Series

The uncertainty of N_2O emissions from nitric acid production has estimated at 200 %. The uncertainty of CO_2 emissions from the production of ammonia is 21 %.

The trends of GHG emissions in this sub sector have given in **Table 4.3.**

The analysis of **Table 4.3** shows a trend of significant reduction of GHG emissions in the year 2005 compared to 1988 – about three times for the ammonia and nitric acid production.

4.4. Metal Production

4.4.1. Source Description

CO_2 process emissions from the ***steel*** production are a key source contributing 2 % of the total GHG emissions in the year 2005 – 1 376.3 Gg. This is the second biggest source of GHG emissions in the Industrial Processes sector after the cement.

CH_4 emissions from the production of metals are non-key GHG emission sources. These are emissions from production of pig iron, sinter and coke.

Non-energy emissions from fuel use in this sub sector are calculated and classified in the Iron and Steel production category of the Energy sector.

4.4.2. Methodology

The production quantities for the purposes of the inventory have provided by the statistics of NSI and the emission factors are determined by taking into account the steel production technologies (basic oxygen furnace and electric arc furnace). For the purpose, we use a method which using the analytical way calculates the emission factor using data from the adapted CORINAIR methodology, used in NSI. Therefore, this factor differs significantly from the recommended in the IPCC Guidelines aggregated emission factor for pig iron and steel production.

As a rule, data for the produces quantities of coke and pig iron is confidential. Therefore, the GHG emissions have calculated following a special methodology, coordinated with NSI.

4.4.3. Uncertainty and Consistency of Time Series

The uncertainty of CO_2 emissions from steel production has estimated at 10 % and those of CH_4 emissions – at 20 %. Total uncertainty of F-gases has estimated at 51 %.

The trends of GHG emissions in this sub sector are given in **Table 4.4**

The analysis of **Table 4.4** reveals significant decrease of GHG emissions in the year 2005 compared to 1988 – 41.7 % for steel production, 49.3 % for coke and 24.8 % for pig iron.

The 2005 inventory report presents also potential HFC emissions, which are determined, based on import substances, containing greenhouse gases - HFC-23, HFC-32, HFC-125, HFC-134a, HFC–152a, HFC-143a and HFC-227ea. The potential GHG emissions are accounted when forming the

summary of GHG emissions because the actual emissions are not valuated. By this the Good Practice Guidance of requirements are regarded.

4.5. Halocarbon and SF_6 Production

F-gases have not produced in Bulgaria.

4.6. Halocarbon and SF_6 Consumption

4.6.1. Source Description

This emission source includes fugitive emissions of SF_6 from high voltage equipment where this gas has used as an insulator. The total emission of this source in the year 2005 is 4.42 Gg CO_2-eq.

4.6.2. Methodology

To determine the fugitive emissions of SF_6 from electrical equipment, the proposal for emission factor from the Good Practice Guidance is applied.

NSI has no data on the actual consumption of HFCs according to the classification in the IPCC Guidelines, namely gases used for the production of refrigeration and air conditioning equipment, foam blowing, fire extinguishers, aerosols, solvents and other applications (tobacco processing, production of adhesive/glue, ink, paint, etc.).

GHG emissions from Chemical industry processes, Gg

Table 4.3

Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
Ammonia Production	1,662	1,642	1,620	1,353	1,120	1,095	1,232	1,490	1,479	1,216	652	468	802	718	457	484	586	597
Calcium Carbide	89.3	108.7	96.5	61.8	43.2	30.3	30.6	34.6	33.4	31.4	20.2	12.3	11.9	6.8	7.6	8.3	24.4	26.3
N_2O																		
Nitric Acid Production	7.8	7.4	7.3	5.2	4.3	3.7	4.3	6.2	6.3	5.2	3.1	2.4	4.2	4.2	3.5	3.7	2.8	3.2

GHG emissions from Metal industry processes, Gg

Table 4.4

Sources	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CO_2																		
Steel	2,360	2,380	1,793	1,326	1,273	1,594	2,045	2,236	2,017	2,158	1,837	1,668	1,458	1,391	1,305	1,640	1,505	1,376
Ferroalloys Production	113	94	43	67	38	46	82	79	77	96	29	36	20	28	18	18	17	22
Aluminum Production	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH_4																		
Pig Iron	1.29	1.37	1.03	0.85	0.75	0.90	1.30	1.42	1.33	1.45	1.25	1.04	1.99	1.01	0.97	1.21	1.01	0.97
Sinter	1.46	1.37	1.04	0.84	0.77	0.90	1.15	1.25	1.13	1.22	0.97	0.93	0.90	0.88	0.71	0.88	0.71	0.68
Coke	0.73	0.78	0.69	0.37	0.42	0.46	0.56	0.62	0.58	0.62	0.40	0.27	0.47	0.40	0.38	0.42	0.42	0.37
F-gases																		
HFCs- potential								62.16	109.30	188.15	576.65	102.80	96.02	97.50	89.59	120.60	217.30	386.84
PFCs-potential																		
SF6-potential													29.40	2.39	2.39	6.36	0.00	0.96

4.6.3. Recalculation of Sources

For the purpose of the GHG inventory report, additional data has collected from all enterprises in the country, using electrical commutation devices with SF_6. Thus, the existing information has updated, and fugitive SF_6 emissions from the operation of this kind of devices are recalculated.

4.7. Other industrial Processes

4.7.1. Source Description

This source includes CO_2 emissions from glass and ferroalloys production and from desulphurization. The emissions for the year 2005 are 91.1 Gg. They decrease by 1.1 % compared to 2004 due to the decreased emissions from the desulphurization process in the Maritza Iztok power stations. These latest emissions account for more than 60 % of the source emissions.

4.7.2. Methodology

Data for the produced quantities from this source is given by NSI and the emission factors are adopted according to the IPCC Guidelines.

Data for calcium carbide is confidential. Therefore, GHG emissions are calculated following special methodology.

4.7.3. Uncertainty and Consistency of Time Series

The uncertainty of CO_2 emissions from this source has estimated at 21 %.

CHAPTER 5. SOLVENT USE

5.1. General Description

GHG emissions in the **Solvent use sector** are result from the processes in the production and use of paint and adhesives, use of solvents in industry and households, dry cleaning, vegetable oil production, production of pharmaceuticals and anaesthesia. The emissions from this sector are mainly of NMVOCs and N_2O.

GHG inventories in Bulgaria use a simplified method for the calculation of NMVOC emissions, which includes use of data from the GHG calculation following the CORINAIR methodology.

N_2O emissions has not been assessed during the inventory in Bulgaria due to lack of data for the substances used in anaesthesia, production of pharmaceuticals, sprays, etc.

5.2. NMVOCs Emissions from Solvent Use

5.2.1. Source Description

NMVOCs emissions are described for the following activities;

- Use of paints (including water based paints);
- Paint and lacquer production;
- Use of chemicals for dry cleaning;
- Vegetable oil production;
- Use of adhesives;
- Use of solvents in industry and households;
- Production of pharmaceutical.

There are no key GHG emissions in this sector.

NMVOCs emissions amount to 30.3 Gg, which is 29.5 % of the emissions of this gas in Bulgaria. The emission growth in the year 2005 is 28.2 % compared to 2004 mainly due to increased use of paints solvents in the households.

5.2.2. Methodology

NMVOCs emissions are calculated with emission factors, given in the approved in Bulgaria methodology for GHG emission calculation with balancing methods. This methodology is prepared based on the CORINAIR methodology, taking into consideration the specifics of some metallurgy and chemical technologies of the country in 2000.

Due lack of data about the emissions from dry cleaning and use of paint and solvents the consistency of the time series after 1997 is not good enough.

5.2.3. Uncertainty and Consistency of Time Series

NMVOCs emissions are GHG-precursors and there is no data in the bibliography on their uncertainty.

The trends in NMVOCs emissions are given in **Table 5.1**.

Trends in NMVOCs emissions from solvent and other product use, Gg

Table 5.1

Gas/sub-source	1988	1989	1990	1991	1992	1993	1994	1995	1996
A. Paint Application	0.14	0.16	0.13	0.06	0.08	0.12	0.16	0.18	0.21
B. Degreasing and Dry Cleaning	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. Chemical Products, Manufacturing and Processing	1.25	1.30	0.83	0.35	0.35	0.27	0.28	0.38	0.45
D. Other (please specify)									
Vegetable oil production	3.11	3.20	2.51	1.92	2.32	2.72	2.54	3.43	2.88
Use of lacquers and solvents	8.99	8.99	8.67	8.60	8.48	8.46	8.43	8.38	8.34
Pharmacy	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Total	**13.62**	**13.77**	**12.25**	**11.04**	**11.36**	**11.69**	**11.53**	**12.49**	**11.99**
Gas/sub-source	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
A. Paint Application	0.17	1.09	2.43	0.52	0.69	0.59	0.90	1.17	1.63
B. Degreasing and Dry Cleaning	0.00000	0.00000	0.33600	0.03540	0.28620	0.01400	0.01053	0.00544	0.00622
C. Chemical Products, Manufacturing and Processing	0.45	4.95	4.12	0.70	11.98	11.96	10.70	18.60	24.05
D. Other (please specify)									
Vegetable oil production	2.80	1.88	1.83	1.84	1.61	1.22	1.39	1.24	1.49
Use of lacquers and solvents	8.28	8.23	2.00	7.48	2.43	3.24	1.43	2.54	3.06
Pharmacy	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Total	**11.82**	**16.26**	**10.83**	**10.69**	**17.10**	**17.13**	**14.54**	**23.65**	**30.34**

The analysis of **Table 5.1** shows violation of the consistency of time series after 1997. This is due to the inclusion of a new emissions source - bitumen production used for covering the roads with asphalt and to the lack of data about dry cleaning.

CHAPTER 6. AGRICULTURE

6.1. General Description

GHG emissions from **sector Agriculture** result from the activities during the production and processing of agricultural products, soil fertilization and animal manure processing and preservation.

All emissions from combustion processes for energy production are reported in the Energy sector while the emissions from agricultural machines are reported in the category Other Transportation of the Transport sub sector.

GHG process emissions in sector Agriculture are grouped in the following sub sectors:

- Enteric fermentation from domestic livestock;
- Manure management;
- Rice cultivation;
- Agricultural soils;
- Field burning of agricultural residues.

The processes and activities, from the sub sectors given above, emit mostly the gases CH_4 and N_2O.

During the process of field burning of agricultural residues, certain quantities of GHG precursors are emitted. Although the burning of stubble-fields is banned in Bulgaria, the practice shows that not only stubble-fields are burnt but also areas with crops with no economical value for their owners. Due to this fact in the inventories valuations of this source of emissions are made.

GHG emissions trends from the sector are given in **Table 6.1**.

The biggest CH_4 emission source in the sector is the sub-sector Enteric Fermentation from domestic livestock.

The biggest N_2O emission source is the Agricultural Soils sub sector.

The following GHG emission sources emerge as key sources for the year 2005:

- CH_4 from Enteric fermentation (ranked 8 with more than 2 % share);
- Direct N_2O emissions from agricultural soils (ranked 12 with 1 % share);
- Indirect emissions of N_2O from the agricultural soil (ranked 16 shares 1 %);

The ranking above comes from the list of key sources, drafted according to the Tier 1 method with an estimation of emissions level. Non-key sources from this list are:

- Methane emissions from manure treatment;
- N_2O emissions from manure treatment;
- CH_4 emissions from rice cultivation;
- CH_4 emissions from field burning of agricultural residues;
- N_2O emissions from field burning of agricultural residues.

Trend in greenhouse gas emissions from Agriculture, Gg

Table 6.1

-	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
CH_4																		
4A. Enteric Fermentation	192.79	187.57	180.17	165.99	137.48	107.19	90.13	85.27	82.38	79.48	81.77	82.95	79.28	62.20	68.97	71.52	70.95	67.34
4B. Manure Management	72.55	73.11	71.49	62.81	51.10	40.90	34.72	34.52	31.60	27.93	29.64	30.30	27.08	19.30	22.42	24.38	24.05	22.75
4C. Rice Cultivation	5.68	5.49	4.26	3.30	1.82	1.26	0.33	0.56	1.05	1.53	1.61	0.57	1.44	1.57	2.11	2.27	2.30	1.89
4F. Field Burning of Agricultural Residues	2.21	2.66	2.20	2.32	1.62	1.33	1.40	1.46	0.81	1.34	1.19	1.30	1.15	1.30	1.50	0.91	1.61	1.29
N_2O																		
4B. Manure Management	3.41	3.41	3.32	2.97	2.45	1.96	1.64	1.60	1.49	1.36	1.46	1.51	1.38	1.03	1.19	1.27	1.26	1.19
4D. Agricultural Soils	25.00	22.77	20.93	15.06	12.01	10.88	11.02	9.27	9.02	9.18	7.91	8.95	8.61	7.88	8.03	7.59	8.40	7.96
4D1 Direct Soil Emissions	10.56	9.46	8.43	5.26	4.02	3.97	4.37	3.38	3.17	3.45	2.66	3.34	3.25	3.48	3.49	3.10	3.73	3.47
a. Synthetic Fertilizers	7.65	6.34	5.60	2.62	1.97	2.34	2.87	1.83	2.01	2.16	1.38	1.98	2.05	2.38	2.20	1.99	2.33	2.26
b. Animal Wastes Applied to Soils	1.92	1.93	1.86	1.62	1.32	1.05	0.88	0.88	0.80	0.70	0.76	0.79	0.72	0.56	0.66	0.72	0.72	0.67
c. N-fixing Crops	0.06	0.08	0.05	0.06	0.05	0.03	0.03	0.05	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
d. Crop Residue	0.92	1.11	0.92	0.97	0.68	0.55	0.58	0.61	0.34	0.56	0.49	0.54	0.47	0.53	0.62	0.38	0.66	0.53
e. Cultivation of Histosols	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4D2 Animal Production	5.33	5.14	4.96	4.62	3.83	3.08	2.76	2.71	2.65	2.56	2.55	2.50	2.34	1.61	1.74	1.75	1.73	1.67
4D3 Indirect Emissions	9.11	8.16	7.53	5.18	4.15	3.82	3.89	3.18	3.20	3.17	2.70	3.11	3.02	2.78	2.80	2.73	2.94	2.82
Atmospheric Deposition	2.00	1.83	1.71	1.27	1.03	0.91	0.88	0.76	0.75	0.74	0.66	0.73	0.70	0.61	0.63	0.62	0.65	0.63
Nitrogen Leaching and Run-off	7.12	6.34	5.82	3.91	3.12	2.92	3.01	2.41	2.44	2.44	2.04	2.38	2.32	2.17	2.17	2.11	2.29	2.20
4F. Field Burning of Agricultural Residues	0.05	0.06	0.05	0.05	0.04	0.02	0.03	0.03	0.02	0.03	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.02

Figure 6.1

Methane emission trends are given in **Figure 6.1**. They form 41 % of the total emissions in the sector in CO_2-eq. A steady trend of emissions increase is observed since 2001.

N_2O emissions from the sector are also significant. The biggest share belongs to the agricultural soils emissions. It is about 87 % in the year 2005 and for the entire period 1988-2003, the share is in the range of 83-88 %. N_2O emissions from manure management and field burning of agricultural residues are of an order of magnitude smaller and in total are about 15-18 % from the aggregated N_2O emissions of the sector.

In total, the N_2O emissions, expressed in CO_2-eq. for 2005, are 44 % bigger than the CH_4 emissions in CO_2-eq.

6.2. Enteric Fermentation

6.2.1. Source Description

The emissions from this key source result from the fermentation in the digestive system of ruminant animals. In Bulgaria are bred all domestic animals indicated in IPCC except for llamas and camels.

CH_4 emissions in CO_2-eq. were 1 414.5 Gg in the year 2005 – some 2 % from the total GHG emissions. A decrease in the year 2005 was 5.1 % compared to 2004 and is due to a distribution of the basic type of animals.

6.2.2. Methodology

CH_4 emissions are determined using standard emission factors from the IPCC Guidelines in the framework of the Tier 1 method. These factors are summarized for different animal types, and only cattle are classified according to geographical regions principle. The inventory adopts cattle emission factor (including dairy cows) for the Eastern European region.

6.2.3. Uncertainty and Consistency of Time Series

The uncertainty from methane emissions from this source is 50 %.

The methane emissions from the enteric fermentation of domestic livestock are given in **Table 6.2**.

The analysis of **Table 6.2** shows a steady trend of the emission growth after 2001. It is evident that the drop of 63 % compared to 1988 can't be easily overcome in the next 10 years at such temps of raising.

The average number of animals per year is given in **Table 6.3**.

The time series for the different types of domestic animals has been consistent despite the change of the survey methodology in the year 2000.

6.3. Manure Management

6.3.1. Source Description

Despite the fact that this emission source does not belong to the group of key sources, it remains one of the biggest CH_4 emitters out of all sectors, ranked 5-6 for the entire 1988-2005 period.

CH_4 emissions expressed in CO_2-eq. were 477.8 Gg for the year 2005. Their decrease compared to the year 2004 is 5.4 %, which is due to the slight general decrease of the average annual number of livestock.

Manure management leads to N_2O emissions, which expressed in CO_2-eq. amount to 369.4 Gg during the year 2005. The emissions decrease is even lower - 6.7 % compared to 2004.

N_2O emissions from this sub sector do not include animal waste from pastures.

6.3.2. Methodology

CH_4 emissions are determined according to the Tier 1 method using standard values from the IPCC Guidelines. Only for cattle (dairy and non-dairy) and swine, emission factors are calculated according to the Tier 2 method. Specific parameters for the systems for management and storage of manure have been given for this method in Bulgaria.

CH_4 emissions due to enteric fermentation, 1988-2005, Gg

Table 6.2

Animal type	1988(a)	1989(a)	1990(a)	19991(a)	1992(a)	1993(a)	1994(a)	1995(a)	1996(a)	1997(a)	1998(a)	1999(a)	2000(a)	2001(a)	2002(a)	2003(a)	2004(a)	2005(a)
Cattle	107.05	104.75	99.93	92.12	77.22	59.60	48.48	44.55	43.07	42.72	46.03	48.54	47.59	40.70	46.19	48.75	48.33	45.17
- Dairy Cattle	50.93	50.93	48.70	47.41	42.96	36.68	31.11	29.12	29.42	30.12	32.74	34.52	34.31	27.57	29.38	29.16	29.59	29.02
- Non-Dairy Cattle	56.12	54.60	51.23	44.71	34.26	22.92	17.37	15.43	13.65	12.60	13.29	14.02	13.28	13.13	16.81	19.59	18.74	16.15
Buffalo	1.31	1.28	1.33	1.39	1.30	1.08	0.85	0.75	0.69	0.60	0.58	0.54	0.47	0.37	0.39	0.42	0.44	0.44
Sheep	69.98	66.96	64.27	58.57	46.07	34.31	28.64	27.12	25.61	23.47	22.48	21.29	19.34	12.10	13.20	13.31	13.16	13.18
Goats	2.16	2.17	2.33	2.63	2.91	3.22	3.68	4.07	4.21	4.54	5.03	5.23	5.04	3.14	3.57	3.70	3.61	3.32
Camels and Llamas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horses	2.20	2.17	2.11	2.07	2.05	2.04	2.22	2.55	2.89	2.87	2.54	2.47	2.53	2.62	2.38	2.16	2.29	2.23
Mules and Asses	3.55	3.52	3.49	3.48	3.36	3.22	3.06	2.95	3.01	2.89	2.55	2.30	2.16	2.03	1.72	1.46	1.44	1.40
Swine	6.11	6.34	6.39	5.50	4.37	3.56	3.04	3.09	2.73	2.24	2.40	2.43	1.99	1.08	1.34	1.52	1.47	1.41
Poultry	0.42	0.39	0.32	0.25	0.21	0.16	0.16	0.19	0.17	0.15	0.15	0.15	0.15	0.16	0.18	0.20	0.21	0.20
Total	**192.79**	**187.57**	**180.17**	**165.99**	**137.48**	**107.19**	**90.13**	**85.27**	**82.38**	**79.48**	**81.77**	**82.95**	**79.28**	**62.20**	**68.97**	**71.52**	**70.95**	**67.34**

Number of animals 1988-2005 (1 000 head)

Table 6.3

Animal type	1988(a)	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cattle	1,631	1,594	1,516	1,384	1,142	862	694	635	607	597	642	677	661	575	663	710	700	647
- Dairy Cattle(3)	629	619	601	585	530	453	384	360	363	372	404	426	424	340	363	360	365	358
- Non-Dairy Cattle	1,002	975	915	798	612	409	310	275	244	225	237	250	237	234	300	350	335	288
Buffalo	24	23	24	25	24	20	15	14	13	11	10	10	9	7	7	8	8	8
Sheep	8,747	8,370	8,034	7,321	5,759	4,289	3,580	3,390	3,201	2,934	2,811	2,661	2,418	1,512	1,650	1,663	1,646	1,647
Goats	432	434	465	525	582	644	736	814	841	907	1,007	1,047	1,008	629	715	740	722	663
Horses	122	120	117	115	114	113	123	142	160	159	141	137	141	146	132	120	127	124
Mules and Asses	355	352	349	348	336	322	306	295	301	289	255	230	216	203	172	146	144	140
Swine	4,076	4,225	4,259	3,664	2,911	2,376	2,029	2,063	1,820	1,490	1,601	1,617	1,328	718	893	1,014	982	937
Poultry	41,614	39,071	32,168	24,853	20,790	16,185	15,812	18,868	17,418	15,497	15,226	15,324	14,977	16,498	18,072	20,036	20,723	19,514

(a) average

6.3.3. Uncertainty and Consistency of Time Series

The uncertainty of methane emissions from this source is 50 % and of N_2O emissions - 300 %.

The methane and N_2O emissions from manure management are given in **Table 6.4**.

The analysis of **Table 6.4** shows decrease of methane emission for the present inventory, compared to the emissions from the preceding year and maintaining the low level compared to the base 1988 year – i.e. 66 % reduction.

6.4. Rice Cultivation

Rice cultivation is a traditional Bulgarian agricultural activity. During the structural reforms, rice crop areas decreased from 14 100 ha in 1988 to 1 420 ha in 1999. There has been a restoration of rice crop areas after 1999, reaching 5 644 ha in 2005.

39.6 Gg CH_4 CO_2-eq. has been emitted in 2005. The emission decrease of 17 % compared to the year 2004 is due to the reduction of the areas of rice crops.

CH_4 emission calculation is carried out according to the default method from the IPCC Guidelines. The value adopted as an emission factor is based on expert assessment taking into consideration the water regime for the rice crops in Bulgaria.

6.5. N_2O Emissions from Agricultural Soils

6.5.1. Source Description

The emissions from this sub sector include the following main categories N_2O emissions;

- Direct emissions;
- Emissions from pasture animals;
- Indirect emissions.

Only the first two categories out of the three listed above are key sources in the year 2003.

Direct emissions are a result of:

- Soil fertilization with synthetic nitrogenous fertilizers;
- Nitrogen input from manure applied to soils (excluding manure from pasture animals);
- Decomposition of waste from N-fixing crops;
- Decomposition of vegetable waste from other cultures;
- Cultivation of histosols.

The emissions of ***pasture animals*** include emissions from the excretion on pasture range and paddock.

Trend in GHG emissions from Manure management 1988-2005, Gg

Table 6.4

Livestocks	1988(a)	1989(a)	1990(a)	19991(a)	1992(a)	1993(a)	1994(a)	1995(a)	1996(a)	1997(a)	1998(a)	1999(a)	2000(a)	2001(a)	2002(a)	2003(a)	2004(a)	2005(a)
CH_4																		
Cattle	23.74	23.23	22.17	20.46	17.17	13.28	10.82	9.94	9.62	9.55	10.29	10.86	10.65	9.09	10.30	10.86	10.77	10.08
- Dairy Cattle	11.51	11.33	11.00	10.71	9.71	8.29	7.03	6.58	6.65	6.80	7.40	7.80	7.75	6.23	6.64	6.59	6.68	6.56
- Non-Dairy Cattle	12.23	11.90	11.17	9.75	7.47	5.00	3.79	3.36	2.97	2.75	2.90	3.06	2.89	2.86	3.66	4.27	4.09	3.52
Buffalo	0.22	0.21	0.22	0.23	0.21	0.18	0.14	0.12	0.11	0.10	0.09	0.09	0.08	0.06	0.06	0.07	0.07	0.07
Sheep	2.45	2.34	2.25	2.05	1.61	1.20	1.00	0.95	0.90	0.82	0.79	0.75	0.68	0.42	0.46	0.47	0.46	0.46
Goats	0.08	0.08	0.08	0.09	0.10	0.12	0.13	0.15	0.15	0.16	0.18	0.19	0.18	0.11	0.13	0.13	0.13	0.12
Horses	0.25	0.25	0.24	0.24	0.24	0.24	0.26	0.29	0.33	0.33	0.29	0.29	0.29	0.30	0.28	0.25	0.26	0.26
Mules and Asses	0.41	0.25	0.40	0.40	0.38	0.37	0.35	0.34	0.34	0.33	0.29	0.26	0.25	0.23	0.20	0.17	0.16	0.16
Swine	40.54	42.02	42.36	36.44	28.95	23.63	20.18	20.52	18.10	14.82	15.92	16.08	13.21	7.14	8.88	10.09	9.77	9.32
Poultry	4.87	4.57	3.76	2.91	2.43	1.89	1.85	2.21	2.04	1.81	1.78	1.79	1.75	1.93	2.11	2.34	2.42	2.28
Total	**72.55**	**72.96**	**71.49**	**62.81**	**51.10**	**40.90**	**34.72**	**34.52**	**31.60**	**27.93**	**29.64**	**30.30**	**27.08**	**19.30**	**22.42**	**24.38**	**24.05**	**22.75**
N_2O																		
Total	**3.41**	**3.41**	**3.32**	**2.97**	**2.45**	**1.96**	**1.64**	**1.60**	**1.49**	**1.36**	**1.46**	**1.51**	**1.38**	**1.03**	**1.19**	**1.27**	**1.26**	**1.19**

Additional information on nitrogen flows related to direct soil emissions, t N/yr

Table 6.5

N input to soils	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Direct soil emissions																		
Use of synthetic fertilizers (kg N/yr)	487,027	403,712	356,347	166,572	125,526	148,840	182,842	116,591	127,800	137,217	87,747	126,242	130,435	151,166	139,870	126,837	148,462	143,555
Nitrogen input from manure applied to soils (kg N/yr)	122,020	122,809	118,355	102,807	84,025	66,711	55,994	55,828	50,753	44,837	48,462	50,429	45,764	35,697	41,733	45,899	45,576	42,852
N-fixinc Crops (kg N/yr)	3,962	4,888	3,441	3,585	3,104	1,919	2,022	3,190	1,773	1,790	1,683	1,515	695	734	745	775	735	667
Crop Residue(kg N/yr)	58,735	70,741	58,362	61,698	43,273	35,029	37,050	39,028	21,541	35,353	31,413	34,356	30,043	33,947	39,336	23,873	42,187	33,733
N excretion on pasture range and paddock (kg N/yr)	169,589	163,409	157,939	146,932	121,979	98,061	87,708	86,345	84,345	81,363	81,038	79,420	74,473	51,326	55,333	55,818	55,164	53,061
% of nitrogen input to soils from total manure	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Indirect soil emissions																		
Indirect deposition kg N/yr	308,147	277,679	256,929	180,394	144,844	132,000	132,799	109,950	110,149	108,839	93,999	107,005	103,597	93,900	95,156	93,138	99,857	95,808

Indirect emissions include:

- ammonia and nitrous oxides release in the ambient air after nitrogen fertilization;
- emissions from drawing of water.

Activities described above are differentiated according to the IPCC classification. One has to take into consideration that the existing emissions of methane from soil are considered natural (non-anthropogenic) and are not subject of the inventory.

Direct N_2O emissions were 1 075.7 Gg CO_2-eq. in 2005, which is more than 1 % of the aggregated GHG emissions during the year. The emission decrease in 2005 compared to 2004 is about 5 % due to the smallest quantities of synthetic nitrogenous fertilizers and manure deposited in soils – see **Table 6.5**.

N_2O emissions from Agricultural soils, Gg

Table 6.6

Nitrogen flows (t N/yr)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Direct soil emissions	***10.56***	***9.46***	***8.43***	***5.26***	***4.02***	***3.97***	***4.37***	***3.38***	***3.17***
Use of synthetic fertilizers	7.65	6.34	5.60	2.62	1.97	2.34	2.87	1.83	2.01
Nitrogen input from manure applied to soils	1.92	1.93	1.86	1.62	1.32	1.05	0.88	0.88	0.80
N-fixinc Crops	0.06	0.08	0.05	0.06	0.05	0.03	0.03	0.05	0.03
Crop Residue	0.92	1.11	0.92	0.97	0.68	0.55	0.58	0.61	0.34
Cultivation of histosols	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
N excretion on pasture range and paddock	***5.33***	***5.14***	***4.96***	***4.62***	***3.83***	***3.08***	***2.76***	***2.71***	***2.65***
Indirect soil emissions	***9.11***	***8.16***	***7.53***	***5.18***	***4.15***	***3.82***	***3.89***	***3.18***	***3.20***
Total	**25.00**	**22.77**	**20.93**	**15.06**	**12.01**	**10.88**	**11.02**	**9.27**	**9.02**
Nitrogen flows (t N/yr)	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Direct soil emissions	***3.45***	***2.66***	***3.34***	***3.25***	***3.48***	***3.49***	***3.10***	***3.73***	***3.47***
Use of synthetic fertilizers	2.16	1.38	1.98	2.05	2.38	2.20	1.99	2.33	2.26
Nitrogen input from manure applied to soils	0.70	0.76	0.79	0.72	0.56	0.66	0.72	0.72	0.67
N-fixing Crops	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Crop Residue	0.56	0.49	0.54	0.47	0.53	0.62	0.38	0.66	0.53
Cultivation of histosols	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N excretion on pasture range and paddock	***2.56***	***2.55***	***2.50***	***2.34***	***1.61***	***1.74***	***1.75***	***1.73***	***1.67***
Indirect soil emissions	***3.17***	***2.70***	***3.11***	***3.02***	***2.78***	***2.80***	***2.73***	***2.94***	***2.82***
Total	**9.18**	**7.91**	**8.95**	**8.61**	**7.88**	**8.03**	**7.59**	**8.40**	**7.96**

Indirect N_2O emissions were 874.2 Gg CO_2-eq. in 2005. These category emissions also decreases with a little more than 4 % compared to 2004.

Also the emissions from pasture animals decrease by 3.5 %.

6.5.2. Methodology

The emissions from this source are determined after a selection of parameters, indicators and emission factors, given as prototypes in the IPCC Guidelines. So far, there are no assessments of these parameters and emission factors, which result from the measurements in the country.

The manure quantity is calculated using the prototype parameters for different types of animals in the Eastern Europe region, given in the IPCC Guidelines. The synthetic fertilizers quantities are provided by the National Service for Plant Protection at the Ministry of Agriculture and Forestry.

6.5.3. Uncertainty and Consistency of Time Series

The uncertainty from the direct N_2O emissions from this source is 250 % and from the indirect emissions - 500 %.

N_2O emissions from this source for all categories n the sub sector are given in **Table 6.6**.

The consistency of time series for the source categories given in **Table 6.6** is provided due to lack of changes in the methodology and in the source of data.

