REPUBLIC OF BULGARIA
MINISTRY OF ENVIRONMENT AND WATER
EXECUTIVE ENVIRONMENT AGENCY

NATIONAL INVENTORY REPORT 2009

For Greenhouse Gas Emissions

Submission under the UNFCCC and the Kyoto Protocol

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Reporting Entity

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LIST OF ABBREVIATIONS

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
ExEA	Executive Environment Agency
EPA	Environmental Protection Act
EUROSTAT	European Statistical Organization
FAO	Food and Agriculture Organization
GHG	Greenhouse Gas (Gases)
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
MAFS	Ministry of Agriculture and Food Supply
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 Communication
NFPS	National Forest Policy and Strategy
NIR	National Inventory Report
NMVOCs	Non-Methane Volatile Organic Compounds
NO_x	Nitrogen oxides
NPP	Nuclear Power Plant
NSI	National Statistical Institute
OECD	Organization for Economic Cooperation and Development
PFC	Perfluorocarbons
QA/QC	Quality Assurance/Quality Control
QMS	Quality Management System
RA	Reference Approach
RCD	Road Control Department
SA	Sectoral Approach
SBSTA	Subsidiary Body for Scientific and Technological Advice
SFA	State Forestry Agency
SF_6	Sulphur hexafluoride
SO_x	Sulphur oxides
SWDS	Solid Waste Disposal Site
TPP	Thermal Power Plant
UNFCCC	UN Framework Convention on Climate Change

EXECUTIVE SUMMARY

Bulgaria ratified the UNFCCC in March 1995 and the KP in August 2002 taking the commitment to reduce its national GHG emissions for the first commitment period (2008-2012) by 8% compared to 1988 (base year).

As an Annex I Party to the Convention Bulgaria reports annually its GHG inventory/emissions from the base year to the year preceding the year of reporting.

The inventories are prepared according to the UNFCCC Guidelines, adopted at the 21st session of the SBSTA (December 2004, Buenos Aires) and establishing the NIR structure in compliance with the Revised IPCC Guidelines from 1996 and the IPCC Good Practice Guidance (for National GHG Inventories) from 2000.

The national reporting obligations to the UNFCCC, UNECE and EC are administered by the MoEW.

Since 2007 the National System for GHG inventories is in accordance with the requirements of Article 5, paragraph 1 from the KP and the Marrakech Accord (respectively, Decision 20/CP.7).

The System's legal basis is provided by the Environmental Protection Act that establishes the National Environmental Monitoring System and lists all of its tasks.

The Single Entity responsible for the preparation of National GHG inventories is ExEA.

The ExEA coordinates the data collection from NSI, RCD, MAFS, MEE, MoEW, SFA and their relevant services, as well as from plant operators and aggregates on a national level the data relevant for GHG emissions.

The annual national energy and material balances as well as the data related to the solid waste generation and the wastewater discharges are prepared by NSI.

NSI uses up-to-date statistical methods and procedures for data collection, summarizing and structuring that are harmonized with EUROSTAT.

The Report presents the National GHG inventory for 2007.

GHG emissions (of CO_2, CH_4, N_2O, HFC, PFC and SF_6) and trends for 1988-2007 for all IPCC source categories are presented and key source categories are identified both excluding and including emissions and removals from LULUCF (Annex 1).

The NIR starts with **Chapter 1** Introduction, which includes general information on the process of elaboration of the GHG inventories 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 and the applied QA/QC system.

Chapter 2 analyzes the GHG trends by sources/gases type.

Chapters 3–9 provide information in detail on the GHG emissions from the different activity sectors.

The final **Chapter 10** presents information and results from GHG emissions recalculations done for the period 1988-2006.

The seven annexes to the Report provide additional assessment of the used data and the achieved results.

Activity data and emission tables for 1988-2007 in the Common Reporting Format (CRF) for annual GHG inventories are submitted together with the Report and are uploaded on http://nfp-bg.eionet.eu.int/ncesd/bul/UNFCCC/2002/home.html (the web page of ExEA).

CHAPTER 1 INTRODUCTION

The Republic of Bulgaria joined the UNFCCC in 1992 and the Parliament ratified it 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 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

The inventories are prepared according to the UNFCCC Guidelines, adopted at the 21st session of the SBSTA (December 2004, Buenos Aires) and establishing the NIR structure in compliance with the Revised IPCC Guidelines from 1996 and the IPCC Good Practice Guidance (for National GHG Inventories) from 2000.

The general objective regarding the preparation of the annual GHG inventories is to improve „TACCC" in emission estimates:

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

The Report presents the National GHG inventory for 2007. 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 method of the type Tier 1, specified in the Good Practice Guidance;

3. Assessment of the quality assurance and control system.

Activity data and emission tables for 1988-2007 in the Common Reporting Format (CRF) for annual GHG inventories are submitted together with the Report and are uploaded on http://nfp-bg.eionet.eu.int/ncesd/bul/UNFCCC/2002/home.html (the web page of ExEA).

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 (21), nitrous oxide (310) and carbon dioxide (1).

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 NIR only the total GHG emissions – precursors, as well as the total SOx emissions were reported.

1.1.2. UNFCCC and the Kyoto Protocol

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).

The Kyoto Protocol (KP) is adopted at the III^{-rd} Session of the Conference of the Parties to the Convention (December 1997, Kyoto). KP is ratified by Bulgaria in August 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 GHG emissions, but also to reduce them by percentage, defined with respect to the base year of each Party. Bulgaria took the commitment to reduce its national GHG emissions for the first commitment period (2008-2012) by 8% compared to 1988 (base year).

1.1.3. Requirements to the Reports: UNFCCC and KP

As an Annex I Party to the Convention Bulgaria reports annually its GHG inventory/emissions from the base year to the year preceding the year of reporting.

Annex I Parties to the KP should report also additional elements as assigned amount information, changes in national system, changes in national registry and voluntary

submission of information relating to activities under Articles 3, paragraphs 3 and 4, of the Kyoto Protocol.

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 IVth 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 GHG emissions' calculations, the Revised 1996 IPCC Guidelines, the IPCC Good Practice Guidance, 2000 and Good Practice Guidance for LULUCF should be used in general.

The tables of the CRF and the NIR are the two main documents, which report the annual consecutive inventories to UNFCCC Secretariat. 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 methodology 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.

1.1.5. Organization of the National Inventory Report

The organization of the inventory report of Bulgaria for 2007 and the corresponding National report have been improved compared to the preceding NIR 2006, as follows:

- In sector Agriculture were recalculated emissions of N_2O during the whole time-series;
- In sector Waste was made change of emission factor in subsector Wastewater treatment, which was introduced in chapter "Recalculations" of this report.

1.2. A description of the Institutional Arrangement for Inventory Preparation

The national reporting obligations to the UNFCCC, UNECE and EC are administered by the MoEW.

The Single Entity responsible for the preparation of National GHG inventories is ExEA.

Legal basis of the Bulgarian National Inventory System

Since 2007 the National System for GHG inventories is in accordance with the requirements of Article 5, paragraph 1 from the KP and the Marrakech Accord (respectively, Decision 20/CP.7).

The legal basis for the Bulgarian National System for GHG inventories is provided in the **Environmental Protection Act** /EPA/ (State Gazette №91/2002) and in particular by the provisions of it's Chapter 8, which establishes the National Environmental Monitoring System and lists all of its tasks.

To ensure the effective and timely functioning of the National System for GHG inventories, as well as complete reporting under the UNFCCC and the Convention of Long-Range Transboundary Air Pollution (CLRTAP), the Minister of Environment and Water has issued the **Order № RD-54/25.01.2007**, based on the EPA, which regulate in detail the institutional, legal and procedural arrangements and responsibilities for inventory preparation under the Secretariats of UNFCCC and CLRTAP.

In additional, on the basis of Article 4 from the Council of Ministers Regulation on the organization of activities with regard to preparation and presentation of reports to the European Commission on the implementation of the legislative acts, which are part from the European Community legislation in the field of environmental protection (State Gazette №43/2007), as well in accordance with Chapter III.2 of the above mentioned Order, is established an **Order № RD-377/08.06.2007** by the Minister of Environment and Water, which determines the following:

1. Procedures and requirements for reporting to the European Commission and the European Environment Agency;
2. Timely performance of all activities concerning the preparation of national greenhouse gas inventory and relevant national report, according to:
   2.1. Decision №280/2004/EC of the European Parliament and the Council of 11 February 2004 concerning a mechanism for the monitoring of Community greenhouse gas emissions and for implementing the Kyoto Protocol and;

2.2. Commission Decision of 10 February 2005 laying down rules for the implementation of Decision №280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol (166/2005/EC).

Besides the EPA there are other legal and institutional arrangements and agreements in place as basis for the National System of GHG inventories:

- **National Statistics Act** - according to it the National Statistical Institute (NSI) has to prepare annually national material and energy balances, which are the data basis for calculating the GHG emissions from sectors Energy and Industrial Processes. NSI has a number of **internal regulations**, which determine the responsibilities of its departments, including their responsibilities with regard to data quality control.
- The National Statistical Institute has an **official agreement (RD21-25/30.01.2003)** with the Ministry of Environment and Water on provision and exchange of statistical and environmental information. Based on this Agreement the ExEA has the possibility to obtain confidential data from NSI for its reporting obligations. In addition, the National Statistics Act allows NSI to provide confidential data to authorities (MoEW, ExEA etc.) that have a legal obligation for the (confidential) processing of these data.

In consequence of the above mentioned orders, all institutional and procedural options of Bulgarian National System of Greenhouse Gas Inventory are determined, ensuring the effective functioning in accordance with the requirements of Article 5.1 of the Kyoto Protocol, as well as the relevant requirement of EU.

National Registry

Bulgaria as an Annex 1 Party to the KP has to establish and maintain a national registry, as one of the eligibility criteria for using the flexible mechanisms of the KP. The purpose of the registry is to ensure accurate accounting of the issuance, holding, transfer, acquisition, cancellation and retirement of ERUs, CERs, AAUs and RMUs and the carry-over of ERUs, CERs and AAUs.

Bulgaria started to set up the national registry, complying with the basic registry requirements as well as the registry is in compliance with the requirements for the EU ETS registries as elaborated by the European Commission and presented in the Commission Regulation №2216/2004/EC for a standardized and secured system of registries pursuant to Directive 2003/87/EC and Decision 280/2004/EC.

The GRETA registry system used in Bulgaria has been developed for the EU Emissions Trading Scheme. This scheme requires its Member States registries to be compliant with the UN Data Exchange Standards specified for the KP.

National Registry has successfully connected the ITL (Independent Transaction Log) during the go-live test from 07 October to 16 October 2008. Registry is live and connected to the ITL-CITL since 16 October 2008 - both system (CITL and ITL) are online.

BG Registry is using Version 3.0 build 84 (CITL-ITL-BG Registry) in production environment of Greta software and digital certificates have installed.

Bulgarian Register successfully performs the following steps:

- Successfully passing the tests by connecting links at European level.
- European Commission sent report confirming successful connection to the European record and approved plan for 2007 based on verified emissions mentioned in the reports of the operators.
- National Registry successfully passed connectivity testing-successfully VPN and SSL tests.
- Open 132 operator accounts of each of the installations for which they are allocated emissions quotas under the national allocation plan for 2007 and laid down in Regulation № 2216/2004 of the European Commission.
- Proposed and approve all verifying emissions of all installations involved in the scheme for trading greenhouse gases.

1.2.1. Data Sources for GHG Inventory

The ExEA coordinates the data collection from NSI, RCD, MAFS, MEE, MoEW, SFA and their relevant services, as well as from plant operators and aggregates on a national level the data relevant for GHG emissions.

The annual national energy and material balances as well as the data related to the solid waste generation and the wastewater discharges are prepared by NSI. The major part of the calculations on the national inventory under the CORINAIR methodology is prepared in NSI also.

NSI uses up-to-date statistical methods and procedures for data collection, summarizing and structuring that are harmonized with EUROSTAT.

The GHG inventory used data, received directly from large GHG emissions sources in the energy sector and the industry and this data is summarized by ExEA.

1.2.2. National Inventory Report and CRF Tables

MoEW is responsible to the UNFCCC for the annual GHG inventory submission. The Ministry organizes preparation of the inventory. ExEA prepares all activities, related to the calculations of GHG emissions, drawing up and structuring of the results and analyses in the NIR.

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.

1.4. Brief General Description of Methodologies and Data Sources Used

The GHG inventory for the year 2007 was carried out in compliance with the Revised 1996 IPCC Guidelines, at closer abidance to the Good Practice Guidance, 2000 recommendations.

The basic source for emission factors for current inventory was again the local practice, the Revised 1996 IPCC Guidelines and the Good Practice Guidance, 2000. Some data is used from the CORINAIR methodology.

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.

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

Methods applied

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;

CR – by CORINAIR;

CS – country-specific.

Table 1.1 CRF Summary table 3 with methods and emission factors applied

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	**D**	**CS**			**D**	**CS**
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**

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 1996 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

Bulgaria reports on CO_2 sequestration from 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 some of these areas are reported in the new LULUCF common table format.

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 by standard emission factors, specified in IPCC Guidance.

CH_4 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.

CH_4 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 ensuring long enough historical series of values of the time series for disposed household solid waste.

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 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 HFCs, PFCs 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 1995-2007.

Original Data Sources for the Inventory

The original data sources on GHG emissions are as follows:

- data on used fuels - general energy balance of Bulgaria, prepared by NSI;

- data on consumed households biomass - MAFS 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 MoEW; reports of factory power-plants to companies;

- number of farming animals and plant crops - "Agrostatistics" Department within MAFS;

- quantity of used synthetic fertilizers - National Service for Plant Protection, Quarantine and Agro chemistry within MAF;

- land-use change and forestry - State Forestry Agency;

- disposal of solid waste and quantity of waste water - "Environment" 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 MAFS.