6.6. Field Burning of Agricultural Residues

CH_4 emissions from this source result from field burning. Despite the fact that field burning is prohibited, this tradition continues and is emission source not only of main GHGs but also of GHGs-precursors.

34.6 Gg CH_4 in CO_2-eq. has been emitted in 2005. The decrease is 20 %, compared to the year 2004, on the assumption that 10 % of the vegetal residues, left on the fields after yielding crop, are burned.

The crop residues quantities are calculated under the methodology of IPCC based on data from MAF for the quantities of vegetable crop yields.

CHAPTER 7. LAND-USE CHANGE AND FORESTRY

7.1. General Description

The Land-Use Change and Forestry sector covers the processes of CO_2 exchange between the biomass sources (forests, grass and other plants, soils, etc.) and the atmosphere. The CO_2 flow exchange from and to the atmosphere is a set of processes, which result from anthropogenic activity. For example, CO_2 sequestration by forests is related to forest management and use of woodlands aimed at industrial timbering. The reforestation of uncultivated lands, aimed at erosion control, also results in CO_2 accumulation in biomass.

CO_2 emissions in the atmosphere are related to thinning and burning of forests to convert them in agricultural lands, and because of changes in the organic compounds of the soils due to erosion or chemical treatment.

Due to the significant complexity and heterogeneity of the CO_2 removal and emission processes, the revised IPCC Guidelines define several sub sectors, which encompass the following categories:

A. Changes in Forest and other woody biomass stocks.

This category includes the processes of woody biomass growing, felling and timbering. As a rule, the net carbon balance in Bulgaria is in the direction of CO_2 removal from the atmosphere.

B. Forest and Grassland conversion.

These activities aim at the conversion of land for agricultural use for the production of crops and animal breeding.

C. Abandonment of managed lands.

These are agricultural lands (fields, pastures, plantations, etc.) which resume their initial vegetation cover (woody or grassy).

D. CO_2 Emissions and removals from soil.

This category includes processes and activities that change the organic composition of the soils. Such is the introduction of minerals during soil treatment, erosion process, etc.

E. Other.

This category includes activities, which also result in changes of CO_2 flows from and to the atmosphere. Such are soil drainage, shifting the cultivation periods of crop farming (mostly in the tropical regions), succession of longer and shorter cultivation periods.

By introduction of Good Practice Guidance 2000, especially for this sector, conditions appeared for better covering of the emission sources. For the purpose CRF tables of new types have been invented, which are united in a new general format for accounts.

The new Guidance includes the five categories described above in more enlarged meaning and range. The different kinds and types of vegetations and plants are classified in the following sections:

- Woods
- Plants (grain crops, industrial crops and others)
- Meadows, pastures and other lawns
- Swampy and marshy areas
- Wood and other plantations in towns and villages, protective forest belts and others

– Other lands

For each of the above-mentioned sectors are defined two conditions of forests (plant areas, meadows and others), which *remain* woodlands or respectively crop fields and others, and lands which distinguish from woodlands, but are converted to woodlands (plant areas, meadows and others). In this way, all the possible changes of lands and the of land using are covered. Six groups, which include all lands and their changes that have relation to the relevant section given above, are formed this way.

The carbon balance of the following activities is described to each of these groups:

– Alteration of the biomass in the over-ground of woods etc.,

– Alteration of the dead biomass (decayed etc.),

– Alteration of the carbon reserves in the relevant soil (forest, field, meadow etc.)

During the analysis of the biomass in the types of soil formed in that way, results including all the aspects of the land using and the alteration of lands come out.

Besides the above-described actions, it is reported information about:

– Synthetic nitrogen fertilizers, brought in the forest soils,

– N_2O emissions from draining of forest etc.,

– Liming of soils,

– N_2O emissions from converting in agricultural lands with grain crops,

– Burning of biomass

For each above-described activity and category there is algorithms submitted in the GPG-PA.

In the 2005 GHG inventory, and for the preceding years, the net CO_2 removal from category A – Changes in Forest and other woody biomass stocks has been determined.

Now a new scientific research is imminent to be introduced, which holds out a method for more exact valuation of the carbon absorption in the over-ground parts of woods and soils. In this research are introduced methods and algorithm for valuation of the CO_2, absorbed by soils.

7.2. CO_2 Sinks from Forestry

7.2.1. Source Description

Bulgarian forests belong to the temperate climate zone. For the most part they are two types – deciduous and coniferous.

The forests in Bulgaria cover about 30 % of the territory of the country. The terrain varies and presumes the presence of big woodlands in the mountain and semi mountain areas of Central and Southern Bulgaria.

In 2005 the total forests area in Bulgaria (deciduous and coniferous) was 4076.5 thousand ha. The total area of the managed woods from this fund is 4029.2 thousand ha or 98.8 %. More than 79 % of the forests are state property, 8 % are municipal and 10 % are private property. The forest areas for timbering and site formation are 65.9 %, the protective and recreational forests – 26.6 % and protected forest and territories – 7.5 %.

The wood stock is more than 598.81 millions m^3 with an average annual growth of 14.12 millions m^3. The volume of cut wood was 7.056 millions m^3 in 2005. Essential characteristics of the Bulgarian forests are:

- Average volume per 1 ha – 162 m^3;
- Average increment per 1 ha – 3.9 m^3;
- Average age – 51 years;
- Average density – 0.72;
- Average yield class- III

7.2.2. Methodology

During the GHG inventory, data for stocked carbon and changes in forests was based on the following elements;

- forest area, in ha;
- average annual growth in m^3/ha/year;
- harvest biomass in m^3/year.

The Forest Law carries out the control on the management and use of forest areas. It sets common rules to which are subjects all forests (according to ownership, type of forest, purpose and other characteristics).

The average annual growth of the forests is determined following a special methodology of the forestry authorities once in each five years within the framework of the successive forest inventory. **Table 7.1** gives the calculated carbon uptake factor in the two main types Bulgarian forests.

Implied carbon uptake factors (in t C/ha)

Table 7.1

Implied uptake factor	1988	1989	1990	1991	1992	1993	1994	1995	1996
Evergreen	0.847	0.802	0.919	0.952	0.988	1.027	1.036	1.057	1.065
Deciduous	0.847	0.735	0.874	0.901	0.929	0.955	0.965	0.971	0.968
Implied uptake factor	**1997**	**1998**	**1999**	**2000**	**2001**	**.2002**	**2003**	**2004**	**2005**
Evergreen	1.078	0.972	1.095	1.202	1.194	1.219	1.192	1.180	1.103
Deciduous	0.963	0.808	0.948	1.031	1.004	0.984	0.971	0.933	0.858

The volume of the ***harvested wood*** is determined annually based on preliminary plans for felling and as a result of real organized felling.

7.2.3. Uncertainty and Consistency of Time Series

CO_2 removal is formed by the net balance of the atmosphere absorbed C and the volume of cut biomass (wood) used for heating, pulp production and other biomass consuming activities.

The trend of the removed CO_2 is showed in **Figure 7.1** on the basis of the prerequisite of having a constant annual forest growth for the periods 1990-1994, 1995-1999 and 2000-2004 and the carbon sink was determinate by the volume of realized cuts.

Figure 7.1

The analysis of the CO_2 removals trend from the forest shows a significant change for the period 1988-1991 in the range of 5 100 - 7 700 Gg, a relative stabilization during the period 1992-1995 at a level of about 7 500 Gg, a drop in the year 1996 to 6 500 Gg and a following steady tendency of increase until 2001. After this period of steady increase follows a drop due to increased felling.

The quantities of CO_2 removals from forests are given in **Table 7.2** for the entire GHGs inventory period.

CO_2 emission/removals from changes in forest and other woody biomass stocks, Gg

Table 7.2

$CO_{2,Gg}$	1988	1989	1990	1991	1992	1993	1994	1995	1996
Carbon uptake increment	2,761.0	2,861.5	2,961.9	3,062.3	3,162.8	3,263.2	3,321.0	3,361.5	3,361.5
Carbon release	-1,361.2	-1,326.2	-1,282.7	-979.9	-1,141.3	-1,224.4	-1,329.6	-1,309.4	-1,584.0
Carbon net uptake	1,399.8	1,535.3	1,679.2	2,082.5	2,021.5	2,038.8	1,991.4	2,052.1	1,777.5
Net CO_2 removals	**5,132.6**	**5,629.3**	**6,157.0**	**7,635.7**	**7,412.0**	**7,475.8**	**7,301.7**	**7,524.5**	**6,517.5**
$CO_{2,Gg}$	1997	1998	1999	2000	2001	2002	2003	2004	2005
Carbon uptake increment	3,361.5	3,361.5	3,361.5	3,697.7	3,697.7	3,697.7	3,697.7	4,110.4	3,812.5
Carbon release	-1,487.4	-1,490.5	-1,397.9	-1,249.6	-1,115.7	-1,429.1	-1,773.3	-1,938.1	-1,904.4
Carbon net uptake	1,874.1	1,871.0	1,963.6	2,448.1	2,581.9	2,268.6	1,924.4	2,172.3	1,908.0
Net CO_2 removals	**6,871.5**	**6,860.5**	**7,199.8**	**8,976.2**	**9,467.1**	**8,318.1**	**7,056.0**	**7,965.2**	**6,996.0**

The quantity of CO_2 removals was 7 965 Gg in 2005. The reduction of the removals in 2005 was about 12.2 % compared to 2004. It is due to the increased woodcut in the current year.

7.2.4. Planned Improvements

A number of discussions with experts on forests, experts on forestry management and GHG inventory experts have been carried out in 2005.

The inclusion of sector 5B is not a question of present interest because after the restitution of the agricultural lands to their owners, there is no need of additional areas of arable land. On the contrary – some portion of the arable land is still not used on purpose and is deserted. We expect this condition to be changed dramatically after the accession of Bulgaria to the EU in 2007.

CHAPTER 8. WASTE

8.1. General Description

GHG emissions in the Waste sector result from the processes of collection, storage and management of solid waste from household and the public sector and wastewater treatment from household and industry.

According to the IPCC nomenclature, the following categories in this sector are considered:

- Solid waste disposal;
- Wastewater handling;
- Waste incineration;
- Other.

Only the first two categories from those mentioned above are included in inventory for Bulgaria.

The methane and N_2O emission trends in this sector are given in **Table 8.1**.

Trend in GHG emissions from Waste handling, Gg

Table 8.1

Gases	1988	1989	1990	1991	1992	1993	1994	1995	1996
CH_4									
6A Solid waste disposal	507.7	510.5	508.5	495.9	482.6	466.1	448.8	429.7	407.8
6B Waste water handling	87.9	77.4	66.5	51.7	47.3	40.1	37.3	49.3	46.9
6C Waste incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_2O									
6B Waste water handling	1.00	0.96	0.72	0.65	0.65	0.62	0.59	0.54	0.52
Gases	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CH_4									
6A Solid waste disposal	384.5	359.1	338.8	323.2	309.4	297.9	288.7	279.6	270.3
6B Waste water handling	39.8	34.3	30.1	28.3	22.9	21.8	58.5	58.7	31.1
6C Waste incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO
N_2O									
6B Waste water handling	0.46	0.52	0.53	0.50	0.48	0.49	0.49	0.48	0.47

Two key GHG emission sources are given in **Table 8.1**:

- Methane emissions from solid waste disposal (ranked 3 with more than 8 % share);
- Methane emissions from wastewater handling (ranked 18 with more than 1 % share).

N_2O emissions from wastewater handling are a non-key source. There are reported nitric oxides emissions from the consumption of proteins by the population.

8.2. Solid Waste Disposal

8.2.1. Source Description

Solid waste can be managed by disposal in landfills, recycling, and incineration for elimination or energy production. GHG emissions in this sector are accounted for only for the disposed solid waste.

As mentioned above, the emissions from this source are key sources only for the level estimation in the total GHG emissions (see ***Annex 1***).

The emissions from this source are ranked first amongst the methane emissions in Bulgaria in 2005, and ranked third amongst all sources of GHG emissions in the country.

In accordance to certain criteria like:

- the presence of mechanical cover materials;
- levelling of waste.

and others Bulgarian depots are classified up to 2004 as controlled and un-controlled. After the Change of the Bulgarian Waste Law, the concept un-controlled depots dropped out.

The criteria analysis given in the Revised IPCC Guidelines gives us grounds to classify all controlled depots to the "managed SWD" category.

8.2.2. Methodology

Solid wastes disposal emit CH_4 because of the processes of anaerobic and aerobic decomposition of their organic content. The current inventory, as the previous inventories assumes that the emitted methane is 50 % of the total emitted biogas from the landfills.

For the determination of the quantities, emitted methane is used methodology that is more precise – Tier 2 from the IPCC Guidance. This methodology requires long enough historical time series of data for the solid waste disposals, which was given by NSI.

The use of this methodology suits the requirements of the Good practices, because it is a key-source.

The parameters used in Bulgaria are given in **Table 8.2**., and parameters necessary for the Tier 2 methodology are included.

8.2.3. Uncertainty and Consistency of Time Series

The uncertainty of the emissions from this source is estimated at 101 %.

The change of the emission trend for the period 1988-2005 is given in **Figure 8.1**.

Figure 8.1

The trend analysis shows that CH_4 emissions from solid waste disposal decrease almost linealy from 507.7 in 1988 to 270.31 Gg in 2005.

8.3. Wastewater Handling

8.3.1. Source Description

The second biggest CH_4 source in this sector is wastewater handling. This source is ranked third amongst all methane sources in the Bulgarian inventory.

N_2O emissions from wastewater handling are not a key source.

Treatment of *industrial wastewater* handling and *domestic and public buildings wastewater* handling is considered in separate groups.

Wastewater handling is a CH_4 source of emissions in anaerobic conditions. The conditions for anaerobic and aerobic processing are usually combined, which is reflected by the introduction of a correction factor.

8.3.2. Methodology

The determination of CH_4 emissions follows the standard methodology given in the IPCC Guidelines. It comprises of the following steps:

1. Determination of the total amount of organic matter in wastewater and sludge in respect to the systems for their handling;
2. Estimation of the emission factors for each wastewater handling system;
3. Calculation of CH_4 emissions via multiplication of the total organic amount by the emission factors for each wastewater handling system.

Household data has higher uncertainty level as some average parameters per capita of the population have been used.

There is statistics for the industrial wastewaters according to types of industry, which allows accounting the diverse degradable organic matter in the related industry. This leads to higher precision for methane emission estimation.

Using Tier 1 methods for this type of non-key source corresponds to the good practice requirements.

8.3.3. Uncertainty and Consistency of Time Series

The uncertainty of the emissions estimation from this source is given at 85 %.

The quantities of wastewater and the share of treated wastewater for the years of the inventories in Bulgaria are given in **Table 8.3**.

CH_4 emissions from wastewater handling, expressed in CO_2-eq., amount to 653 Gg in 2005, which is 1 % of the total GHG emissions. CH_4 emissions from industrial wastewater are the dominant here, forming 54 % of the total CH_4 emissions from wastewater.

The trend analysis of the industrial wastewater shows a steady tendency for a decrease, reaching its minimum in 2002. However, there is a rapid rise in 2003 compared to the preceding year. The reason for this is the decision of the Ministry of Environment and Water for the discharge of several big tailing ponds in the country. This high level of the emissions of wastewater is kept in 2004 due to the same reason. In the present inventory this reason is omitted and the level of that kind of emissions is almost 2 time less.

Wastewater with nitrogen content, which is released as N_2O in the atmosphere, results from food consumption by the population. N_2O emissions, expressed in CO_2-eq., amount to 147 Gg in 2005. The decrease is 2.1 % compared to 2004. It reflects not only the decrease of population, which is 0.54 %, but also the decreased consumption of some foods (bread, milk, sugar, vegetables and others).

8.4. Waste Incineration

Bulgaria has no solid waste incineration for energy production.

Parameters used in the IPCC Tier 2 method for Solid Waste handling

Table 8.2

Description	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Waste generation rate (kg/capita/day)	2.36	2.17	2.44	2.59	2.59	2.37	1.92	1.47	1.32	1.20	1.06	1.07	1.12	1.11	1.12	1.13	1.09	1.15
Fraction of MSW disposed to SWDS	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.99	0.99	0.97	0.99	0.99	0.99	1.00	1.00	1.00	1.00	0.97
Fraction of DOC in MSW	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
Fraction of wastes incinerated	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Fraction of wastes recycled	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0.00	0.01	0.01	0.01
CH_4 oxidation factor	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CH_4 fraction in landfill gas	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Number of SWDS recovering CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CH_4 generation rate, constant (k)	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Time delay, years	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	39.00	40.00	41.00	42.00	43.00	44.00	45.00
Composition of landfilled waste (%)																		
Paper and paperboard	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.00	10.00	11.10	10.30	10.14	5.91
Food and garden waste	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	40.00	39.00	39.50	39.58	37.80	47.83
Plastics	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.00	9.00	11.10	11.70	13.58	7.59
Glass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.00	5.00	5.30	5.01	5.59	3.19
Textiles	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.00	4.00	3.80	4.10	4.35	2.53
Other (specify)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	34.00	33.00	29.20	29.30	26.06	32.95

Wastewater handling

Table 8.3

Wastewater handling	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total wastewater (th. m^3)																		
domestic	347,697	34,101	334,340	277,235	271,250	264,392	248,206	240,255	235,209	241,912	271,766	254,509	264,648	245,692	229,870	241,331	236,564	232,315
industrial	1,297,706	1,109,410	958,103	778,460	819,389	637,690	535,978	584,023	550,233	485,169	415,492	438,693	328,497	274,475	225,023	666,142	657,812	276,289
Treated wastewater (%)																		
domestic	50	50	51	53	53	53	56	60	63	68	68	68	69	72	73	73	75	75
industrial	60	61	60	57	49	50	56	61	60	62	60	62	48	44	60	84	84	72

CHAPTER 9. OTHER (SECTOR 7 FROM CRF)

This sector from the IPCC classification is designated to submit all GHGs emission sources, which for one or another reason have not been categorized at one of the six preceding sectors.

The Bulgaria inventory has no such specific sources to be reported in this sector.

Even so, the Other category can be commented here, because it is used in various places in the inventory.

The Other category appears in each sector, described in the preceding Chapters 2-8. It includes emission sources that belong to the sector but cannot be related to, and included in any of the categories of the sector.

The Other category appears as one of the emission sources in the list of key and non-key sources, drafted according to the good practice requirements. The emissions of this source are 6.14 Gg for the inventory in 2005. It incorporates GHG emissions from all small sources that cannot be regarded as part of the remaining 40 entries in this list.

Bulgaria has GHG emissions, which are not included in the inventory, so in future, research on their actual volume, and influence on the total GHG emissions in the country should be conducted. Such sources are:

- forest fires;
- use of candles for various purposes;
- drinking water purification;
- gas emissions from food stores.

CHAPTER 10. RECALCULATION OF GHG EMISSIONS AND IMPROVEMENTS

10.1. Prerequisites and Assumptions During the Recalculations

The GHG emission recalculation for the period 1988-2004, was made because of changes, made in some of the elements of the inventory (data, emission factors and others) for each sector as follows:

- **Energy**
  - Stationary combustion processes in Energy and Industry; household, agriculture and forestry;
  - Transport
  - Fugitive emissions from liquid fuels and natural gas
- **Industrial Processes**
  - Main GHG emissions and their precursors from industrial technological processes in the industry (minerals, chemistry);
  - F-gases emissions – PFC, HFC and SF_6.
- **Waste**
  - Solid waste collection and treatment.

For each of the above-mentioned categories some changes are made and they can be classified in the following groups:

A. Changes in the methodology and methods for process modelling and activities;

B. Changes in the parameters, data and emission factors;

The changes from group A involve change of most of the elements in the processes of calculation, while the changes in group B might be vastly limited.

Energy sector

Group B changes were made in the Energy sector.

- In sub-sector **Transformation of fuels and other energy industries,** the data about consumed quantities coke gas and dry gas for 1998 is corrected.
- In sub-sector **Industry and building,** the data about consumed quantities coke gas for 1998 is corrected.
- In the previous inventories the GHG emissions from burning of biomass (firewood and firewood wastes), mainly in sub-sector **Other sectors,** were calculated with a highly lowered emission factor. This was leading to big differences with inventories made with other methodologies mainly for GHG precursors. This is why the emission factors were increased.
- In sub-sector **Transport,** the emissions from burning of condensed gas propane-butane were recalculated. The corrections are from group A because the very method has been changed, i.e. a method of type Tier 2 is used.

These calculations are a result a the revaluation of the pipelines for 2000-2004.

.

Industrial Processes sector

A great revision of data for the volume of production and consumption of minerals has been carried out, using data from the enterprises.

- Evaluation of the emissions of cement production completely on the base of the clinker produced data– group A.

For the purpose, the quantities of clinker produced in the country for the period 1989-1998 have been actualized.

- Revision and actualization of the data for consumption of limestone and dolomite for the period 1988-2005.
- Correction of the CO_2 emission factors during the ammonia production;

In all the inspections from international teams of the Bulgarian inventories the attention was called to the lowered almost two times emission factor, which was specific for the country. It was based on the data, shown in the Methodology from 2000 based on CORINAIR.

After the application of the analytical method in which are reported the expenditure standards of non-energy natural gas for ammonia production, the emission factor was increased with about 50 %.

- Invalidation of PFC's emissions during the aluminium production;

The implemented research found out that in Bulgaria only secondary aluminum is produced, i.e. casting of aluminum blocks for ware production. In this kind of technological process, there are not emissions of F-gases from the PFC's group.

Waste sector

Solid Waste Disposed (SWD) quantities have been recalculated for the period before 1988, as NSI has proposed a temporary series for the period from 1960 until now. This opens a possibility for applying of a methodology from Tier 2 type for calculating of methane emissions from solid waste disposals.

With the application of this method, the requirements of the good practices for using a method with higher complexity as a key source are met.

10.2. Introducing Improvements for GHG Emissions Levels

The differences between inventories due to the recalculations in the National GHG Inventory Report 2004 (Submission 2006) and the present report (Submission 2007) are given in **Table 10.1.**

10.2.1. Recalculation of the Base Year - 1988

In the previous NIR 2006 the main allowances and requirements were described in detail at the preparation of the inventory for the base 1988.

At the present inventory the base 1988 has been recalculated only on the base of the changes shown in p. 10.1 The following results turned out.

Total GHG emissions

Total aggregated emissions in Bulgaria are 132 612.57 Gg CO_2-eq. (without accounting CO_2 sequestration by the forests) for 1988. The difference with the preceding estimation is 0.02 % increase.

Out of the total emissions, the share of CO_2 is 74.3 %, of CH_4 16.5 % and of N_2O 9.1 % expressed in CO_2–eq.

The distribution of the aggregated emissions in sectors (without forests) is as follows:

- Energy – 32.8 %;
- Industry- burning processes- 18.7 %;
- Transport 10.5 %;
- Household and services- 6.8 %;
- Industrial Processes -8 %
- Agriculture – 11 %;
- Waste – 9.8 %.

CO_2 emissions

The biggest CO_2 emitter is the Energy sector – 90 726 Gg or 68.4 % from the total GHG emissions in Bulgaria (without accounting sequestration by forests).

In sector Industrial processes CO_2 emissions have been increased by 6.5 % because of the re-evaluated emissions from the clinker and ammonia production.

CH_4 emissions

The total CH_4 emissions are 1 036 Gg, which displays a minimum decrease, compared to the preceding inventory by 0.5 %. This decrease is mainly on behalf of the emissions from solid wastes.

N_2O emissions

The total N_2O emissions are 38.9 Gg. This quantity hasn't changed compared to the preceding inventory.

10.2.2. Inventory of GHG emissions for 1989.

In the present report are shown the results from the GHG inventory from 1989. This inventory was missing until now because of the specific position that it has in the time series. It is intermediate between the base year and 1990, which is base year for the most countries in the world. A main difficulty for the later inclusion of 1989 in the time series is the lack of energy balance. NSI prepares energy balances from 1990. Before that, energy balance on basis of available material balances had to be prepared. Similar transformation was made during the preparation of the energy balance for 1988.

The total GHG emissions expressed in CO_2-eq. in 1989 are 131 940.7 Gg. It shows a decrease only of 0.5 % according to the base year. The distribution of the emissions by sectors is rather close to the 1988.

In all trend tables and in the emission tables (by sectors and by gases) are included concrete values for 1989. The results are consistent.

Differences between NIR 2007 and NIR 2006 for 1988-2004 due to recalculation, %

Table 10.1

Gas/Sector	Source	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Energy	*NIR-2007 versus NIR- 2006, %*																	
CO_2		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
CH_4		1.5		1.8	2.0	1.9	1.8	2.0	2.1	2.4	2.9	4.7	5.3	6.1	6.0	7.2	7.4	7.6
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.9	2.1	2.6	3.2	3.2	3.0
Industrial Processes																		
CO_2		6.5		14.6	17.7	17.0	18.8	23.3	29.7	29.5	27.9	9.3	5.7	6.5	5.4	4.0	1.1	3.2
CH_4		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solvent and Other Product Use																		
NMVOCs		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.3	0.0	0.0	0.0	0.0	0.0	0.0
Agriculture																		
CH_4		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4
Land-Use Change and Forestry																		
CO_2 sink		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste																		
CH_4		-1.2		10.7	21.9	23.2	28.1	30.3	32.8	39.2	58.0	69.4	63.4	53.1	49.1	44.3	33.9	23.0
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL without LUCF																		
CO_2-eq-without F-gases		0.3		1.9	3.2	3.4	3.7	4.4	5.0	5.3	6.1	6.2	5.2	4.6	4.1	3.8	3.0	2.4
CO_2-eq- total		0.2		1.9	3.1	3.3	3.7	4.3	4.9	5.2	6.1	6.1	5.1	4.6	4.1	3.8	3.0	2.4
CO_2		0.5		1.1	1.2	1.1	1.2	1.8	2.5	2.4	2.2	1.4	0.5	0.6	0.5	0.4	0.1	0.3
CH_4		-0.5		6.5	12.8	14.1	17.4	19.2	20.4	23.8	33.4	37.5	34.8	29.6	28.9	25.8	21.1	14.9
N_2O		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.0

10.2.3. Recalculation of GHG Inventories for 1990-2004

The analysis of **Table 10.1** shows that the change in GHG emissions, as a result of recalculation, is different in different years. Only methane emissions are changed.

- CH_4- from 1.8 to 7.6 %;

Obviously the range of change is not big if compare to previous inventory.

10.3. Introduction of Improvements in the GHG Emissions Trends

In total, the recalculation of GHG emissions should lead to improvement of the common trend, which is expressed in its reduction of absolute value compared to the previous year.

The changes of the common trend 1988-2004 between two consecutive inventory submissions are given in **Table 10.2.**

Difference between NIR 2006 and NIR 2007 for emission trends 1988-2005 (1995 for F- gases)

Table 10.2

Gas, Gg CO_2-eqv.	Trend (absolute)			Trend (percentage)		
	NIR 2006	NIR 2007	Difference	NIR 2006	NIR 2007	Difference
CO_2	-45,206	-45,529	-322	-46	-46	-0.10
CH_4	-12,098	-10,537	1,561	-55	-48	6.91
N_2O	-7,666	-7,668	-2	-64	-64	-0.01
HFCS	217	217	0			
PFCs	0	0	0	0	0	0
SF_6	4	4	0			
Total	**-64,750**	**-63,513**	**1,237**	**-49.0**	**-47.9**	**1.08**

The trends in absolute values are defined as differences between the aggregated GHG emissions in 2005 and 1988. If one assumes that the lower the absolute trend value is, the better it is, undoubtedly the recalculation gives a positive result.

The trends in percentages are defined as absolute trends in relation to base year emissions. Despite the emissions change in the base year, for this case, a percentage decline in the trend is observed, which demonstrates once again a positive result from the recalculation.

10.4. Recalculation, Inventory Revisions and Planned Improvements.

10.4.1. Restructuring of Sources

The changes in the inventory recalculations were shown in detail in item 10.1. Some of these changes concern the structuring of emission sources.

In general, the structure of the inventory in Bulgaria follows exactly the structure of IPCC, therefore there were no problems during the preparation and inserting data in the CRF tables and in the files of CRF- reporter.

10.4.2. Source Complexity

GHGs inventories include all sectors and categories from the Revised IPCC Guidelines, 1996 with the exception of the following:

- N_2O emissions during fire extinguishers use, aerosol packing and for anaesthesia;
- Fugitive CO_2 emissions from coal mining;
- Actual emissions from use of HFC gases.

As a whole the complexity of sources has been greatly increased because new sources has been introduced – emissions from the use of limestone and dolomite, emissions from the use of soda ash as well as a improvement of methodology for the evaluation of the emissions in the cement and ammonia production.

10.4.3. Changes in Tables of CRF Reporter

The tables included in ***Annex 7*** are part of all CRF reporter tables, included in the GHGs inventory report for 2005. These are:

- Aggregated CRF tables for the base year and for the last 4 years - 2001-2005 (Tables 7A);
- CRF tables 10 for the trends of main GHGs;
- CRF trend tables for precursors and SOx;
- CRF tables for sector Change in the use of lands and forests.

Table 9 for the completeness of the inventory is given in ***Annex 5***.

10.4.4. Completeness of CRF Fails

As shown above, CRF tables include all background tables. In the tables, fuels are aggregated, the secondary gases – coke gas and blast furnace gas are related to solid fuels, while the dry gas from petroleum refining – to liquid fuels. Petrol coke is also related to liquid fuels.

Liquid Petroleum Gas (LPG) emissions are related to liquid fuels with the exception of the transport sub sector, where they belong to a separate category Other.

Lack of specific numbers for some data has been substituted by notation keys, which describe the status of certain data cell. For example, NE denotes “has not been estimated but exists”, NO – “does not exist”, C – “confidential”, etc.

10.4.5. Results from Revisions of GHG Inventories.

GHG inventories in Bulgaria are being inspected and revised by local and international teams.

During the adoption and approval of the annual inventories at the Bulgarian Ministry of Environment and Water (MoEW), a two level system is being used, where the Submissions are reviewed by expert scientific councils:

- Scientific and technical council at the Energy Institute;
- Ecological expert council (EEC within NEEA).

The necessary condition for EEC assembly is the presence of reviews of the Submission by independent experts and assessment by the relevant departments from the Ministry and the National Environmental Executive Agency.

So far the GHG inventories in Bulgaria have been subject of the following international verifications and revisions:

- Revision in the country by international team of the UNFCCC Secretariat, September 2003;
- Desk review of the 2002 inventory, November 2004;
- Second Centralized Review of Inventories for 2003 in Bon, Germany, October 2005.

The results from those revisions showed some omissions in the inventories, which have been removed. Some of them are:

- *Comparison of the inventory data with the corresponding data of international organizations.*

The analysis of the data used Bulgaria inventory sometimes shows some differences with the respective data from international organizations such as IEA, FAO and others. This is due to several reasons, which are result of the missing sub-ordination of Bulgarian institutions. In this connection, the respective Bulgarian organizations are familiar with these differences and they work to lessen them to their minimum.

As a rule for all inventories, references are made for including data and materials for increasing the popularity and consistency of the inventory. Obviously, this should be performed through wise combination of the volume and importance of the additional information.

In the preliminary report- NIR 2006, were commented in detail the recommendations and the remarks from the last revision of the Inventory 2003. There wee shown the possibilities for improvements and the difficulties, connected with this.

In the present report, we can report the improvement in this way, which expresses in:

- Applying of Tier 2 method for evaluation of the methane emissions from solid wastes
- Creating a new methodology for evaluation of the over-ground biomass in forests and CO_2 sink from soils.

10.4.6. Planned Improvements

The basic element for the planned improvements of the inventories of GHG in Bulgaria is the National System for evaluation of anthropogenesis emissions of GHG.The preparation of this system starts in 2005 with a project for preliminary research of basic principals, structures and rules for its preparation.

It will be developed as element of the monitoring emissions system for air pollution. This system works successfully in the last years under coordination and guidance on the national level by the Executive Environment Agency.

REFERENCES

1. IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000.

2. UNFCCC Guidelines on reporting and review. FCCC/CP/1999/7.

3. Fourth National Communication of Bulgaria under UNFCCC, 2002.

4. Metodika za izchisliavane po balansovi metodi na emisiite na vredni veshtestva v atmosfernia vuzduh, Sofia, 2000.

5. Second National Action Plan on Climate Change, Sofia, 2004.

ANNEX 1: KEY SOURCES OF GHG EMISSIONS

1.1 Introduction

According to the definition of Good Practice Guidance, key sources of GHG emissions are these sources, which are responsible for 95 % of the sum of aggregated GHG emission expressed in CO_2-eq. in the country.

The key sources are defined according to the IPCC classification. It is advisably that the key sources in superior degree are correspondent to the structure of the fuels and the activities in the country.

By method **type Tier 1** are defined key sources accounting two rules:

- Rule A – Level assessment of the GHG emissions in absolute value expressed in Gg;
- Rule B – Trend assessment of the emissions from the base year until the current year of the inventory.

By applying ***rule A*** is used information for the volume of the source emissions only for the current year of the inventory.

The application of ***rule B*** requires information for the GHG emissions for the base year in the country. That means that the trend assessment includes additional information and gives the possibility for thorough analysis of the key sources.

The application of method from **type Tier 2** requires the introduction of uncertainty assessments for each source of GHG emissions. As expected, this method increases the weight of such sources of emissions, which are more incorrect. In this sense a contradiction can occur as for example – more insignificant source (with lower level of GHG emissions) to stand at fore-place in the list of key sources due to its higher inaccuracy.

1.2 Tier 1 method for Assessment of Key Sources.

In **Table A1.1** and **Table A1.2** are presented lists with the key sources determined in accordance with the rules A and B.

Source ranking using IPCC Tier 1 level assessment 2005, Gg CO_2-eq.

Table A1.1

T1-lev	IPCC source category	Gas	CO_2-eqv. 2005	Share	Cumul. share
1	CO_2 Emissions from Stationary Combustion- Energy Industries,Coal	CO_2	26,083.66	0.37	0.37
2	Mobile Combustion- road transportation	CO_2	7,177.62	0.10	0.48
3	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	5,675.38	0.08	0.56
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	5,129.59	0.07	0.63
5	CO_2 Emissions from Stationary Combustion- Manufacturing Industries,Coal	CO_2	4,349.14	0.06	0.69
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	4,066.38	0.06	0.75
7	CO_2 Emissions from Cement Production	CO_2	1,551.80	0.02	0.77
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1,414.15	0.02	0.79
9	CO_2 Emissions from Steel Production	CO_2	1,376.30	0.02	0.81
10	CO_2 Emissions from Stationary Combustion- Other Sectors,Coal	CO_2	1,190.29	0.02	0.83
11	Fugitive Emissions from Coal Mining and Handling	CH_4	1,106.74	0.02	0.84
12	Direct N_2O Emissions from Agriculture Soils	N_2O	1,076.45	0.02	0.86
13	CO_2 from Lime Production	CO_2	996.13	0.01	0.87
14	N_2O Emissions from Nitric Acid Production	N_2O	992.16	0.01	0.89
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	875.04	0.01	0.90
16	Non-energy fuel use- gas	CO_2	830.50	0.01	0.91
17	Mobile Combustion-other transportation	CO_2	723.94	0.01	0.92
18	Emissions from Wastewater Handling	CH_4	652.99	0.01	0.93
19	Fugitive Emissions from Oil and Gas Operations	CH_4	628.74	0.01	0.94
20	CO_2 from Ammonia Production	CO_2	596.92	0.01	0.95
21	N_2O Emissions from Animal Production	N_2O	516.96	0.01	0.96
22	CH_4 Emissions from Manure Management	CH_4	477.79	0.01	0.96
23	New gases	PFC, HFC, SF_6	391.26	0.01	0.97
24	N_2O Emissions from Manure Management	N_2O	369.40	0.01	0.98
25	CO_2 from Limestone and Dolomit use	CO_2	313.78	0.00	0.98
26	N_2O Emissions from Stationary Combustion	N_2O	308.77	0.00	0.98
27	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	192.10	0.00	0.99
28	Emissions from Wastewater Handling	N_2O	147.08	0.00	0.99
29	CO_2 from Soda Ash Production	CO_2	146.47	0.00	0.99
30	CH_4 Emissions from Stationary Combustion	CH_4	130.35	0.00	0.99
31	Mobile Combustion-Railways	CO_2	93.86	0.00	0.99
32	CO_2 Emissions from Industrial Processes - others	CO_2	91.60	0.00	1.00
33	Non-energy fuel use- liquid	CO_2	68.29	0.00	1.00
34	Mobile Combustion-road transportation	N_2O	56.94	0.00	1.00
35	Non-energy fuel use- solid	CO_2	45.75	0.00	1.00
36	CH_4 Emissions from Industrial Processes - metal production	CH_4	42.61	0.00	1.00
37	CH_4 Emissions from Rice Production	CH_4	39.61	0.00	1.00
38	Mobile Combustion-road transportation	CH_4	27.57	0.00	1.00
39	CH_4 Emissions from Agricultural Residue Burning	CH_4	27.10	0.00	1.00
40	N_2O Emissions from Agricultural Residue Burning	N_2O	7.53	0.00	1.00
41	Total others		6.14	0.00	1.00
Totals			**69,994.88**		

The analysis of the **Table A1.1** shows that sum number of the key sources is 20 from total 41 sources. They are ordered in places by their growth in the first row of the table. This row is called ***primary*** with its symbol **T1 – l.**

A big difference is observed between the first and the following key sources in the primary row. Whereas the first source renders 37 % of the total emissions in the country, the second one gives 10 % and the third one – 8 %.

The order of the key sources accounting the emission trend is presented in **Table A1.2**. The table's analysis and its comparison with the upper table show the following changes:

- The total number of key sources is not changed;
- 4 sources have dropped out from the list with key sources and 4 more are included;

- There is a re-arrangement of the key sources – some of them are in upper place (from 6th, 10, 17 and 12h relatively to a 2nd, 4th, 5 and 8), others are in lower places (from 5,4th and 7th to a 10th, 19 and 11th place).
- Three new key sources are added –from 22 to 13, from 23 to 14 and from 21 to 17.

In the last column of **Table A1.2** is given the order of the sources in line with the Rule B (with a designation **T1-t**) and in the first column are the numbers of the sources from the primary row.

A considerable step upper have such sources as ***Stationary combustion, other sectors, coals*** – from 10th place to 4th place, and ***CO_2 from combustion in transport*** - other type of transport – from 17th place to a 5th place, etc.

The determination of the key sources according to this rule leads to an accounting of the rate of emissions change of each source for the past period expressed in its trend towards the base year. This brings the opportunity for additional assessments of performances of the key sources.

Source ranking using IPCC Tier 1 trend assessment, Gg CO_2-eq.

Table A1.2

T1- level	IPCC Source Categories	Gas	CO_2-eqv. 1988	CO_2-eqv. 2005	Trend assessment	Contribution to Trend in p.u.	Cumulative total of Trend	T1- trend
1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	31,317.79	26,083.66	0.26	0.32	0.32	1
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	19,684.73	4,066.38	0.17	0.21	0.53	2
2	Mobile Combustion- road transportation	CO_2	7,747.49	7,177.62	0.08	0.10	0.63	3
10	CO_2 Emissions from Stationary Combustion- Other Sectors, Coal	CO_2	4,953.42	1,190.29	0.04	0.05	0.68	4
17	Mobile Combustion-other transportation	CO_2	3,998.39	723.94	0.04	0.05	0.73	5
41	Total others		1,897.87	6.14	0.03	0.03	0.76	6
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	4,048.54	1,414.15	0.02	0.02	0.78	7
12	Direct N_2O Emissions from Agriculture Soils	N_2O	3,273.15	1,076.45	0.02	0.02	0.80	8
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	2,824.66	875.04	0.02	0.02	0.82	9
5	CO_2 Emissions from Stationary Combustion- Manufacturing Industries, Coal	CO_2	9,272.44	4,349.14	0.01	0.02	0.84	10
7	CO_2 Emissions from Cement Production	CO_2	2,006.25	1,551.80	0.01	0.02	0.86	11
13	CO_2 from Lime Production	CO_2	1,117.84	996.13	0.01	0.01	0.87	12
22	CH_4 Emissions from Manure Management	CH_4	1,662.13	477.79	0.01	0.01	0.89	13
23	New gases	PFC, HFC, SF6	0.00	391.26	0.01	0.01	0.90	14
18	Emissions from Wastewater Handling	CH_4	1,844.93	652.99	0.01	0.01	0.91	15
16	Non-energy fuel use- gas	CO_2	990.06	830.50	0.01	0.01	0.92	16
21	N_2O Emissions from Animal Production	N_2O	1,523.64	516.96	0.01	0.01	0.93	17
14	N_2O Emissions from Nitric Acid Production	N_2O	2,421.72	992.16	0.01	0.01	0.94	18
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	10,258.84	5,129.59	0.01	0.01	0.95	19
20	CO_2 from Ammonia Production	CO_2	1,652.29	596.92	0.01	0.01	0.96	20
24	N_2O Emissions from Manure Management	N_2O	1,056.05	369.40	0.01	0.01	0.96	21
27	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	85.24	192.10	0.00	0.00	0.97	22
9	CO_2 Emissions from Steel Production	CO_2	2,360.38	1,376.30	0.00	0.00	0.97	23
33	Non- energy fuel use- liquide	CO_2	354.00	68.29	0.00	0.00	0.98	24
31	Mobile Combustion-Railways	CO_2	368.04	93.86	0.00	0.00	0.98	25
26	N_2O Emissions from Stationary Combustion	N_2O	396.43	308.77	0.00	0.00	0.98	26
30	CH_4 Emissions from Stationary Combustion	CH_4	99.58	130.35	0.00	0.00	0.99	27
32	CO_2 Emissions from Industrial Processes - others	CO_2	26.61	91.60	0.00	0.00	0.99	28
25	CO_2 from Limestone and Dolomite use	CO_2	457.87	313.78	0.00	0.00	0.99	29
11	Fugitive Emissions from Coal Mining and Handling	CH_4	1,991.58	1,106.74	0.00	0.00	0.99	30
3	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	10,661.98	5,675.38	0.00	0.00	0.99	31
19	Fugitive Emissions from Oil and Gas Operations	CH_4	1,278.86	628.74	0.00	0.00	1.00	32
34	Mobile Combustion-road transportation	N_2O	48.27	56.94	0.00	0.00	1.00	33
29	CO_2 from Soda Ash Production	CO_2	233.19	146.47	0.00	0.00	1.00	34
37	CH_4 Emissions from Rice Production	CH_4	119.25	39.61	0.00	0.00	1.00	35
28	Emissions from Wastewater Handling	N_2O	310.49	147.08	0.00	0.00	1.00	36

T1- level	IPCC Source Categories	Gas	CO_2-eqv. 1988	CO_2-eqv. 2005	Trend assessment	Contribution to Trend in p.u.	Cumulative total of Trend	T1- trend
36	CH_4 Emissions from Industrial Processes - metal production	CH_4	73.20	42.61	0.00	0.00	1.00	37
35	Non-energy fuel use- solid	CO_2	80.42	45.75	0.00	0.00	1.00	38
39	CH_4 Emissions from Agricultural Residue Burning	CH_4	46.35	27.10	0.00	0.00	1.00	39
38	Mobile Combustion-road transportation	CH_4	53.52	27.57	0.00	0.00	1.00	40
40	N_2O Emissions from Agricultural Residue Burning	N_2O	15.10	7.53	0.00	0.00	1.00	41
	Totals		**132,612.57**	**69,994.88**	**0.81**			

1.3 Method Tier 2 for Assessment of the Key Sources

With the use of the uncertainty assessments for each key source in the form of weight factor/coefficient is done a new order of the key sources. This is the core of the method from type Tier 2, described in the Good Practice Guidance.

In **Table A1.3** is presented the list of key sources after the application of Rule A. In the last column are given the serial numbers from the list with designation **T2-l**.

In the order of the key sources in the upper table are present the following changes in comparison with the primary row:

- the total number of key sources is not changed compare to previous submission;
- 6 sources are out the list of the key sources and three new are included;
- there is a re-order of the key sources – some are at upper place (from 15, 12, 14 relatively to a 2, 3, 6) and others are come down (from 1, 2 and 4 to 4, 13 and 16 place respectively).

It is evident that the use of the uncertainties as weight coefficients gives more priority to the incorrect emission sources.

In the **Table A1.4** is presented the list of key sources received of the application of Rule B. In the last are given the serial numbers of the list with designation **T2-t.**

In the order of the key sources according to this approach in the upper table are shown the biggest changes compared to the primary row:

- 8 sources dropped out of the list with the key sources and 6 more are included;
- there is a significant re-order of the sources related to the solid wastes and agricultural soils – from 15 and 12 place, they moved to the first two places;
- significant sources of GHG emissions are moved down notably – from 2, 3, and 5 places relatively to 13, 21, and 22nd place.

Obviously, the use of the uncertainties as weight coefficients in combination with the emission trend toward the base year shows a completely different picture of the key sources compared to the assessments by the method type Tier 1 in which only the emission absolute level is accounted.

Sorted Tier 2 level assessment Key sources

Table A1.3

T1-level	IPCC source category	Gas	CO_2-eqv. 2005	Share	Comb. Unc., %	T2 Level ass., %	p.u. of Level ass.	Cumul. share	T2-level
3	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	5,675.38	0.081	102.0	8.27	0.212	0.294	1
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	875.04	0.013	500.0	6.25	0.160	0.454	2
12	Direct N_2O Emissions from Agriculture Soils	N_2O	1,076.45	0.015	250.0	3.85	0.098	0.552	3
1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	26,083.66	0.373	8.6	3.21	0.082	0.082	4
11	Fugitive Emissions from Coal Mining and Handling	CH_4	1,106.74	0.016	200.2	3.17	0.081	0.633	5
14	N_2O Emissions from Nitric Acid Production	N_2O	992.16	0.014	200.2	2.84	0.073	0.706	6
21	N_2O Emissions from Animal Production	N_2O	516.96	0.007	250.0	1.85	0.047	0.753	7
24	N_2O Emissions from Manure Management	N_2O	369.40	0.005	300.0	1.58	0.041	0.793	8
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	1,414.15	0.020	50.0	1.01	0.026	0.819	9
26	N_2O Emissions from Stationary Combustion	N_2O	308.77	0.004	200.1	0.88	0.023	0.842	10
18	Emissions from Wastewater Handling	CH_4	652.99	0.009	85.4	0.80	0.020	0.862	11
7	CO_2 Emissions from Cement Production	CO_2	1,551.80	0.022	30.1	0.67	0.017	0.879	12
2	Mobile Combustion- road transportation	CO_2	7,177.62	0.103	5.8	0.60	0.015	0.895	13
23	New gases	PFC, HFC, SF6	391.26	0.006	104.4	0.58	0.015	0.909	14
5	CO_2 Emissions from Stationary Combustion- Manufacturing Industries, Coal	CO_2	4,349.14	0.062	8.6	0.53	0.014	0.923	15
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	5,129.59	0.073	7.1	0.52	0.013	0.936	16
19	Fugitive Emissions from Oil and Gas Operations	CH_4	628.74	0.009	50.2	0.45	0.012	0.948	17
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	4,066.38	0.058	7.1	0.41	0.011	0.958	18
13	CO_2 from Lime Production	CO_2	996.13	0.014	15.8	0.23	0.006	0.964	19
9	CO_2 Emissions from Steel Production	CO_2	1,376.30	0.020	10.4	0.21	0.005	0.969	20
20	CO_2 from Ammonia Production	CO_2	596.92	0.009	20.6	0.18	0.004	0.974	21
10	CO_2 Emissions from Stationary Combustion- Other Sectors, Coal	CO_2	1,190.29	0.017	8.6	0.15	0.004	0.978	22
22	CH_4 Emissions from Manure Management	CH_4	477.79	0.007	20.6	0.14	0.004	0.981	23
30	CH_4 Emissions from Stationary Combustion	CH_4	130.35	0.002	50.2	0.09	0.002	0.984	24
16	Non-energy fuel use- gas	CO_2	830.50	0.012	7.1	0.08	0.002	0.986	25
17	Mobile Combustion-other transportation	CO_2	723.94	0.010	7.1	0.07	0.002	0.988	26
25	CO_2 from Limestone and Dolomite use	CO_2	313.78	0.004	15.8	0.07	0.002	0.990	27
36	CH_4 Emissions from Industrial Processes - metal production	CH_4	42.61	0.001	100.0	0.06	0.002	0.991	28
27	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	192.10	0.003	20.6	0.06	0.001	0.993	29
35	Non-energy fuel use- solid	CO_2	45.75	0.00	83.82	0.05	0.00	0.994	30
28	Emissions from Wastewater Handling	N_2O	147.08	0.002	20.6	0.04	0.001	0.995	31
29	CO_2 from Soda Ash Production	CO_2	146.47	0.002	20.6	0.04	0.001	0.996	32
34	Mobile Combustion-road transportation	N_2O	56.94	0.001	51.0	0.04	0.001	0.997	33
40	N_2O Emissions from Agricultural Residue Burning	N_2O	7.53	0.000	201.6	0.02	0.001	0.998	34
39	CH_4 Emissions from Agricultural Residue Burning	CH_4	27.10	0.000	55.9	0.02	0.001	0.998	35
33	Non- energy fuel use- liquide	CO_2	68.29	0.001	20.6	0.02	0.001	0.999	36
38	Mobile Combustion-road transportation	CH_4	27.57	0.000	40.1	0.02	0.000	0.999	37

T1-level	IPCC source category	Gas	CO_2-eqv. 2005	Share	Comb. Unc., %	T2 Level ass., %	p.u. of Level ass.	Cumul. share	T2-level
37	CH_4 Emissions from Rice Production	CH_4	39.61	0.001	20.6	0.01	0.000	1.000	38
31	Mobile Combustion-Railways	CO_2	93.86	0.001	7.1	0.01	0.000	1.000	39
32	CO_2 Emissions from Industrial Processes - others	CO_2	91.60	0.001	5.8	0.01	0.000	1.000	40
41	Total others		6.14	0.000	20.6	0.00	0.000	1.000	41
	TOTALS		**69,994.88**			**39.09**			

Sorted Tier 2 trend assessment Key sources

Table A1.4

T1-level	IPCC Source Categories	Gas	CO_2-eqv. 1988	CO_2-eqv. 2005	Trend assessment	Comb. Unc. %	T2 Trend ass. %	% of Trend ass.	Cumul. of Trend	T2-trend
15	Indirect N_2O Emissions from Agriculture Soils	N_2O	2,824.66	875.043	0.017	500.009	8.335	0.294	0.294	1
12	Direct N_2O Emissions from Agriculture Soils	N_2O	3,273.15	1,076.446	0.018	250.018	4.407	0.155	0.449	2
1	CO_2 Emissions from Stationary Combustion- Energy Industries, Coal	CO_2	31,317.79	26,083.658	0.259	8.602	2.225	0.078	0.528	3
21	N_2O Emissions from Animal Production	N_2O	1,523.64	516.965	0.008	250.018	1.944	0.069	0.596	4
14	N_2O Emissions from Nitric Acid Production	N_2O	2,421.72	992.165	0.008	200.250	1.551	0.055	0.651	5
24	N_2O Emissions from Manure Management	N_2O	1,056.05	369.403	0.005	300.007	1.527	0.054	0.705	6
6	CO_2 Emissions from Stationary Combustion – Oil	CO_2	19,684.73	4,066.380	0.171	7.071	1.210	0.043	0.748	7
23	New gases	PFC, HFC, SF6	0.00	391.258	0.011	104.403	1.106	0.039	0.787	8
8	CH_4 Emissions from Enteric Fermentation in Domestic Livestock	CH_4	4,048.54	1,414.145	0.020	50.040	0.979	0.035	0.821	9
18	Emissions from Wastewater Handling	CH_4	1,844.93	652.994	0.009	85.440	0.742	0.026	0.847	10
41	Total others		1,897.87	6.140	0.027	20.616	0.556	0.020	0.867	11
26	N_2O Emissions from Stationary Combustion	N_2O	396.43	308.770	0.003	200.062	0.539	0.019	0.886	12
2	Mobile Combustion- road transportation	CO_2	7,747.49	7,177.621	0.084	5.831	0.487	0.017	0.903	13
7	CO_2 Emissions from Cement Production	CO_2	2,006.25	1,551.800	0.013	30.150	0.402	0.014	0.917	14
10	CO_2 Emissions from Stationary Combustion- Other Sectors, Coal	CO_2	4,953.42	1,190.294	0.039	8.602	0.332	0.012	0.929	15
11	Fugitive Emissions from Coal Mining and Handling	CH_4	1,991.58	1,106.737	0.002	200.250	0.301	0.011	0.940	16
17	Mobile Combustion-other transportation	CO_2	3,998.39	723.937	0.038	7.071	0.265	0.009	0.949	17
22	CH_4 Emissions from Manure Management	CH_4	1,662.13	477.789	0.011	20.616	0.223	0.008	0.957	18
13	CO_2 from Lime Production	CO_2	1,117.84	996.129	0.011	15.811	0.174	0.006	0.963	19
20	CO_2 from Ammonia Production	CO_2	1,652.29	596.919	0.007	20.616	0.154	0.005	0.969	20
3	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	10,661.98	5,675.377	0.001	101.980	0.132	0.005	0.973	21
5	CO_2 Emissions from Stationary Combustion- Manufacturing Industries, Coal	CO_2	9,272.44	4,349.139	0.015	8.602	0.127	0.004	0.978	22
30	CH_4 Emissions from Stationary Combustion	CH_4	99.58	130.350	0.002	50.249	0.106	0.004	0.981	23
27	Non- CO_2 emissions from biomass combustion for energy use	CH_4, N_2O	85.24	192.102	0.004	20.616	0.082	0.003	0.984	24
33	Non- energy fuel use- liquide	CO_2	354.00	68.293	0.003	20.616	0.066	0.002	0.987	25
19	Fugitive Emissions from Oil and Gas Operations	CH_4	1,278.86	628.741	0.001	50.249	0.063	0.002	0.989	26
16	Non-energy fuel use- gas	CO_2	990.06	830.504	0.008	7.071	0.059	0.002	0.991	27
4	CO_2 Emissions from Stationary Combustion – Gas	CO_2	10,258.84	5,129.590	0.008	7.071	0.055	0.002	0.993	28

T1-level	IPCC Source Categories	Gas	CO_2-eqv. 1988	CO_2-eqv. 2005	Trend assessment	Comb. Unc. %	T2 Trend ass. %	% of Trend ass.	Cumul. of Trend	T2-trend
34	Mobile Combustion-road transportation	N_2O	48.27	56.940	0.001	50.990	0.043	0.002	0.994	29
9	CO_2 Emissions from Steel Production	CO_2	2,360.38	1,376.301	0.004	10.440	0.037	0.001	0.996	30
25	CO_2 from Limestone and Dolomite use	CO_2	457.87	313.778	0.002	15.811	0.031	0.001	0.997	31
31	Mobile Combustion-Railways	CO_2	368.04	93.861	0.003	7.071	0.019	0.001	0.997	32
29	CO_2 from Soda Ash Production	CO_2	233.19	146.471	0.001	20.616	0.013	0.000	0.998	33
37	CH_4 Emissions from Rice Production	CH_4	119.25	39.608	0.001	20.616	0.013	0.000	0.998	34
32	CO_2 Emissions from Industrial Processes - others	CO_2	26.61	91.600	0.002	5.831	0.012	0.000	0.999	35
36	CH_4 Emissions from Industrial Processes - metal production	CH_4	73.20	42.605	0.000	100.045	0.011	0.000	0.999	36
28	Emissions from Wastewater Handling	N_2O	310.49	147.077	0.000	20.616	0.009	0.000	0.999	37
35	Non-energy fuel use- solid	CO_2	80.42	45.747	0.000	83.815	0.007	0.000	1.000	38
39	CH_4 Emissions from Agricultural Residue Burning	CH_4	46.35	27.096	0.000	55.902	0.004	0.000	1.000	39
40	N_2O Emissions from Agricultural Residue Burning	N_2O	15.10	7.531	0.000	201.556	0.002	0.000	1.000	40
38	Mobile Combustion-road transportation	CH_4	53.52	27.571	0.000	40.112	0.001	0.000	1.000	41
	Totals		**132,612.57**	**69,994.88**						

ANNEX 2: METHODOLOGY AND DATA FOR ASSESSMENT OF CO_2 EMISSIONS FROM FUEL COMBUSTION

CO_2 emissions from fuel combustion are calculated based on statistics for combustible fuels, carbon content of the fuels and the degree of oxidation. The following main categories are defined:

- Stationary combustion of fossil fuels;
- Mobile combustion of fossil fuels;
- Non-energy use of the fuels;
- Waste and biomass combustion.

Stationary Combustion

CO_2 emissions from fuels in electric plants, refineries, large industrial consumers and other sources are determined on the basis of fuel quantities given in the overall energy balance of the country and emissions factors presented in **Table A2.1**. These factors are aggregated at a level type of fuel. As it is seen from the table, they account also the type of the combustion technology depending on the source.

In the present inventory is made a change of emission factors for methane emissions from combusting of firewood in households, agriculture and sub-sector services and institutions. The emission factors have increased multiply in accordance with the values from the IPCC Guidance.

Table A2.1

Fuels	Carbon content	LCV	EF	EF
	%	GJ/t	kg/t	kg/GJ
Hard coal				
Residential	79	24.0	2 431	101.3
Metal industry	68.5	21.0	2 127	101.3
Public Power Plant	66.6	23.1	2 342	101.4
CHP	65.9	26.0	2 938	113.0
Coke	84	30.0	3 180	106.0
Petroleum Coke	99	31.0	3 193	103.0
Brown Coal				
Public Power Plant	55	12.0	1 141	95.1
CHP	47	9.0	810	90.0
Metal industry	58	18.0	1 721	95.6
Residential	55	18.0	1 721	95.6
Lignite				
Public Power Plant	18	6.5	728	112.0
CHP	25	7.6	760	100.0
Residential	30	10.4	1 147	110.3
Wood, sp. m^3	45	3.8	375	98.7
BKB	62	18.2	1 820	100.0
Gasoline	87	44.0	3 172	72.1
Diesel Oil	87	41.9	3 189	76.1
LPG	82	52.0	3 245	62.4
Gas Oil	87	41.5	3 042	73.3
Residual Fuel Oil	86	39.8	3 049	76.6
Natural Gas, th. nm^3	58	33.5	1 870	55.8
Dry gas		45.0	2 970	66.0
Coke oven gas, th. m^3		17.6	827	47.0
Blast furnace gas, th. m^3		3.7	877	237.0

Mobile Combustion

The mobile sources of CO_2 emissions include all types of transport as well as the internal-combustion engines used in the agriculture and forestry and construction sector (so-called "off-road" motor vehicles).

The methodology of GHG emission calculation, including the carbon dioxide is based on the method from type Tier 2 which uses the following main data sources:

- Quantities of consumed fuels by types;
- Number, type and size of the motor vehicles;
- Average size of the road distance and the delivered cargoes;
- Differentiated emission factors by kind, type and size of the motor vehicles.

In defining the CO_2 emissions, the emission factors do not depend significantly on the type and the technology of the combustion and in this sense the differentiation of the factors is only by type of fuel. However, regarding the other GHGs the type of the motor vehicle play a main role. The classification of emission factors by types of motor vehicles is given in annex to the previous National Inventory Report for the year 2004.

CO_2 emissions from international marine and air transport combustion are calculated with the same data and emission factors as for the domestic transport.

Non-energy use of fuels

The application of the Reference Approach for calculation of the national CO_2 emissions includes also a determination of the stored carbon in the products. In this manner is accounted the non-energy use of the fuels as well as their usage as row materials for the production of chemicals.

The share of the carbon stored in products is presented in **Table A2.2**

The values indicated in the table are standard and are taken from the Revised IPCC Guidance. It is evident from the data in the table that one part of the carbon is emitted in the atmosphere as CO_2 emissions.

CO_2 emissions from non-energy use of fuels are structured in category Manufacturing Industry and Construction at sector Energy.

Carbon storage fractions for energy carriers used as feedstock

Table A2.2

FUEL TYPE	Fraction of carbon stored 2005
Naphtha	0.75
Lubricants	0.50
Bitumen	1.00
Coal Oils and Tars (from Coking Coal)	0.75
Natural Gas	0.33
Gas/Diesel Oil	0.50
LPG	0.80
Gudron	0.85
Other (please specify)	
Petroleum Coke	0.85
Residual Oil	0.75
Kerosene	0.8
Distillate	1
Turpentine and Solvent gasoline	0.85
Low octane gasoline, refinery gasoline	0.8

Waste and biomass combustion

A practice of waste combustion for energy production is not introduced yet in Bulgaria. The wastes are combusted only for the purpose of their liquidation as emission pollutants and they are not calculated by the IPCC methodology.

Biomass combustion (mainly wood and wooden wastes form felling) for energy production, food preparation and other purposes is a common practice in Bulgaria. The CO_2 emissions from these activities are net emissions and they do not participate in the GHG Inventory. The same is applied to the plant combustible wastes, which are picked up by the people.

Other GHG emissions and GHG precursors are calculating and are including in GHG inventory.

ANNEX 3: METHODOLOGY FOR CALCULATION OF GHG EMISSIONS FOR SOME SOURCES AND SINKS

3.1 Methodology for Calculation of GHG Emissions from Sources in Bulgaria

The GHG emissions from fuel combustion and technological processes are calculated on the basis of combination of specific for the country methodologies and emission factors and such as those given in the IPCC Guidance as standards.

Emissions of carbon dioxide from sources other than fuels

The sources of CO_2 emissions in Bulgaria regardless of fuels are:

- Steel production;
- Cement production; Lime production;
- Lime production;
- Ammonia production;
- Production and consumption of soda ash;
- Carbide production;
- Consumption of limestone and dolomite;
- Glass production;
- Desulphurization of output gases in thermo-electric power plants;
- Steel, aluminium and Ferro-alloys production.

The determination of the emissions from the upper sources is done by the methods of types Tier 1 and Tier 2 (only for cement) according the Good Practice Guidance. The first sulphur purification installation works from the end of the year 2002 at the energy complex Maritza East. The calculation of the emitted CO_2 in the atmosphere is based on an analytic method.

Emissions of methane

Methane emissions from *fuel combustion* represent considerable smaller part from the other emission sources from these type GHG emissions. They stay at the end of the list of non-emission key sources of GHG emissions.

The fugitive emissions of methane from the coal extraction and systems of extraction and transmission/distribution of gas comprise over 3 % of the overall emissions in the country. They are a key source.