1.5. Brief Description of Key Categories

The identification of key source categories is described in the IPCC Good Practice Guidance, 2000, Chapter 7. A key source category is one that is prioritised within the National System because its estimate has a significant influence on a country's total inventory of greenhouse gases in terms of the absolute level of emissions, the trend in emissions, or both.

The identification includes all reported greenhouse gases CO_2, CH_4, N_2O, HFC, PFC and SF_6, and all IPCC source categories. The results of a key category analysis excluding and including emissions and removals from LULUCF are presented in Annex 1.

The presented key source analysis was performed with data for greenhouse gas emissions of the submission 2009 to the UNFCCC and comprises a level assessment for the years between 1988 and 2007 and a trend assessment for the trend of the year 2007 with respect to base year emissions.

The identified key source categories are presented in Table 1.2

Table 1.2 Key source categories 2007

IPCC Source Categories		Gas	Emissions 2007 Gg CO_2 - eq.	Share in National Total Emissions 2007
1A1.A	Public Electricity and Heat Production - Solid fuels	CO_2	28981.39	38.28%
6A	Solid Waste Disposal on Land	CH_4	6674.48	47.09%
1A2	Manufacturing Industries and Construction - Solid fuels	CO_2	4352.23	52.84%
1A3b	Road Transportation - Diesel Oil	CO_2	4261.96	58.47%
1A2	Manufacturing Industries and Construction - Gaseous fuels	CO_2	3229.55	62.73%
1A2	Manufacturing Industries and Construction - Liquid fuels	CO_2	3200.37	66.96%
1A1.A	Public Electricity and Heat Production - Gaseous fuels	CO_2	1910.55	69.48%
2A1	Cement Production	CO_2	1896.98	71.99%
1A3b	Road Transportation - Gasoline	CO_2	1892.96	74.49%
2C1	Iron and Steel Production	CO_2	1440.06	76.39%
4D1	Direct soil emissions	N_2O	1346.40	78.17%
2B2	Nitric Acid Production	N_2O	1324.01	79.92%
1B1	Fugitive Emissions from Fuels - Solid Fuels	CH_4	1306.19	81.64%
1A3b	Road Transportation - LPG	CO_2	1142.98	83.15%
2A2	Lime Production	CO_2	1061.47	84.55%
1A4b	Residential - Solid fuels	CO_2	946.75	85.80%
4D3	Indirect Emissions	N_2O	915.46	87.01%
4A1	Enteric Fermentation - Cattle	CH_4	903.52	88.21%
6B	Waste Water Handling	CH_4	838.97	89.32%
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO_2	777.96	90.34%
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuels	CO_2	706.60	91.28%

1A3e	Other Transportation - Liquid fuels	CO_2	687.32	92.18%
1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	636.88	93.02%
2B1	Ammonia Production	CO_2	532.10	93.73%
4D2	Pasture, Range and Paddock Manure	N_2O	492.19	94.38%
4B	N2O emission from Manure Management	N_2O	357.26	94.85%
1A1	Energy Industries	N_2O	286.11	95.23%
4A.3	Enteric Fermentation - Sheep	CH_4	265.59	95.58%
2F	ODS substitutes	HFCs	246.61	95.90%
1A1.A	Public Electricity and Heat Production - Liquid fuels	CO_2	210.94	96.18%
4B.8	Manure Management - Swine	CH_4	198.55	96.71%
6B	Waste Water Handling	N_2O	144.44	97.98%
1A3a	Civil Aviation - Liquid fuels	CO_2	133.15	98.34%
1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO_2	88.37	98.61%
1A4b	Residential - Liquid fuels	CO_2	69.30	98.91%
1A4a	Commercial/Institutional - Solid fuels	CO_2	13.69	99.88%
1A3d	Navigation - Liquid fuels	CO_2	0.00	100.00%

The key category with the highest contribution to national total emissions is 1A1a Public Electricity and Heat Production - Solid fuels (CO_2). It ranked 1 in all level assessments and number 1 in trend assessment in 2007.

The second most important source for greenhouse gas emissions in Bulgaria is 6A Solid Waste Disposal on Land (CH_4) and the third most important source in terms of its contribution to national total emissions is 1A2 Manufacturing Industries and Construction - Solid fuels (CO_2).

Table 1.3 Key categories based on the emission and removal data submitted in 2007

IPCC Source Categories		Gas	Emissions 2007 Gg CO_2 - eq.
5A1	Forest Land remaining Forest Land	CO_2	-6 993
5B1	Cropland remaining Cropland	CO_2	-412
5D1	Wetlands remaining Wetlands	CO_2	603

The key category with the highest contribution to national removals is 5A1 Forest Land remaining Forest Land.

The method used to identify key source categories follows the Tier 1 method – quantitative approach describe in the Good Practice Guideline, 2000, Chapter 7 Methodological Choice and Recalculation.

Key categories were first identified for the inventory excluding LULUCF and then the key category analysis was repeated for the full inventory including LULUCF categories. The identification of key categories consists of five steps:

- Identifying categories
- Level Assessment excluding LULUCF
- Trend Assessment excluding LULUCF
- Level Assessment including LULUCF

- Trend Assessment including LULUCF

Results of applying the method Tier 1 are given on the Annex 1 of this report.

1.6. Quality assurance and quality control (QA/QC)

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, QA/QC procedures within NSI have been harmonized with the relevant instructions and provisions of EUROSTAT.

Some of the large enterprises – GHG emission sources, have arranged 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

According to the IPCC GPG, 2000 the QA/QC system that was implemented for GHG inventories consists of several elements:

(1) Inventory agency responsible for coordinated QA/QC activities;

(2) QA/QC Plan;

(3) General QC procedures (Tier 1);

(4) Source category-specific QC procedures (Tier 2);

(5) QA review;

(6) Reporting, documentation and archiving.

Bulgaria's reporting obligations to the UNFCCC and EC are being administered by the MoEW. The ExEA has been identified as the single national entity with the overall responsibility for preparation of Bulgaria's National GHG Inventory and relevant NIR.

The QA/QC plan is a fundamental element of a QA/QC system. The plan outline QA/QC activities that are implemented and include a scheduled time frame that follows inventory preparation from its initial development through to final reporting in any year. It contains an outline of the processes and schedules to review all source categories.

The QA/QC plan is an internal document to organise, plan and implement QA/QC activities. Once developed, it is referenced and used in subsequent inventory preparation, or modified as appropriate.

The preparation of the inventory includes the three main stages: planning, preparation and management.

I. Inventory planning

Every reporting year begin with the following discussions and activities:

- to determine of the sector experts;
- to notice the objectives, activities and improvements;
- to prepare a timetable with the relevant deadlines according submission under Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the KP and submission under UNFCCC.

When planning the particular inventory the following documents are taken into account with regard to potential inventory improvements:

- Inventory Improvement Plan for the relevant reported year
- Recommendations of UNFCCC (reviews)
- Other recommendations
- Research
- Plan operators and industrial associations recommendations and/or remarks

Inventory improvements are implemented before the inventory is compiled.

II. QA/QC Activities

The QA/QC Manager performs the following general activities:

- Prepare the QA/QC plan for the current inventory/year and manage its implementation;
- Follow-up and understanding of the QA/QC Procedures and the content of the IPCC Good Practice Guidance (Chapter 8, Quality Assurance and Quality Control);
- Check whether spreadsheets for each source category follow these procedures; both general procedures and specific checks are indicated below;
- Document the findings and results of the checks, by completing the Tier 1 checklist and Attendant File (AF), including the summaries of results and problems to be corrected. Thus, providing the potential for improvements in the inventory and lightening the work of developers of next inventory;
- Take any corrective action as needed, documenting (in the appropriate place on the Tier 1 checklist and AF) the actions taken and the results.
- Placing of all relevant documentation (including the final completed checklist and AF) in the project file (with copies given to the responsible agencies). Also preparing the draft AF for the next inventory.

III. Quality Control Procedures

The quality control procedures were followed both to control and to check the quality of the inventory estimates and the Inventory Report, and to manage and handle the data associated with the inventory.

Quality Control, as defined by the Intergovernmental Panel on Climate Change (IPCC) in its IPCC Good Practice Guidance is a system of routine technical activities to measure and control the quality of the inventory as it is being developed. A basic QC system provides routine and consistent checks to ensure data integrity, correctness, and completeness, and to identify and address errors and omissions. It also provides procedures for documenting and archiving inventory material and recording all QC activities.

Following the definitions developed for the IPCC Good Practice Guidance, general procedures (Tier 1) that all source categories follow when gathering, maintaining, handling, documenting, checking and archiving the data, supporting documents, and files (both text documents and spreadsheets) are associated with the inventory.

While procedures for maintaining data quality were followed at all times, not all checks need to be performed always when the inventory is modified. Some activities were conducted every time (e.g., reviewing electronic data quality checks or inspecting files for completeness) or at least routinely (e.g., checking that all primary data points in the spreadsheet have citations to references). Some checks need to be performed thoroughly once (e.g., checking the entire content of the archives for completeness and consistency) and then only occasionally thereafter. Other procedures or checks were triggered by changes that occur (e.g., changes in assumptions or in the calculation methodology).

1. Data Gathering, Input, and Handling

A number of common procedures governed the collection, maintenance, and use of electronic and transcribed data for all activity data, emission factors, and other primary data elements. Appropriate procedures minimized the extent to which errors in data collection occur; various checks on the data and files can further reduce the errors that occur.

Procedures for the Inventory Team to follow include:

- Electronic data were used to minimize transcription errors;
- Spreadsheet features were used to minimize user error or entry error;
- If identical data are used by different source categories;
- The same electronic data file were used by these source categories;
- It is useful to build in computerized and automated quality checks to highlight possible problems;
- Data flagged as confidential information were password protected in the spreadsheets.

The QA/QC staff (and inventory staff) performed various hand checks to minimize data input errors. Checks included the following:

- Check for transcription errors among a representative sample of input data by cross-checking data against original source, among a sample of parameters used in calculations, activity data, or emission factors;
- Inspect possible problems highlighted by automated checks. Automated systems should also be reviewed periodically to ensure that they are functioning properly.

2. Data Documentation

Documentation of the inventory is sufficiently detailed and clear as to allow an independent but knowledgeable analyst to obtain and review the references used and reproduce the emission estimates. Complete and accessible documentation of methods, spreadsheets, data and data sources is important.

2.1 Maintaining Files for whole inventory

The Inventory Team Leader (ITL) maintained a complete and separate file for whole inventory. The intent is that this file includes all the materials and the analyst needs to develop the inventory for the relevant year. The most important is that the files should

be maintained in a transparent manner. The ITL have considerable discretion over the form and content of the file (files).

A file is maintained for the current inventory and includes all relevant information. The file contains a list of the names and locations of all "working" spreadsheets, with explanations of links among them, and any recent electronic back-up copies of working drafts of the spreadsheets. It also contains results of check/review with all necessary contact information, copies of reference materials or data. Copies of hand calculations or notes made by the inventory staff, appropriately documented, are placed in the file. In addition, copies of the checklist completed for QA/QC purposes, together with the attendant file, are placed in the file.

The QA/QC Manager checks the files for completeness as part of Tier 1 quality control activities. Completed checks are reported on the QA/QC checklist.

2.2 Documenting the Inventory Spreadsheets and the Inventory Report

The inventory staff ensured that the documentation associated with the inventory is sufficient for an independent analyst to determine the reference source for each piece of data used to calculate emissions, and to locate the data in the inventory archives. The documentation also provided complete information on any changes that are made to data sources or methodological changes that occur in a given inventory. Both the inventory spreadsheets and the Inventory Report itself are subject to scrutiny to determine that the references are complete, accurate, and consistent in format. Both the inventory staff and especially QA/QC Manager are familiar with the following procedures, which are designed to maintain high quality.

In the spreadsheets, every primary data element (activity data, emission factor, etc.) must have a reference for the source of the data. No non-calculated values should appear in the spreadsheets that are not referenced, with the exception of standard unit conversion factors or similar information.

Everything - supporting documentation, comments, and especially all printouts made from spreadsheets - are dated.

The inventory team and QA/QC Manager perform various checks to verify the adequacy of the documentation of the spreadsheet.

2.3 General documentation of references

To the extent feasible, effort is made to ensure the documentation follows a uniform format across the inventory spreadsheets.

Individuals, agency, institution, or company providing information are identified by full name, association, phone and fax numbers, and the date information was provided and to whom. Complete bibliographical information is provided in references.

3. Calculating Emissions and Checking Calculations

The Inventory leader adopts appropriate procedures for designing and modifying spreadsheets, in order to reduce calculation errors occurring in the emission estimates. A number of checks ensure that appropriate procedures have been followed, as well as catch remaining errors. Checks include the following.

- Parameters, emission units and conversion factors for calculations are clearly labelled and referenced.
- Emission units, parameters, and conversion factors should not be hardwired into formulas; any value used more than once should be included in the spreadsheet (preferably at the head of the page where it first appears and highlighted) and every calculation using that value should reference that cell.
- Maintain the integrity of the database files and spreadsheets:
    - ✓ Confirm that the appropriate data processing steps are correctly represented in the spreadsheets (that the equations are correct).
    - ✓ Confirm that data relationships are correctly represented in the spreadsheets
    - ✓ Clearly differentiate between spreadsheet input data and calculated data.
- Check calculations within a source category:
    - ✓ Reproduce a representative sample of emission calculations to ensure mathematical correctness.
    - ✓ Build in automated checks, such as computational checks for calculations, or range checks for input data.
- Check that emissions data are correctly (1) aggregated from lower reporting levels to higher reporting levels when preparing summaries and (2) transcribed between different intermediate products.
- Check for temporal consistency in time series input data for each source category and check the method used to fill in gaps in reported data, if possible.
- Check for consistency in the algorithm/method used for calculations through the time series, if possible.
- Check that changes in methods or data are consistent with IPCC guidance on both inventory methods and good practices.

4. Coordination on Cross Cutting Activities

It is critical that the QA/QC Manager follows procedures that are designed to reduce errors not only in the inventory estimates for individual source categories, but in the aggregated estimates that are reported, and in the Inventory Report and other documents that report the results of the inventory.

Some checks are performed for the overall inventory, or require checking data across source categories:

- Checking emission calculations across source categories;
- Check that internal documentation is comparable across source categories, (check that spreadsheets and references are consistently documented and procedures are consistently applied).
- Completeness:
    - ✓ Confirm that estimates are reported for all source categories.

- ✓ Check that known data gaps that result in incomplete source category emission estimates are documented. Gaps resulting from the use of preliminary data, missing data, or proxy data should be documented in cell comments in the spreadsheet.

- Current inventory estimates are compared to previous estimates. If there are significant changes or departure from expected trends, re-check estimates and explain any differences.

5. Quality Assurance Procedures

Quality Assurance, as defined in the IPCC Good Practice Guidance, comprises a "planned system of review procedures conducted by personnel not directly involved in the inventory compilation and development process." The quality assurance process includes both expert review and a general public review.

The expert review was conducted in two stages: a review of the initial set of draft emission estimates and, subsequently, a review of the estimates and text of the Inventory Report. In addition, experts are consulted and involved throughout the development of the inventory estimates, providing further review and opportunities for evaluation and assessment of the inventory methodologies and data. The ultimate goal of these expert reviews is to provide an objective review of the inventory in order to ensure that the final inventory estimates and Inventory Report reflect sound technical information and analysis.

The expert review present opportunity to uncover technical issues related to the application of methodologies, selection of activity data, or the development and choice of emission factors. The comments received during these processes are reviewed and, as appropriate, incorporated into the Inventory Report or reflected in the inventory estimates.

6. Internal Quality Audits for Tier 1

In perspective, an audit system will be developed to provide additional QA measures. One approach to auditing is to conduct periodic audits, using internal or external personnel, but excluding the analyst involved in a particular source category. Analysts from other source categories could be used to conduct these audits.

Several types of activities could be conducted during an audit, including duplicating/repeating all the QC procedures, checking the qualifications of staff involved in inventory preparation, checking procedures for project file maintenance, reviewing organizational functions and knowledge of procedures, etc.

IV. Inventory management (data archiving)

For the inventory management a reliable, user-friendly and effective data management to fulfill the data collecting and reporting requirements is needed.

The data was stored in a central network server, which is backed up **daily** for the needs of data security. Furthermore, as part of the QMS, backups of the entire inventory information are made **twice** a year on write-protected DVDs. The inventory management, as part of the QMS, includes a control system for all documents and data, for records and their archives as well as documentation on QA/QC activities.

This ensures the necessary documentation and archiving for future reconstruction of the inventory and for the timely response to requests during the review process.

Within the inventory system, a system for transparent documentation of inventory data and information that allows reproduction of inventory has to be implemented. This documentation is at this stage the National Inventory Report (NIR). To allow clear references in documentation of inventory, an archiving system for literature, mails, documents, calculations, two excel sheets are needed: *Archiv_Inventory.xls* and *Archiv_mails.xls*

The archived documents were stored on server and in inventory archive (paper).

For each sector the documentation includes: Description; Information on completeness; Methodology; References for activity data, emission factor and emissions; Uncertainty; Recalculations; Planned improvements.

1.7. General Uncertainty Evaluation

As a whole, the uncertainty assessment of the GHG inventories follows the methodology of Good Practice Guidance, Chapter 6.

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 2007 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 1.4**.

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.

Table 1.4 Uncertainty calculation and reporting (level assessment), %

IPCC Source category	Gas	Activity data uncertainty	Emission factor uncertainty
Solvent and Other Product Use	CO_2	10	30
Solvent and Other Product Use	N_2O	100	0
Energy Industries	CH_4	5	50
Energy Industries	N_2O	5	200
Public Electricity and Heat Production - Gaseous fuels	CO_2	5	5
Public Electricity and Heat Production - Liquid fuels	CO_2	5	5
Public Electricity and Heat Production - Solid fuels	CO_2	5	7
Petroleum Refining - Gaseous fuels	CO_2	5	5
Petroleum Refining - Liquid fuels	CO_2	5	5
Manufacture of Solid Fuels and Other Energy Industries - Gaseous Fuels	CO_2	5	5
Manufacture of Solid Fuels and Other Energy Industries - Liquid Fuels	CO_2	5	5
Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO_2	5	7
Manufacturing Industries and Construction - Gaseous Fuels	CO_2	5	5
Manufacturing Industries and Construction - Liquid Fuels	CO_2	5	5
Manufacturing Industries and Construction - Solid Fuels	CO_2	5	7
Manufacturing Industries and Construction	CH_4	5	50
Manufacturing Industries and Construction	N_2O	5	200
Civil Aviation - Liquid Fuels	CO_2	5	5
Civil Aviation - Liquid Fuels	CH_4	3	40
Civil Aviation - Liquid Fuels	N_2O	3	40
Road Transportation - Diesel Oil	CO_2	3	5
Road Transportation - Gasoline	CO_2	3	5
Road Transportation - Liquid Fuels	CH_4	3	40
Road Transportation - Liquid Fuels	N_2O	3	40
Road Transportation - LPG	CO_2	3	5
Railways - liquid fuels	CO_2	5	5
Railways - liquid fuels	CH_4	5	100
Railways - liquid fuels	N_2O	5	150
Navigation - Liquid Fuels	CO_2	50	5

Navigation - Liquid Fuels	CH_4	50	50
Navigation - Liquid Fuels	N_2O	50	100
Other Transportation - Liquid Fuels	CO_2	5	5
Other Transportation - Liquid Fuels	CH_4	5	100
Other Transportation - Liquid Fuels	N_2O	5	150
Other sectors	CH_4	5	50
Other sectors	N_2O	5	200
Commercial/Institutional - Gaseous Fuels	CO_2	5	5
Commercial/Institutional - Liquid Fuels	CO_2	5	5
Commercial/Institutional - Solid Fuels	CO_2	5	7
Residential - Liquid Fuels	CO_2	5	5
Residential - Solid Fuels	CO_2	5	7
Residential - Gaseous Fuels	CO_2	5	5
Agriculture/Forestry/Fisheries - Gaseous Fuels	CO_2	5	5
Agriculture/Forestry/Fisheries - Liquid Fuels	CO_2	5	7
Agriculture/Forestry/Fisheries - Solid Fuels	CO_2	5	20
Stationary - Biomass	CH_4	5	20
Stationary - Biomass	N_2O	5	5
Stationary	CO_2	10	200
Fugitive Emissions from Fuels - Solid Fuels	CH_4	5	50
Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	3	30
Cement Production	CO_2	5	15
Lime Production	CO_2	5	15
Limestone and Dolomite Use	CO_2	5	20
Soda Ash Production and Use	CO_2	5	20
Other	CO_2	5	20
Ammonia Production	CO_2	10	200
Nitric Acid Production	N_2O	5	20
Calcium Carbide	CO_2	5	50
Other	CH_4	5	20
Metal Production	CH_4	3	10
Iron and Steel Production	CO_2	5	25
Ferroalloys Production	CO_2	10	50
ODS substitutes	HFCs	10	50
Electrical Equipment	SF_6	10	50
Other	CH_4	2	50
Buffalo	CH_4	2	50
Sheep	CH_4	2	50
Goats	CH_4	2	50
Horses	CH_4	2	50
Mules and Asses	CH_4	2	50
Swine	CH_4	2	50
Poultry	CH_4	2	50
Cattle	CH_4	2	300
N_2O emission from Manure Management	N_2O	2	50
Buffalo	CH_4	2	50

Sheep	CH_4	2	50
Coats	CH_4	2	50
Horses	CH_4	2	50
Mules and Asses	CH_4	2	50
Swine	CH_4	2	50
Poultry	CH_4	2	50
Cattle	CH_4	25	80
Rice Cultivation	CH_4	3	250
Direct soil emissions	N_2O	3	250
Pasture, Range and Paddock Manure	N_2O	3	500
Indirect Emissions	N_2O	25	50
Field Burning	CH_4	25	200
Field Burning	N_2O	20	100
Solid Waste Disposal on Land	CH_4	30	80
Waste Water Handling	CH_4	30	100
Waste Water Handling	N_2O	10	30

The calculations for the uncertainty of every source of emission (key or non-key) are given in **Table 1.5**. Here combined uncertainty means the mean quadratic value of the uncertainty for every source and for every emission factor, given in **Table 1.4**.

Table 1.5 Tier 1 Uncertainty Calculation and Reporting (level assessment), Gg CO_2-eq.

IPCC source category	Gas	1988	2007	Comb. uncertainty, %	Combined uncertainty as % of total national emissions in year 2007	Uncertainty introduced into the trend in total national emissions
Solvent and Other Product Use	CO_2	23.05	8.98	31.6	0.00	0.00
Solvent and Other Product Use	N_2O	52.93	45.12	100.0	0.06	0.05
Energy Industries	CH_4	17.73	10.92	50.2	0.01	0.00
Energy Industries	N_2O	302.11	286.11	200.1	0.76	0.17
Public Electricity and Heat Production - Gaseous fuels	CO_2	3378.80	1910.55	7.1	0.18	0.10
Public Electricity and Heat Production - Liquid fuels	CO_2	8520.31	210.94	7.1	0.02	0.17
Public Electricity and Heat Production - Solid fuels	CO_2	31317.79	28981.39	8.6	3.29	1.64
Petroleum Refining - Gaseous fuels	CO_2	0.00	59.00	7.1	0.01	0.00
Petroleum Refining - Liquid fuels	CO_2	0.00	0.00	7.1	0.00	0.00
Manufacture of Solid Fuels and Other Energy Industries - Gaseous Fuels	CO_2	0.00	777.96	7.1	0.07	0.05
Manufacture of Solid Fuels and Other Energy Industries - Liquid Fuels	CO_2	0.00	706.60	7.1	0.07	0.05
Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO_2	0.00	148.61	8.6	0.02	0.01
Manufacturing Industries and Construction - Gaseous Fuels	CO_2	7661.43	3229.55	7.1	0.30	0.18
Manufacturing Industries and Construction - Liquid Fuels	CO_2	7740.27	3200.37	7.1	0.30	0.17
Manufacturing Industries and Construction - Solid Fuels	CO_2	9352.86	4352.23	8.6	0.49	0.24
Manufacturing Industries and Construction	CH_4	11.91	4.64	50.2	0.00	0.00

Manufacturing Industries and Construction	N_2O	44.90	21.12	200.1	0.06	0.01
Civil Aviation - Liquid Fuels	CO_2	611.59	133.15	7.1	0.01	0.01
Civil Aviation - Liquid Fuels	CH_4	1.31	0.10	40.1	0.00	0.00
Civil Aviation - Liquid Fuels	N_2O	0.22	0.00	40.1	0.00	0.00
Road Transportation - Diesel Oil	CO_2	3183.96	4261.96	5.8	0.33	0.16
Road Transportation - Gasoline	CO_2	4562.80	1892.96	5.8	0.15	0.07
Road Transportation - Liquid Fuels	CH_4	53.52	29.30	40.1	0.02	0.00
Road Transportation - Liquid Fuels	N_2O	48.28	57.39	40.1	0.03	0.01
Road Transportation - LPG	CO_2	0.73	1142.98	5.8	0.09	0.06
Railways - liquid fuels	CO_2	368.04	78.65	7.1	0.01	0.01
Railways - liquid fuels	CH_4	0.57	0.13	100.1	0.00	0.00
Railways - liquid fuels	N_2O	2.86	0.61	150.1	0.00	0.00
Navigation - Liquid Fuels	CO_2	1088.46	0.00	50.2	0.00	0.02
Navigation - Liquid Fuels	CH_4	1.75	0.00	70.7	0.00	0.00
Navigation - Liquid Fuels	N_2O	8.47	0.00	111.8	0.00	0.00
Other Transportation - Liquid Fuels	CO_2	3940.74	687.32	7.1	0.06	0.07
Other Transportation - Liquid Fuels	CH_4	5.32	1.87	100.1	0.00	0.00
Other Transportation - Liquid Fuels	N_2O	29.91	5.35	150.1	0.01	0.01
Other sectors	CH_4	34.81	117.66	50.2	0.08	0.04
Other sectors	N_2O	49.41	41.66	200.1	0.11	0.02
Commercial/Institutional - Gaseous Fuels	CO_2	197.23	157.58	7.1	0.01	0.01
Commercial/Institutional - Liquid Fuels	CO_2	524.72	151.34	7.1	0.01	0.01
Commercial/Institutional - Solid Fuels	CO_2	345.59	13.69	8.6	0.00	0.01
Residential - Liquid Fuels	CO_2	2158.34	69.30	7.1	0.01	0.04
Residential - Solid Fuels	CO_2	4495.56	946.75	8.6	0.11	0.10
Agriculture/Forestry/Fisheries - Gaseous Fuels	CO_2	11.44	75.78	7.1	0.01	0.00
Agriculture/Forestry/Fisheries - Liquid Fuels	CO_2	1095.09	88.37	7.1	0.01	0.02
Agriculture/Forestry/Fisheries - Solid Fuels	CO_2	112.27	35.15	8.6	0.00	0.00
Stationary – Biomass	CH_4	35.13	27.44	20.6	0.01	0.00
Stationary – Biomass	N_2O	10.62	8.29	20.6	0.00	0.00
Stationary	CO_2	0.00	0.00	7.1	0.00	0.00
Fugitive Emissions from Fuels - Solid Fuels	CH_4	1991.58	1306.19	200.2	3.45	0.30
Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	1278.97	636.88	50.2	0.42	0.05
Cement Production	CO_2	2006.25	1896.98	30.1	0.76	0.18
Lime Production	CO_2	1117.84	1061.47	15.8	0.22	0.07
Limestone and Dolomite Use	CO_2	457.87	140.88	15.8	0.03	0.02
Soda Ash Production and Use	CO_2	233.19	178.38	20.6	0.05	0.01
Other	CO_2	26.61	177.91	20.6	0.05	0.03
Ammonia Production	CO_2	1662.13	532.10	20.6	0.14	0.07
Nitric Acid Production	N_2O	2421.72	1324.01	200.2	3.50	0.16
Calcium Carbide	CO_2	89.32	19.81	20.6	0.01	0.00
Other	CH_4	0.84	2.91	50.2	0.00	0.00
Metal Production	CH_4	73.20	37.24	20.6	0.01	0.00
Iron and Steel Production	CO_2	2360.38	1440.06	10.4	0.20	0.05
Ferroalloys Production	CO_2	112.80	44.38	25.5	0.01	0.00
ODS substitutes	HFCs	0.00	246.61	51.0	0.17	0.10
Electrical Equipment	SF_6	0.00	3.40	51.0	0.00	0.00
Other	CH_4	7.62	0.00	51.0	0.00	0.00