One of the most considerable sources of methane is the *Agriculture*. The emissions from enteric fermentation and from manure management take up bigger part of these emissions. They are determined by method from type Tier 1 and only for the emissions of cattle and swine manure is applied method from type Tier 2. Most part of the emission factors are taken from the Good Practice Guidance and from the Revised IPCC Guidelines.

Methane emissions from the *deposing of solid waste* are the biggest GHG source in Bulgaria. They comprise 8 % of the overall emissions in the country for the year 2005. From this inventory began the applying of the method for their determination from type Tier 2, which does not meet the requirement of the good practices.

Emissions of nitrogen oxide

N_2O emissions from *fuel combustion* represent small part of the overall emissions from this type GHGs for the year 2005 – around 8.7 %. The energy sub-sectors – electricity and heat production emit the major part of them.

Certain quantities of N_2O – 22.7 % are emitted from the *technological processes* and moreover in production of nitric acid. At a present there are no data for the emissions of this GHG within the category sources from sector Solvent Use.

One of the most significant sources of N_2O is the *Agriculture*. The emissions of this sector are 65 % from the overall emissions from this type GHG for the year 2005.

The biggest source of N_2O emissions within the sector is the agricultural soils. The parameters and the emission factors that are used for their calculation are taken from the Revised IPCC Guidance.

Emissions of HFCs, PFCs and SF_6

There is no production of F-gases in Bulgaria.

There is an import of substances and products, which contain halocarbons. In this way, only potential emissions of HFCs are determined.

Actual emissions of SF_6 are defined only on the basis of the fugitive emissions from the fulfilled with this gas electric commutation apparatuses. For this purpose the standard method from the Good Practice Guidance is applied.

3.2 Additional Data for the Forest in Bulgaria

Background

The area of the territories and forests from the forestry fund of Bulgaria (forestry fund) in 2005 is 4 076 464 ha, which is 36.4 % of the country's territory. The area covered with forests is 3 674 320 ha, which defines 32.1 % wooded territories of the country.

The total wooded surface (including pine-scrub) has increased with 100 549 ha as a result of newly arranged forests and the completed forestations. The un-afforested area prepared for forestation as well the forestry pastures have decreased respectively with 9 100 ha and 12 132 ha.

The area of the forests by type of property is distributed according to **Table A3.1** as follows, where data are for 2003:

Forest Area by type of ownership 2003

Table A3.1

Type	Area – ha		%	
	total	afforested	From total	from afforested
State	3 195 314	2 797 529	79.6	78.9
Municipal	339 273	304 857	8.4	8.6
Private subjects	376 919	351 381	9.4	9.9
Private law subjects	7 604	6 861	0.2	0.2
Religious organizations	33 666	27 393	0.8	0.8
Others	62 460	59 416	1.6	1.6
Total	**4 015 236**	**3 547 456**	**100**	**100**

The changes in type of property are expressed in decrease the forests that are state property on the account of the increase in the forests that are municipality's property. These changes are due to the undertaken processes of reinstatement of the forests to the former owners.

The wooden reserve exceeds 598 millions m^3 within average annaul increase of around 14.120 millions m^3 and usage of the wood – 7 055 885 m^3.

The distribution of the afforested forestry area by type of woods is presented in **Figure A3.1** in percents.

Figure A3.1

The area of forests that are mainly kept for timbering and site formation are 65.9 %. The forests for recreation and protection occupy 26.6 % and the forests and lands at the protective territories – 7.5 % from the country's forestry fund.

In the year 2005 have been planted 3.65 millions new forests. 67.7 % from them are afforested with deciduous types. The afforested are mainly orientated towards an increase in the afforested area in the country, recuperation of the forests, destroyed by fires, droughts and natural disasters.

3.3 Emission factors and parameters for sectors: Energy, Industrial Processes, Agriculture and Waste.

EF – ENERGY INDUSTRIES

Electricity *Public Generation*	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	2.5	0.1	71	22.3	2.5	0
LPG	0	0	0.6	0	0	0	0
Gas Oil	73.3	7.8	0.4	1432	528	169.6	0.4
Residual Fuel Oil	78.4	3	0.3	242	14.5	3	1.8
Anthracite	101.4	1.5	1.6	571	24.7	1.5	0.81
Black Coal	101.4	1.5	1.6	571	24.7	1.5	0.81
Brown Coal	95.1	1.5	1.6	184	9.3	1.5	2.14
Lignite	112.1	1.5	4,5	147	16.8	1.5	5.49
Coke	106	0	1.6	0	0	0	0.2
Diesel Oil	73.3	7.8	0.4	1432	528	169.6	0.4
BKB	112.1	1.5	4.2	147	16.8	1.5	3.5

Combined Heat & Electricity *Public Generation*	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Coke Gas	47,0	1.40	0.1	67.00	17.00	0.00	0.7
Blast Gas	237,0	1.40	0.1	67.00	17.00	0.00	0.7
Natural Gas	55.82	2.5	0.1	60	22.3	2.5	0
LPG	0	0	0.6	0	0	0	0
Gas Oil	73.3	7.8	0.4	1432	528	169.6	0.4
Residual Fuel Oil	74.5	3	0.3	200	14.5	3	1.43
Anthracite	113	1.5	1.6	410	36.3	1.5	1.2
Black Coal	113	1.5	1.6	410	36.3	1.5	1.8
Brown Coal	90	1.5	1.6	157	59.5	1.5	1.62
Lignite	99.9	1.5	4.5	179	16.8	1.5	5.65
Dry gas	66,0	1.4	0.1	67	17	0	0.4
Diesel Oil	73.3	7.8	0.4	1432	528	169.6	0.5
BKB	100	1.5	4.2	179	16.8	1.5	3

Combined Heat & Electricity *Auto-generation*	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas 1000 m^3	55.82	2.5	0.1	71.7	22.3	2.5	0
LPG	76	0.03	0.1	103	15	0	0.5
Gas Oil	76	0.03	0.4	103	15	0	0.5
Res. Fuel Oil + Gudron	78.5	3	0.3	134	14.5	3	1.47
Anthracite	113	1.5	1.6	410	36.3	1.5	1.2
Black Coal	113	1.5	1.6	410	36.3	1.5	1.8
Brown Coal	90	1.5	1.6	157	59.5	1.5	1.62
Lignite	99.9	1.5	4.5	179	16.8	1.5	5.65
Coke/Tar	106	1.5	1.6	410	36.3	1.5	0.5
Dry gas	66,0	1.4	0.1	67	17	0	0.4
BKB/ Waste industrial	100	1.5	4.2	179	16.8	1.5	3
Coke Gas	47,0	1.40	0.1	67.00	17.00	0.00	0.7
Blast Gas	237,0	1.40	0.1	67.00	17.00	0.00	0.7

Heat Plants	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	0.1	0.1	54	19	0	0
LPG	0	0	0.1	0	0	0	0
Gas Oil	73.3	2.9	0.4	161	15	0	0.5
Residual Fuel Oil	70	0.7	0.3	139	15	0	1.79
Anthracite	113	15	1.6	410	36.3	15	0
Black Coal	113	15	1.6	410	36.3	15	1.7
Brown Coal	90	15	1.6	157	59.5	15	1.7
Lignite	99.9	15	4.0	179	16.8	15	4
Coke	106	0	1.6	0	0	0	0.4
Wood	98.7	15	1.4	115	1504	0	0
BKB	100	15	4.0	179	16.8	15	3.88

Petroleum Refining	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.1	67	17	0	0
Gas Oil	73.3	0.6	0.6	64	16	0	0
Residual Fuel Oil / Distillate	76.6	2.9	0.4	161	15	0	0
Anthracite	101.33	2.4	0	329	93	0	0
Black Coal	101.33	2.4	0	329	93	0	0
Brown Coal	95.6	2.5	0	345	98	0	0
Lignite	110.3	2.5	0	345	98	0	0
Coke	106	0	0	0	0	0	0
Dry gas	66,0	1.4	0.1	67	17	0	0.4
BKB	100	11	0	248	205	0	0
Crude oil	1.7	0.07	0	1.5	2.35	15.6	0.0235
Kerosene	70.8	1.9	0	280	116.8	17.4	0.04

Solid Fuels Transformation Coke& BKB & Blast furnace	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	100	0	0	0	0	0	0
LPG	0	0	0	0	0	0	0
Gas Oil	0	0	0	0	0	0	0
Residual Fuel Oil	0	0	0	0	0	0	0
Anthracite	0	0	0	0	0	0	0
Black Coal	0	1	0	35	211	16	0
Brown Coal	0	0	0	0	0	0	0
Lignite	0	0	0	0	0	60	0
Coke	5	5.6	1.6	7.2	3.5	0.31	0.003

Other Energy Industries	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0	67	17	0	0
Gas Oil (diesel + gas oil)	73.3	0.6	0.6	64	16	0	0.48
Residual Fuel Oil	76.6	2.9	0.4	161	15	0	0.5
Anthracite	101.33	2.4	1.4	329	93	0	1.33
Black Coal	101.33	2.4	1.4	329	93	0	1.33
Brown Coal	95.6	2.5	1.4	345	98	0	2.7
Lignite	110.3	2.5	4.0	345	98	0	3.3
Coke	106	0	1.40	0	0	0	0.58
Coke Gas	47,0	1.40	0.1	67.00	17.00	0.00	0.7
BKB	100	11	1.4	248	205	0	3.88
Blast Gas	237,0	1.40	0.1	67.00	17.00	0.00	0.7
Kerosene	70.78	1.9	0.6	280	116.8	17.4	0.03
Wood	98.7	15	1.4	115	1504	0	0
Dry gas	66,0	1.4	0.1	67	17	0	0.4

EF - MANUFACTURING INDUSTRIES AND CONSTRUCTION

Iron and Steel	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.40	0.1	67.00	17.00	0.00	0
LPG	62.40	1.40	0.6	67.00	17.00	0.00	0
Gas Oil	73.30	2.90	0.6	161.00	15.00	0.00	0.48
Residual Fuel Oil	76.60	2.90	0.6	161.00	15.00	0.00	1.5
Anthracite	101.30	2.40	1.4	329.0	93.00	0.00	1.1
Black Coal	101.30	2.40	1.4	329.0	93.00	0.00	1.33
Brown Coal	95.60	2.50	1.4	345.00	98.00	0.00	2.5
Lignite	110.30	2.50	1.4	345.00	98.00	0.00	3.8
Coke	106.00	0.00	1.4	0.00	0.00	0.00	0.58
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.50	2.50	1.4	345.00	98.00	0.00	2.9
Coke Gas	47,0	1.40	0.7	67.00	17.00	0.00	0.7
Blast Gas	237,0	1.40	0.7	67.00	17.00	0.00	0.7

Non-ferrous metals	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.6	67	17	0	0
Gas Oil	73.3	2.9	0.6	161	15	0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161	15	0	1.5
Anthracite	101.3	2.4	1.4	329	93	0	1.2
Black Coal	101.3	2.4	1.4	329	93	0	1.4
Brown Coal	95.60	2.5	1.4	345	98	0	2.5
Lignite	110.30	2.5	1.4	345	98	0	3.26
Coke	106	0	1.4	0	0	0	0.4
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.5	2.5	1.4	345	98	0	2.8

Chemicals	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.6	67	17	0	0
Gas Oil	73.3	2.9	0.6	161	15	0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161	15	0	1.5
Anthracite	101.3	2.4	1.4	329	93	0	1.2
Black Coal	101.3	2.4	1.4	329	93	0	1.4
Brown Coal	95.60	2.5	1.4	345	98	0	2.5
Lignite	110.30	2.5	1.4	345	98	0	3.26
Coke	106	0	1.4	0	0	0	0.4
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.5	2.5	1.4	345	98	0	2.8
Jet Gasoline-Non-energy	70.8	58.93	0.6	73.33	23080	535.7	0.045

Pulp, Paper and Printing	**Emission Factor**						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.6	67	17	0	0
Gas Oil	73.3	2.9	0.6	161	15	0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161	15	0	1.5
Anthracite	101.3	2.4	1.4	329	93	0	1.2
Black Coal	101.3	2.4	1.4	329	93	0	1.4
Brown Coal	95.60	2.5	1.4	345	98	0	2.5
Lignite	110.30	2.5	1.4	345	98	0	3.26
Coke	106	0	1.4	0	0	0	0.4
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.5	2.5	1.4	345	98	0	2.8
Jet Gasoline-No	70.8	58.93	0.6	73.33	23080	535.7	0.045

Food Processing Beverages and Tobacco	**Emission Factor**						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.6	67	17	0	0
Gas Oil	73.3	2.9	0.6	161	15	0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161	15	0	1.5
Anthracite	101.3	2.4	1.4	329	93	0	1.2
Black Coal	101.3	2.4	1.4	329	93	0	1.4
Brown Coal	95.60	2.5	1.4	345	98	0	2.5
Lignite	110.30	2.5	1.4	345	98	0	3.26
Coke	106	0	1.4	0	0	0	0.4
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.5	2.5	1.4	345	98	0	2.8

Others	**Emission Factor**						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.82	1.4	0.1	67	17	0	0
LPG	62.4	1.4	0.6	67	17	0	0
Gas Oil	73.3	2.9	0.6	161	15	0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161	15	0	1.5
Anthracite	101.3	2.4	1.4	329	93	0	1.2
Black Coal	101.3	2.4	1.4	329	93	0	1.4
Brown Coal	95.60	2.5	1.4	345	98	0	2.5
Lignite	110.30	2.5	1.4	345	98	0	3.26
Coke	106	0	1.4	0	0	0	0.4
Wood	98.70	15.00	1.4	115.00	1504	0.00	0
BKB	107.5	2.5	1.4	345	98	0	2.8
Jet Gasoline-No	70.8	58.93	1.4	73.33	23080	535.7	0.04
Kerosene	70.6	2	0.7	283	116.6	17.5	0.03
Dry gas	66,0	1.4	0.7	67	17	0	0.4
Petroleum Coke	103		0.7				0.4

EF – TRANSPORT

Emission factors for mobile sources, g/kg fuel						
	NOx	CH_4	NMVOC	CO	N_2O	CO_2
Gasoline						
Pass. cars < 1000 ccm	13.56	2.04	27.6	185.78	0.06	3172
Pass. cars 1000-1500 ccm	15.92	2.04	37.54	287.87	0.06	3172
Pass. cars 1500-2000 ccm	16.51	2.04	43.33	323.55	0.06	3172
Pass. cars > 2000 ccm	15.23	2.04	45.35	390.45	0.06	3172
Busses < 12 p	18.34	2.04	32.64	188.99	0.04	3172
Busses 12 ÷ 32 p	19.19	1.07	59.72	251.32	0.04	3172
Trucks < 1.5 t	7.79	0.63	23.04	147.86	0.04	3172
Trucks 1.5-5 t	11.67	0.68	34.97	221.41	0.04	3172
Trucks 5-7 t	12.98	0.65	38.12	251.32	0.02	3172
Trucks 7-10 t	10.57	1.02	49.44	264.98	0.02	3172
Motorcycles	2.64	3.75	150	495	0.05	3172
Diesel - road						
Pass. cars < 2000 ccm	8.89	0.09	2.8	10.29	0.08	3188
Pass. cars > 2000 ccm	9.75	0.09	3.59	11.87	0.08	3188
Busses<12p	6.15	0.08	3.29	6.29	0.08	3188
Busses 12 ÷ 32 p	6.97	0.12	3.93	7.85	0.08	3188
Busses >32 p	11.6	0.16	4.02	11.78	0.08	3188
Long busses(buss + trailer)	12.51	0.28	6.57	14.07	0.08	3188
Trucks < 1.5 t	7.05	0.09	3.74	6.23	0.08	3188
Trucks 1.5-5 t	6.17	0.09	3.99	5.82	0.08	3188
Trucks 5-7 t	7.17	0.1	4.11	7.96	0.08	3188
Trucks 7-10 t	22.79	0.16	4.79	17.3	0.08	3188
Trucks 10-15 t	30	0.21	6.55	20.09	0.08	3188
Trucks > 15 t	42.86	0.26	7.63	21.8	0.08	3188
Diesel off - road						
Farm equipment	63.5	0.45	9.6	25.4	0.08	3188
Construction equipment	50.2	0.18	3.9	16.3	0.08	3188
Water transport	67.5	0.23	4.9	21.3	0.08	3188
Rail transport	74.3	0.25	5.5	26.1	0.08	3188
Piston aircraft	3.52	2.64	24	1034	0.04	3172
Jet aircraft	12.5	0.09	0.78	5.2	0	3149
Ships	87	0	0	1.9	0.08	3212

LPG- benzin						
Pass. cars < 1000 ccm	36,8	0,68	25,7	122	0,12	3286
Pass. cars 1000-1500 ccm	36,8	0,68	25,7	122	0,12	3286
Pass. cars 1500-2000 ccm	36,8	0,68	25,7	122	0,12	3286
Pass. cars > 2000 ccm	36,8	0,68	25,7	122	0,12	3286
Trucks < 1.5 t	27,4	0,45	33,4	341	0,36	3286
Trucks 1.5-5 t	27,4	0,45	33,4	341	0,36	3286
Trucks 5-7 t	33,2	1,25	8	13,9	0,072	3286
Trucks 7-10 t	33,2	1,25	8	13,9	0,072	3286
LPG- diesel						
Pass. cars < 2000 ccm	36	0,68	25	120	0,12	3286
Pass. cars > 2000 ccm	36	0,68	25	120	0,12	3286
Trucks < 1.5 t	26	0,07	3	17	0,06	3286
Trucks 1.5-5 t	26	0,07	3	17	0,06	3286
Trucks 5-7 t	33,2	0,34	8	13,9	0,36	3286
Trucks 7-10 t	33,2	0,34	8	13,9	0,36	3286

Trucks 10-15 t	33,2	0,34	8	13,9	0,36	3286
Trucks > 15 t	33,2	1,02	8	13,9	0,36	3286

EF – OTHER SECTORS

Commercial/ Institutional	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.8	1.2	1.4	48.0	9.6	0.0	0
Kerosene	70.8	1.9	0.6	280.0	116.8	0.0	0.02
Gas Oil	73.3	0.6	0.6	64.0	16.0	0.0	0.48
Residual Fuel Oil	76.6	2.9	0.6	161.0	15.0	0.0	1.50
Anthracite	101.3	10.0	1.4	236.0	195.0	0.0	1.33
Black Coal	101.3	10.0	1.4	236.0	195.0	0.0	1.00
Brown Coal	95.60	11.0	1.4	260.0	214.0	0.0	3.00
Lignite	110.30	11.0	1.4	260.0	214.0	0.0	3.30
Coke	106.0	0.0	1.4	0.0	0.0	0.0	0.50
Wood, Nm^3	90.0	370	4.3	80	1504	0.0	0.00
BKB	100.0	11.0	1.4	248.0	205	0.0	3.50
LPG	62.4	1.1	1.4	47	10	0.0	0.03

Residential	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.8	1.1	0	47.0	10.0	0.0	0
Kerosene	70.8	1.9	1.55	280.0	116.8	0.0	0.03
Gas Oil	73.3	5.0	1.55	51.0	13.0	0.0	0.48
Residual Fuel Oil	76.6	2.9	0.15	161.0	15.0	0.0	1.50
Anthracite	101.3	0.0	1.4	179.0	35.8	0.0	1.70
Black Coal	101.3	0.0	1.4	179.0	35.8	0.0	1.80
Brown Coal	95.60	0.0	1.4	197.0	3938.0	0.0	3.90
Lignite	110.30	0.0	1.4	197.0	3938.0	0.0	4.27
Coke	106.0	0.0	1.4	0.0	0.0	0.0	0.60
Wood, Nm^3	90	210	4.3	80	10000	600	0.00
BKB	100.0	0.0	1.4	188.0	3760	0.0	3.88
Avia Gasoline	68.6	57.0	0.6	76.0	22366.0	519.0	0.02
LPG	62.4	1.1	0.3	47	10	0	0

Agriculture	Emission Factor						
	kg/GJ CO_2	g/GJ CH_4	g/GJ N_2O	g/GJ NOx	g/GJ CO	g/GJ NMVOC	kg/GJ SO_2
Natural Gas	55.8	1.2	1.4	48.0	9.6	0.0	0
Kerosene	70.8	1.9	0.6	280.0	116.8	0.0	0.02
Gas Oil	73.3	0.6	0.6	64.0	16.0	0.0	0.48
Residual Fuel Oil	76.6	1.6	0.6	155.0	17.0	0.0	1.5
Anthracite	101.3	0.0	1.4	179.0	3580.0	0.0	1.5
Black Coal	101.3	0.0	1.4	179.0	3580.0	0.0	1.8
Brown Coal	95.60	0.0	1.4	197.0	214.0	0.0	3.8
Lignite	110.30	0.0	1.4	197.0	3938.0	0.0	4.3
Coke	106.0	0.0	1.4	0.0	0.0	0.0	0.6
Wood, Nm^3	90	210	4.3	200.0	15000	600	0
BKB	100.0	11.0	1.4	248.0	205	0.0	3.7
Avia Gasoline	68.6	57.0	0.6	76.0	22366.0	519.0	0.02
LPG	62.4	1.4	0.6	67	17	0	0
Diesel oil	73.3	0.6	0.6	64.0	16.0	0.0	0.48
Motor gasoline	0	0	0.6	0	0	0	0.04

EF – FUGITIVE CH_4 EMISSIONS

Fugitive - Coal EF- m^3 CH_4 /t	
Underground – mining activities	17.50
Underground – post mining activities	2.50
Surface - mining activities	1.20
Surface – post mining activities	0.10

Fugitive – Oil and Gas EF – kg CH_4/PJ	
Oil	
Exploration	0
Production	2650
Transport	745
Refining / Storage	745
Distribution of oil products (LPG consumed)	38278
Natural Gas	
Exploration	
Production Processing	83682
Transmission	44630
Transit	5224
Distribution	4847
Other Leakage	-
at industrial plants and power stations	279500
in residential and commercial sectors	139500
Venting	
Oil	2000
Gas	18000
Combined	-
Flaring	
Oil	9
Gas	329
Combined	-

Other- LPG consumed	kg/t	*2*
Natural Gas - production	10-3Gg/106m3	*2,8*
Natural Gas - transit	10-3Gg/km	*2,5*
Natural Gas - domestic transmit ion	10-3Gg/km	*2,5*
Natural Gas - domestic distribution	10-3Gg/km	*0,62*
Natural Gas - production- flaring	10-3Gg/106m3	*0,011*
Oil - refined - flaring	kg/t	*0,0004*

EF – INDUSTRIAL PROCESSES

№	Resource type	Units	CO_2	CH_4	N_2O	CO	NOx	NMVOC	SO_2
			kg	kg	kg	kg	kg	kg	kg
1	**Vegetal oils (sunflower, soy, etc)-** Sunflower - 15.42.11.40.00 Maize - 15.62.10.50.00	t						18.0	
2	**Food and Drinks**– Meat - 15.11.1x.yy.zz Poultry - 15.12.1x.yy.zz Fish - 15.20.11.yy.zz Margarine and solid fats - 15.43.10.yy.zz Animal feed - 15.71.1x.yy.zz Pets - 15.72.1x.yy.zz Bread - 15.81.11.00.00 Cakes and biscuits – 15.82.12.yy.zz 15.82.13.yy.zz 15.81.12.00.00 Sugar - 15.83.12.yy.zz Coffee roasting – 15.86.11.30.00 15.86.11.50.00 High spirits (grapes, cognacs, vodka, whiskey, liqueurs, etc.)- 15.91.10.yy.zz Spirit- 15.92.1x.yy.zz Wine – white - 15.93.12.11.00 15.93.12.13.00 15.93.12.15.00 Whine – red - 15.93.12.17.00 15.93.12.19.00 15.93.12.30.00 Beer- 15.96.10.00.00	t t t t t t t t th.l th.l th.l th.l th.l						0.3 10.0 1.0 8.0 1.0 10.0 0.55 0.35 1.5 0.0035 0.008 0.0035	

№	Resource type	Units	CO_2	CH_4	N_2O	CO	NOx	NMVOC	SO_2
			kg	kg	kg	kg	kg	kg	kg
3	**Rice-**	Mha. day		4.14					
4	**Petroleum products (without fuels):**								
	Ethylene 24.14.11.30.00	t		1.0				1.4	
	Propylene 24.14.11.40.00	t						1.4	
	Dychlorethan 24.14.13.53.00	t		0.4				7.3	
	Stirene 24.16.20.50.00	t		4.0				18.0	
	Ethylbenzene 24.14.12.60.00	t						2.0	
	Methanol- 24.14.22.10.00	t		2.0					
	Caprolactam- 24.14.52.70.00	t			NAV			6.5	
	Polystyrene 24.16.2x.yy.zz	t						5.4	
	Polypropylene 24.16.51.30.00	t						12.0	
	Polyethylene 24.16.1x.yy.zz	t						4.0	
	Polyvinylchloride 24.16.3x.yy.zz	t						8.5	
	Lubricants and other mineral oils 23.20.18.yy.zz		36.3 kg/GJ						
	Gasoline producing	t						0.31	
	Gasoline consuming from stations	t						2.88	
5	**Asphalt (oil bitumen) producing**								
	- 26.82.13.00.0	t						27.2	
	- asphalt roofing	th. m2						50.0	
6	**Organic chemical processes - (plastic, synthetic resins and glues)** 24.16.4x.yy.zz	t						7.5	
	Glues use 24.62.10.13.00	t						600	
	Formaldehyde 24.14.61.11.00	t						5.0	
	Phtalic anhydride 24.14.34.33.00	t						6.0	
	Refinery flaring	t				0.012	0.054	0.0016	0.077
7	**Paints and lacquers (dissolved in water and other solvent)** 24.30.11.yy.zz, 24.30.12.yy.zz	t							.
	Paints and glue productions 24.30.22.73.00							18	
	Paint use							500	
	Water-soluble paint use - latex							30	
	Use of paints and solvents in households							400	
	Solvents use in metal industry							900	
	Dry cleaning							600	
8	**Pulp and Paper** 21.11.1x.yy.zz	t				5.6	1.5	3.7	7.0
9	**Urea –** 24.15.30.13.00	tN+ t		NE					

№	Resource type	Units	CO_2	CH_4	N_2O	CO	NOx	NMVOC	SO_2
			kg	kg	kg	kg	kg	kg	kg
10	**Sulphur acid** 24.13.14.33.00	t							17.5
11	**Ammonia-** 24.15.10.75.00	t	862.0			7.9		4.7	0.03
12	**Nitric acid-** 24.15.10.50.00	t			6.0		15.0		
13	**Nitric fertilizers - base 100 % N** 24.15.30.yy.zz	t		NE					
14	**Carbide -** 24.13.54.50.00	t	2190						1.5
15	**Soda ash** Production- 24.13.33.10.00 Use	t	 97 415						
16	**Lime production** Quick lime production 26.52.10.33.00 Lime use Dolomite production Dolomite use	t	 785 440 910 477						
17	**Cement – total –** 26.51.12.yy.zz Clinker 26.51.11.00.00	t	498.5 520						0.3
18	**Plate glass – base 2 mm** 26.11.11.yy.zz 26.11.11.50.00	t	41					4.5	
19	**Packing glass –** Jars - 26.13.11.10.00 Bottles - 26.13.11.28.00 26.13.11.34.00 Glass fibers - 26.14.11.yy.zz	t	41					4.5	
20	**Glass insulators -** 26.15.25.00.00	t	41					4.5	
21	**Ceramic bricks, tiles and ridge-tiles -** 26.40.11.yy.zz	Th. pieces			NEG				
22	**Sinter (Smelters)** – 13.10.10.50.00	t		0.5					
23	**Coke-** 23.10.10.30.00	t		0.5					
24	**Refinery flaring**	t				0,012	0,054	0,0016	0,077

№	Resource type	Units	CO_2	CH_4	N_2O	CO	NOx	NMVOC	SO_2
			kg	kg	kg	kg	kg	kg	kg
24	**Retort ember-** 23.10.10.70.00	t			NAV				
25	**Ferroalloys (high-carbon)** Pig iron - 27.10.11.yy.zz Ferromanganese with > 2 % C- 27.10.12.00.00	t		0.9		1.33		0.1	1.0
26	**Ferroalloys (low-carbon)** Ferromanganese with < 2 % C - 27.35.11.00.00 Ferrochromium – 27.35.12.00.00 Ferronickel- 27.35.13.00.00 Other ferroalloys- 27.35.20.yy.zz	t	 1600 1300 1400 3500			 1.2	 0.05	 1.7	 0.035
27	**Steel** 27.10.20.yy.zz marten steel electro steel	t	821 1200 50				0.04	0.03	0.045
28	**Chrome, magnesium, nickel** Beryllium, chrome and others.- 27.45.30.55.00 Raw nickel - 27.45.12.30.00 Magnesium - 27.45.30.25.00	t			NE				
29	**Aluminum (secondary, unprocessed)** 27.42.1x.yy.zz	t	0				0	0	0
30	**Lead** 27.43.11.50.00	t			NO				
31	**Zink** 27.43.12.30.00	t			NO				
32	**Refined copper** 27.44.13.30.00	t			NO				
33	**Production and use of halocarbons (HFC and PFC)**	t			NAV				
34	**Production and use of SF_6**	t			NAV				
35	**Production of medicines**	g/person						14	

EF - AGRICULTURE

Enteric Fermentation	CH_4 EF (kg/head/yr)
1. Cattle	
Dairy Cattle	81.00
Non-Dairy Cattle	56.00
2. Buffalo	55.00
3. Sheep	8.00
4. Goats	5.00
5. Camels and Llamas	0.00
6. Horses	18.00
7. Mules and Asses	10.00
8. Swine	1.50
9. Poultry	0.01

Manure Management	CH_4 EF (kg/head/yr)
1. Cattle	16.00
Dairy Cattle	18.30
Non-Dairy Cattle	12.21
2. Buffalo	9.00
3. Sheep	0.28
4. Goats	0.18
5. Camels and Llamas	NO
6. Horses	2.08
7. Mules and Asses	1.14
8. Swine	9.95
9. Poultry	0.12

Manure Management	N kg/head/yr
Non-Dairy Cattle	50.0
Dairy Cattle	70.0
Sheep	16.0
Swine	20.0
Poultry	0.6
Other (please specify)	25.0

Animal Waste Management System	N_2O **EF3**, kg N_2O - N/kg N excretad
Anaerobic lagoon	0.001
Liquid system	0.001
Solid storage and dry lot	0.020
Other	0.005

Agriculture soils- Direct N_2O Emissions		
EF1	kg N_2O – N/ kg N	0.01
EF2	kg N_2O – N/ ha/yr	8.00
$Frac_{BURN}$	kg N/ kg crop-N	0.1
$Frac_{R}$	kg N/ kg crop-N	0.45
$Frac_{FUEL}$	kg N/ kg N excreted	0.0
$Frac_{GASF}$	kg NH_3 – N+NOx-N/ kg of synthetic fertilizer N applied	0.1
$Frac_{GASM}$	kg NH_3 – N+NOx-N/ kg of N excreted by livestock	0.2
$Frac_{GRAZ}$	Range 45-50 %	43,89 % for 2005
$Frac_{NCRBF}$	kg N/ kg of dry biomass	0.030
$Frac_{NCR0}$	kg N/ kg of dry biomass	0.015
EF3	kg N_2O – N/ kg N excreted	
Animal Waste Management System	*Daily spread*	0.00
	Pasture range and paddock(grazing)	0.02

Agriculture soil - Indirect N_2O Emissions		
EF4 $_{(N\ deposition)}$	kg N_2O – N/ kg NH_3 – N and NOx – N emitted	0.01
EF5 $_{(leaching/runoff)}$	kg N_2O – N/ kg N leaching/runoff	0.025
$Frac_{LEACH}$	kg N/ kg of fertilizer or manure N	0.10
EF6 $_{(sewage)}$	kg N_2O – N/ kg N sewage-N produced	0.01
$Frac_{NPR}$	kg N/ kg of protein	0.16

Rice Cultivation	With fertilizing	Without fertilizing
	kg/ha/yr	
EF - CH_4	403	162

Agriculture Residue		
	C fraction	N-C ratio
	% dm	
1. Cereals		
Wheat	0.4853	0.0058
Barley	0.4567	0.0094
Maize - corn	0.4709	0.0200
Oats	0.4567	0.0154
Rye	0.4567	0.0102
Rice	0.4144	0.0162
Other (please specify)		
Maize – for fodder	0.4709	0.0200
2. Pulse (1)		
Dry bean	0.45	0.0444
Peas	0.45	0.0316
Soybeans	0.45	0.0511
Other (please specify)		
Lentils	0.45	0.0511
Chick-Peas	0.45	0.0511
3 Tuber and Root		
Potatoes	0.4226	0.0260
Other (please specify)		
4 Sugar Beet	0.4072	0.0246
5 Other (please specify)		
Cotton	0.450	0.018
Sunflower	0.471	0.02
Tobacco	0.471	0.02
Feed beet	0.407	0.0560
Peanut	0.450	0.0236

SOLID WASTE

Fraction dissimilated DOC	per unit	0.6
CH_4 fraction in landfill gas	per unit	0.5
CH_4 recovery	per unit	0
DOC content	per unit	0.175
MCF - managed disposal	per unit	1
MCF – uncontrolled disposal	per unit	0.6

DOMESTIC WASTEWATER

CH_4 recover	0.0	Methane recovered /or flared
BOD - kg/1000 person/yr	18250	
Part of Wwater -	0.95	
Part of sludge -	0.05	
BO, kg CH_4/kg BOD	0.25	Maximum methane producing capacity
WS, %	25	Fraction of wastewater anaerobicaly treated
SS, %	25	Fraction of sludge anaerobicaly treated
MCF	1.0	Methane conversion factor

INDUSTRIAL WASTEWATER

Branches	**COD**
	kg/l
Iron and Steel	0.001
Non-ferrous Metals	0.001
Fertilizers	0.001
Food & Beverages-	
Beer	0.0029
Wine	0.0015
Meat packing	0.0041
Diary products	0.0027
Sugar	0.0032
Fish processing	0.0025
Oil & Grease	0.0010
Coffee	0.0090
Soft Drinks	0.0020
Other	0.0050
Pulp and Paper	0.0090
Petroleum refining/petrochemicals	0.0010
Textiles	0.0009
Rubber	0.0037
Others	0.0020
Sludge	0.003

EF_{IndWW} (kg CH_4 /kg COD) = 0.0375

ANNEX 4: CO_2 REFERENCE APPROACH AND COMPARISON WITH SECTORAL APPROACH

There is a possibility for comparison and verification of the results with the sectoral approach when it is applied the reference approach for determination of CO_2 emissions from fuel combustion.

First step in the Reference Approach is calculating the gross consumption using the following formula:

Gross consumption = Production + Import – Export – International Bunkers – Provision Change

In the above equation the fuels are taken in natural fuel units (tons, m^3, etc.) from the Energy Balance.

In the second step the determination of CO_2 emissions is applied. In general, the emission factors provided in the Revised IPCC Guidelines are applied.

Third step in this approach is correction of overall CO_2 emissions by excluding emissions from fuels used as feedstock and for non-energy use.

In **Table A4.1** are presented the CO_2 emissions from the Energy Sector estimated both by the Reference and the Sectoral Approach.

The comparison between the overall emissions in these two approaches varies within 0.5 – 1.7 % for the last five years under GHG inventory.

Main causes for the difference between Reference and Sectoral Approaches

Differences among the two approaches are mainly due to:

- Differences in the methodological approach;
- Different quantities of consumed fuels, including not taking into account the losses during fuel transformation in the sectoral approach;
- Different conversion factors for fuel conversion from natural units to energy units;
- Different emission factors for different combustion technologies used in the sectoral approach;
- Sensibility of the CO_2 emissions to the distribution of the petrol products produced in the refinery and to the carbon content of the crude petrol.

The above factors had dominant additive action in the former inventories. It means that the influence is in one direction, which leads to accumulation of differences. In the last inventory, the many-sided influence of the part of the factors is expressed clearly, which leads to compensations of the differences and reduction of the error. Such combination of the influence observes in 1988, 1989, 1992, 1998 and in the last two inventory years. The error between the two approaches is less than 0.5 %.

Influence upon differences between the two approaches has also the different emission factors. Since in the case raised the question for CO_2 emissions, these differences are small. Cause for that is the relative independence of this GHG from the technology of fuel combustion.

Recalculations and corrections of mistakes

As a result of the recalculations there is a possibility for correction of mistakes and quality improvement of the calculated GHG emissions. In **Table A4.2** are presented the comparative CO_2 emission assessments from fuel combustion for the last five National Inventory Reports for the years 2001-2005.

The analyses of **Table A4.2** give opportunity for overall assessment of the result of the presented in Chapter 10 preconditions for carrying out the recalculations. In quantity expression it showed that CO_2 emissions are not changed after that last recalculation in present report (Presentation 2007).

Differences in emissions with 5 – 7 % are observed only in Submission 2005.

Comparison of CO_2 emissions: Reference Approach (RA) versus Sectoral Approach (SA) - NIR 2007, Gg

Table A4.1

Method/ Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Reference Aproach																		
Liquid	34,832	34,055	28,320	19,254	15,300	18,317	16,873	16,634	14,575	12,068	11,412	11,742	10,879	10,683	11,923	12,198	11,631	13,227
Solid	44,926	44,926	40,554	34,727	32,758	34,722	31,760	32,835	33,418	34,897	32,541	28,693	28,900	31,564	28,649	32,151	31,451	30,560
Gaseous	11,401	11,401	12,085	10,158	8,978	8,435	8,493	10,293	10,440	8,225	7,436	5,978	6,358	5,905	5,271	5,475	5,444	6,178
Others																		
TOTAL - RA	**91,159**	**90,382**	**80,960**	**64,139**	**57,036**	**61,474**	**57,126**	**59,763**	**58,432**	**55,190**	**51,389**	**46,413**	**46,136**	**48,152**	**45,843**	**49,825**	**48,526**	**49,966**
Sectoral Aproach																		
Liquid	33,795	33,015	26,753	18,376	14,699	15,614	14,457	14,645	13,458	11,576	12,503	11,909	10,533	10,484	10,865	11,747	11,700	12,250
Solid	45,682	46,239	39,903	34,925	33,640	35,847	34,052	34,709	34,907	36,958	31,840	28,943	29,055	31,315	29,103	32,138	31,289	31,669
Gaseous	11,249	11,535	12,016	10,055	8,858	8,221	8,149	10,022	9,843	8,168	6,891	5,898	6,281	5,687	5,098	5,295	5,300	5,960
Others																		
TOTAL - SA	**90,726**	**90,789**	**78,673**	**63,357**	**57,197**	**59,682**	**56,658**	**59,376**	**58,208**	**56,703**	**51,235**	**46,750**	**45,869**	**47,486**	**45,066**	**49,180**	**48,289**	**49,879**
Difference, %																		
Liquid	3.07	3.15	5.86	4.77	4.09	17.31	16.71	13.58	8.30	4.26	-8.73	-1.40	3.28	1.90	9.74	3.84	-0.59	7.98
Solid	-1.65	-2.84	1.63	-0.57	-2.62	-3.14	-6.73	-5.40	-4.27	-5.58	2.20	-0.86	-0.53	0.80	-1.56	0.04	0.52	-3.50
Gaseous	1.35	-1.17	0.57	1.03	1.35	2.60	4.22	2.71	6.06	0.69	7.91	1.36	1.22	3.82	3.39	3.40	2.72	3.66
Others																		
TOTAL	**0.48**	**-0.45**	**2.91**	**1.23**	**-0.28**	**3.00**	**0.83**	**0.65**	**0.39**	**-2.67**	**0.30**	**-0.72**	**0.58**	**1.40**	**1.72**	**1.31**	**0.49**	**0.17**

Differences of CO_2 emissions from fuel combustion in the Sectoral Approach due to recalculation, Gg, %

Table A4.2

Gas/Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
NIR 2007	90,726	90,789	78,673	63,357	57,197	59,682	56,658	59,376	58,208	56,703	51,235	46,750	45,869	47,486	45,066	49,180	48,289
Difference 2007/2006	0.00		0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.83	0.01	0.02	0.02	0.03	0.30	0.03
NIR 2006	90,726		78,673	63,357	57,197	59,682	56,658	59,376	58,214	56,703	50,813	46,746	45,861	47,475	45,054	49,035	48,276
Difference 2006/2005	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	
NIR 2005	90,726		78,673	63,357	57,197	59,682	56,658	59,376	57,955	56,733	50,813	46,746	45,861	47,475	45,054	49,035	
Difference 2005/2004	-4.2		3.6	4.4	4.3	4.4	5.6	6.1	6.3	6.9	5.6	6.0	7.5	5.7	4.7		
NIR 2004	94,673		75,942	60,674	54,839	57,173	53,659	55,986	54,541	53,067	48,113	44,104	42,649	44,917	43,052		
Difference 2004/2003	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
NIR 2003	94,673		75,942	60,674	54,839	57,173	53,659	55,986	54,541	53,067	48,113	44,104	42,649	44,917			
Difference 2003/2001	-0.9		-1.1	-0.8	-0.4	-0.9	-1.1	-1.1	-10.9	-0.9	-0.8	-0.9					
NIR 2001	95,495		76,804	61,170	55,064	57,678	54,239	56,609	61,215	53,560	48,515	44,513					

Reference Approach and comparison with the Sectoral Approach

In **Table A4.3** are presented the reported emission differences in the Reference Approach and Sectoral Approach for the last five National Inventory Reports.

The analysis of the Table shows overall improvement of the quality assessment of total CO_2 emissions. It is expressed in reduction of the differences between the two approaches like the last seven years; the differences are lower from 1.5 % with exception for the year 2002 with 1.7 %.

Effect of recalculations on the comparison of CO_2 emissions in the RA versus SA (NIR's 2001-2006), Gg

Table A4.3

Gas/Sector	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
NIR 2007																		
Reference Approach	91,159	90,382	80,960	64,139	57,036	61,474	57,126	59,763	58,432	55,190	51,389	46,413	46,136	48,152	45,843	49,825	48,526	49,966
National Approach	90,726	90,789	78,673	63,357	57,197	59,682	56,658	59,376	58,208	56,703	51,235	46,750	45,869	47,486	45,066	49,180	48,289	49,879
Difference	***0.5***	***-0.4***	***2.9***	***1.2***	***-0.3***	***3.0***	***0.8***	***0.7***	***0.4***	***-2.7***	***0.3***	***-0.7***	***0.6***	***1.4***	***1.7***	***1.3***	***0.5***	***0.2***
NIR 2006																		
Reference Approach	91,159		80,960	64,139	57,036	61,474	57,126	59,763	58,432	55,190	51,389	46,413	46,136	48,152	45,843	49,825	48,526	
National Approach	90,726		78,673	63,357	57,197	59,682	56,658	59,376	58,214	56,703	50,813	46,746	45,861	47,475	45,054	49,167	48,276	
Difference	***0.5***		***2.9***	***1.2***	***-0.3***	***3.0***	***0.8***	***0.7***	***0.4***	***-2.7***	***1.1***	***-0.7***	***0.6***	***1.4***	***1.7***	***1.3***	***0.5***	
NIR 2005																		
Reference Approach	91,159		80,960	64,139	57,036	61,474	57,126	59,763	58,432	55,190	51,389	46,413	46,136	48,152	45,843	49,825		
National Approach	90,726		78,673	63,357	57,197	59,682	56,658	59,376	57,955	56,733	50,813	46,746	45,861	47,475	45,054	49,035		
Difference	***0.5***		***2.9***	***1.2***	***-0.3***	***3.0***	***0.8***	***0.7***	***0.8***	***-2.7***	***1.1***	***-0.7***	***0.6***	***1.4***	***1.7***	***1.6***		
NIR 2004																		
Reference Approach	91,688		72,784	60,451	56,589	61,159	56,697	58,565	56,859	55,262	51,344	45,144	44,764	47,268	45,012			
National Approach	94,673		75,942	60,674	54,839	57,173	53,659	55,986	54,541	53,067	48,113	44,104	42,649	44,917	43,052			
Difference	***-3.2***		***-4.2***	***-0.4***	***3.2***	***7.0***	***5.7***	***4.6***	***4.2***	***4.1***	***6.7***	***2.4***	***5.0***	***5.2***	***4.6***			
NIR 2003																		
Reference Approach	90,790		71,760	59,204	55,551	60,251	55,810	57,716	55,870	54,414	50,810	44,573	43,816	46,331				
National Approach	94,673		75,942	60,674	54,839	57,173	53,659	55,986	54,541	53,067	48,113	44,104	42,649	44,917				
Difference	***-4.1***		***-5.5***	***-2.4***	***1.3***	***5.4***	***4.0***	***3.1***	***2.4***	***2.5***	***5.6***	***1.1***	***2.7***	***3.1***				
NIR 2001																		
Reference Approach	90,790		71,760	59,204	55,551	60,251	55,810	57,716	55,870	54,414	50,810	44,573						
National Approach	95,495		76,804	61,170	55,064	57,678	54,239	56,609	54,442	53,560	48,515	44,513						
Difference	***-4.9***		***-6.6***	***-3.2***	***0.9***	***4.5***	***2.9***	***2.0***	***2.6***	***1.6***	***4.7***	***0.1***						

ANNEX 5: ASSESSMENT OF COMPLETENESS OF INVENTORIES

In the 2004 GHG Inventory are included all the sectors mentioned in the Revised IPCC Guidelines, 1996 with the exception of:

- Actual F – gases emissions from use of aerosol preparations, fire-extinguishers, etc;
- Actual emissions of F – gases from production of primary aluminum;
- N_2O emissions from solvent use.

The emissions mentioned above exist (excepting the ones from aluminum production), but there are no methodologies elaborated yet for quality collection of the input data.

In **Table A5.1** are presented explanations for the used symbols for designation of the type data in the inventory (Table 9 from CRF files).

INFORMATION ON NOTATION KEYS

Table A5.1

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
Carbon	5 LULUCF	5.A.2.1 Cropland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.3 Wetlands converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.4 Settlements converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.5 Other Land converted to Forest Land	No AD available
Carbon	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No Model available.
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No Model available
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	No Model available
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No Model available
Carbon	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No Model available
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	No Model available
Carbon	5 LULUCF	5.C.2.3 Wetlands converted to Grassland	No Model available
Carbon	5 LULUCF	5.D.2.2 Cropland converted to Wetlands	No Model available
Carbon	5 LULUCF	5.D.2.3 Grassland converted to Wetlands	No Model available
Carbon	5 LULUCF	5.E.1 Settlements remaining Settlements	No Model available
Carbon	5 LULUCF	5.E.2.1 Forest Land converted to Settlements	No Model available
Carbon	5 LULUCF	5.F.2.1 Forest Land converted to Other Land	No Model available
Carbon	5 LULUCF	5.F.2.2 Cropland converted to Other Land	No Model available
Carbon	5 LULUCF	lakes	No Model available
Carbon	5 LULUCF	reservoars	No Model available.
Carbon	5 LULUCF	rivers	No Model available
Carbon	5 LULUCF	marshlands	No Model available
Carbon	5 LULUCF	5.A.2.1 Cropland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.3 Wetlands converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.4 Settlements converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.5 Other Land converted to Forest Land	No AD available
Carbon	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No Model available.
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No Model available
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	No Model available
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No Model available
Carbon	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No Model available
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	No Model available
Carbon	5 LULUCF	5.C.2.3 Wetlands converted to Grassland	No Model available
Carbon	5 LULUCF	5.D.2.2 Cropland converted to Wetlands	No Model available
Carbon	5 LULUCF	5.D.2.3 Grassland converted to Wetlands	No Model available
Carbon	5 LULUCF	5.E.1 Settlements remaining Settlements	No Model available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
Carbon	5 LULUCF	5.E.2.1 Forest Land converted to Settlements	No Model available
Carbon	5 LULUCF	5.F.2.1 Forest Land converted to Other Land	No Model available
Carbon	5 LULUCF	5.F.2.2 Cropland converted to Other Land	No Model available
Carbon	5 LULUCF	5.A.2.1 Cropland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.3 Wetlands converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.4 Settlements converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.5 Other Land converted to Forest Land	No AD available
Carbon	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No AD available
Carbon	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.3 Wetlands converted to Grassland	No AD available
Carbon	5 LULUCF	5.D.2.2 Cropland converted to Wetlands	No AD available
Carbon	5 LULUCF	5.D.2.3 Grassland converted to Wetlands	No AD available
Carbon	5 LULUCF	5.E.1 Settlements remaining Settlements	No AD available
Carbon	5 LULUCF	5.E.2.1 Forest Land converted to Settlements	No AD available
Carbon	5 LULUCF	5.F.2.1 Forest Land converted to Other Land	No AD available
Carbon	5 LULUCF	5.F.2.2 Cropland converted to Other Land	No AD available
Carbon	5 LULUCF	Evergreen	No AD available
Carbon	5 LULUCF	deciduous	No AD available
Carbon	5 LULUCF	arable land	No AD available
Carbon	5 LULUCF	fallow land	No AD available
Carbon	5 LULUCF	permanent cultures	No AD available
Carbon	5 LULUCF	pastures	No AD available
Carbon	5 LULUCF	hayfield	No AD available
Carbon	5 LULUCF	lakes	No AD available
Carbon	5 LULUCF	reservoars	No AD available
Carbon	5 LULUCF	rivers	No AD available
Carbon	5 LULUCF	marshlands	No AD available
Carbon	5 LULUCF	5.D.2.2 Cropland converted to Wetlands	No AD available
Carbon	5 LULUCF	5.D.2.3 Grassland converted to Wetlands	No AD available
Carbon	5 LULUCF	5.E.1 Settlements remaining Settlements	No AD available
Carbon	5 LULUCF	5.E.2.1 Forest Land converted to Settlements	No AD available
Carbon	5 LULUCF	5.F.2.1 Forest Land converted to Other Land	No AD available
Carbon	5 LULUCF	5.F.2.2 Cropland converted to Other Land	No AD available
Carbon	5 LULUCF	lakes	No AD available
Carbon	5 LULUCF	reservoars	No AD available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
Carbon	5 LULUCF	rivers	No AD available
Carbon	5 LULUCF	marshlands	No AD available
Carbon	5 LULUCF	5.A.2.1 Cropland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.3 Wetlands converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.4 Settlements converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.5 Other Land converted to Forest Land	No AD available
Carbon	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No AD available
Carbon	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.3 Wetlands converted to Grassland	No AD available
Carbon	5 LULUCF	Evergreen	No AD available
Carbon	5 LULUCF	deciduous	No AD available
Carbon	5 LULUCF	arable land	No AD available
Carbon	5 LULUCF	fallow land	No AD available
Carbon	5 LULUCF	permanent cultures	No AD available
Carbon	5 LULUCF	pastures	No AD available
Carbon	5 LULUCF	hayfield	No AD available
Carbon	5 LULUCF	5.A.2.1 Cropland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.2 Grassland converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.3 Wetlands converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.4 Settlements converted to Forest Land	No AD available
Carbon	5 LULUCF	5.A.2.5 Other Land converted to Forest Land	No AD available
Carbon	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No AD available.
Carbon	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.4 Settlements converted to Cropland	No AD available
Carbon	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No AD available
Carbon	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.2 Cropland converted to Grassland	No AD available
Carbon	5 LULUCF	5.C.2.3 Wetlands converted to Grassland	No AD available
Carbon	5 LULUCF	Evergreen	No AD available
Carbon	5 LULUCF	deciduous	No AD available
Carbon	5 LULUCF	arable land	No AD available
Carbon	5 LULUCF	fallow land	No AD available
Carbon	5 LULUCF	permanent cultures	No AD available
Carbon	5 LULUCF	pastures	No AD available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
Carbon	5 LULUCF	hayfield	No AD available
CH_4	1 Energy	1.B.1.B Solid Fuel Transformation	No AD available.
CH_4	1 Energy	1.B.2.A.1 Exploration	No Metodology and AD available
CH_4	1 Energy	1.B.2.B.1 Exploration	No Metodology and EF available
CH_4	1 Energy	1.B.2.C.1.3 Combined	No AD available
CH_4	1 Energy	1.B.2.C.2.3 Combined	No AD available.
CH_4	2 Industrial Processes	Bricks	No EF available
CH_4	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CH_4	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CH_4	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CH_4	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CH_4	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
CH_4	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
CH_4	5 LULUCF	5.B.1 Cropland remaining Cropland	No AD available.
CH_4	5 LULUCF	5.B.2 Land converted to Cropland	No AD available.
CH_4	5 LULUCF	5.B.2 Land converted to Cropland	No AD available
CH_4	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
CH_4	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
CH_4	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
CH_4	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
CH_4	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
CH_4	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
CH_4	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
CH_4	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
CH_4	5 LULUCF	5.D.2 Land converted to Wetlands	No AD available
CH_4	5 LULUCF	5.D.2 Land converted to Wetlands	No AD available
CH_4	5 LULUCF	5.E Settlements	No AD available
CH_4	5 LULUCF	5.E.1 Settlements remaining Settlements	No AD available
CH_4	5 LULUCF	5.E.2 Land converted to Settlements	No AD available
CH_4	5 LULUCF	5.F.2 Land converted to Other Land	No AD available
CH_4	5 LULUCF	Forest Land converted to Other Land-Use Categories	No AD available
CH_4	5 LULUCF	Grassland converted to Other Land-Use Categories	No AD available
CH_4	6 Waste	6.A.2.1 deep (>5 m)	No AD available
CH_4	6 Waste	6.A.2.1 deep (>5 m)	No AD available
CH_4	6 Waste	6.A.2.2 shallow (<5 m)	No AD available
CH_4	6 Waste	6.A.2.2 shallow (<5 m)	No AD available
CO_2	1 Energy	1.B.1.A.1.1 Mining Activities	No Metodology and AD available
CO_2	1 Energy	1.B.1.A.1.2 Post-Mining Activities	No Metodology and AD available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
CO_2	1 Energy	1.B.1.A.2.1 Mining Activities	No Metodology and AD available
CO_2	1 Energy	1.B.1.A.2.2 Post-Mining Activities	No Metodology and AD available
CO_2	1 Energy	1.B.1.B Solid Fuel Transformation	No AD available
CO_2	1 Energy	1.B.2.A.1 Exploration	No Metodology and AD available
CO_2	1 Energy	1.B.2.A.2 Production	No EF available
CO_2	1 Energy	1.B.2.A.3 Transport	No Metodology and EF available
CO_2	1 Energy	1.B.2.A.4 Refining / Storage	No Metodology and EF available
CO_2	1 Energy	1.B.2.B.1 Exploration	No Metodology and EF available
CO_2	1 Energy	1.B.2.B.2 Production / Processing	No Metodology available
CO_2	1 Energy	1.B.2.B.3 Transmission	No Metodology available
CO_2	1 Energy	1.B.2.B.4 Distribution	No Metodology available
CO_2	1 Energy	1.B.2.B.5.1 at industrial plants and power stations	No Metodology available
CO_2	1 Energy	1.B.2.B.5.2 in residential and commercial sectors	No Metodology available
CO_2	1 Energy	1.B.2.C.1.1 Oil	No Metodology available
CO_2	1 Energy	1.B.2.C.1.2 Gas	No Metodology available
CO_2	1 Energy	1.B.2.C.1.3 Combined	No Metodology and AD available
CO_2	1 Energy	1.B.2.C.2.1 Oil	No Metodology available
CO_2	1 Energy	1.B.2.C.2.2 Gas	No Metodology available
CO_2	1 Energy	1.B.2.C.2.3 Combined	No Methodology and AD available.
CO_2	2 Industrial Processes	2.A.5 Asphalt Roofing	No Metodology available
CO_2	2 Industrial Processes	Bricks	No EF available
CO_2	3 Solvent and Other Product Use	3.A Paint Application	No Metodology available
CO_2	3 Solvent and Other Product Use	3.B Degreasing and Dry Cleaning	No Metodology available
CO_2	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CO_2	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
CO_2	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
CO_2	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
CO_2	5 LULUCF	5.B.1 Cropland remaining Cropland	No AD available
CO_2	5 LULUCF	5.B.1 Cropland remaining Cropland	No AD available.
CO_2	5 LULUCF	5.B.2 Land converted to Cropland	No AD available.
CO_2	5 LULUCF	5.B.2 Land converted to Cropland	No AD available
CO_2	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
CO_2	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
CO_2	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
CO_2	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
CO_2	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
CO_2	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
CO_2	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
CO_2	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
CO_2	5 LULUCF	5.E Settlements	No AD available
CO_2	5 LULUCF	Forest Land converted to Other Land-Use Categories	No AD available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
CO_2	5 LULUCF	Grassland converted to Other Land-Use Categories	No AD available
CO_2	6 Waste	6.A.1 Managed Waste Disposal on Land	No Metodology available
CO_2	6 Waste	6.A.2.1 deep (>5 m)	No AD available
CO_2	6 Waste	6.A.2.2 shallow (<5 m)	No AD available
HFCs	2 Industrial Processes	2.F.1 Refrigeration and Air Conditioning Equipment	No AD available
HFCs	2 Industrial Processes	2.F.2 Foam Blowing	No AD available
HFCs	2 Industrial Processes	2.F.3 Fire Extinguishers	No AD available
HFCs	2 Industrial Processes	2.F.4 Aerosols/ Metered Dose Inhalers	No AD available
HFCs	2 Industrial Processes	2.F.5 Solvents	No AD available
HFCs	2 Industrial Processes	2.F.7 Semiconductor Manufacture	No AD available
HFCs	2 Industrial Processes	2.F.8 Electrical Equipment	No AD available
N_2O	1 Energy	1.B.2.A.1 Exploration	No Metodology and AD available
N_2O	1 Energy	1.B.2.C.2.1 Oil	No Metodology available
N_2O	1 Energy	1.B.2.C.2.2 Gas	No Metodology available
N_2O	1 Energy	1.B.2.C.2.3 Combined	No Methodology and AD available.
N_2O	2 Industrial Processes	Bricks	No EF available
N_2O	3 Solvent and Other Product Use	3.D.1 Use of N_2O for Anaesthesia	No Methodology and AD available.
N_2O	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
N_2O	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
N_2O	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
N_2O	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
N_2O	5 LULUCF	5.A.1 Forest Land remaining Forest Land	No AD available
N_2O	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
N_2O	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
N_2O	5 LULUCF	5.A.2 Land converted to Forest Land	No AD available
N_2O	5 LULUCF	5.B.1 Cropland remaining Cropland	No AD available.
N_2O	5 LULUCF	5.B.2 Land converted to Cropland	No AD available.
N_2O	5 LULUCF	5.B.2 Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.1 Forest Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.2 Grassland converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.3 Wetlands converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No AD available
N_2O	5 LULUCF	5.B.2.5 Other Land converted to Cropland	No AD available

Sources and sinks not estimated (NE)[1]			
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**
N_2O	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
N_2O	5 LULUCF	5.C.1 Grassland remaining Grassland	No AD available
N_2O	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
N_2O	5 LULUCF	5.C.2 Land converted to Grassland	No AD available
N_2O	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
N_2O	5 LULUCF	5.C.2.1 Forest Land converted to Grassland	No AD available
N_2O	5 LULUCF	5.D.2 Land converted to Wetlands	No AD available
N_2O	5 LULUCF	5.D.2 Land converted to Wetlands	No AD available
N_2O	5 LULUCF	5.E Settlements	No AD available
N_2O	5 LULUCF	5.E.1 Settlements remaining Settlements	No AD available
N_2O	5 LULUCF	5.E.2 Land converted to Settlements	No AD available
N_2O	5 LULUCF	5.F.2 Land converted to Other Land	No AD available
N_2O	5 LULUCF	Forest Land converted to Other Land-Use Categories	No AD available
N_2O	5 LULUCF	Grassland converted to Other Land-Use Categories	No AD available
N_2O	6 Waste	6.B.1 Industrial Wastewater	No Metodology available
N_2O	6 Waste	6.B.1 Industrial Wastewater	No Metodology available
N_2O	6 Waste	6.B.2.1 Domestic and Commercial (w/o human sewage)	No Metodology available
N_2O	6 Waste	6.B.2.1 Domestic and Commercial (w/o human sewage)	No Metodology available
PFCs	2 Industrial Processes	2.F.1 Refrigeration and Air Conditioning Equipment	No AD available
PFCs	2 Industrial Processes	2.F.2 Foam Blowing	No AD available
PFCs	2 Industrial Processes	2.F.3 Fire Extinguishers	No AD available
PFCs	2 Industrial Processes	2.F.4 Aerosols/ Metered Dose Inhalers	No AD available.
PFCs	2 Industrial Processes	2.F.5 Solvents	No AD available
PFCs	2 Industrial Processes	2.F.7 Semiconductor Manufacture	No AD available.
PFCs	2 Industrial Processes	2.F.8 Electrical Equipment	No AD available
PFCs	2 Industrial Processes	Other non-specified	No AD available
SF6	2 Industrial Processes	2.F.5 Solvents	No AD available
SF6	2 Industrial Processes	2.F.8 Electrical Equipment	No AD available
SF6	2 Industrial Processes	2.F.P2.2 In products	Base year 1995
SF6	2 Industrial Processes	Other non-specified	No AD available

Sources and sinks reported elsewhere (IE)[3]				
GHG	**Source/sink category**	**Allocation as per IPCC Guidelines**	**Allocation used by the Party**	**Explanation**
CH_4	4.A Enteric Fermentation			
CH_4	5.B.1 Cropland remaining Cropland	4.F	4.F	Biomass burning on cropland remaining cropland is reported in the Agriculture sector.
CO_2	5.B.1 Cropland remaining Cropland	4.F	4.F	Biomass burning on cropland remaining cropland is reported in the Agriculture sector.
N_2O	5.B.1 Cropland remaining Cropland	4.F	4.F	Biomass burning on cropland remaining cropland is reported in the Agriculture sector.

Sources and sinks not estimated (NE)[1]				
GHG	**Sector[2]**	**Source/sink category [2]**	**Explanation**	

ANNEX 6: ADDITIONAL INFORMATION TO BE CONSIDERED AS PART OF NIR SUBMISSION.

Additional information regarding GHG Inventories in Bulgaria can be found in the following publications and works:

1. Fourth National Communication on Climate Change under UNFCCC, 2006.
2. Guidelines for balance method estimation of the pollutants emissions released in atmosphere, Sofia, 2000.
3. Second National Action Plan on Climate Change of Bulgaria under UNFCCC, Sofia, 2004.

ANNEX 7: SOME CRF TABLES

In this Annex 7 were done some common tables from CRF. They show a complex characteristic of GHG inventory for 2005 as well as for a part of the previous years.