Buffalo	CH_4	27.60	9.94	50.0	0.01	0.00
Sheep	CH_4	1469.57	265.59	50.0	0.18	0.21
Goats	CH_4	45.36	54.84	50.0	0.04	0.01
Horses	CH_4	46.27	65.16	50.0	0.04	0.01
Mules and Asses	CH_4	74.61	38.38	50.0	0.03	0.00
Swine	CH_4	128.41	29.94	50.0	0.02	0.02
Poultry	CH_4	8.74	4.08	50.0	0.00	0.00
Cattle	CH_4	2248.00	903.52	50.0	0.60	0.14
N_2O emission from Manure Management	N_2O	1056.05	357.26	300.0	1.42	0.54
Buffalo	CH_4	4.52	1.63	50.0	0.00	0.00
Sheep	CH_4	51.43	9.30	50.0	0.01	0.01
Coats	CH_4	1.63	1.97	50.0	0.00	0.00
Horses	CH_4	5.35	7.53	50.0	0.00	0.00
Mules and Asses	CH_4	8.51	4.38	50.0	0.00	0.00
Swine	CH_4	851.44	198.55	50.0	0.13	0.11
Poultry	CH_4	102.25	47.73	50.0	0.03	0.00
Cattle	CH_4	498.52	201.59	50.0	0.13	0.03
Rice Cultivation	CH_4	119.25	54.58	83.8	0.06	0.02
Direct soil emissions	N_2O	4104.28	1346.40	250.0	4.45	1.83
Pasture, Range and Paddock Manure	N_2O	1652.29	492.19	250.0	1.63	0.83
Indirect Emissions	N_2O	2824.66	915.46	500.0	6.05	2.56
Field Burning	CH_4	46.35	16.24	55.9	0.01	0.01
Field Burning	N_2O	15.10	4.05	201.6	0.01	0.01
Solid Waste Disposal on Land	CH_4	10587.86	6674.48	102.0	8.99	1.50
Waste Water Handling	CH_4	2146.29	838.97	85.4	0.95	0.35
Waste Water Handling	N_2O	310.49	144.44	104.4	0.20	0.05
Overall uncertainty in the year					**13.43**	**4.06**

Results for every source are given in **Table 1.5** as follows:

– combined uncertainty as a part of overall emissions for 2007;

It means that for every source has been calculated MCUi =(EMi/EMtotal)x CUi, where MCUi – measured combined uncertainty, EMi- source emissions for 2007, EMtotal – total country emissions for 2007, CNi – combined uncertainty of the i-th source.

– uncertainty of the overall emissions trend for 2007;

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 2007 (row 7, column H in Table 6.1 of the GPG), and the overall emission trend related to the base inventory year until 2007 (row 7, column M in Table 6.1.) are given in **Table 1.6**. The relevant data for the previous inventories for 2005 and 2006 are given for comparison (NIR 2007 and NIR 2008).

Table 1.6 Uncertainty in total GHG emissions, %

Uncertainty	Uncertainty NIR 2007	Uncertainty NIR 2008	Uncertainty NIR 2009
Uncertainty in total GHG emissions	12.70	13.33	13.43
Overall uncertainty into the trend in total GHG emissions	3.47	3.92	4.06

1.8. General Assessment of Inventory Completeness

GHG inventory for 2007 covered all sectors, included in IPCC Good Practice Guidance, 2000, excluding:

- F-gases emissions from utilization of aerosols, fire extinguishers, solvents, semiconductor manufacture, etc.;
- CH_4 emissions from 1.B.1.B Solid Fuel Transformation – the activity data, emission factors and methodology are not available.

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 EMISSIN TRENDS

2.1. Aggregated GHG Emission Trends

GHG emissions inventory for 2007 showed that the overall GHG emissions in CO_2–eq. amounted to 75 792.79 Gg, without reporting of sequestration from sector Land-Use Change and Forestry (LUCF). The net emissions (with reporting of sequestration from LUCF) were 68 990.89 Gg.

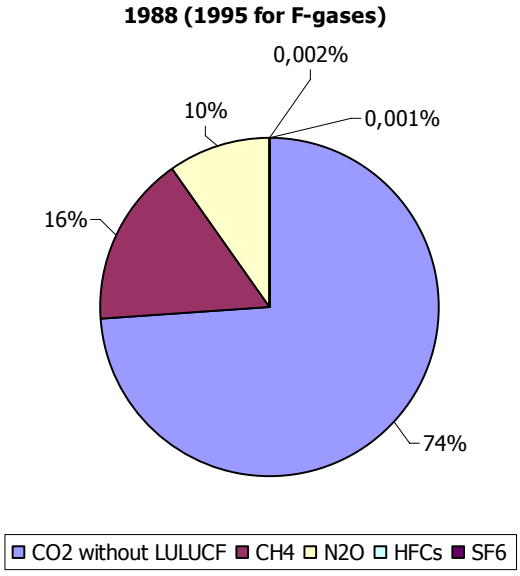
In **Table 2.1** are given emission trends of the main GHGs, the summary emissions (without reporting of LUCF) and the overall emissions share of the emissions from the base year 1988, assumed as 100%.

Analysis of **Table 2.1** shows, that in 2007, CO_2 emissions headed the list with the biggest share – 77.7% of the overall GHG emissions, expressed in CO_2-eq., CH_4 emissions ranked the second place with 15.3%, and N_2O emissions ranked the third place with 6.7%. This distribution has undergone some changes compared to the base 1988, as it is shown in **Figure 2.1**.

Table 2.1 Summary of emission trends per gas, Gg, CO_2-eq.

GHGs	CO_2 with LUCF	CO_2 without LUCF	CH_4	N_2O	HFCs	PFC	SF_6	Total	Index CO_2 without LUCF	Index CH_4	Index N_2O	Index [group of six]	Index HFCs	Index PFC	Index SF_6
									Index 1988 = 100				Index 1995 = 100		
1988	93766	98815	21986	12946				133 747	100	100	100	100			
1989	93524	99063	21795	12041				132 899	100.25	99.13	93.01	99.37			
1990	80194	86269	20238	11166				117 672	87.30	92.05	86.25	87.98			
1991	61180	68777	19012	8262				96 051	69.60	86.47	63.82	71.82			
1992	54433	61785	17962	6748				86 495	62.53	81.70	52.13	64.67			
1993	57034	64376	16778	6034				87 188	65.15	76.31	46.61	65.19			
1994	55227	62361	15979	6199				84 540	63.11	72.68	47.89	63.21			
1995	59017	66361	16038	6158	2.95	-	1.26	88 561	67.16	72.94	47.57	66.22	100	NA.NE.NO	100
1996	58679	65010	15521	6057	109.30	-	1.31	86 699	65.79	70.59	46.79	64.82	3700	NA.NE.NO	104
1997	56514	63200	14700	5726	188.15	-	1.75	83 817	63.83	66.86	44.23	62.57	6370	NA.NE.NO	139
1998	48365	55197	14328	4662	576.66	-	1.83	74 765	55.86	65.17	36.01	55.90	19523	NA.NE.NO	145
1999	43798	50973	13670	4788	102.80	-	1.88	69 536	51.58	62.18	36.98	51.99	3480	NA.NE.NO	149
2000	41574	50482	13421	5221	96.02	-	2.23	69 223	51.09	61.04	40.33	51.76	3251	NA.NE.NO	177
2001	42724	52105	12446	4896	97.50	-	2.29	69 547	52.73	56.61	37.82	52.00	3301	NA.NE.NO	182
2002	41094	49265	12381	4772	89.59	-	2.51	66 510	49.86	56.31	36.86	49.73	3033	NA.NE.NO	199
2003	46956	53864	13020	4735	120.60	-	2.52	71 741	54.51	59.22	36.58	53.64	4083	NA.NE.NO	199
2004	45465	53270	12878	4730	217.30	-	3.68	71 100	53.91	58.57	36.54	53.16	7357	NA.NE.NO	292
2005	47243	54028	11925	4682	386.84	-	4.42	71 027	54.68	54.24	36.17	53.11	13096	NA.NE.NO	350
2006	48355	55144	11693	4483	610.68	0.04	5.30	71 936	55.81	53.18	34.63	53.79	20674	100	420
2007	52088	58890	11604	5049	246.61	-	3.40	75 793	59.60	52.78	39.01	56.67	8349	NA.NE.NO	269

Figure 2.1 Distribution of the main greenhouse gases in 1988 and 2007



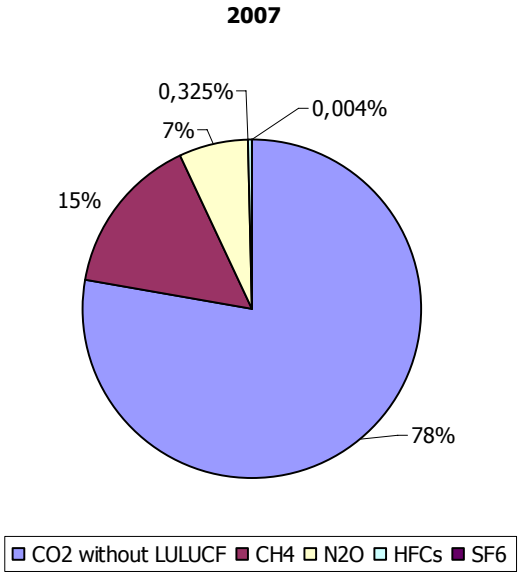
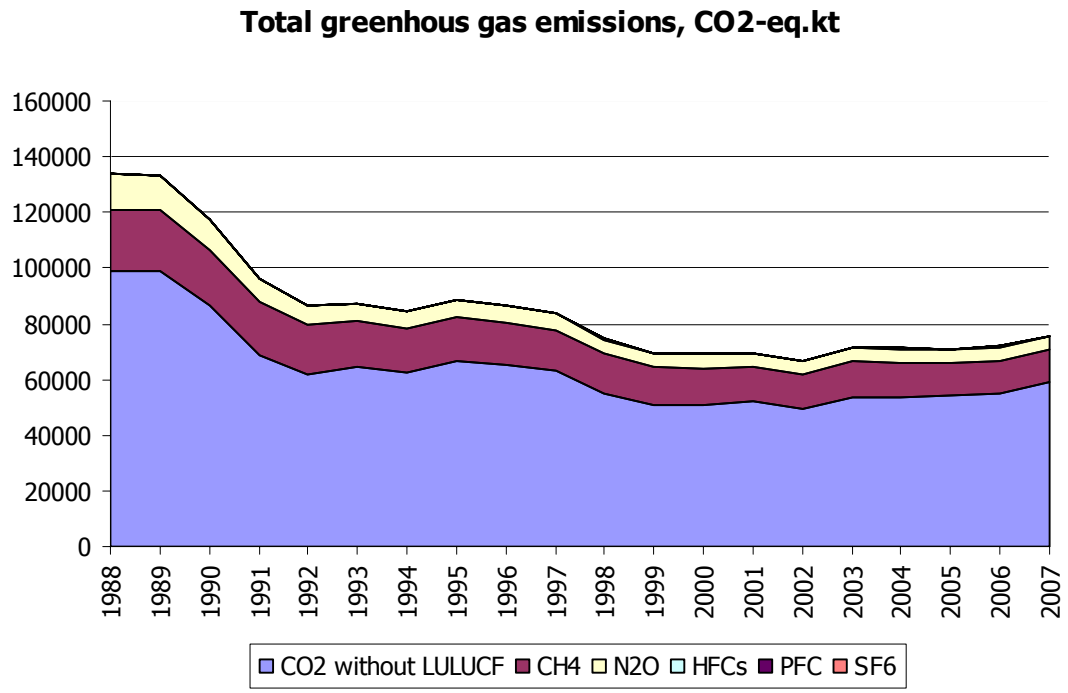


Figure 2.2 shows the change in the overall emissions for the period 1988-2007

Figure 2.2



It can be seen that in 2007, the total GHG emissions in CO_2-eq., indicated a little increase. In 2007 emissions were 43.3% from the emissions in the base year (1988) and increase compared to the preceding 2006 by 5.4%.

Table 2.2 shows the overall emissions by sectors for the period 1988-2007, in CO_2-eq. The quantities of CO_2, sequestrated by forestry, are also included (without F-gases).

Table 2.2 Aggregated GHG emissions by sector, Gg, CO_2-eq.