Annex 7.1 – Overall CRF Tables 7 for base 1988 year, 1989, 1990, 1995 and for period 2000-2005.

Annex 7.2 – IPCC tables 8A and 8B for the base 1988 year and for the period 1990-2004

Annex 7.3 – CRF Trend tables 10 for CO_2, CH_4, N_2O and F-gases as well as for total emissions in CO_2-eq.

7.1 IPCC Table 7A for the base 1988 year, 1989, 1990, 1995, and for the period 2000-2005

Table A7.1 GHG emissions in Bulgaria; IPCC Table 7A: 1988

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals		**93,766.15**	**1,036.15**	**38.91**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**284.87**	**884.51**	**128.99**	**1,781.41**
1. Energy		**90,725.68**	**163.46**	**1.64**							**261.44**	**820.47**	**76.32**	**1,756.52**
A. Fuel Combustion	Reference Approach (2)	91,159.45												
	Sectoral Approach (2)	90,725.68	7.72	1.64							261.44	820.47	76.32	1,756.52
1. Energy Industries		43,216.90	0.84	0.97							96.25	10.03	0.77	1,285.57
2. Manufacturing Industries and Construction		24,754.56	0.57	0.14							34.94	11.23	0.28	200.73
3. Transport		13,813.98	2.98	0.33							115.56	454.37	67.08	57.85
4. Other Sectors		8,940.25	1.66	0.16							14.04	225.37	3.41	212.37
5. Other		NO	1.67	0.03							0.64	119.47	4.78	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	155.74	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	94.84	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	60.90	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**8,066.37**	**3.89**	**7.81**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**21.67**	**17.69**	**39.05**	**24.89**
A. Mineral Products		3,841.75	NE,NO	NE,NO							NE,NO	NE,NO	3.41	1.33
B. Chemical Industry		1,751.45	0.04	7.81	NO	NO	NO	NO	NO	NO	20.23	10.76	6.33	15.79
C. Metal Production		2,473.18	3.49	NA				NA,NE,NO		NA,NO	0.12	1.97	0.23	1.57
D. Other Production (3)		NO									1.33	4.97	22.77	6.21
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					NA,NE,NO	NE,NO	NA,NE,NO	NE,NO	NA,NE,NO	NE,NO				
G. Other		NO	0.36	NO	NO	NO	NO	NO	NO	NO	NO	NO	6.31	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)				(Gg)				
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**13.62**
4. Agriculture		**273.23**	**28.46**							**1.76**	**46.35**	**NA,NO**
A. Enteric Fermentation		192.79										
B. Manure Management		72.55	3.41									NO
C. Rice Cultivation		5.68										NA,NO
D. Agricultural Soils(4)		NA,NO	25.00									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		2.21	0.05							1.76	46.35	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-5,025.90**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -5,137.61	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -308.26	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -174.24	NE	NE							NE	NE	NO
D. Wetlands	(5) 594.22	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**595.57**	**1.00**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	507.71								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		87.85	1.00							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items: (8)													
International Bunkers	**1,718.36**	**0.06**	**0.02**							**25.78**	**5.36**	**1.08**	**8.53**
Aviation	749.41	0.02	NO							2.99	1.24	0.19	0.24
Marine	968.95	0.04	0.02							22.80	4.12	0.90	8.29
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**1,343.93**												

Table A7.2 GHG emissions in Bulgaria; IPCC Table 7A: 1989

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**93,542.00**	**1,025.91**	**36.25**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**283.44**	**916.72**	**124.08**	**1,799.93**
1. Energy		**90,788.55**	**165.33**	**1.62**							**260.62**	**843.57**	**79.98**	**1,775.09**
A. Fuel Combustion	Reference Approach (2)	90,454.58												
	Sectoral Approach (2)	90,788.55	7.98	1.62							260.62	843.57	79.98	1,775.09
1. Energy Industries		43,689.95	0.81	1.00							95.66	10.15	0.74	1,309.14
2. Manufacturing Industries and Construction		25,215.21	0.58	0.13							35.88	9.76	0.25	208.54
3. Transport		13,244.79	3.08	0.31							114.61	468.72	70.18	49.32
4. Other Sectors		8,638.60	1.61	0.15							13.74	218.82	3.37	208.08
5. Other		NO	1.91	0.04							0.73	136.13	5.45	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	157.35	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	92.60	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	64.75	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**8,251.67**	**3.89**	**7.43**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**20.66**	**17.37**	**30.33**	**24.84**
A. Mineral Products		4,027.82	NE,NO	NE,NO							NE,NO	NE,NO	2.79	1.42
B. Chemical Industry		1,750.16	0.04	7.43	NO	NO	NO	NO	NO	NO	19.29	10.63	6.25	15.94
C. Metal Production		2,473.68	3.52	NA				NA,NE,NO		NA,NO	0.12	2.07	0.24	1.65
D. Other Production (3)		NO									1.25	4.66	17.62	5.83
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NE,NO				
G. Other		NO	0.33	NO	NO	NA,NO	NO	NO	NO	NO	NO	NO	3.43	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)				(Gg)				
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**13.77**
4. Agriculture		**268.83**	**26.24**							**2.16**	**55.78**	**NA,NO**
A. Enteric Fermentation		187.57										
B. Manure Management		73.11	3.41									NO
C. Rice Cultivation		5.49										NA,NO
D. Agricultural Soils(4)		NA,NO	22.77									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		2.66	0.06							2.16	55.78	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-5,498.22**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -5,634.31	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -283.89	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -174.24	NE	NE							NE	NE	NO
D. Wetlands	(5) 594.22	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**587.86**	**0.96**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	510.49								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		77.37	0.96							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items: (8)													
International Bunkers	**1,718.58**	**0.06**	**0.02**							**26.37**	**5.17**	**1.03**	**9.34**
Aviation	731.24	0.02	NO							2.91	1.21	0.18	0.24
Marine	987.34	0.04	0.02							23.46	3.97	0.85	9.11
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**1,437.14**												

Table A7.3 GHG emissions in Bulgaria; IPCC Table 7A: 1990

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**80,327.81**	**948.32**	**33.71**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**242.26**	**789.67**	**117.48**	**1,517.33**
1. Energy		**78,672.85**	**112.12**	**1.41**							**220.98**	**728.01**	**74.53**	**1,500.61**
A. Fuel Combustion	Reference Approach [2]	80,959.88												
	Sectoral Approach [2]	78,672.85	6.92	1.41							220.98	728.01	74.53	1,500.61
1. Energy Industries		39,601.23	0.91	0.80							61.81	10.03	0.84	1,114.64
2. Manufacturing Industries and Construction		21,821.39	0.35	0.21							49.83	8.73	0.19	220.08
3. Transport		10,863.71	2.91	0.25							97.80	434.83	66.25	17.99
4. Other Sectors		5,380.59	1.11	0.10							8.56	159.88	2.64	139.68
5. Other		1,005.93	1.64	0.04							2.98	114.54	4.61	8.22
B. Fugitive Emissions from Fuels		NA,NE,NO	105.20	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	75.80	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	29.40	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**7,573.56**	**3.02**	**7.28**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**19.64**	**15.41**	**30.69**	**16.72**
A. Mineral Products		4,020.50	NE,NO	NE,NO							NE,NO	NE,NO	2.87	1.32
B. Chemical Industry		1,716.80	0.02	7.28	NO	NO	NO	NO	NO	NO	18.64	10.44	6.16	9.88
C. Metal Production		1,836.26	2.76	NA				NA,NE,NO		NA,NO	0.09	1.54	0.18	1.24
D. Other Production [3]		NO									0.92	3.43	16.10	4.29
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					NA,NE,NO	NE,NO	NA,NE,NO	NE,NO	NA,NE,NO	NE,NO				
G. Other		NO	0.25	NO	NO	NO	NO	NO	NO	NO	NO	NO	5.38	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)				(Gg)				
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**12.25**
4. Agriculture		**258.13**	**24.30**							**1.63**	**46.25**	**NA,NO**
A. Enteric Fermentation		180.17										
B. Manure Management		71.49	3.32									NO
C. Rice Cultivation		4.26										NA,NO
D. Agricultural Soils(4)		NA,NO	20.93									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		2.20	0.05							1.63	46.25	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-5,918.61**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -6,161.98	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -276.61	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -82.74	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**575.04**	**0.72**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	508.53								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		66.52	0.72							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items: (8)													
International Bunkers	**1,766.14**	**0.06**	**0.02**							**25.96**	**9.26**	**0.68**	**13.55**
Aviation	892.27	0.04	0.00							3.52	7.45	0.36	0.30
Marine	873.88	0.02	0.02							22.44	1.81	0.32	13.25
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**1,205.76**												

Table A7.4 GHG emissions in Bulgaria; IPCC Table 7A: 1995

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)						(Gg)			
Total National Emissions and Removals		**58,806.56**	**710.50**	**18.83**	**62.16**	**2.95**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**151.45**	**644.37**	**94.45**	**1,299.62**
1. Energy		**59,375.82**	**106.09**	**1.20**							**133.68**	**599.50**	**57.18**	**1,285.05**
A. Fuel Combustion	Reference Approach [2]	59,762.71												
	Sectoral Approach [2]	59,375.82	5.83	1.20							133.68	599.50	57.18	1,285.05
1. Energy Industries		31,571.95	0.56	0.84							56.13	8.98	0.69	1,055.67
2. Manufacturing Industries and Construction		18,023.19	0.34	0.11							21.36	4.30	0.18	127.15
3. Transport		6,844.64	2.02	0.14							49.38	327.58	48.22	8.82
4. Other Sectors		2,621.01	1.33	0.06							5.25	147.38	3.63	90.96
5. Other		315.02	1.58	0.04							1.57	111.26	4.47	2.45
B. Fugitive Emissions from Fuels		NA,NE,NO	100.27	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	69.21	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	31.05	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**6,963.84**	**3.52**	**6.20**	**62.16**	**2.95**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**16.69**	**14.19**	**24.78**	**14.57**
A. Mineral Products		3,124.09	NE,NO	NE,NO							NE,NO	NE,NO	2.20	1.20
B. Chemical Industry		1,524.14	0.04	6.20	NO	NO	NO	NO	NO	NO	15.92	9.60	5.67	8.62
C. Metal Production		2,315.60	3.29	NA				NA,NE,NO		NA,NO	0.11	2.14	0.24	1.70
D. Other Production [3]		NO									0.65	2.44	12.30	3.06
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					62.16	2.95	NA,NE,NO	NE,NO	NA,NE,NO	0.00				
G. Other		NO	0.20	NO	NO	NO	NO	NO	NO	NO	NO	NO	4.37	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**12.49**
4. Agriculture		**121.81**	**10.89**							**1.09**	**30.69**	**NA,NO**
A. Enteric Fermentation		85.27										
B. Manure Management		34.52	1.60									NO
C. Rice Cultivation		0.56										NA,NO
D. Agricultural Soils(4)		NA,NO	9.27									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.46	0.03							1.09	30.69	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-7,533.09**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -7,524.48	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -564.10	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -47.23	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**479.08**	**0.54**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	429.74								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		49.34	0.54							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**1,431.78**	**0.03**	**0.02**							**24.90**	**3.83**	**0.47**	**13.24**
Aviation	549.40	0.02	0.00							2.19	2.08	0.16	0.18
Marine	882.37	0.01	0.02							22.71	1.75	0.31	13.06
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**1,442.25**												

Table A7.5 GHG emissions in Bulgaria; IPCC Table 7A: 2000

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**41,564.90**	**557.54**	**15.87**	**96.02**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**127.77**	**634.83**	**78.90**	**1,044.60**
1. Energy		**45,869.33**	**93.62**	**1.10**							**115.95**	**602.08**	**53.81**	**1,029.34**
A. Fuel Combustion	Reference Approach [2]	46,136.32												
	Sectoral Approach [2]	45,869.33	8.19	1.10							115.95	602.08	53.81	1,029.34
1. Energy Industries		26,215.75	0.43	0.76							49.07	5.89	0.40	885.80
2. Manufacturing Industries and Construction		11,868.18	0.23	0.07							14.06	4.36	0.04	79.97
3. Transport		5,889.32	1.42	0.13							47.29	221.28	36.37	7.09
4. Other Sectors		1,896.08	4.71	0.12							5.00	270.14	12.98	56.48
5. Other		NO	1.41	0.03							0.54	100.41	4.02	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	85.43	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	57.09	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	28.33	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**4,593.87**	**3.51**	**4.24**	**96.02**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**11.09**	**8.61**	**14.39**	**15.26**
A. Mineral Products		2,302.37	NE,NO	NE,NO							NE,NO	NE,NO	0.93	0.71
B. Chemical Industry		813.42	0.15	4.24	NO	NO	NO	NO	NO	NO	10.89	5.18	4.77	11.66
C. Metal Production		1,478.08	3.37	NA				NA,NE,NO		NA,NO	0.07	2.96	0.27	2.30
D. Other Production [3]		NO									0.13	0.47	6.21	0.59
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					96.02	NE,NO	NA,NE,NO	NE,NO	0.00	0.00				
G. Other		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.22	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**10.69**
4. Agriculture		**108.95**	**10.02**							**0.73**	**24.15**	**NA,NO**
A. Enteric Fermentation		79.28										
B. Manure Management		27.08	1.38									NO
C. Rice Cultivation		1.44										NA,NO
D. Agricultural Soils(4)		NA,NO	8.61									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.15	0.02							0.73	24.15	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-8,898.30**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -8,976.23	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -489.95	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -34.84	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**351.46**	**0.50**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE	323.19								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		28.27	0.50							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**475.16**	**0.02**	**0.01**							**5.43**	**1.82**	**0.38**	**0.47**
Aviation	269.84	0.01	NO							1.08	0.45	0.07	0.09
Marine	205.31	0.01	0.01							4.35	1.37	0.32	0.38
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**2,705.07**												

Table A7.6 GHG emissions in Bulgaria; IPCC Table 7A: 2001

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**42,875.35**	**510.63**	**14.77**	**97.50**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**137.60**	**583.00**	**81.80**	**1,095.80**
1. Energy		**47,485.79**	**91.52**	**1.18**							**125.93**	**549.02**	**51.23**	**1,081.91**
A. Fuel Combustion	Reference Approach [2]	48,151.65												
	Sectoral Approach [2]	47,485.79	7.78	1.18							125.93	549.02	51.23	1,081.91
1. Energy Industries		29,035.91	0.47	0.83							59.84	6.34	0.43	956.90
2. Manufacturing Industries and Construction		10,788.11	0.22	0.07							13.43	5.24	0.03	79.20
3. Transport		6,023.96	1.27	0.14							48.06	202.20	34.57	7.30
4. Other Sectors		1,637.81	4.44	0.11							4.08	237.18	12.26	38.51
5. Other		NO	1.37	0.03							0.52	98.05	3.92	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	83.74	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	57.70	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	26.04	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**4,613.04**	**2.42**	**4.18**	**97.50**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**10.93**	**6.66**	**13.47**	**13.88**
A. Mineral Products		2,468.79	NE,NO	NE,NO							NE,NO	NE,NO	1.17	0.77
B. Chemical Industry		724.87	0.14	4.18	NO	NO	NO	NO	NO	NO	10.72	4.64	4.37	11.28
C. Metal Production		1,419.38	2.28	NA				NA,NE,NO		NA,NO	0.07	1.51	0.16	1.20
D. Other Production [3]		NO									0.14	0.51	5.77	0.64
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					97.50	NE,NO	NA,NE,NO	NE,NO	0.00	0.00				
G. Other		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.99	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**17.10**
4. Agriculture		**84.37**	**8.93**							**0.74**	**27.32**	**NA,NO**
A. Enteric Fermentation		62.20										
B. Manure Management		19.30	1.03									NO
C. Rice Cultivation		1.57										NA,NO
D. Agricultural Soils(4)		NA,NO	7.88									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.30	0.02							0.74	27.32	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-9,223.48**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -9,467.15	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -345.50	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -13.55	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**332.32**	**0.48**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE	309.39								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		22.93	0.48							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**699.16**	**0.03**	**0.01**							**8.07**	**2.67**	**0.56**	**0.75**
Aviation	393.30	0.01	NO							1.58	0.65	0.10	0.13
Marine	305.85	0.02	0.01							6.50	2.02	0.46	0.62
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**2,638.21**												

Table A7.7 GHG emissions in Bulgaria; IPCC Table 7A: 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**41,016.46**	**507.98**	**14.37**	**89.59**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**134.41**	**677.93**	**87.41**	**982.91**
1. Energy		**45,066.38**	**91.05**	**1.13**							**124.21**	**641.49**	**57.08**	**966.87**
A. Fuel Combustion	Reference Approach (2)	45,842.68												
	Sectoral Approach (2)	45,066.38	8.90	1.13							124.21	641.49	57.08	966.87
1. Energy Industries		26,465.57	0.43	0.75							53.99	5.98	0.40	821.53
2. Manufacturing Industries and Construction		10,198.06	0.21	0.07							12.73	5.23	0.03	78.61
3. Transport		6,328.65	1.39	0.15							51.47	220.02	37.42	7.47
4. Other Sectors		2,074.11	5.30	0.13							5.41	298.22	14.76	59.27
5. Other		NO	1.57	0.03							0.60	112.03	4.48	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	82.15	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	58.50	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	23.66	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**4,190.61**	**2.19**	**3.51**	**89.59**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**9.25**	**4.89**	**13.19**	**16.03**
A. Mineral Products		2,403.43	NE,NO	NE,NO							NE,NO	NE,NO	1.89	0.73
B. Chemical Industry		464.12	0.13	3.51	NO	NO	NO	NO	NO	NO	9.06	2.98	3.37	13.56
C. Metal Production		1,323.06	2.06	NA				NA,NE,NO		NA,NO	0.06	1.44	0.15	1.14
D. Other Production (3)		NO									0.13	0.48	5.71	0.60
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					89.59	NE,NO	NA,NE,NO	NE,NO	0.00	0.00				
G. Other		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.07	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)				(Gg)				
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**17.13**
4. Agriculture		**95.00**	**9.24**							**0.95**	**31.55**	**NA,NO**
A. Enteric Fermentation		68.97										
B. Manure Management		22.42	1.19									NO
C. Rice Cultivation		2.11										NA,NO
D. Agricultural Soils(4)		NA,NO	8.03									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.50	0.03							0.95	31.55	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-8,240.53**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -8,318.06	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -508.32	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -16.85	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**319.74**	**0.49**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE	297.95								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		21.79	0.49							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)				(Gg)					
Memo Items: (8)													
International Bunkers	**735.38**	**0.04**	**0.01**							**8.72**	**2.91**	**0.62**	**0.75**
Aviation	399.14	0.01	NO							1.60	0.66	0.10	0.13
Marine	336.24	0.02	0.01							7.12	2.25	0.52	0.62
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,107.83**												

Table A7.8 GHG emissions in Bulgaria; IPCC Table 7A: 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs[1]		PFCs[1]		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**46,796.04**	**539.76**	**14.34**	**120.60**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**146.63**	**654.03**	**85.63**	**1,043.19**
1. Energy		**49,180.23**	**90.75**	**1.24**							**136.05**	**629.36**	**57.86**	**1,025.56**
A. Fuel Combustion	Reference Approach [2]	49,824.54												
	Sectoral Approach [2]	49,180.23	8.97	1.24							136.05	629.36	57.86	1,025.56
1. Energy Industries		28,329.87	0.45	0.82							57.73	6.04	0.42	866.04
2. Manufacturing Industries and Construction		11,533.47	0.24	0.08							15.85	6.34	0.05	90.39
3. Transport		7,111.29	1.44	0.17							56.19	221.69	38.46	8.78
4. Other Sectors		2,205.59	5.58	0.14							5.80	305.11	15.33	60.36
5. Other		NO	1.26	0.03							0.48	90.19	3.61	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	81.78	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	57.54	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	24.24	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**4,679.47**	**2.79**	**3.74**	**120.60**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**9.89**	**5.65**	**13.23**	**17.62**
A. Mineral Products		2,528.91	NE,NO	NE,NO							NE,NO	NE,NO	1.02	0.78
B. Chemical Industry		492.10	0.27	3.74	NO	NO	NO	NO	NO	NO	9.62	3.15	4.13	14.53
C. Metal Production		1,658.45	2.51	NA				NA,NE,NO		NA,NO	0.08	1.80	0.19	1.44
D. Other Production [3]		NO									0.19	0.70	5.90	0.88
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					120.60	NE,NO	NA,NE,NO	NE,NO	0.00	0.00				
G. Other		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	1.99	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**14.54**
4. Agriculture		**99.07**	**8.88**							**0.69**	**19.01**	**NA,NO**
A. Enteric Fermentation		71.52										
B. Manure Management		24.38	1.27									NO
C. Rice Cultivation		2.27										NA,NO
D. Agricultural Soils(4)		NA,NO	7.59									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		0.91	0.02							0.69	19.01	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-7,063.65**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -7,055.98	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -590.74	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -19.65	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**347.15**	**0.49**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE	288.67								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		58.48	0.49							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**920.82**	**0.05**	**0.01**							**11.17**	**3.71**	**0.79**	**0.96**
Aviation	485.03	0.01	NO							1.94	0.80	0.12	0.16
Marine	435.78	0.03	0.01							9.23	2.91	0.67	0.80
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,131.22**												

Table A7.9 GHG emissions in Bulgaria; IPCC Table 7A: 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**45,089.12**	**534.37**	**14.17**	**217.30**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**136.79**	**673.83**	**95.53**	**997.50**
1. Energy		**48,288.69**	**94.84**	**1.23**							**128.29**	**634.33**	**57.99**	**977.37**
A. Fuel Combustion	Reference Approach (2)	48,526.29												
	Sectoral Approach (2)	48,288.69	9.35	1.23							128.29	634.33	57.99	977.37
1. Energy Industries		28,297.62	0.45	0.81							57.87	6.09	0.41	844.40
2. Manufacturing Industries and Construction		10,817.76	0.23	0.07							14.11	6.67	0.04	79.65
3. Transport		7,415.24	1.29	0.18							50.59	205.46	36.89	9.52
4. Other Sectors		1,758.07	5.75	0.14							5.10	300.02	16.01	43.81
5. Other		NO	1.63	0.03							0.62	116.09	4.64	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	85.49	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	58.70	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	26.79	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**4,974.82**	**2.27**	**2.77**	**217.30**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**7.38**	**5.69**	**13.89**	**20.13**
A. Mineral Products		2,842.67	NE,NO	NE,NO							NE,NO	NE,NO	1.75	0.91
B. Chemical Industry		610.00	0.14	2.77	NO	NO	NO	NO	NO	NO	7.21	3.80	3.87	17.53
C. Metal Production		1,522.16	2.13	NA				NA,NO		NA,NO	0.07	1.50	0.17	1.21
D. Other Production (3)		NO									0.10	0.39	6.06	0.48
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					217.30	NE,NO	NA,NE,NO	NE,NO	NA,NE,NO	0.00				
G. Other		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	2.04	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**23.65**
4. Agriculture		**98.90**	**9.69**							**1.11**	**33.80**	**NA,NO**
A. Enteric Fermentation		70.95										
B. Manure Management		24.05	1.26									NO
C. Rice Cultivation		2.30										NA,NO
D. Agricultural Soils(4)		NA,NO	8.40									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.61	0.03							1.11	33.80	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-8,174.39**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -7,965.21	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -787.41	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -24.48	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**338.35**	**0.48**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	279.64								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		58.72	0.48							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**771.79**	**0.04**	**0.01**							**9.38**	**3.12**	**0.66**	**0.81**
Aviation	405.35	0.01	NO							1.62	0.67	0.10	0.13
Marine	366.45	0.03	0.01							7.76	2.45	0.56	0.67
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,390.97**												

Table A7.10 GHG emissions in Bulgaria; IPCC Table 7A: 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		Net CO_2 emissions/removals	CH_4	N_2O	HFCs(1)		PFCs(1)		SF_6		NO_x	CO	NMVOC	SO_2
					P	A	P	A	P	A				
		(Gg)			CO_2 equivalent (Gg)				(Gg)					
Total National Emissions and Removals		**36,941.13**	**488.55**	**14.08**	**386.84**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**149.57**	**646.20**	**102.83**	**956.58**
1. Energy		**49,878.73**	**91.73**	**1.23**							**140.11**	**613.11**	**57.84**	**935.16**
A. Fuel Combustion	Reference Approach (2)	49,965.62												
	Sectoral Approach (2)	49,878.73	9.08	1.23							140.11	613.11	57.84	935.16
1. Energy Industries		29,642.46	0.45	0.80							60.94	6.31	0.41	819.15
2. Manufacturing Industries and Construction		10,420.95	0.21	0.06							13.21	5.79	0.03	68.60
3. Transport		8,115.13	1.42	0.20							60.54	218.44	38.04	10.54
4. Other Sectors		1,700.20	5.54	0.13							4.86	278.40	15.20	36.88
5. Other		NO	1.46	0.03							0.56	104.17	4.17	NO
B. Fugitive Emissions from Fuels		NA,NE,NO	82.64	NA,NE							NA,NE	NA,NE	NA,NE	NA,NE,NO
1. Solid Fuels		NA,NE	52.70	NA							NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas		NA,NE,NO	29.94	NA,NE							NA,NE	NA,NE	NA,NE	NA,NO
2. Industrial Processes		**5,099.34**	**2.21**	**3.20**	**386.84**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**	**0.00**	**8.58**	**5.99**	**14.65**	**21.42**
A. Mineral Products		3,078.24	NE,NO	NE,NO							NE,NO	NE,NO	1.88	1.07
B. Chemical Industry		623.26	0.18	3.20	NO	NO	NO	NO	NO	NO	8.34	3.88	4.11	18.36
C. Metal Production		1,397.84	2.03	NA				NA,NO		NA,NO	0.07	1.45	0.16	1.16
D. Other Production (3)		NO									0.18	0.66	6.51	0.83
E. Production of Halocarbons and SF_6						NA,NO		NA,NO		NA,NO				
F. Consumption of Halocarbons and SF_6					386.84	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	0.00				
G. Other		NO	NO	NO	NO	NA,NO	NO	NO	NO	NO	NO	NO	2.00	NO

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs (1)		PFCs(1)		SF_6		NO_x	CO	NMVOC
				P	A	P	A	P	A			
	(Gg)			CO_2 equivalent (Gg)						(Gg)		
3. Solvent and Other Product Use	**NE,NO**		**NA,NE,NO**							**NO**	**NO**	**30.34**
4. Agriculture		**93.27**	**9.18**							**0.88**	**27.10**	**NA,NO**
A. Enteric Fermentation		67.34										
B. Manure Management		22.75	1.19									NO
C. Rice Cultivation		1.89										NA,NO
D. Agricultural Soils(4)		NA,NO	7.96									NA,NO
E. Prescribed Burning of Savannas		NA	NA							NO	NO	NO
F. Field Burning of Agricultural Residues		1.29	0.02							0.88	27.10	NO
G. Other		NA	NA							NA	NA	NA
5. Land Use, Land-Use Change and Forestry	(5) **-18,036.94**	**IE,NE,NO**	**IE,NE,NO**							**NE,NO**	**NE,NO**	**NE,NO**
A. Forest Land	(5) -6,872.74	NE	NE							NE	NE	NE,NO
B. Cropland	(5) -11,742.42	IE,NE	IE,NE							NE	NE	NO
C. Grassland	(5) -24.49	NE	NE							NE	NE	NO
D. Wetlands	(5) 602.71	NE,NO	NE,NO							NE	NE	NE
E. Settlements	(5) NE,NO	NE	NE							NE	NE	NE
F. Other Land	(5) NE,NO	NE,NO	NE,NO							NE	NE	NE
G. Other	(5) NO	NO	NO							NO	NO	NO
6. Waste	**NA,NE,NO**	**301.35**	**0.47**							**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	(6) NE,NO	270.26								NA,NE,NO	NA,NE,NO	NA,NE,NO
B. Waste-water Handling		31.09	0.47							NA,NE	NA,NE	NA,NE
C. Waste Incineration	(6) NO	NO	NO							NO	NO	NO
D. Other	NA	NA	NA							NA	NA	NA
7. Other ***(please specify)*** (7)	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/removals	CH_4	N_2O	HFCs		PFCs		SF_6		NO_x	CO	NMVOC	SO_2
				P	A	P	A	P	A				
	(Gg)			CO_2 equivalent (Gg)						(Gg)			
Memo Items: (8)													
International Bunkers	**822.16**	**0.04**	**0.01**							**9.29**	**3.12**	**0.65**	**0.80**
Aviation	472.74	0.01	NO							1.89	0.78	0.12	0.15
Marine	349.42	0.03	0.01							7.40	2.33	0.54	0.64
Multilateral Operations	**NO**	**NO**	**NO**							**NO**	**NO**	**NO**	**NO**
CO_2 Emissions from Biomass	**3,146.58**												

7.2 IPCC tables 8A and 8B for the base 1988 year and for the period 1990-2004

Table A 7.11 CRF recalculation tables, Tables 8a and 8b for 1988

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**72,996.28**	**93,766.15**	**20,769.88**	28.45	15.66	16.28	21,864.16	21,759.09	**-105.08**	-0.48	-0.08	-0.08	12,061.43	12,061.44	**0.01**	0.00	0.00	0.00
1. Energy		**90,725.67**	**90,725.68**	**0.01**	0.00	0.00	0.00	3,381.88	3,432.74	**50.86**	1.50	0.04	0.04	507.98	507.99	**0.01**	0.00	0.00	0.00
1.A.	Fuel Combustion Activities	90,725.67	90,725.68	0.01	0.00	0.00	0.00	111.33	162.18	50.86	45.68	0.04	0.04	507.98	507.99	0.01	0.00	0.00	0.00
1.A.1.	Energy Industries	43,216.90	43,216.90					17.73	17.73					302.11	302.11				
1.A.2.	Manufacturing Industries and Construction	24,754.56	24,754.56					11.91	11.91					44.90	44.90				
1.A.3.	Transport	13,813.97	13,813.98	0.01	0.00	0.00	0.00	62.60	62.60	0.00	0.00	0.00	0.00	100.94	100.94	0.01	0.01	0.00	0.00
1.A.4.	Other Sectors	8,940.25	8,940.25	0.00	0.00	0.00	0.00	6.71	34.81	28.11	418.97	0.02	0.02	49.41	49.41				
1.A.5.	Other	NO	NO					12.38	35.13	22.75	183.78	0.02	0.02	10.62	10.62				
1.B.	Fugitive Emissions from Fuels	NA,NE	NA,NE,NO					3,270.55	3,270.55					NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,991.58	1,991.58					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE	NA,NE,NO					1,278.97	1,278.97					NA,NE	NA,NE				
2. Industrial Processes		**7,576.34**	**8,066.37**	**490.03**	**6.47**	**0.37**	**0.38**	**81.66**	**81.66**					**2,421.72**	**2,421.72**				
2.A.	Mineral Products	3,844.72	3,841.75	-2.97	-0.08	0.00	0.00	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	1,246.45	1,751.45	505.00	40.52	0.38	0.40	0.84	0.84					2,421.72	2,421.72				
2.C.	Metal Production	2,485.18	2,473.18	-12.00	-0.48	-0.01	-0.01	73.20	73.20					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					7.62	7.62					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**5,737.78**	**5,737.78**					**8,821.24**	**8,821.24**				
4.A.	Enteric Fermentation							4,048.54	4,048.54										
4.B.	Manure Management							1,523.64	1,523.64					1,056.05	1,056.05				
4.C.	Rice Cultivation							119.25	119.25										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					7,750.09	7,750.09				
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							46.35	46.35					15.10	15.10				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net)(5)		**-25,305.74**	**-5,025.90**	20,279.84	-80.14		15.89	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-5,137.61	-5,137.61					NE	NE					NE	NE				
5.B.	Cropland	-20,588.10	-308.26	20,279.84	-98.50	15.29	15.89	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-174.24	-174.24					NE	NE					NE	NE				
5.D.	Wetlands	594.22	594.22					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		NA,NE,NO	NA,NE,NO					12,662.84	12,506.91	-155.93	-1.23	-0.12	-0.12	310.49	310.49				
6.A.	Solid Waste Disposal on Land	NE,NO	NE,NO					10,817.92	10,661.98	-155.93	-1.44								
6.B.	Waste-water Handling							1,844.93	1,844.93					310.49	310.49				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**1,718.36**	**1,718.36**					**1.32**	**1.32**					**7.52**	**7.52**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**1,468.56**	**1,343.93**	**-124.63**	**-8.49**	**-0.09**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		NA,NE,NO	NA,NE,NO					**75.55**	NA,NE,NO	**-75.55**	**-100.00**	**-0.06**	**-0.06**	NA,NE,NO	NA,NE,NO				
2.C.3.	Aluminium Production							75.55	NA,NE,NO	-75.55	-100.00	-0.06	-0.06						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		NA,NE,NO	NA,NE,NO					NA,NE,NO	NA,NE,NO					NA,NE,NO	NA,NE,NO				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	106,997.42	127,586.68	20,589.26	19.24
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	132,303.16	132,612.58	309.42	0.23

Table A 7.12 CRF recalculation tables, Tables 8a and 8b for 1990

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**59,196.03**	**80,327.81**	**21,131.77**	35.70	18.12	19.09	18,703.29	19,914.64	**1,211.35**	6.48	1.04	1.09	10,449.56	10,449.56	**0.01**	0.00	0.00	0.00
1. Energy		**78,672.85**	**78,672.85**	**0.00**	0.00	0.00	0.00	2,313.90	2,354.58	**40.68**	1.76	0.03	0.04	437.90	437.91	**0.01**	0.00	0.00	0.00
1.A.	Fuel Combustion Activities	78,672.85	78,672.85	0.00	0.00	0.00	0.00	104.70	145.39	40.68	38.85	0.03	0.04	437.90	437.91	0.01	0.00	0.00	0.00
1.A.1.	Energy Industries	39,601.23	39,601.23					19.17	19.17					248.27	248.27				
1.A.2.	Manufacturing Industries and Construction	21,821.39	21,821.39					7.45	7.45					65.53	65.53				
1.A.3.	Transport	10,863.71	10,863.71	0.00	0.00	0.00	0.00	61.02	61.02	0.00	0.00	0.00	0.00	78.74	78.75	0.01	0.01	0.00	0.00
1.A.4.	Other Sectors	5,380.59	5,380.59					4.39	23.39	19.01	432.96	0.02	0.02	31.95	31.95				
1.A.5.	Other	1,005.93	1,005.93					12.67	34.35	21.68	171.08	0.02	0.02	13.41	13.41				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					2,209.20	2,209.20					NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,591.81	1,591.81					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					617.39	617.39					NA,NE	NA,NE				
2. Industrial Processes		**6,609.97**	**7,573.56**	**963.59**	**14.58**	**0.83**	**0.87**	**63.46**	**63.46**					**2,255.50**	**2,255.50**				
2.A.	Mineral Products	3,541.68	4,020.50	478.81	13.52	0.41	0.43	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	1,224.51	1,716.80	492.29	40.20	0.42	0.44	0.38	0.38					2,255.50	2,255.50				
2.C.	Metal Production	1,843.78	1,836.26	-7.51	-0.41	-0.01	-0.01	57.87	57.87					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					5.21	5.21					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**5,420.73**	**5,420.73**					**7,532.50**	**7,532.50**				
4.A.	Enteric Fermentation							3,783.64	3,783.64										
4.B.	Manure Management							1,501.28	1,501.28					1,030.42	1,030.42				
4.C.	Rice Cultivation							89.56	89.56										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					6,488.10	6,488.10				
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							46.25	46.25					13.98	13.98				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net)(5)		**-26,086.79**	**-5,918.61**	20,168.18	-77.31		18.22	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-6,161.98	-6,161.98	0.00	0.00	0.00	0.00	NE	NE					NE	NE				
5.B.	Cropland	-20,444.79	-276.61	20,168.18	-98.65	17.30	18.22	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-82.74	-82.74					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					10,905.20	12,075.87	1,170.67	10.73	1.00	1.06	223.66	223.66				
6.A.	Solid Waste Disposal on Land	NE,NO	NE,NO					9,508.38	10,679.05	1,170.67	12.31								
6.B.	Waste-water Handling							1,396.82	1,396.82					223.66	223.66				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**1,766.14**	**1,766.14**					**1.16**	**1.16**					**6.83**	**6.83**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**1,311.71**	**1,205.76**	**-105.95**	**-8.08**	**-0.09**											**0.03**	**0.00**	**0.00**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**NA,NE,NO**	**NA,NE,NO**					**47.31**	**NA,NE,NO**	**-47.31**	**-100.00**	**-0.04**	**-0.04**	**NA,NE,NO**	**NA,NE,NO**				
2.C.3.	Aluminium Production							47.31	NA,NE,NO	-47.31	-100.00	-0.04	-0.04						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**NA,NE,NO**	**NA,NE,NO**					**NA,NE,NO**	**NA,NE,NO**					**NA,NE,NO**	**NA,NE,NO**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	88,396.19	110,692.01	22,295.82	25.22
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	114,482.98	116,610.62	2,127.64	1.86

Table A 7.13 CRF recalculation tables, Tables 8a and 8b for 1995

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**44,286.68**	**58,806.56**	**14,519.88**	32.79	16.67	18.25	12,389.84	14,920.60	**2,530.76**	20.43	2.91	3.18	5,837.83	5,837.85	**0.03**	0.00	0.00	0.00
1. Energy		**59,375.81**	**59,375.82**	**0.00**	0.00	0.00	0.00	2,181.25	2,227.99	**46.74**	2.14	0.05	0.06	370.53	370.56	**0.03**	0.01	0.00	0.00
1.A.	Fuel Combustion Activities	59,375.81	59,375.82	0.00	0.00	0.00	0.00	75.67	122.41	46.74	61.76	0.05	0.06	370.53	370.56	0.03	0.01	0.00	0.00
1.A.1.	Energy Industries	31,571.95	31,571.95					11.86	11.86					259.53	259.53				
1.A.2.	Manufacturing Industries and Construction	18,023.19	18,023.19					7.09	7.09					35.40	35.40				
1.A.3.	Transport	6,844.63	6,844.64	0.00	0.00	0.00	0.00	42.50	42.50	0.01	0.02	0.00	0.00	44.16	44.19	0.03	0.06	0.00	0.00
1.A.4.	Other Sectors	2,621.01	2,621.01					2.17	27.83	25.66	1,184.57	0.03	0.03	19.32	19.32				
1.A.5.	Other	315.02	315.02					12.06	33.13	21.07	174.65	0.02	0.03	12.12	12.12				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					2,105.58	2,105.58					NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,453.48	1,453.48					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					652.10	652.10					NA,NE	NA,NE				
2. Industrial Processes		**5,367.81**	**6,963.84**	**1,596.03**	**29.73**	**1.83**	**2.01**	**73.92**	**73.92**					**1,921.08**	**1,921.08**				
2.A.	Mineral Products	1,973.17	3,124.09	1,150.92	58.33	1.32	1.45	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	1,071.58	1,524.14	452.56	42.23	0.52	0.57	0.74	0.74					1,921.08	1,921.08				
2.C.	Metal Production	2,323.06	2,315.60	-7.46	-0.32	-0.01	-0.01	69.06	69.06					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					4.12	4.12					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**2,558.00**	**2,558.00**					**3,377.33**	**3,377.33**				
4.A.	Enteric Fermentation							1,790.77	1,790.77										
4.B.	Manure Management							724.87	724.87					495.73	495.73				
4.C.	Rice Cultivation							11.67	11.67										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,872.29	2,872.29	0.00	0.00	0.00	0.00
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							30.69	30.69					9.31	9.31				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net) (5)		**-20,456.94**	**-7,533.09**	12,923.85	-63.18		16.24	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-7,524.48	-7,524.48					NE	NE					NE	NE				
5.B.	Cropland	-13,487.95	-564.10	12,923.85	-95.82	14.84	16.24	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-47.23	-47.23	0.00	0.00	0.00	0.00	NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					7,576.66	10,060.69	2,484.02	32.79	2.85	3.12	168.88	168.88				
6.A.	Solid Waste Disposal on Land	NE,NO	NE,NO					6,540.42	9,024.44	2,484.02	37.98								
6.B.	Waste-water Handling							1,036.24	1,036.24					168.88	168.88				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**1,431.78**	**1,431.78**					**0.69**	**0.69**					**6.84**	**6.84**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**1,560.14**	**1,442.25**	**-117.89**	**-7.56**	**-0.14**											**0.11**	**0.00**	**0.00**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**2.95**	**2.95**					**46.94**	**NA,NE,NO**	**-46.94**	**-100.00**	**-0.05**	**-0.06**	**1.26**	**1.26**				
2.C.3.	Aluminium Production							46.94	NA,NE,NO	-46.94	-100.00	-0.05	-0.06						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	2.95	2.95					NE,NO	NE,NO					1.26	1.26				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**62.16**	**62.16**					**NA,NE,NO**	**NA,NE,NO**					**NA,NE,NO**	**NA,NE,NO**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	62,565.50	79,569.22	17,003.72	27.18
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	83,022.44	87,102.32	4,079.87	4.91

Table A 7.14 CRF recalculation tables, Tables 8a and 8b for 2000

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**31,368.93**	**41,564.90**	**10,195.97**	32.50	15.18	17.49	9,035.16	11,708.41	**2,673.25**	29.59	3.98	4.59	4,911.45	4,918.47	**7.02**	0.14	0.01	0.01
1. Energy		**45,861.46**	**45,869.33**	**7.87**	0.02	0.01	0.01	1,853.49	1,965.92	**112.42**	6.07	0.17	0.19	335.34	342.35	**7.02**	2.09	0.01	0.01
1.A.	Fuel Combustion Activities	45,861.46	45,869.33	7.87	0.02	0.01	0.01	59.52	171.94	112.42	188.88	0.17	0.19	335.34	342.35	7.02	2.09	0.01	0.01
1.A.1.	Energy Industries	26,215.75	26,215.75					8.96	8.96					234.81	234.81				
1.A.2.	Manufacturing Industries and Construction	11,868.18	11,868.18					4.90	4.90					20.15	20.15				
1.A.3.	Transport	5,881.45	5,889.32	7.87	0.13	0.01	0.01	27.32	29.74	2.42	8.85	0.00	0.00	34.48	41.50	7.02	20.35	0.01	0.01
1.A.4.	Other Sectors	1,896.08	1,896.08					7.93	98.82	90.89	1,145.58	0.14	0.16	36.97	36.97				
1.A.5.	Other	NO	NO					10.40	29.52	19.12	183.78	0.03	0.03	8.92	8.92				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					1,793.97	1,793.97	0.00	0.00	0.00	0.00	NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,198.98	1,198.98					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					594.99	594.99					NA,NE	NA,NE				
2. Industrial Processes		**4,315.01**	**4,593.87**	**278.86**	**6.46**	**0.42**	**0.48**	**73.81**	**73.81**					**1,314.42**	**1,314.42**				
2.A.	Mineral Products	2,261.77	2,302.37	40.60	1.79	0.06	0.07	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	569.90	813.42	243.52	42.73	0.36	0.42	3.10	3.10					1,314.42	1,314.42				
2.C.	Metal Production	1,483.34	1,478.08	-5.26	-0.35	-0.01	-0.01	70.70	70.70					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					NO	NO					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**2,287.95**	**2,287.95**					**3,106.12**	**3,106.12**				
4.A.	Enteric Fermentation							1,664.90	1,664.90										
4.B.	Manure Management							568.71	568.71					429.29	429.29				
4.C.	Rice Cultivation							30.20	30.20										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,670.57	2,670.57	0.00	0.00	0.00	0.00
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							24.15	24.15					6.26	6.26				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net)(5)		**-18,807.54**	**-8,898.30**	9,909.24	-52.69		17.00	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-8,976.23	-8,976.23					NE	NE					NE	NE				
5.B.	Cropland	-10,399.19	-489.95	9,909.24	-95.29	14.75	17.00	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-34.84	-34.84					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					4,819.91	7,380.74	2,560.83	53.13	3.81	4.39	155.57	155.57				
6.A.	Solid Waste Disposal on Land	NE	NE					4,226.25	6,787.08	2,560.83	60.59								
6.B.	Waste-water Handling							593.66	593.66					155.57	155.57				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**475.16**	**475.16**					**0.47**	**0.47**					**1.60**	**1.60**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**2,955.11**	**2,705.07**	**-250.04**	**-8.46**	**-0.37**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**NA,NE,NO**	**NA,NE,NO**					**33.14**	**NA,NE,NO**	**-33.14**	**-100.00**	**-0.05**	**-0.06**	**2.23**	**2.23**				
2.C.3.	Aluminium Production							33.14	NA,NE,NO	-33.14	-100.00	-0.05	-0.06						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					2.23	2.23				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**96.02**	**96.02**					**NA,NE,NO**	**NA,NE,NO**					**29.40**	**29.40**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	45,446.94	58,290.03	12,843.10	28.26
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	64,158.46	67,092.32	2,933.86	4.57

Table A 7.15 CRF recalculation tables, Tables 8a and 8b for 2001

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**31,266.75**	**42,875.35**	**11,608.61**	37.13	17.20	19.92	8,317.34	10,723.28	**2,405.94**	28.93	3.56	4.13	4,568.13	4,577.45	**9.31**	0.20	0.01	0.02
1. Energy		**47,475.34**	**47,485.79**	**10.45**	0.02	0.02	0.02	1,813.62	1,921.86	**108.24**	5.97	0.16	0.19	355.75	365.06	**9.31**	2.62	0.01	0.02
1.A.	Fuel Combustion Activities	47,475.34	47,485.79	10.45	0.02	0.02	0.02	55.07	163.31	108.24	196.53	0.16	0.19	355.75	365.06	9.31	2.62	0.01	0.02
1.A.1.	Energy Industries	29,035.91	29,035.91					9.77	9.77					257.93	257.93				
1.A.2.	Manufacturing Industries and Construction	10,788.11	10,788.11					4.69	4.69					20.73	20.73				
1.A.3.	Transport	6,013.52	6,023.96	10.45	0.17	0.02	0.02	23.56	26.77	3.21	13.62	0.00	0.01	34.46	43.77	9.31	27.03	0.01	0.02
1.A.4.	Other Sectors	1,637.81	1,637.81					6.89	93.25	86.36	1,253.48	0.13	0.15	33.92	33.92				
1.A.5.	Other	NO	NO					10.16	28.83	18.67	183.78	0.03	0.03	8.71	8.71				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					1,758.55	1,758.55					NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,211.79	1,211.79					NA,NE	NA,NE				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					546.75	546.75					NA,NE	NA,NE				
2. Industrial Processes		**4,375.18**	**4,613.04**	**237.87**	**5.44**	**0.35**	**0.41**	**50.90**	**50.90**					**1,295.16**	**1,295.16**				
2.A.	Mineral Products	2,446.50	2,468.79	22.29	0.91	0.03	0.04	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	506.70	724.87	218.17	43.06	0.32	0.37	2.97	2.97					1,295.16	1,295.16				
2.C.	Metal Production	1,421.97	1,419.38	-2.59	-0.18	0.00	0.00	47.93	47.93					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					NO	NO					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**1,771.73**	**1,771.73**					**2,768.93**	**2,768.93**				
4.A.	Enteric Fermentation							1,306.25	1,306.25										
4.B.	Manure Management							405.21	405.21					320.64	320.64				
4.C.	Rice Cultivation							32.96	32.96										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,441.96	2,441.96				
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							27.32	27.32					6.33	6.33				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net) (5)		**-20,583.77**	**-9,223.48**	11,360.29	-55.19		19.49	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-9,467.15	-9,467.15					NE	NE					NE	NE				
5.B.	Cropland	-11,705.79	-345.50	11,360.29	-97.05	16.83	19.49	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-13.55	-13.55					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					4,681.08	6,978.79	2,297.70	49.08	3.40	3.94	148.29	148.29				
6.A.	Solid Waste Disposal on Land	NE	NE					4,199.50	6,497.20	2,297.70	54.71								
6.B.	Waste-water Handling							481.59	481.59					148.29	148.29				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**699.16**	**699.16**					**0.69**	**0.69**					**2.38**	**2.38**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**2,876.11**	**2,638.21**	**-237.89**	**-8.27**	**-0.35**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**NA,NE,NO**	**NA,NE,NO**					**16.29**	**NA,NE,NO**	**-16.29**	**-100.00**	**-0.02**	**-0.03**	**2.29**	**2.29**				
2.C.3.	Aluminium Production							16.29	NA,NE,NO	-16.29	-100.00	-0.02	-0.03						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					2.29	2.29				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**97.50**	**97.50**					**NA,NE,NO**	**NA,NE,NO**					**2.39**	**2.39**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	44,268.30	58,275.88	14,007.57	31.64
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	64,754.57	67,401.86	2,647.28	4.09

Table A 7.16 CRF recalculation tables, Tables 8a and 8b for 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**27,587.59**	**41,016.46**	**13,428.87**	48.68	20.83	23.88	8,479.70	10,667.60	**2,187.91**	25.80	3.39	3.89	4,442.98	4,453.71	**10.73**	0.24	0.02	0.02
1. Energy		**45,054.34**	**45,066.38**	**12.04**	0.03	0.02	0.02	1,783.89	1,912.01	**128.12**	7.18	0.20	0.23	339.33	350.06	**10.73**	3.16	0.02	0.02
1.A.	Fuel Combustion Activities	45,054.34	45,066.38	12.04	0.03	0.02	0.02	58.70	186.82	128.12	218.27	0.20	0.23	339.33	350.06	10.73	3.16	0.02	0.02
1.A.1.	Energy Industries	26,465.57	26,465.57					8.97	8.97					231.12	231.12				
1.A.2.	Manufacturing Industries and Construction	10,198.06	10,198.06					4.40	4.40					21.08	21.08				
1.A.3.	Transport	6,316.61	6,328.65	12.04	0.19	0.02	0.02	25.51	29.20	3.70	14.49	0.01	0.01	35.55	46.27	10.73	30.18	0.02	0.02
1.A.4.	Other Sectors	2,074.11	2,074.11					8.22	111.31	103.09	1,254.38	0.16	0.18	41.63	41.63				
1.A.5.	Other	NO	NO					11.61	32.94	21.33	183.78	0.03	0.04	9.96	9.96				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					1,725.19	1,725.19					NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,228.43	1,228.43					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					496.76	496.76					NA,NE	NA,NE				
2. Industrial Processes		**4,028.47**	**4,190.61**	**162.14**	**4.02**	**0.25**	**0.29**	**46.08**	**46.08**					**1,088.82**	**1,088.82**				
2.A.	Mineral Products	2,376.60	2,403.43	26.83	1.13	0.04	0.05	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	325.40	464.12	138.72	42.63	0.22	0.25	2.82	2.82					1,088.82	1,088.82				
2.C.	Metal Production	1,326.47	1,323.06	-3.40	-0.26	-0.01	-0.01	43.26	43.26					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					NO	NO					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**1,995.05**	**1,995.05**					**2,864.27**	**2,864.27**	**0.00**	**0.00**	**0.00**	**0.00**
4.A.	Enteric Fermentation							1,448.46	1,448.46										
4.B.	Manure Management							470.79	470.79					368.31	368.31				
4.C.	Rice Cultivation							44.25	44.25										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,487.81	2,487.81				
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							31.55	31.55					8.16	8.16				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net) (5)		**-21,495.22**	**-8,240.53**	13,254.69	-61.66		23.57	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-8,318.06	-8,318.06					NE	NE					NE	NE				
5.B.	Cropland	-13,763.02	-508.32	13,254.69	-96.31	20.56	23.57	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-16.85	-16.85					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					4,654.67	6,714.46	2,059.79	44.25	3.19	3.66	150.55	150.55				
6.A.	Solid Waste Disposal on Land	NE	NE					4,197.14	6,256.93	2,059.79	49.08								
6.B.	Waste-water Handling							457.53	457.53					150.55	150.55				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**735.38**	**735.38**					**0.75**	**0.75**					**2.62**	**2.62**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**3,389.72**	**3,107.83**	**-281.88**	**-8.32**	**-0.44**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**NA,NE,NO**	**NA,NE,NO**					**21.42**	**NA,NE,NO**	**-21.42**	**-100.00**	**-0.03**	**-0.04**	**2.51**	**2.51**				
2.C.3.	Aluminium Production							21.42	NA,NE,NO	-21.42	-100.00	-0.03	-0.04						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					2.51	2.51				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**89.59**	**89.59**					**NA,NE,NO**	**NA,NE,NO**					**2.39**	**2.39**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	40,623.78	56,229.87	15,606.09	38.42
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	62,029.42	64,380.81	2,351.39	3.79

Table A 7.17 CRF recalculation tables, Tables 8a and 8b for 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**38,931.56**	**46,796.04**	**7,864.48**	20.20	11.27	12.54	9,358.42	11,334.91	**1,976.48**	21.12	2.83	3.15	4,434.11	4,446.11	**12.00**	0.27	0.02	0.02
1. Energy		**49,166.77**	**49,180.23**	**13.46**	0.03	0.02	0.02	1,774.68	1,905.74	**131.05**	7.38	0.19	0.21	371.43	383.43	**12.00**	3.23	0.02	0.02
1.A.	Fuel Combustion Activities	49,166.77	49,180.23	13.46	0.03	0.02	0.02	58.53	188.34	129.81	221.79	0.19	0.21	371.43	383.43	12.00	3.23	0.02	0.02
1.A.1.	Energy Industries	28,329.87	28,329.87					9.45	9.45					254.33	254.33				
1.A.2.	Manufacturing Industries and Construction	11,533.47	11,533.47					5.02	5.02					23.94	23.94				
1.A.3.	Transport	7,097.83	7,111.29	13.46	0.19	0.02	0.02	26.07	30.20	4.13	15.86	0.01	0.01	41.16	53.16	12.00	29.15	0.02	0.02
1.A.4.	Other Sectors	2,205.59	2,205.59					8.64	117.14	108.51	1,256.41	0.16	0.17	43.99	43.99				
1.A.5.	Other	NO	NO					9.34	26.52	17.17	183.78	0.02	0.03	8.01	8.01				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					1,716.15	1,717.39	1.24	0.07	0.00	0.00	NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,208.32	1,208.32					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					507.83	509.07	1.24	0.24	0.00	0.00	NA,NE	NA,NE				
2. Industrial Processes		**4,628.14**	**4,679.47**	**51.33**	**1.11**	**0.07**	**0.08**	**58.54**	**58.54**					**1,159.38**	**1,159.38**				
2.A.	Mineral Products	2,621.30	2,528.91	-92.39	-3.52	-0.13	-0.15	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	345.10	492.10	147.00	42.60	0.21	0.23	5.73	5.73					1,159.38	1,159.38				
2.C.	Metal Production	1,661.74	1,658.45	-3.29	-0.20	0.00	-0.01	52.81	52.81					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					NO	NO					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**2,080.57**	**2,080.57**					**2,752.15**	**2,752.15**	**0.00**	**0.00**	**0.00**	**0.00**
4.A.	Enteric Fermentation							1,501.94	1,501.94										
4.B.	Manure Management							511.89	511.89					394.56	394.56				
4.C.	Rice Cultivation							47.73	47.73										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,351.66	2,351.66				
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							19.01	19.01					5.94	5.94				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net) (5)		**-14,863.35**	**-7,063.65**	7,799.69	-52.48		12.44	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-7,055.98	-7,055.98					NE	NE					NE	NE				
5.B.	Cropland	-8,390.43	-590.74	7,799.69	-92.96	11.18	12.44	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-19.65	-19.65					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2						CH_4						N_2O					
	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste	NA,NE,NO	NA,NE,NO					5,444.63	7,290.06	1,845.43	33.89	2.65	2.94	151.14	151.14				
6.A. Solid Waste Disposal on Land	NE	NE					4,216.55	6,061.98	1,845.43	43.77								
6.B. Waste-water Handling							1,228.08	1,228.08					151.14	151.14				
6.C. Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D. Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*	NA	NA					NA	NA					NA	NA				
Memo Items:																		
International Bunkers	**920.82**	**920.82**					**0.95**	**0.95**					**3.39**	**3.39**				
Multilateral Operations	**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass	**3,410.54**	**3,131.22**	**-279.32**	**-8.19**	**-0.40**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs						PFCs						SF_6					
	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
	CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions	**NA,NE,NO**	**NA,NE,NO**					**20.69**	**NA,NE,NO**	**-20.69**	**-100.00**	**-0.03**	**-0.03**	**2.52**	**2.52**				
2.C.3. Aluminium Production							20.69	NA,NE,NO	-20.69	-100.00	-0.03	-0.03						
2.E. Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F. Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					2.52	2.52				
2.G. Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6	**120.60**	**120.60**					**NA,NE,NO**	**NA,NE,NO**					**6.36**	**6.36**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	52,867.91	62,700.17	9,832.27	18.60
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	67,610.65	69,643.23	2,032.57	3.01

Table A 7.18 CRF recalculation tables, Tables 8a and 8b for 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total National Emissions and Removals		**30,987.50**	**45,089.12**	**14,101.62**	45.51	20.41	23.15	9,765.73	11,221.70	**1,455.97**	14.91	2.11	2.39	4,395.44	4,393.70	**-1.74**	-0.04	0.00	0.00
1. Energy		**48,276.24**	**48,288.69**	**12.45**	0.03	0.02	0.02	1,850.66	1,991.63	**140.97**	7.62	0.20	0.23	370.47	381.56	**11.09**	2.99	0.02	0.02
1.A.	Fuel Combustion Activities	48,276.24	48,288.69	12.45	0.03	0.02	0.02	58.54	196.33	137.79	235.36	0.20	0.23	370.47	381.56	11.09	2.99	0.02	0.02
1.A.1.	Energy Industries	28,297.62	28,297.62					9.40	9.40					250.79	250.79				
1.A.2.	Manufacturing Industries and Construction	10,817.76	10,817.76					4.81	4.81					22.23	22.23				
1.A.3.	Transport	7,402.79	7,415.24	12.45	0.17	0.02	0.02	23.37	27.19	3.82	16.36	0.01	0.01	43.63	54.72	11.09	25.42	0.02	0.02
1.A.4.	Other Sectors	1,758.07	1,758.07					8.93	120.80	111.86	1,251.99	0.16	0.18	43.50	43.50				
1.A.5.	Other	NO	NO					12.03	34.13	22.10	183.78	0.03	0.04	10.32	10.32				
1.B.	Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO					1,792.12	1,795.29	3.18	0.18	0.00	0.01	NA,NE	NA,NE				
1.B.1.	Solid fuel	NA,NE	NA,NE					1,232.71	1,232.71					NA	NA				
1.B.2.	Oil and Natural Gas	NA,NE,NO	NA,NE,NO					559.40	562.58	3.18	0.57	0.00	0.01	NA,NE	NA,NE				
2. Industrial Processes		**4,819.35**	**4,974.82**	**155.47**	**3.23**	**0.22**	**0.26**	**47.67**	**47.67**					**858.11**	**858.11**				
2.A.	Mineral Products	2,859.84	2,842.67	-17.17	-0.60	-0.02	-0.03	NE,NO	NE,NO					NE,NO	NE,NO				
2.B.	Chemical Industry	432.09	610.00	177.91	41.17	0.26	0.29	2.85	2.85					858.11	858.11				
2.C.	Metal Production	1,527.43	1,522.16	-5.27	-0.35	-0.01	-0.01	44.82	44.82					NA	NA				
2.D.	Other Production	NO	NO																
2.G.	Other	NO	NO					NO	NO					NO	NO				
3. Solvent and Other Product Use		**NE,NO**	**NE,NO**											**NA,NE,NO**	**NA,NE,NO**				
4. Agriculture								**2,089.08**	**2,076.96**	**-12.13**	**-0.58**	**-0.02**	**-0.02**	**3,016.91**	**3,004.08**	**-12.83**	**-0.43**	**-0.02**	**-0.02**
4.A.	Enteric Fermentation							1,491.48	1,489.89	-1.59	-0.11								
4.B.	Manure Management							515.60	505.07	-10.54	-2.04	-0.02	-0.02	395.85	390.39	-5.46	-1.38	-0.01	-0.01
4.C.	Rice Cultivation							48.20	48.20										
4.D.	Agricultural Soils (4)							NA,NO	NA,NO					2,611.51	2,604.14	-7.37	-0.28	-0.01	-0.01
4.E.	Prescribed Burning of Savannas							NA	NA					NA	NA				
4.F.	Field Burning of Agricultural Residues							33.80	33.80					9.55	9.55				
4.G.	Other							NA	NA					NA	NA				
5. Land Use, Land-Use Change and Forestry (net) (5)		**-22,108.10**	**-8,174.39**	13,933.71	-63.03		22.87	IE,NE,NO	IE,NE,NO					IE,NE,NO	IE,NE,NO				
5.A.	Forest Land	-7,965.21	-7,965.21					NE	NE					NE	NE				
5.B.	Cropland	-14,721.11	-787.41	13,933.71	-94.65	20.16	22.87	IE,NE	IE,NE					IE,NE	IE,NE				
5.C.	Grassland	-24.48	-24.48					NE	NE					NE	NE				
5.D.	Wetlands	602.71	602.71					NO	NE,NO					NE,NO	NE,NO				
5.E.	Settlements	NE,NO	NE,NO					NE	NE					NE	NE				
5.F.	Other Land	NE,NO	NE,NO					NE,NO	NE,NO					NE,NO	NE,NO				
5.G.	Other	NO	NO					NO	NO					NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		CO_2						CH_4						N_2O					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
6. Waste		**NA,NE,NO**	**NA,NE,NO**					5,778.31	7,105.44	1,327.13	22.97	1.92	2.18	149.94	149.94				
6.A.	Solid Waste Disposal on Land	NE,NO	NE,NO					4,545.24	5,872.37	1,327.13	29.20								
6.B.	Waste-water Handling							1,233.07	1,233.07					149.94	149.94				
6.C.	Waste Incineration	NO	NO					NO	NO					NO	NO				
6.D.	Other	NA	NA					NA	NA					NA	NA				
7. Other *(as specified in Summary 1.A)*		NA	NA					NA	NA					NA	NA				
Memo Items:																			
International Bunkers		**771.79**	**771.79**					**0.80**	**0.80**					**2.85**	**2.85**				
Multilateral Operations		**NO**	**NO**					**NO**	**NO**					**NO**	**NO**				
CO_2 Emissions from Biomass		**3,693.66**	**3,390.97**	**-302.69**	**-8.19**	**-0.44**													