Sector/year	Energy	Industrial Processes	Solvent and Other Product Use	Agriculture	Forestry	Waste	Total (without LUCF)
1988	94 666	10 570	76	15 390	-5 050	13 045	**133 747**
1989	94 763	10 638	76	14 527	-5 539	12 894	**132 899**
1990	81 465	9 893	73	13 618	-6 074	12 623	**117 672**
1991	65 770	7 071	73	10 948	-7 597	12 190	**96 051**
1992	59 674	5 933	72	8 846	-7 352	11 970	**86 495**
1993	62 163	5 857	72	7 464	-7 342	11 633	**87 188**
1994	59 091	7 087	71	6 936	-7 134	11 355	**84 540**
1995	61 974	8 963	71	6 206	-7 344	11 347	**88 561**
1996	60 773	8 922	71	5 947	-6 330	10 986	**86 699**
1997	59 044	8 224	70	5 863	-6 687	10 484	**83 686**
1998	53 617	5 551	70	5 521	-6 832	10 007	**74 765**
1999	48 852	5 113	54	5 930	-7 175	9 587	**69 536**
2000	48 178	6 080	67	5 648	-8 908	9 249	**69 223**
2001	49 773	6 059	53	4 813	-9 381	8 850	**69 547**
2002	47 328	5 418	55	5 132	-8 172	8 578	**66 510**
2003	51 469	6 021	50	5 075	-6 908	9 126	**71 741**
2004	50 662	6 102	52	5 372	-7 805	8 912	**71 100**

2005	51 228	6 529	53	5 075	-6 785	8 141	**71 027**
2006	52 287	6 794	55	4 973	-6 790	7 827	**71 936**
2007	55 944	7 106	54	5 030	-6 802	7 658	**75 793**

Table 2.3 shows the shares in percentage of the overall GHG emissions by sectors for the period 1988-2007. This percent is calculated on the overall emissions, excluding CO_2 sequestration by forestry.

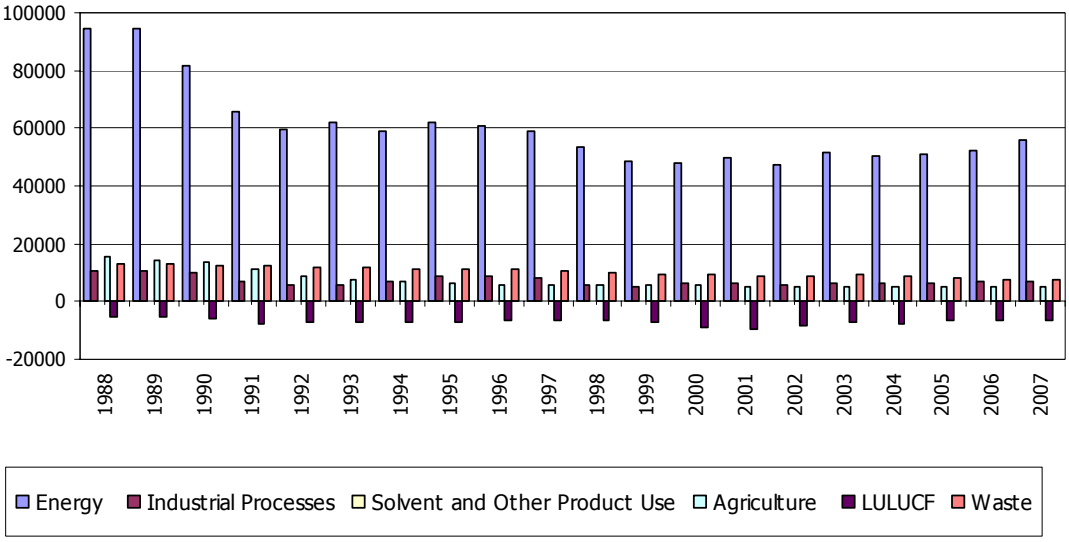
Table 2.3 Sector contribution in aggregated emissions, %

Sector/year	Energy	Industrial Processes	Solvent and Other Product Use	Agriculture	Forestry	Waste
1988	70.78	7.90	0.06	11.51	-3.78	9.75
1989	71.30	8.00	0.06	10.93	-4.17	9.70
1990	69.23	8.41	0.06	11.57	-5.16	10.73
1991	68.47	7.36	0.08	11.40	-7.91	12.69
1992	68.99	6.86	0.08	10.23	-8.50	13.84
1993	71.30	6.72	0.08	8.56	-8.42	13.34
1994	69.90	8.38	0.08	8.20	-8.44	13.43
1995	69.98	10.12	0.08	7.01	-8.29	12.81
1996	70.10	10.29	0.08	6.86	-7.30	12.67
1997	70.55	9.83	0.08	7.01	-7.99	12.53
1998	71.71	7.42	0.09	7.38	-9.14	13.38
1999	70.26	7.35	0.08	8.53	-10.32	13.79
2000	69.60	8.78	0.10	8.16	-12.87	13.36
2001	71.57	8.71	0.08	6.92	-13.49	12.72
2002	71.16	8.15	0.08	7.72	-12.29	12.90
2003	71.74	8.39	0.07	7.07	-9.63	12.72
2004	71.25	8.58	0.07	7.56	-10.98	12.53
2005	72.13	9.19	0.08	7.15	-9.55	11.46
2006	72.68	9.44	0.08	6.91	-9.44	10.88
2007	73.81	9.38	0.07	6.64	-8.97	10.10

Analysis of **Table 2.3** shows that sector Energy, where GHG emissions come from fuel combustion, headed the list in 2007 with the biggest share – 73.81%. Sector Waste ranked the second place with 10.10% and sector Industrial processes ranked the third place with 9.38%.

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

Figure 2.3 Aggregated GHG emissions by sectors according to the IPCC classification, Gg



The aggregated GHG emission trend's uncertainty, according to the method Tier 1, was 4.06%. The level (quantity) uncertainty of the overall emissions was much larger and achieved about 13.4%. 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 **CO_2 emission** trends by IPCC sectors.

Compared to the base year (1988) by end 2007 the total net national CO2 emissions (excl. LULUCF) have been reduced by 40%.

The reduction by IPCC sectors is respectively 56% in industry (manufacturing), 41% in transport and 84% in households (residential sector). The lowest reduction has been achieved in the electricity and heat production sector (28%), which is still the biggest contributor to the total net national CO2 emissions (with a share of 44% in 1988 and 53% in 2007).

Compared to the previous year (2006), the total net national CO_2 emissions in 2007 are increasing by 7% corresponding to the increase by 13% in the electricity and heat production sector caused by the decommissioning (by end 2006) of units/reactors 3 and 4 in the NPP Kozloduy.

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

Reduction of the CH_4 overall emissions in 2007 compared to the base 1988 was 47%. That reduction is conditioned mostly by the reduction in agriculture – 67%, in fugitive emissions from coal mining and gas and oil systems - 41%, and particularly in the solid waste - 37%. The reduction in the wastewater treatment is essential - 61%. The

indicated reductions describe best the processes of changes and restructuring of the agricultural production.

Compared to the preceding 2006, a reduction of CH_4 emissions can be seen in the current year for overall emissions of 0.8%, reduction in agriculture was 2.7% and reduction in wastes - 2.5%.

Table 2.6 shows the N_2O emission trends by IPCC sectors.

The overall N_2O emission reduction in 2007, compared to the base 1988, was 61%. That reduction is conditioned mostly by the reduction in the industrial processes - 45%, and particularly in the agriculture – 68%. The indicated reductions describe best the processes of fertilizers and manure handling, and the reduction of plant crops.

Compared to the preceding 2006, an increase of N_2O emissions can be seen in the current year as follows: overall increase of 13%, growth in energy sector was 8%, growth in industrial processes – 47%, and in agriculture with 3.7%.

Table 2.4 CO_2 emissions and sinks per IPCC sector 1988- 2007, Gg

Year	Total net national emissions incl. LUCF	Total net national emissions excl. LUCF	1. All energy (combustion and fugitive)	1A.Fuel Combustion	1A1a Electricity and heat production	1A1b Petroleum Refinery	1A1c Manufacture of Solid Fuels	1.A.2.Manufacturing Industries and Constriction	1A.3.Transport	1A4a. Commercial/ Institutional	1A4b. Residential	1A4c. Agriculture/ Forestry/Fishing	1A.5. Other	1.B. Fugitive Emissions from Fuels	2. Industrial Processes (ISIC)	3. Solvent and Other Product Use	5.. Changes in Forest and Other Woody Biomass Stocks	6. Waste	CO_2 Marine	CO_2 Aviation
1988	73327	98815	90726	90726	43217	NO	NO	24755	13814	1068	6654	1219	NO	NA. NE	8066	23.1	-5050	NA.NE	969	749
1989	73086	99063	90789	90789	43690	NO	NO	25215	13245	773	6609	1256	NO	NA. NE	8252	23.1	-5539	NA.NE	987	731
1990	59920	86269	78673	78673	37939	356	1306	21821	10864	172	4787	422	1006	NA. NE	7574	22.2	-6074	NA.NE	874	892
1991	39672	68777	63357	63357	35823	362	921	14758	6525	124	3633	330	882	NA. NE	5398	22.1	-7597	NA.NE	878	320
1992	39565	61785	57197	57197	32882	58	922	12093	6435	107	4354	149	196	NA. NE	4566	21.8	-7352	NA.NE	873	565
1993	45050	64376	59682	59682	32969	59	1063	13296	7444	114	3890	114	733	NA. NE	4673	21.7	-7342	NA.NE	844	739
1994	42639	62361	56658	56658	29830	48	1067	15032	6547	96	2962	267	810	NA. NE	5681	21.6	-7134	NA.NE	850	632
1995	45817	66361	59376	59376	30350	51	1171	18023	6845	64	2456	102	315	NA. NE	6964	21.5	-7344	NA.NE	882	549
1996	51362	65010	58208	58208	29470	51	1131	17499	6559	114	3095	28	261	NA. NE	6780	21.4	-6330	NA.NE	732	472
1997	44321	63070	56703	56703	29929	51	957	17691	5285	46	2632	NO	112	NA. NE	6346	21.2	-6687	NA.NE	1092	428
1998	37665	55197	51235	51235	26458	NO	1044	14217	6478	288	2544	157	49	NA. NE	3941	21.1	-6832	NA.NE	1022	490
1999	32007	50973	46750	46750	24499	142	1120	12283	6215	503	1795	194	NO	NA. NE	4218	5.4	-7175	NA.NE	26	319
2000	31272	50482	45869	45869	24881	48	1286	11868	5889	330	1362	204	NO	NA. NE	4594	19.2	-8908	NA.NE	205	270
2001	28255	52105	47486	47486	27805	52	1179	10788	6024	574	884	180	NO	NA. NE	4613	6.4	-9381	NA.NE	306	393
2002	27607	49265	45066	45066	25201	48	1217	10198	6329	388	1511	174	NO	NA. NE	4191	8.5	-8172	NA.NE	336	399
2003	38767	53864	49180	49180	27264	42	1024	11533	7111	287	1741	178	NO	NA. NE	4679	3.9	-6908	NA.NE	436	485
2004	30996	53270	48289	48289	27043	53	1202	10818	7415	200	1354	204	NO	NA. NE	4975	6.7	-7805	NA.NE	366	405
2005	35667	54028	48921	48921	27263	49	1373	10421	8115	224	1241	235	NO	NA. NE	5099	8.0	-6785	NA.NE	349	473
2006	36922	55144	49900	49900	27502	51	1565	10264	8622	383	1295	219	NO	NA. NE	5234	10.2	-6790	NA.NE	338	484
2007	40772	58890	53389	53389	31103	59	1633	10782	8197	323	1093	199	NO	NA. NE	5492	9.0	-6802	NA.NE	166	528

Table 2.5 CH_4 emissions per IPCC sector 1988- 2007, Gg

IPCC Sector	TOTAL NET NATIONAL EMISSIONS	1. All energy (combustion and fugitive)	A. Fuel combustion total	1A1. Energy	1A2. Industry	1A3. Transport	1A4. Other sectors	1A5. Other	1B. Fugitive fuel emissions	1B1. Solid fuels	1B2. Crude oil and natural gas	2. Industrial Processes	4. Agriculture	4A. Enteric Fermentation	4B. Manure Management	4C. Rice Cultivation	4F. Field Burning of Agricultural Residues	6. Waste	6A. Solid Waste Disposal on Land	6B. Wastewater Handling
1988	1047	163	7.7	0.8	0.6	3.0	1.7	1.7	155.7	94.8	60.9	3.9	273.2	192.8	72.55	5.68	2.21	606.4	504.18	102.2
1989	1038	165	8.0	0.8	0.6	3.1	1.6	1.9	157.3	92.6	64.8	3.9	268.8	187.6	73.11	5.49	2.66	599.8	508.07	91.73
1990	964	112	6.9	0.9	0.4	2.9	1.1	1.6	105.2	75.8	29.4	3.0	258.1	180.2	71.49	4.26	2.20	590.4	510.08	80.36
1991	905	98	5.1	0.7	0.3	1.4	0.8	1.8	92.7	65.1	27.6	2.2	234.4	166.0	62.81	3.30	2.32	570.9	505.47	65.40
1992	855	101	5.2	0.7	0.3	1.7	1.0	1.6	95.6	71.5	24.1	2.1	192.0	137.5	51.10	1.82	1.62	560.4	499.63	60.80
1993	799	101	5.2	0.6	0.3	1.9	0.9	1.5	95.9	71.4	24.5	2.4	150.7	107.2	40.90	1.26	1.33	544.8	491.16	53.63
1994	761	99	5.3	0.5	0.3	1.9	1.0	1.6	93.8	66.7	27.1	3.2	126.6	90.1	34.72	0.33	1.40	532.0	481.26	50.74
1995	764	106	5.8	0.6	0.3	2.0	1.3	1.6	100.3	69.2	31.1	3.5	121.8	85.3	34.52	0.56	1.46	532.3	469.55	62.73
1996	739	105	5.7	0.5	0.3	1.7	1.6	1.6	98.8	67.3	31.4	3.3	115.8	82.4	31.60	1.05	0.81	515.5	455.31	60.18
1997	700	94	5.4	0.5	0.3	1.3	1.6	1.7	88.4	60.7	27.7	3.5	110.3	79.5	27.93	1.53	1.34	492.4	439.39	53.02
1998	682	96	7.3	0.5	0.3	1.4	3.5	1.5	88.9	63.7	25.1	3.0	114.2	81.8	29.64	1.61	1.19	468.9	421.43	47.47
1999	651	84	7.2	0.4	0.3	1.5	3.5	1.6	77.1	56.0	21.1	2.8	115.1	83.0	30.30	0.57	1.30	448.7	405.49	43.19
2000	639	94	8.2	0.4	0.2	1.4	4.7	1.4	85.4	57.1	28.3	3.5	108.9	79.3	27.08	1.44	1.15	433.0	391.74	41.28
2001	593	92	7.8	0.5	0.2	1.3	4.4	1.4	83.7	57.7	26.0	2.4	84.4	62.2	19.30	1.57	1.30	414.4	378.77	35.60
2002	590	91	8.9	0.4	0.2	1.4	5.3	1.6	82.2	58.5	23.7	2.2	95.0	69.0	22.42	2.11	1.50	401.3	367.00	34.32
2003	620	91	9.0	0.5	0.2	1.4	5.6	1.3	81.8	57.5	24.2	2.8	99.1	71.5	24.38	2.27	0.91	427.4	356.45	70.94
2004	613	95	9.3	0.4	0.2	1.3	5.8	1.6	85.5	58.7	26.8	2.3	98.9	70.9	24.05	2.30	1.61	417.2	346.12	71.11
2005	568	92	9.1	0.4	0.2	1.4	5.5	1.5	82.6	52.7	29.9	2.2	93.3	67.3	22.75	1.89	1.29	380.7	337.24	43.42
2006	557	95	9.5	0.5	0.2	1.5	5.9	1.4	85.6	56.5	29.1	2.1	93.7	67.3	23.08	2.05	1.24	365.8	326.05	39.78
2007	553	102	9.1	0.5	0.2	1.5	5.6	1.3	92.5	62.2	30.3	1.9	91.2	65.3	22.51	2.60	0.77	357.8	317.83	39.95