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		HFCs						PFCs						SF_6					
		Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)	Previous submission	Latest submission	Difference	Difference(1)	Impact of recalculation on total emissions excluding LULUCF (2)	Impact of recalculation on total emissions including LULUCF(3)
		CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)			CO_2 equivalent (Gg)			(%)		
Total Actual Emissions		**NA,NE,NO**	**NA,NE,NO**					**33.18**	**NA,NE,NO**	**-33.18**	**-100.00**	**-0.05**	**-0.05**	**3.68**	**3.68**				
2.C.3.	Aluminium Production							33.18	NA,NO	-33.18	-100.00	-0.05	-0.05						
2.E.	Production of Halocarbons and SF_6	NA,NO	NA,NO					NA,NO	NA,NO					NA,NO	NA,NO				
2.F.	Consumption of Halocarbons and SF_6	NE,NO	NE,NO					NE,NO	NE,NO					3.68	3.68				
2.G.	Other	NO	NO					NO	NO					NO	NO				
Potential Emissions from Consumption of HFCs/PFCs and SF_6		**217.30**	**217.30**					**NA,NE,NO**	**NA,NE,NO**					**NA,NE,NO**	**NA,NE,NO**				

	Previous submission	Latest submission	Difference	Difference(1)
	CO_2 equivalent (Gg)			(%)
Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry	45,402.82	60,925.49	15,522.67	34.19
Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry	67,293.62	68,882.59	1,588.96	2.36

7.3 CRF Trend tables 10 for main GHG

Table A 7.19 CRF Trend Tables 10: CO_2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1988)	1989	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**90,725.68**	**90,788.55**	**78,672.85**	**63,356.62**	**57,197.49**	**59,681.67**	**56,658.24**	**59,375.82**	**58,207.67**	**56,702.56**
A. Fuel Combustion (Sectoral Approach)	90,725.68	90,788.55	78,672.85	63,356.62	57,197.49	59,681.67	56,658.24	59,375.82	58,207.67	56,702.56
1. Energy Industries	43,216.90	43,689.95	39,601.23	37,106.22	33,862.39	34,091.59	30,944.73	31,571.95	30,651.62	30,936.08
2. Manufacturing Industries and Construction	24,754.56	25,215.21	21,821.39	14,757.67	12,093.40	13,296.03	15,032.19	18,023.19	17,498.72	17,691.26
3. Transport	13,813.98	13,244.79	10,863.71	6,524.57	6,435.38	7,443.93	6,546.96	6,844.64	6,558.51	5,284.75
4. Other Sectors	8,940.25	8,638.60	5,380.59	4,086.25	4,610.45	4,117.02	3,324.75	2,621.01	3,237.68	2,678.29
5. Other	NO	NO	1,005.93	881.89	195.86	733.11	809.61	315.02	261.14	112.18
B. Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
1. Solid Fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Oil and Natural Gas	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
2. Industrial Processes	**8,066.37**	**8,251.67**	**7,573.56**	**5,398.10**	**4,565.67**	**4,672.77**	**5,681.43**	**6,963.84**	**6,780.44**	**6,346.23**
A. Mineral Products	3,841.75	4,027.82	4,020.50	2,590.07	2,090.41	1,907.77	2,292.01	3,124.09	3,174.18	2,844.78
B. Chemical Industry	1,751.45	1,750.16	1,716.80	1,414.91	1,163.49	1,125.84	1,262.70	1,524.14	1,512.26	1,247.86
C. Metal Production	2,473.18	2,473.68	1,836.26	1,393.12	1,311.77	1,639.16	2,126.71	2,315.60	2,094.00	2,253.59
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
4. Agriculture										
A. Enteric Fermentation										
B. Manure Management										
C. Rice Cultivation										
D. Agricultural Soils										
E. Prescribed Burning of Savannas										
F. Field Burning of Agricultural Residues										
G. Other										
5. Land Use, Land-Use Change and Forestry[(2)]	**-5,025.90**	**-5,498.22**	**-5,918.61**	**-7,522.42**	**-7,345.08**	**-7,248.35**	**-7,173.24**	**-7,533.09**	**-6,365.44**	**-6,678.94**
A. Forest Land	-5,137.61	-5,634.31	-6,161.98	-7,637.28	-7,412.03	-7,475.77	-7,301.67	-7,524.48	-6,517.45	-6,871.54
B. Cropland	-308.26	-283.89	-276.61	-376.84	-465.08	-334.36	-444.07	-564.10	-413.92	-368.28
C. Grassland	-174.24	-174.24	-82.74	-102.63	-70.68	-40.93	-30.21	-47.23	-36.78	-41.83
D. Wetlands	594.22	594.22	602.71	594.33	602.71	602.71	602.71	602.71	602.71	602.71
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Solid Waste Disposal on Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE
B. Waste-water Handling										
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**93,766.15**	**93,542.00**	**80,327.81**	**61,232.29**	**54,418.08**	**57,106.09**	**55,166.42**	**58,806.56**	**58,622.67**	**56,369.85**
Total CO_2 emissions excluding net CO_2 from LULUCF	**98,792.05**	**99,040.22**	**86,246.41**	**68,754.71**	**61,763.16**	**64,354.44**	**62,339.66**	**66,339.65**	**64,988.11**	**63,048.79**
Memo Items:										
International Bunkers	**1,718.36**	**1,718.58**	**1,766.14**	**1,198.34**	**1,438.15**	**1,582.72**	**1,482.87**	**1,431.78**	**1,203.60**	**1,519.50**
Aviation	749.41	731.24	892.27	320.22	565.07	738.75	632.43	549.40	472.02	427.55
Marine	968.95	987.34	873.88	878.12	873.09	843.97	850.44	882.37	731.58	1,091.95
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	1,343.93	1,437.14	1,205.76	1,201.30	1,184.37	1,072.28	1,181.82	1,442.25	1,479.04	1,544.02

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**51,234.93**	**46,749.64**	**45,869.33**	**47,485.79**	**45,066.38**	**49,180.23**	**48,288.69**	**49,878.73**	**-45.02**
A. Fuel Combustion (Sectoral Approach)	51,234.93	46,749.64	45,869.33	47,485.79	45,066.38	49,180.23	48,288.69	49,878.73	-45.02
1. Energy Industries	27,501.99	25,760.34	26,215.75	29,035.91	26,465.57	28,329.87	28,297.62	29,642.46	-31.41
2. Manufacturing Industries and Construction	14,217.30	12,283.00	11,868.18	10,788.11	10,198.06	11,533.47	10,817.76	10,420.95	-57.90
3. Transport	6,477.68	6,214.88	5,889.32	6,023.96	6,328.65	7,111.29	7,415.24	8,115.13	-41.25
4. Other Sectors	2,988.84	2,491.43	1,896.08	1,637.81	2,074.11	2,205.59	1,758.07	1,700.20	-80.98
5. Other	49.12	NO	NO	NO	NO	NO	NO	NO	0.00
B. Fugitive Emissions from Fuels	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
1. Solid Fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	0.00
2. Oil and Natural Gas	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
2. Industrial Processes	**3,940.59**	**4,218.15**	**4,593.87**	**4,613.04**	**4,190.61**	**4,679.47**	**4,974.82**	**5,099.34**	**-36.78**
A. Mineral Products	1,401.91	2,033.57	2,302.37	2,468.79	2,403.43	2,528.91	2,842.67	3,078.24	-19.87
B. Chemical Industry	672.63	480.71	813.42	724.87	464.12	492.10	610.00	623.26	-64.41
C. Metal Production	1,866.05	1,703.87	1,478.08	1,419.38	1,323.06	1,658.45	1,522.16	1,397.84	-43.48
D. Other Production	NO	NO	NO	NO	NO	NO	NO	NO	0.00
E. Production of Halocarbons and SF_6									
F. Consumption of Halocarbons and SF_6									
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
3. Solvent and Other Product Use	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
4. Agriculture									
A. Enteric Fermentation									
B. Manure Management									
C. Rice Cultivation									
D. Agricultural Soils									
E. Prescribed Burning of Savannas									
F. Field Burning of Agricultural Residues									
G. Other									
5. Land Use, Land-Use Change and Forestry[(2)]	**-6,707.39**	**-7,112.43**	**-8,898.30**	**-9,223.48**	**-8,240.53**	**-7,063.65**	**-8,174.39**	**-18,036.94**	**258.88**
A. Forest Land	-6,860.50	-7,199.77	-8,976.23	-9,467.15	-8,318.06	-7,055.98	-7,965.21	-6,872.74	33.77
B. Cropland	-409.20	-466.67	-489.95	-345.50	-508.32	-590.74	-787.41	-11,742.42	3,709.25
C. Grassland	-40.41	-48.70	-34.84	-13.55	-16.85	-19.65	-24.48	-24.49	-85.94
D. Wetlands	602.71	602.71	602.71	602.71	602.71	602.71	602.71	602.71	1.43
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Waste	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**
A. Solid Waste Disposal on Land	NE	NE	NE	NE	NE	NE	NE,NO	NE,NO	0.00
B. Waste-water Handling									
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CO_2 emissions including net CO_2 from LULUCF	**48,468.12**	**43,855.36**	**41,564.90**	**42,875.35**	**41,016.46**	**46,796.04**	**45,089.12**	**36,941.13**	**-60.60**
Total CO_2 emissions excluding net CO_2 from LULUCF	**55,175.52**	**50,967.79**	**50,463.21**	**52,098.84**	**49,256.99**	**53,859.70**	**53,263.51**	**54,978.07**	**-44.35**
Memo Items:									
International Bunkers	**1,512.41**	**344.76**	**475.16**	**699.16**	**735.38**	**920.82**	**771.79**	**822.16**	**-52.15**
Aviation	490.42	319.22	269.84	393.30	399.14	485.03	405.35	472.74	-36.92
Marine	1,021.99	25.53	205.31	305.85	336.24	435.78	366.45	349.42	-63.94
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass	2,198.83	2,209.02	2,705.07	2,638.21	3,107.83	3,131.22	3,390.97	3,146.58	134.13

Table A 7.20 CRF Trend tables 10: CH_4

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1988)	1989	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	163.46	165.33	112.12	97.83	100.80	101.05	99.12	106.09	104.52	93.82
A. Fuel Combustion (Sectoral Approach)	7.72	7.98	6.92	5.13	5.20	5.17	5.31	5.83	5.74	5.41
1. Energy Industries	0.84	0.81	0.91	0.74	0.66	0.59	0.53	0.56	0.52	0.52
2. Manufacturing Industries and Construction	0.57	0.58	0.35	0.31	0.25	0.27	0.28	0.34	0.32	0.30
3. Transport	2.98	3.08	2.91	1.41	1.70	1.93	1.88	2.02	1.70	1.26
4. Other Sectors	1.66	1.61	1.11	0.83	1.01	0.87	1.02	1.33	1.58	1.62
5. Other	1.67	1.91	1.64	1.83	1.58	1.52	1.61	1.58	1.61	1.72
B. Fugitive Emissions from Fuels	155.74	157.35	105.20	92.71	95.59	95.88	93.80	100.27	98.78	88.41
1. Solid Fuels	94.84	92.60	75.80	65.12	71.53	71.42	66.74	69.21	67.33	60.69
2. Oil and Natural Gas	60.90	64.75	29.40	27.58	24.07	24.46	27.06	31.05	31.45	27.72
2. Industrial Processes	**3.89**	**3.89**	**3.02**	**2.21**	**2.09**	**2.45**	**3.21**	**3.52**	**3.27**	**3.51**
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	0.04	0.04	0.02	0.01	0.01	0.03	0.03	0.04	0.02	0.02
C. Metal Production	3.49	3.52	2.76	2.05	1.94	2.25	3.00	3.29	3.04	3.29
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	0.36	0.33	0.25	0.14	0.14	0.17	0.18	0.20	0.20	0.20
3. Solvent and Other Product Use										
4. Agriculture	**273.23**	**268.83**	**258.13**	**234.43**	**192.02**	**150.67**	**126.58**	**121.81**	**115.83**	**110.27**
A. Enteric Fermentation	192.79	187.57	180.17	165.99	137.48	107.19	90.13	85.27	82.38	79.48
B. Manure Management	72.55	73.11	71.49	62.81	51.10	40.90	34.72	34.52	31.60	27.93
C. Rice Cultivation	5.68	5.49	4.26	3.30	1.82	1.26	0.33	0.56	1.05	1.53
D. Agricultural Soils	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	2.21	2.66	2.20	2.32	1.62	1.33	1.40	1.46	0.81	1.34
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**
A. Forest Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Cropland	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**595.57**	**587.86**	**575.04**	**547.53**	**529.81**	**506.25**	**486.07**	**479.08**	**454.65**	**424.27**
A. Solid Waste Disposal on Land	507.71	510.49	508.53	495.86	482.56	466.13	448.78	429.74	407.79	384.48
B. Waste-water Handling	87.85	77.37	66.52	51.67	47.25	40.12	37.28	49.34	46.86	39.79
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**1,036.15**	**1,025.91**	**948.32**	**882.01**	**824.72**	**760.42**	**714.98**	**710.50**	**678.27**	**631.87**
Total CH_4 emissions excluding CH_4 from LULUCF	**1,036.15**	**1,025.91**	**948.32**	**882.01**	**824.72**	**760.42**	**714.98**	**710.50**	**678.27**	**631.87**
Memo Items:										
International Bunkers	0.06	0.06	0.06	0.03	0.03	0.04	0.03	0.03	0.03	0.03
Aviation	0.02	0.02	0.04	0.01	0.02	0.02	0.02	0.02	0.01	0.01
Marine	0.04	0.04	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	96.14	84.39	93.62	91.52	91.05	90.75	94.84	91.73	-43.89
A. Fuel Combustion (Sectoral Approach)	7.27	7.25	8.19	7.78	8.90	8.97	9.35	9.08	17.62
1. Energy Industries	0.45	0.43	0.43	0.47	0.43	0.45	0.45	0.45	-46.28
2. Manufacturing Industries and Construction	0.30	0.28	0.23	0.22	0.21	0.24	0.23	0.21	-62.97
3. Transport	1.43	1.51	1.42	1.27	1.39	1.44	1.29	1.42	-52.42
4. Other Sectors	3.55	3.48	4.71	4.44	5.30	5.58	5.75	5.54	234.38
5. Other	1.54	1.55	1.41	1.37	1.57	1.26	1.63	1.46	-12.81
B. Fugitive Emissions from Fuels	88.87	77.14	85.43	83.74	82.15	81.78	85.49	82.64	-46.94
1. Solid Fuels	63.73	56.01	57.09	57.70	58.50	57.54	58.70	52.70	-44.43
2. Oil and Natural Gas	25.14	21.13	28.33	26.04	23.66	24.24	26.79	29.94	-50.84
2. Industrial Processes	**3.01**	**2.77**	**3.51**	**2.42**	**2.19**	**2.79**	**2.27**	**2.21**	**-43.27**
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
B. Chemical Industry	0.21	0.46	0.15	0.14	0.13	0.27	0.14	0.18	343.66
C. Metal Production	2.62	2.23	3.37	2.28	2.06	2.51	2.13	2.03	-41.80
D. Other Production									
E. Production of Halocarbons and SF_6									
F. Consumption of Halocarbons and SF_6									
G. Other	0.18	0.07	NO	NO	NO	NO	NO	NO	-100.00
3. Solvent and Other Product Use									
4. Agriculture	**114.21**	**115.13**	**108.95**	**84.37**	**95.00**	**99.07**	**98.90**	**93.27**	**-65.86**
A. Enteric Fermentation	81.77	82.95	79.28	62.20	68.97	71.52	70.95	67.34	-65.07
B. Manure Management	29.64	30.30	27.08	19.30	22.42	24.38	24.05	22.75	-68.64
C. Rice Cultivation	1.61	0.57	1.44	1.57	2.11	2.27	2.30	1.89	-66.79
D. Agricultural Soils	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0.00
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	0.00
F. Field Burning of Agricultural Residues	1.19	1.30	1.15	1.30	1.50	0.91	1.61	1.29	-41.54
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**0.00**
A. Forest Land	NE	NE	NE	NE	NE	NE	NE	NE	0.00
B. Cropland	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	0.00
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	0.00
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	0.00
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Waste	**393.46**	**368.91**	**351.46**	**332.32**	**319.74**	**347.15**	**338.35**	**301.35**	**-49.40**
A. Solid Waste Disposal on Land	359.13	338.81	323.19	309.39	297.95	288.67	279.64	270.26	-46.77
B. Waste-water Handling	34.33	30.11	28.27	22.93	21.79	58.48	58.72	31.09	-64.61
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total CH_4 emissions including CH_4 from LULUCF	**606.83**	**571.19**	**557.54**	**510.63**	**507.98**	**539.76**	**534.37**	**488.55**	**-52.85**
Total CH_4 emissions excluding CH_4 from LULUCF	**606.83**	**571.19**	**557.54**	**510.63**	**507.98**	**539.76**	**534.37**	**488.55**	**-52.85**
Memo Items:									
International Bunkers	0.03	0.01	0.02	0.03	0.04	0.05	0.04	0.04	-38.55
Aviation	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-35.43
Marine	0.01	0.00	0.01	0.02	0.02	0.03	0.03	0.03	-40.08
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass									

Table A7.21 CRF Trend tables 10: N_20

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1988)	1989	1990	1991	1992	1993	1994	1995	1996	1997
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**1.64**	**1.62**	**1.41**	**1.16**	**1.16**	**1.16**	**1.13**	**1.20**	**1.19**	**1.20**
A. Fuel Combustion (Sectoral Approach)	1.64	1.62	1.41	1.16	1.16	1.16	1.13	1.20	1.19	1.20
1. Energy Industries	0.97	1.00	0.80	0.79	0.82	0.80	0.79	0.84	0.83	0.85
2. Manufacturing Industries and Construction	0.14	0.13	0.21	0.09	0.08	0.08	0.10	0.11	0.11	0.13
3. Transport	0.33	0.31	0.25	0.15	0.14	0.17	0.14	0.14	0.14	0.12
4. Other Sectors	0.16	0.15	0.10	0.07	0.08	0.07	0.06	0.06	0.08	0.07
5. Other	0.03	0.04	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04
B. Fugitive Emissions from Fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2. Oil and Natural Gas	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
2. Industrial Processes	**7.81**	**7.43**	**7.28**	**5.25**	**4.27**	**3.65**	**4.32**	**6.20**	**6.33**	**5.21**
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Chemical Industry	7.81	7.43	7.28	5.25	4.27	3.65	4.32	6.20	6.33	5.21
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Solvent and Other Product Use	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
4. Agriculture	**28.46**	**26.24**	**24.30**	**18.08**	**14.49**	**12.86**	**12.69**	**10.89**	**10.53**	**10.56**
A. Enteric Fermentation										
B. Manure Management	3.41	3.41	3.32	2.97	2.45	1.96	1.64	1.60	1.49	1.36
C. Rice Cultivation										
D. Agricultural Soils	25.00	22.77	20.93	15.06	12.01	10.88	11.02	9.27	9.02	9.18
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
F. Field Burning of Agricultural Residues	0.05	0.06	0.05	0.05	0.04	0.02	0.03	0.03	0.02	0.03
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5. Land Use, Land-Use Change and Forestry	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**
A. Forest Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
B. Cropland	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Waste	**1.00**	**0.96**	**0.72**	**0.65**	**0.65**	**0.62**	**0.59**	**0.54**	**0.52**	**0.46**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	1.00	0.96	0.72	0.65	0.65	0.62	0.59	0.54	0.52	0.46
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**38.91**	**36.25**	**33.71**	**25.14**	**20.57**	**18.29**	**18.73**	**18.83**	**18.57**	**17.43**
Total N_2O emissions excluding N_2O from LULUCF	**38.91**	**36.25**	**33.71**	**25.14**	**20.57**	**18.29**	**18.73**	**18.83**	**18.57**	**17.43**
Memo Items:										
International Bunkers	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**
Aviation	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass										

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
1. Energy	**1.17**	**1.07**	**1.10**	**1.18**	**1.13**	**1.24**	**1.23**	**1.23**	**-24.93**
A. Fuel Combustion (Sectoral Approach)	1.17	1.07	1.10	1.18	1.13	1.24	1.23	1.23	-24.93
1. Energy Industries	0.80	0.73	0.76	0.83	0.75	0.82	0.81	0.80	-18.20
2. Manufacturing Industries and Construction	0.09	0.07	0.07	0.07	0.07	0.08	0.07	0.06	-55.73
3. Transport	0.13	0.13	0.13	0.14	0.15	0.17	0.18	0.20	-37.28
4. Other Sectors	0.11	0.10	0.12	0.11	0.13	0.14	0.14	0.13	-15.51
5. Other	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	-12.81
B. Fugitive Emissions from Fuels	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	0.00
1. Solid Fuels	NA	NA	NA	NA,NE	NA	NA	NA	NA	0.00
2. Oil and Natural Gas	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	0.00
2. Industrial Processes	**3.12**	**2.36**	**4.24**	**4.18**	**3.51**	**3.74**	**2.77**	**3.20**	**-59.03**
A. Mineral Products	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
B. Chemical Industry	3.12	2.36	4.24	4.18	3.51	3.74	2.77	3.20	-59.03
C. Metal Production	NA	NA	NA	NA	NA	NA	NA	NA	0.00
D. Other Production									
E. Production of Halocarbons and SF_6									
F. Consumption of Halocarbons and SF_6									
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
3. Solvent and Other Product Use	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
4. Agriculture	**9.39**	**10.48**	**10.02**	**8.93**	**9.24**	**8.88**	**9.69**	**9.18**	**-67.74**
A. Enteric Fermentation									
B. Manure Management	1.46	1.51	1.38	1.03	1.19	1.27	1.26	1.19	-65.02
C. Rice Cultivation									
D. Agricultural Soils	7.91	8.95	8.61	7.88	8.03	7.59	8.40	7.96	-68.15
E. Prescribed Burning of Savannas	NA	NA	NA	NA	NA	NA	NA	NA	0.00
F. Field Burning of Agricultural Residues	0.02	0.03	0.02	0.02	0.03	0.02	0.03	0.02	-50.12
G. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
5. Land Use, Land-Use Change and Forestry	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**IE,NE,NO**	**0.00**
A. Forest Land	NE	NE	NE	NE	NE	NE	NE	NE	0.00
B. Cropland	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	IE,NE	0.00
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	0.00
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	0.00
F. Other Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	0.00
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	0.00
6. Waste	**0.52**	**0.53**	**0.50**	**0.48**	**0.49**	**0.49**	**0.48**	**0.47**	**-52.63**
A. Solid Waste Disposal on Land									
B. Waste-water Handling	0.52	0.53	0.50	0.48	0.49	0.49	0.48	0.47	-52.63
C. Waste Incineration	NO	NO	NO	NO	NO	NO	NO	NO	0.00
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**0.00**
Total N_2O emissions including N_2O from LULUCF	**14.20**	**14.44**	**15.87**	**14.77**	**14.37**	**14.34**	**14.17**	**14.08**	**-63.80**
Total N_2O emissions excluding N_2O from LULUCF	**14.20**	**14.44**	**15.87**	**14.77**	**14.37**	**14.34**	**14.17**	**14.08**	**-63.80**
Memo Items:									
International Bunkers	**0.03**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**-63.83**
Aviation	0.00	NO	NO	NO	NO	NO	NO	NO	0.00
Marine	0.03	0.00	0.01	0.01	0.01	0.01	0.01	0.01	-63.83
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	0.00
CO_2 Emissions from Biomass									

Table A7.22 CRF Trend tables 10: F-gases

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1988) (Gg)	1989 (Gg)	1990 (Gg)	1991 (Gg)	1992 (Gg)	1993 (Gg)	1994 (Gg)	1995 (Gg)	1996 (Gg)	1997 (Gg)
Emissions of HFCs(3) - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**2.95**	**109.30**	**188.15**
HFC-23	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-32	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-41	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-43-10mee	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-125	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	NA,NE,NO	NA,NE,NO
HFC-134	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-134a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	NA,NE,NO	NA,NE,NO
HFC-152a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-143	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-143a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	NA,NE,NO	NA,NE,NO
HFC-227ea	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-236fa	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
HFC-245ca	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
Unspecified mix of listed HFCs(4) - (Gg CO_2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
Emissions of PFCs(3) - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
CF_4	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
C_2F_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
C_3F_8	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
C_4F_{10}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
$c\text{-}C_4F_8$	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
C_5F_{12}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
C_6F_{14}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
Emissions of SF6(3) - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**1.26**	**1.31**	**1.75**
SF_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00	0.00	0.00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	%
Emissions of HFCs(3) - (Gg CO_2 equivalent)	**576.66**	**102.80**	**96.02**	**97.50**	**89.59**	**120.60**	**217.30**	**386.84**	**100.00**
HFC-23	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-32	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-41	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-43-10mee	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-125	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-134	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-134a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-152a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-143	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-143a	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-227ea	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-236fa	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
HFC-245ca	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
Unspecified mix of listed HFCs(4) - (Gg CO_2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
Emissions of PFCs(3) - (Gg CO_2 equivalent)	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**0.00**
CF_4	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
C_2F_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
C_3F_8	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
C_4F_{10}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
c-C_4F_8	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
C_5F_{12}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
C_6F_{14}	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
Unspecified mix of listed PFCs(4) - (Gg CO_2 equivalent)	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
Emissions of SF6(3) - (Gg CO_2 equivalent)	**1.83**	**1.88**	**2.23**	**2.29**	**2.51**	**2.52**	**3.68**	**4.42**	**100.00**
SF_6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Table A7.23 CRF Trend tables 10: Total trend

GREENHOUSE GAS EMISSIONS	Base year (1988)	1989	1990	1991	1992	1993	1994	1995	1996	1997
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
CO_2 emissions including net CO_2 from LULUCF	93,766.15	93,542.00	80,327.81	61,232.29	54,418.08	57,106.09	55,166.42	58,806.56	58,622.67	56,369.85
CO_2 emissions excluding net CO_2 from LULUCF	98,792.05	99,040.22	86,246.41	68,754.71	61,763.16	64,354.44	62,339.66	66,339.65	64,988.11	63,048.79
CH_4 emissions including CH_4 from LULUCF	21,759.09	21,544.01	19,914.64	18,522.12	17,319.13	15,968.89	15,014.60	14,920.60	14,243.59	13,269.29
CH_4 emissions excluding CH_4 from LULUCF	21,759.09	21,544.01	19,914.64	18,522.12	17,319.13	15,968.89	15,014.60	14,920.60	14,243.59	13,269.29
N_2O emissions including N_2O from LULUCF	12,061.44	11,238.96	10,449.56	7,792.69	6,376.52	5,670.62	5,805.07	5,837.85	5,756.72	5,404.32
N_2O emissions excluding N_2O from LULUCF	12,061.44	11,238.96	10,449.56	7,792.69	6,376.52	5,670.62	5,805.07	5,837.85	5,756.72	5,404.32
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	2.95	109.30	188.15
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
SF_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	1.26	1.31	1.75
Total (including LULUCF)	**127,586.68**	**126,324.97**	**110,692.01**	**87,547.10**	**78,113.73**	**78,745.60**	**75,986.10**	**79,569.22**	**78,733.59**	**75,233.35**
Total (excluding LULUCF)	**132,612.58**	**131,823.19**	**116,610.62**	**95,069.52**	**85,458.81**	**85,993.95**	**83,159.34**	**87,102.32**	**85,099.03**	**81,912.30**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year (1988)	1989	1990	1991	1992	1993	1994	1995	1996	1997
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)
1. Energy	94,666.41	94,763.21	81,465.34	65,770.25	59,673.50	62,163.45	59,091.21	61,974.36	60,772.53	59,044.40
2. Industrial Processes	10,569.76	10,637.95	9,892.52	7,070.61	5,933.30	5,856.81	7,086.92	8,963.05	8,921.96	8,224.28
3. Solvent and Other Product Use	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
4. Agriculture	14,559.02	13,778.43	12,953.23	10,528.85	8,524.76	7,150.11	6,591.20	5,935.33	5,696.14	5,590.83
5. Land Use, Land-Use Change and Forestry[(5)]	-5,025.90	-5,498.22	-5,918.61	-7,522.42	-7,345.08	-7,248.35	-7,173.24	-7,533.09	-6,365.44	-6,678.94
6. Waste	12,817.40	12,643.60	12,299.53	11,699.81	11,327.25	10,823.58	10,390.01	10,229.57	9,708.41	9,052.78
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)[(5)]	**127,586.68**	**126,324.97**	**110,692.01**	**87,547.10**	**78,113.73**	**78,745.60**	**75,986.10**	**79,569.22**	**78,733.59**	**75,233.35**

GREENHOUSE GAS EMISSIONS	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
CO_2 emissions including net CO_2 from LULUCF	48,468.12	43,855.36	41,564.90	42,875.35	41,016.46	46,796.04	45,089.12	36,941.13	-60.60
CO_2 emissions excluding net CO_2 from LULUCF	55,175.52	50,967.79	50,463.21	52,098.84	49,256.99	53,859.70	53,263.51	54,978.07	-44.35
CH_4 emissions including CH_4 from LULUCF	12,743.41	11,995.08	11,708.41	10,723.28	10,667.60	11,334.91	11,221.70	10,259.58	-52.85
CH_4 emissions excluding CH_4 from LULUCF	12,743.41	11,995.08	11,708.41	10,723.28	10,667.60	11,334.91	11,221.70	10,259.58	-52.85
N_2O emissions including N_2O from LULUCF	4,402.16	4,475.99	4,918.47	4,577.45	4,453.71	4,446.11	4,393.70	4,365.96	-63.80
N_2O emissions excluding N_2O from LULUCF	4,402.16	4,475.99	4,918.47	4,577.45	4,453.71	4,446.11	4,393.70	4,365.96	-63.80
HFCs	576.66	102.80	96.02	97.50	89.59	120.60	217.30	386.84	100.00
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
SF_6	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42	100.00
Total (including LULUCF)	**66,192.18**	**60,431.11**	**58,290.03**	**58,275.88**	**56,229.87**	**62,700.17**	**60,925.49**	**51,957.93**	**-59.28**
Total (excluding LULUCF)	**72,899.57**	**67,543.54**	**67,188.34**	**67,499.36**	**64,470.39**	**69,763.83**	**69,099.89**	**69,994.88**	**-47.22**

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1998	1999	2000	2001	2002	2003	2004	2005	Change from base to latest reported year
	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	CO_2 equivalent (Gg)	(%)
1. Energy	53,616.87	48,852.40	48,177.61	49,772.72	47,328.45	51,469.40	50,661.88	52,186.31	-44.87
2. Industrial Processes	5,550.88	5,113.46	6,080.35	6,058.90	5,417.61	6,020.50	6,101.58	6,529.09	-38.23
3. Solvent and Other Product Use	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	0.00
4. Agriculture	5,309.36	5,666.09	5,394.07	4,540.66	4,859.32	4,832.73	5,081.04	4,804.03	-67.00
5. Land Use, Land-Use Change and Forestry[(5)]	-6,707.39	-7,112.43	-8,898.30	-9,223.48	-8,240.53	-7,063.65	-8,174.39	-18,036.94	258.88
6. Waste	8,422.46	7,911.58	7,536.31	7,127.08	6,865.01	7,441.20	7,255.39	6,475.45	-49.48
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	0.00
Total (including LULUCF)[(5)]	**66,192.18**	**60,431.11**	**58,290.03**	**58,275.88**	**56,229.87**	**62,700.17**	**60,925.49**	**51,957.93**	**-59.28**