Table 2.6 N_2O emissions per IPCC sector 1988- 2007, Gg

IPCC Sector	TOTAL NET NATIONAL EMISSIONS	1. All energy (combustion and fugitive)	1A. Fuel combustion total	1A1a Electricity and heat production	1A1c. Other transformation	1A2.Industry	1A3.Transport	1A4. Other Sectors	5. Other	1B. Fugitive fuel emissions	2. Industrial Processes (ISIC)	3. Solvent and Other Product Use	4. Agriculture	4A. Enteric Fermentation	4B. Manure Management	4D. Agricultural Soils	4F. Field Burning of Agricultural Residues	6. Waste
1988	41.76	1.64	1.64	0.97	NO	0.14	0.33	0.16	0.03	NA.NE	7.81	0.17	31.14		3.41	27.68	0.05	1.00
1989	38.84	1.62	1.62	1.00	NO	0.13	0.31	0.15	0.04	NA.NE	7.43	0.17	28.65		3.41	25.18	0.06	0.96
1990	36.02	1.41	1.41	0.80	0.004	0.21	0.25	0.10	0.04	NA.NE	7.28	0.16	26.44		3.32	23.08	0.05	0.72
1991	26.65	1.16	1.16	0.79	0.004	0.09	0.15	0.07	0.05	NA.NE	5.25	0.16	19.44		2.97	16.41	0.05	0.65
1992	21.77	1.16	1.16	0.81	0.004	0.08	0.14	0.08	0.04	NA.NE	4.27	0.16	15.53		2.45	13.04	0.04	0.65
1993	19.46	1.16	1.16	0.80	0.004	0.08	0.17	0.07	0.04	NA.NE	3.65	0.16	13.87		1.96	11.89	0.02	0.62
1994	20.00	1.13	1.13	0.79	0.004	0.10	0.14	0.06	0.04	NA.NE	4.32	0.16	13.80		1.64	12.13	0.03	0.59
1995	19.87	1.20	1.20	0.83	0.004	0.11	0.14	0.06	0.04	NA.NE	6.20	0.16	11.77		1.60	10.14	0.03	0.54
1996	19.54	1.19	1.19	0.82	0.005	0.11	0.14	0.08	0.04	NA.NE	6.33	0.16	11.34		1.49	9.83	0.02	0.52
1997	18.47	1.20	1.20	0.85	0.004	0.13	0.12	0.07	0.04	NA.NE	5.21	0.16	11.44		1.36	10.06	0.03	0.46
1998	15.04	1.17	1.17	0.80	0.004	0.09	0.13	0.11	0.03	NA.NE	3.12	0.16	10.07		1.46	8.59	0.02	0.52
1999	15.44	1.07	1.07	0.72	0.004	0.07	0.13	0.10	0.03	NA.NE	2.36	0.16	11.33		1.51	9.80	0.03	0.53
2000	16.84	1.10	1.10	0.75	0.004	0.07	0.13	0.12	0.03	NA.NE	4.24	0.15	10.84		1.38	9.43	0.02	0.50
2001	15.79	1.18	1.18	0.83	0.004	0.07	0.14	0.11	0.03	NA.NE	4.18	0.15	9.81		1.03	8.75	0.02	0.48
2002	15.39	1.13	1.13	0.74	0.003	0.07	0.15	0.13	0.03	NA.NE	3.51	0.15	10.12		1.19	8.90	0.03	0.49
2003	15.27	1.24	1.24	0.82	0.003	0.08	0.17	0.14	0.03	NA.NE	3.74	0.15	9.66		1.27	8.37	0.02	0.49
2004	15.26	1.23	1.23	0.81	0.003	0.07	0.18	0.14	0.03	NA.NE	2.77	0.15	10.63		1.26	9.34	0.03	0.48
2005	15.10	1.23	1.23	0.79	0.003	0.06	0.20	0.13	0.03	NA.NE	3.20	0.15	10.05		1.19	8.84	0.02	0.47
2006	14.46	1.25	1.25	0.80	0.003	0.06	0.21	0.14	0.03	NA.NE	2.90	0.15	9.69		1.18	8.49	0.02	0.47
2007	16.29	1.36	1.36	0.92	0.004	0.07	0.20	0.13	0.03	NA.NE	4.27	0.15	10.05		1.15	8.88	0.01	0.47

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

In 2007 there is some changes of the overall F-gases emissions, compared to the base 1995. During 2007 have been imported a large quantity of F-gases. It is due to the fact that a lot of ozone depletion substances are replaced with F-gases. Still there is not production of primary aluminium in the country. There is casting of aluminium products, which is classified as production of secondary aluminium.

Table 2.7 Actual and potential emissions of HFCs, PFCs, SF_6, Gg CO_2-eq.

New gases/ Year	Total HFCs	Total PFCs	SF_6	HFCs- potential	PFCs-potential	SF_6-potential
1995	2.95	-	1.26	62.16	-	-
1996	-	-	1.31	109.30	-	-
1997	-	-	1.75	188.15	-	-
1998	-	-	1.83	576.66	-	-
1999	-	-	1.88	102.80	-	-
2000	-	-	2.23	96.02	-	29.4
2001	-	-	2.29	97.50	-	2.39
2002	-	-	2.51	89.59	-	2.39
2003	-	-	2.52	120.60	-	6.36
2004	-	-	3.68	217.30	-	-
2005	-	-	4.42	386.84	-	0.96
2006	-	-	5.30	610.68	0.04	4.83
2007	-	-	3.40	246.61	-	-

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) - 84%, industry - 56%, and transport - 41%, and the lowest in the power engineering - 28%.

Compared to the preceding 2006, a growth of emissions of all categories in the energy sector can be seen in 2007, except for transport and public sector. 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 CH_4 – 51%, N_2O - 45% and with CO_2 it was 32%. The reporting of the potential emissions of HFCs in the new gases leads to an increase compared to the base year for them 1995.

Compared to the preceding 2006, a growth of 13% of the overall emissions of the sector can be seen in 2007. 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 2006, an increase of emissions in the sector can be seen in 2007 by 1.0%. Chapter 6 of this Report contains a more detailed analysis of GHG emissions in the sector.

Land-Use Change and Forestry

The annual CO_2 sequestration was about 5-9 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 41%. This reduction described best the emission reduction from solid waste, which was about 37%.

During the current year, the emissions from the sector were reduced by 2.2%, compared to 2006. 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 59.7%.

Table 2.8 Summary of emission trend per source category and gas, Gg CO_2-eq.

Source category	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1. All energy	94666	94763	81465	65770	59674	62163	59091	61974	60773	59044
1A. Energy: fuel combustion	91396	91459	79256	63823	57666	60150	57121	59869	58698	57188
CO_2: 1. Energy industries	43217	43690	39601	37106	33862	34092	30945	31572	30652	30936
CO_2: 2. Industry	24755	25215	21821	14758	12093	13296	15032	18023	17499	17691
CO_2: 3. Transport	13814	13245	10864	6525	6435	7444	6547	6845	6559	5285
CO_2: 4. Other sectors	8940	8639	5381	4086	4610	4117	3325	2621	3238	2678
CO_2: 5. Other	NO	NO	1006	882	196	733	810	315	261	112
CH_4	162.2	167.6	145.4	107.6	109.3	108.6	111.6	122.4	120.5	113.7
N_2O	508.0	502.8	437.9	359.1	359.3	359.7	351.5	370.6	370.0	371.6
B. Fugitive fuel emissions	3271	3304	2209	1947	2007	2013	1970	2106	2074	1857
CH_4	3271	3304	2209	1947	2007	2013	1970	2106	2074	1857
N_2O	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE
2. Industrial Processes (ISIC)	10570	10638	9893	7071	5933	5857	7087	8963	8922	8224
CO_2	8066	8252	7574	5398	4566	4673	5681	6964	6780	6346
CH_4	82	82	63	46	44	51	68	74	69	74
N_2O	2422	2305	2255	1626	1324	1133	1338	1921	1962	1614
HFCs								62	109	188
PFCs										
SF6								1.26	1.31	1.75
3. Solvent and Other Product Use	76	76	73	73	72	72	71	71	71	70
CO_2	23.1	23.1	22.2	22.1	21.8	21.7	21.6	21.5	21.4	21.2
N_2O	53	53	51	51	50	50	50	49	49	49
4. Agriculture	15390	14527	13618	10948	8846	7464	6936	6206	5947	5863
CH_4 Enteric fermentation	4049	3939	3784	3486	2887	2251	1893	1791	1730	1669
CH_4 Manure management	1524	1535	1501	1319	1073	859	729	725	664	587
CH_4 Rice cultivation	119	115	90	69	38	26	7	12	22	32
CH_4 Field Burning of Agricultural Residues	46.3	55.8	46.3	48.7	34.1	27.8	29.4	30.7	16.9	28.1
N_2O Manure Management	1056	1057	1030	921	760	606	510	496	461	422
N_2O Agricultural soils	8581	7806	7153	5087	4043	3686	3760	3143	3048	3117
N_2O Field Burning of Agricultural Residue	15.10	18.51	13.98	16.49	10.99	7.63	7.95	9.31	5.51	7.97
5. LULUCF	-5050	-5539	-6074	-7597	-7352	-7342	-7134	-7344	-6330	-6687
CO_2	-5050	-5539	-6074	-7597	-7352	-7342	-7134	-7344	-6330	-6687
6. Waste	12743	12593	12332	11902	11686	11349	11072	11066	10706	10206
CO_2	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE
CH_4	12734	12596	12399	11988	11769	11441	11172	11178	10825	10341
N_2O	310	299	224	202	201	192	183	169	161	143
7. Other										
NATIONAL TOTAL EMISSIONS	133747	132899	117672	96051	86495	87188	84540	88561	86699	83686
International bunker	1727	1727	1774	1206	1446	1590	1490	1439	1210	1529

Source category	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1. All energy	53617	48852	48178	49773	47328	51469	50662	51228	52287	55944
1A. Energy: fuel combustion	51751	47232	46384	48014	45603	49752	48867	49493	50488	54001
CO_2: 1. Energy industries	27502	25760	26216	29036	26466	28330	28298	28685	29118	32795
CO_2: 2. Industry	14217	12283	11868	10788	10198	11533	10818	10421	10264	10782
CO_2: 3. Transport	6478	6215	5889	6024	6329	7111	7415	8115	8622	8197
CO_2: 4. Other sectors	2989	2491	1896	1638	2074	2206	1758	1700	1897	1614
CO_2: 5. Other	49	NO	NO	NO	NO	NO	NO	NO	NO	NO
CH_4	152.7	152.2	171.9	163.3	186.8	188.3	196.3	190.6	199.7	192.1
N_2O	363.0	330.7	342.4	365.1	350.1	383.4	381.6	381.2	387.9	420.5
B. Fugitive fuel emissions	1866	1620	1794	1759	1725	1717	1795	1735	1799	1943
CH_4	1866	1620	1794	1759	1725	1717	1795	1735	1799	1943
N_2O	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	
2. Industrial Processes (ISIC)	5551	5113	6080	6059	5418	6021	6102	6529	6794	7106
CO_2	3941	4218	4594	4613	4191	4679	4975	5099	5234	5492
CH_4	63	58	74	51	46	59	48	46	45	40
N_2O	968	732	1314	1295	1089	1159	858	992	900	1324
HFCs	577	103	96	98	90	121	217	387	611	247
PFCs									0.04	
SF6	1.83	1.88	2.23	2.29	2.51	2.52	3.68	4.42	5.3	3.4
3. Solvent and Other Product Use	70	54	67	53	55	50	52	53	55	54
CO_2	21.1	5.4	19.2	6.4	8.5	3.9	6.7	8.0	10.2	9.0
N_2O	48	48	48	47	46	46	46	45	45	45
4. Agriculture	5521	5930	5648	4813	5132	5075	5372	5075	4973	5030
CH_4 Enteric fermentation	1717	1742	1665	1306	1448	1502	1490	1414	1414	1371
CH_4 Manure management	623	636	569	405	471	512	505	478	485	473
CH_4 Rice cultivation	34	12	30	33	44	48	48	40	43	55
CH_4 Field Burning of Agricultural Residues	25.0	27.4	24.1	27.3	31.6	19.0	33.8	27.1	26.1	16.2
N_2O Manure Management	452	467	429	321	368	395	390	369	366	357
N_2O Agricultural soils	2663	3037	2925	2714	2760	2594	2895	2739	2631	2754
N_2O Field Burning of Agricultural Residue	7.05	8.38	6.26	6.33	8.16	5.94	9.55	7.53	7.36	4.05
5. LULUCF	-6832	-7175	-8908	-9381	-8172	-6908	-7805	-6785	-6790	-6802
CO_2	-6832	-7175	-8908	-9381	-8172	-6908	-7805	-6785	-6790	-6802
6. Waste	9731	9312	8976	8584	8315	8865	8651	7882	7570	
CO_2	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	NA, NE	
CH_4	9847	9422	9094	8702	8428	8975	8762	7994	7682	7513
N_2O	160	164	156	148	151	151	150	147	145	144
7. Other										
NATIONAL TOTAL EMISSIONS	74765	69536	69223	69547	66510	71741	71100	71027	71936	75793
International bunker	1521	345	477	702	739	925	775	826	826	695

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.

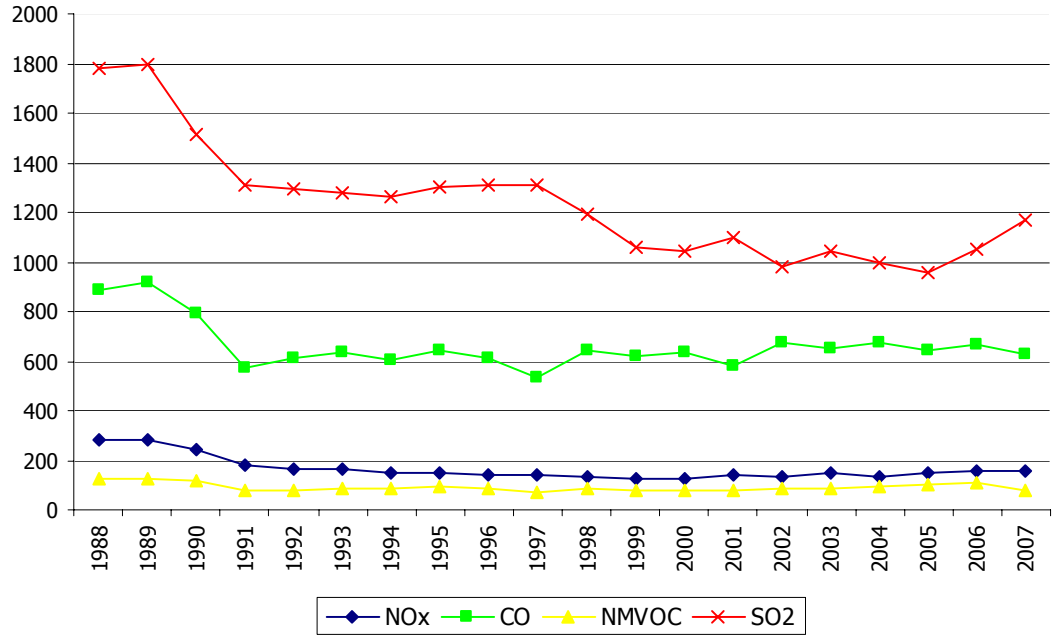
Table 2.9 Trend in emissions of ozone and aerosol precursors, 1988-2007, Gg

Emissions/ Year	NOx	Index total NOx (1988=100)	CO	Index total CO (1988=100)	NMVOC	Index total NMVOC (1988=100)	SO_2	Index total SO_2 (1988=100)
1988	284.87	100	884.51	100	128.99	100	1781	100
1989	283.44	99	916.72	104	124.08	96	1800	101
1990	242.26	85	789.67	89	117.48	91	1517	85
1991	179.36	63	571.62	65	76.92	60	1313	74
1992	161.96	57	609.05	69	78.53	61	1291	72
1993	165.34	58	634.05	72	86.37	67	1279	72
1994	146.12	51	607.55	69	86.67	67	1262	71
1995	151.45	53	644.37	73	94.45	73	1300	73
1996	144.89	51	609.81	69	87.00	67	1311	74
1997	140.62	49	531.04	60	72.47	56	1311	74
1998	135.75	48	640.93	72	87.49	68	1192	67
1999	123.40	43	618.00	70	78.28	61	1056	59
2000	127.77	45	634.83	72	78.90	61	1045	59
2001	137.60	48	583.00	66	81.80	63	1096	62
2002	134.41	47	677.93	77	87.41	68	983	55
2003	146.63	51	654.03	74	85.63	66	1043	59
2004	136.79	48	673.83	76	95.53	74	998	56
2005	149.29	52	646.13	73	102.83	80	957	54
2006	154.17	54	666.62	75	108.86	84	1049	59
2007	153.33	54	629.48	71	77.90	60	1168	66

Figure 2.4 shows changes of GHG-precursors emission trends

Figure 2.4

Trend in emissions of ozone and aerosol precursors, Gg



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 plants have significant influence.

NOx Emissions

Overall NOx emissions for the country in 2007 were 153 Gg. Compared to 2006, a decrease of the emissions by 0.5% could be seen.

Sector Energy was a main source of NOx emissions in Bulgaria. It emitted 92% of the overall NOx emissions in 2007. 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 2007 were 629 Gg. Compared to 2006, a reduction by 6% could be seen.

Sector Energy was a main source of CO emissions in Bulgaria, and it emitted 97% of the overall emissions in the country, including 43% 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.

Sector Agriculture covers 2.6% from the total CO emissions in Bulgaria. They are 37.8% less than the level in 2006 because of the more unfavourable climate conditions in food and other crop production.

NMVOCs Emissions

The NMVOC emitters for Bulgaria were sectors: Energy, Industrial processes and Solvent and Other Product Use.

Overall emissions for the country in 2007 were 77.9 Gg. The emissions' decrease, compared to 2006, was 28%.

Sector Energy was a main source of NMVOC emissions in Bulgaria, and it emitted 57.3 Gg in 2007. This is 73.5% of the overall NMVOC emissions in the country. Almost 2/3 of them come from sub-sector Transport.

Sector Solvent and Other Product Use was the third largest NMVOC emission source in Bulgaria, with 10.3% of the overall emissions in the country.

SOx Emissions

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

Overall emissions in 2007 were 1168 Gg (with the consideration of the desulphurization of output gases in thermo-electric power plants the emissions are with 234.74 Gg lower). The emissions' growth, compared to 2006, was 39.4%.

Sector Energy was a main source of SOx emissions in Bulgaria. It emitted over 98% of the overall SOx emissions in 2007. The main part of emissions in this sector came from sub-sector Energy industries – 1037 Gg in 2007.

The second largest SOx emission source was sub-sector Manufacturing industries and construction, with 6%, and on third place – sector Other sectors, with 2.4%.

CHAPTER 3 ENERGY (CRF SECTOR 1)

3.1. Overview

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 (1A1);
- Manufacturing Industries and Construction (1A2);
- Transport (1A3);
- Other sectors - Commercial, Households, Agriculture and Forestry (1A4);
- Other (1A5).

The fugitive emissions are:

- Coal Mining (1B1);
- Extraction, Transportation and Distribution of Petrol Products and Natural Gas (1B2).

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 2007.

Table 3.1 shows CO_2 emission trends of the above sub-sectors for the period 1988 - 2007.

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, it can be observed – from 47.6% up to 58.6% in 2007. For all other sectors this share decreased: manufacturing industries from 27 down to 19%, transport from 15 to 14.6%, and especially in the public sector and households – from 9.8 down to 2.9%. 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 fuel combustion, compared to the preceding year, can be observed only in Energy industries and Manufacturing industries and construction.

The trend of **Transport** sector shows decrease with 4.9% in 2007 compared to the previous year. The reasons are the fluctuations resulted from variations of liquid fuel prices, and from restructuring and renovation of the vehicles after 2000 as well.

The overall trend in subsector **Other sectors** (Commercial, 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.

Table 3.1 Trends in greenhouse gas emissions from Energy sector, Gg CO_2-eq.

Year	IPCC Source Category										
			CO_2					CH_4	N_2O	1B. Fugitive Fuel Emissions	
	1. All (Energy Combustion and Fugitive)	1.A.Energy Fuel Combustion	Energy Industries	Industry	Transport	Other Sectors	Other			CH_4	N_2O
1988	**94 666**	91 396	43 217	24 755	13 814	8 940	NO	162	508	3 271	NA, NE
1989	**94 763**	91 459	43 690	25 215	13 245	8 639	NO	168	503	3 304	NA, NE
1990	**81 466**	79 257	39 601	21 821	10 864	5 381	1 006	145	438	2 209	NA, NE
1991	**65 771**	63 824	37 106	14 758	6 525	4 086	882	108	360	1 947	NA, NE
1992	**59 674**	57 666	33 862	12 093	6 435	4 610	196	109	359	2 007	NA, NE
1993	**62 163**	60 150	34 092	13 296	7 444	4 117	733	109	360	2 013	NA, NE
1994	**59 091**	57 121	30 945	15 032	6 547	3 325	810	112	352	1 970	NA, NE
1995	**61 974**	59 869	31 572	18 023	6 845	2 621	315	122	371	2 106	NA, NE
1996	**60 773**	58 698	30 652	17 499	6 559	3 238	261	120	370	2 074	NA, NE
1997	**59 044**	57 188	30 936	17 691	5 285	2 678	112	114	372	1 857	NA, NE
1998	**53 617**	51 751	27 502	14 217	6 478	2 989	49	153	363	1 866	NA, NE
1999	**48 853**	47 233	25 760	12 283	6 215	2 491	NO	152	331	1 620	NA, NE
2000	**48 178**	46 384	26 216	11 868	5 889	1 896	NO	172	342	1 794	NA, NE
2001	**49 773**	48 014	29 036	10 788	6 024	1 638	NO	163	365	1 759	NA, NE
2002	**47 328**	45 603	26 466	10 198	6 329	2 074	NO	187	350	1 725	NA, NE
2003	**51 469**	49 752	28 330	11 533	7 111	2 206	NO	188	383	1 717	NA, NE
2004	**50 662**	48 867	28 298	10 818	7 415	1 758	NO	196	382	1 795	NA, NE
2005	**52 186**	50 451	29 642	10 421	8 115	1 700	NO	191	381	1 735	NA, NE
2006	**52 287**	50 488	29 118	10 264	8 622	1 897	NO	200	388	1 799	NA, NE
2007	**55 944**	54 001	32 795	10 782	8 197	1 615	NO	192	421	1 943	NA, NE

Key Sources

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

Table 3.2. Key sources in Energy sector (Methods Tier 1)

CRF categories	Key Category	GHG	Criteria (excluding LULUCF)	Criteria (including LULUCF)
1A1.A	Public Electricity and Heat Production - Solid Fuels	CO_2	L,T	L,T

1A1.A	Public Electricity and Heat Production - Liquid Fuels	CO_2	L,T	L (BY),T
1A1.A	Public Electricity and Heat Production - Gaseous Fuels	CO_2	L	L
1A2	Manufacturing Industries and Construction - Solid Fuels	CO_2	L,T	L,T
1A2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	L,T	L,T
1A2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	L,T	L,T
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid Fuels	CO_2	L (2007),T	L (2007),T
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous Fuels	CO_2	L (2007),T	L (2007),T
1A1	Energy Industries	N_2O	L (2007)	-
1A3a	Civil Aviation - Liquid Fuels	CO_2	T	-
1A3b	Road Transportation - Diesel Oil	CO_2	L,T	L,T
1A3b	Road Transportation - Gasoline	CO_2	L,T	L,T
1A3b	Road Transportation - LPG	CO_2	L (2007),T	L (2007),T
1A3d	Navigation - Liquid Fuels	CO_2	L (BY)	L (BY)
1A3e	Other Transportation - Liquid Fuels	CO_2	L,T	L,T
1A4a	Commercial/ Institutional - Solid Fuels	CO_2	T	-
1A4b	Residential - Solid Fuels	CO_2	L,T	L,T
1A4b	Residential - Liquid Fuels	CO_2	L (BY), T	L (BY), T
1A4c	Agriculture/Forestry/Fisheries - Liquid Fuels	CO_2	L (BY), T	L (BY), T
1B1	Fugitive Emissions from Fuels - Solid Fuels	CH_4	L,T	L
1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	L	L

* L – Level Assessment
T – Trend Assessment

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.

Table 3.3 Organic CO_2 emissions (Gg) reported as "CO_2 from biomass" (from CRF 1A combustion)

	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Commercial/ Institutional	Residential	Agriculture/Forestry/Fishing	Other	Fuel Combustion
	1.A.1	1.A.2	1A.3	1.A.4	1.A.4a	1.A.4b	1.A.4c	1.A.5	1.A
1988	IE	54.7	NO	572	68.5	467.9	36.0	716.8	1344
1989	IE	52.4	NO	568	65.1	467.6	35.4	816.8	1437
1990	IE	56.0	NO	413	17.0	365.3	30.7	683.1	1152
1991	IE	36.6	NO	324	13.5	290.2	19.9	769.0	1129
1992	IE	42.9	NO	409	15.0	368.0	26.0	667.7	1120
1993	IE	21.6	NO	361	10.6	346.7	3.5	631.4	1014
1994	IE	25.5	NO	423	11.6	397.4	13.9	671.3	1120
1995	IE	26.6	NO	556	11.4	540.9	3.4	663.9	1246
1996	IE	23.0	NO	668	5.7	662.3	0.0	681.7	1373
1997	IE	17.3	NO	685	7.8	676.9	0.0	731.7	1434
1998	IE	95.1	NO	1444	94.2	1346	3.8	660.3	2199
1999	IE	100.5	NO	1442	51.4	1349	42.5	666.1	2209
2000	IE	118.4	NO	1984	36.5	1893	55.0	602.5	2705
2001	IE	177.3	NO	1873	33.1	1834	5.9	588.3	2638
2002	IE	191.7	NO	2244	30.1	2205	9.1	672.2	3108
2003	IE	241.6	NO	2348	48.8	2288	11.9	541.1	3131
2004	IE	259.6	NO	2435	33.8	2388	12.8	696.6	3391
2005	IE	190.5	NO	2331	51.0	2260	20.0	625.0	3146
2006	IE	193.1	NO	2473	68.6	2393	11.3	587.5	3254
2007	IE	132.2	NO	2352	56.2	2287	8.8	559.9	3044

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 2007 compared to 1988. This growth was realized mainly in households, which held the largest share, namely 75.13% from the overall CO_2 emissions from biomass in 2007. 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 2007 are reduced by 41% compared to 1988. The corresponding reduction of CH_4 emissions was 38% and of N_2O emissions by 17%.

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 – 61%. Manufacturing industries and construction ranked the second place by 20%, followed by transport – 15%.

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 than 5%.

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:

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

where:

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

Table 3.4 Emissions and sinks for Energy sector 1988-2007 Gg

IPCC Sector	All energy	Fuel combustion total	Energy	Industry	Transport	Other sectors	Commercial/ Institutional	Residential	Agriculture/ Forestry/ Fishing	Other	Fugitive fuel emissions
	1	1A	1A1	1A2	1A3	2A4	1.A.4a	1.A.4b	1.A.4c	1.A.5	1B
CO_2											
1988	90726	90726	43217	24755	13814	8940	1068	6654	1219	NO	NA, NE
1989	90789	90789	43690	25215	13245	8639	773	6609	1256	NO	NA, NE
1990	78673	78673	39601	21821	10864	5381	172	4787	422	1006	NA, NE
1991	63357	63357	37106	14758	6525	4086	124	3633	330	882	NA, NE
1992	57197	57197	33862	12093	6435	4610	107	4354	149	196	NA, NE
1993	59682	59682	34092	13296	7444	4117	114	3890	114	733	NA, NE
1994	56658	56658	30945	15032	6547	3325	96	2962	267	810	NA, NE
1995	59376	59376	31572	18023	6845	2621	64	2456	102	315	NA, NE
1996	58208	58208	30652	17499	6559	3238	114	3095	28	261	NA, NE
1997	56703	56703	30936	17691	5285	2678	46	2632	NO	112	NA, NE
1998	51235	51235	27502	14217	6478	2989	288	2544	157	49	NA, NE
1999	46750	46750	25760	12283	6215	2491	503	1795	194	NO	NA, NE
2000	45869	45869	26216	11868	5889	1896	330	1362	204	NO	NA, NE
2001	47486	47486	29036	10788	6024	1638	574	884	180	NO	NA, NE
2002	45066	45066	26466	10198	6329	2074	388	1511	174	NO	NA, NE
2003	49180	49180	28330	11533	7111	2206	287	1741	178	NO	NA, NE
2004	48289	48289	28298	10818	7415	1758	200	1354	204	NO	NA, NE
2005	49879	49879	29642	10421	8115	1700	224	1241	235	NO	NA, NE
2006	49900	49900	29118	10264	8622	1897	383	1295	219	NO	NA, NE
2007	53389	53389	32795	10782	8197	1615	323	1093	1999	NO	NA, NE
CH_4											
1988	163.5	7.72	0.84	0.57	2.98	1.66	0.32	1.23	0.10	1.67	155.7
1989	165.3	7.98	0.81	0.58	3.08	1.61	0.29	1.22	0.10	1.91	157.3
1990	112.1	6.92	0.91	0.35	2.91	1.11	0.08	0.95	0.09	1.64	105.2
1991	97.8	5.13	0.74	0.31	1.41	0.83	0.06	0.71	0.06	1.83	92.7
1992	100.8	5.20	0.66	0.25	1.70	1.01	0.07	0.88	0.07	1.58	95.6
1993	101.0	5.17	0.59	0.27	1.93	0.87	0.05	0.81	0.01	1.52	95.9
1994	99.1	5.31	0.53	0.28	1.88	1.02	0.05	0.93	0.04	1.61	93.8
1995	106.1	5.83	0.56	0.34	2.02	1.33	0.05	1.27	0.01	1.58	100.3
1996	104.5	5.74	0.52	0.32	1.70	1.58	0.03	1.55	0.00	1.61	98.8
1997	93.8	5.41	0.52	0.30	1.26	1.62	0.03	1.58	NO	1.72	88.4
1998	96.1	7.27	0.45	0.30	1.43	3.55	0.39	3.14	0.01	1.54	88.9
1999	84.4	7.25	0.43	0.28	1.51	3.48	0.23	3.15	0.10	1.55	77.1
2000	93.6	8.19	0.43	0.23	1.42	4.71	0.16	4.42	0.13	1.41	85.4
2001	91.5	7.78	0.47	0.22	1.27	4.44	0.14	4.28	0.02	1.37	83.7
2002	91.0	8.90	0.43	0.21	1.39	5.30	0.13	5.15	0.02	1.57	82.2
2003	90.7	8.97	0.45	0.24	1.44	5.58	0.21	5.34	0.03	1.26	81.8
2004	94.8	9.35	0.45	0.23	1.29	5.75	0.14	5.57	0.03	1.63	85.5
2005	91.7	9.08	0.45	0.21	1.42	5.54	0.22	5.28	0.05	1.46	82.6
2006	95.2	9.51	0.45	0.23	1.54	5.91	0.29	5.59	0.03	1.37	85.7
2007	101.7	9.15	0.52	0.22	1.50	5.60	0.24	5.34	0.02	1.31	92.5
N_2O											
1988	1.64	1.64	0.97	0.14	0.33	0.16	0.018	0.13	0.012	0.03	NA, NE
1989	1.62	1.62	1.00	0.13	0.31	0.15	0.014	0.13	0.012	0.04	NA, NE
1990	1.41	1.41	0.80	0.21	0.25	0.10	0.003	0.09	0.006	0.04	NA, NE
1991	1.16	1.16	0.79	0.09	0.15	0.07	0.002	0.07	0.004	0.05	NA, NE
1992	1.16	1.16	0.82	0.08	0.14	0.08	0.002	0.08	0.003	0.04	NA, NE
1993	1.16	1.16	0.80	0.08	0.17	0.07	0.002	0.07	0.001	0.04	NA, NE
1994	1.13	1.13	0.79	0.10	0.14	0.06	0.002	0.06	0.003	0.04	NA, NE
1995	1.20	1.20	0.84	0.11	0.14	0.06	0.002	0.06	0.001	0.04	NA, NE
1996	1.19	1.19	0.83	0.11	0.14	0.08	0.003	0.07	0.000	0.04	NA, NE
1997	1.20	1.20	0.85	0.13	0.12	0.07	0.001	0.07	NO	0.04	NA, NE
1998	1.17	1.17	0.80	0.09	0.13	0.11	0.007	0.10	0.002	0.03	NA, NE

1999	1.07	1.07	0.73	0.07	0.13	0.10	0.008	0.09	0.004	0.03	NA, NE
2000	1.10	1.10	0.76	0.07	0.13	0.12	0.005	0.11	0.005	0.03	NA, NE
2001	1.18	1.18	0.83	0.07	0.14	0.11	0.007	0.10	0.002	0.03	NA, NE
2002	1.13	1.13	0.75	0.07	0.15	0.13	0.006	0.13	0.003	0.03	NA, NE
2003	1.24	1.24	0.82	0.08	0.17	0.14	0.006	0.13	0.003	0.03	NA, NE
2004	1.23	1.23	0.81	0.07	0.18	0.14	0.005	0.13	0.003	0.03	NA, NE
2005	1.23	1.23	0.80	0.06	0.20	0.13	0.006	0.12	0.004	0.03	NA, NE
2006	1.25	1.25	0.81	0.06	0.21	0.14	0.009	0.13	0.003	0.03	NA, NE
2007	1.36	1.36	0.92	0.07	0.20	0.13	0.008	0.12	0.003	0.03	NA, NE

3.2.1. Energy Industries (CRF 1A1)

3.2.1.1. Source Category Description

Sub-sector Energy Industries included the groups:

- Public Electricity and Heat Production (1A1a);
- Petroleum Refining (1A1b);
- Manufacture of Solid fuels Production and Other Energy Industries (1A1c).

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 GHGs - CO_2, CH_4 and N_2O, for the GHG-precursors - CO, NOx 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 29 130 Gg of CO_2 in 2007, which represented 38% of the total GHG emissions, expressed in CO2-eq.

3.2.1.2. 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**.

Compared to the previous year (2006), the total CO_2 emissions (1A1) in 2007 are increasing by 13% corresponding to the increase by 13% in the electricity and heat production sector (1A1a) caused by the decommissioning (by end 2006) of units/reactors 3 and 4 in the NPP Kozloduy.

Table 3.5 GHG emissions from the Energy Industries, Gg

Gas/Sub-sources	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
CO_2										
1A1a.Public Electricity and Heat Production	43216.90	43689.95	37939.36	35823.31	32881.79	32969.43	29830.20	30350.15	29470.32	29928.82
1A1b.Petroleum Refining	NO	NO	355.90	362.04	58.44	59.06	47.93	50.66	50.63	50.67
1A1c.Manufacture of Solid Fuels and Other Energy Industries	NO	NO	1305.97	920.87	922.16	1063.10	1066.60	1171.14	1130.67	956.59
CH_4										
1A1a.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
1A1b.Petroleum Refining	NO	NO	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
1A1c.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
N_2O										
1A1a.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
1A1b.Petroleum Refining	NO	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A1c.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

Gas/Sub-sources	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CO_2										
1A1a.Public Electricity and Heat Production	26457.74	24498.73	24881.39	27805.16	25200.66	27264.06	27043.49	27262.52	27502.24	31102.88
1A1b.Petroleum Refining	NO	141.81	48.06	51.52	48.40	42.14	52.53	48.73	50.63	59.00
1A1c.Manufacture of Solid Fuels and Other Energy Industries	1044.24	1119.79	1286.30	1179.22	1216.51	1023.66	1201.60	1373.49	1564.79	1633.17
CH_4										
1A1a.Public Electricity and Heat Production	0.42	0.39	0.39	0.43	0.39	0.42	0.41	0.41	0.41	0.47
1A1b.Petroleum Refining	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A1c.Manufacture of Solid Fuels and Other Energy Industries	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.04	0.04	0.04
N_2O										
1A1a.Public Electricity and Heat Production	0.80	0.72	0.75	0.83	0.74	0.82	0.81	0.79	0.80	0.92
1A1b.Petroleum Refining	NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A1c.Manufacture of Solid Fuels and Other Energy Industries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.2.1.3. Uncertainty and time-series consistency

The uncertainty of this source category was 9%.

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.

3.2.1.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.2.1.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is no recalculation in time series (1988-2007) except the correction in the emissions during 2006.

3.2.1.6. Source-specific planned improvements

To improve the accuracy of the estimates.

3.2.2. Manufacturing Industries and Construction (CRF 1A2)

3.2.2.1. Source Category Description

Sub-sector Manufacturing Industries and Construction included the groups:

- Ferrous Metallurgy (1A2a);
- Non-ferrous Metallurgy (1A2b);
- Chemical Industry (1A2c);
- Pulp and Paper Production and Printing Industry (1A2d);
- Food Industry (1A2e);
- Other (1A2f).

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 3.6** shows basic GHG emissions in the sub-sector categories.

Table 3.6 Emissions from Manufacturing Industries and Construction (1A2), Gg

Gas/ Sub-sources	Iron and Steel	Non-ferrous metals	Chemicals	Pulp. Paper and Print	Food Processing, Beverage and Tobacco	Other
	1A2.a	1A2.b	1A2.c	1A2.d	1A2.e	1A2.f
			CO_2			
1988	5171	637	4049	196	613	14089
1989	5308	682	4019	128	617	14461
1990	3448	366	3487	61	228	14231
1991	3080	275	2844	121	154	8284
1992	2757	243	2115	72	219	6688
1993	3163	324	2125	24	131	7528
1994	4318	336	2337	29	87	7926
1995	5198	366	3237	33	88	9102
1996	4675	388	3210	30	53	9143
1997	5079	344	2741	8	69	9450
1998	3420	420	2079	274	676	7348
1999	2420	447	1781	201	674	6760
2000	3332	399	3129	191	642	4175
2001	3057	362	2748	138	548	3935
2002	2843	293	2145	362	526	4029
2003	3486	277	1980	280	485	5025
2004	3028	332	2369	221	474	4393
2005	2817	317	2254	220	422	4391
2006	2662	323	2266	193	498	4322
2007	2566	293	2339	198	485	4901
			CH_4			
1988	0.05	0.015	0.07	0.005	0.020	0.41
1989	0.06	0.015	0.06	0.004	0.019	0.42
1990	0.04	0.006	0.05	0.008	0.008	0.25
1991	0.03	0.004	0.03	0.006	0.005	0.23
1992	0.02	0.003	0.02	0.005	0.008	0.19
1993	0.02	0.005	0.03	0.002	0.005	0.21
1994	0.03	0.005	0.03	0.002	0.003	0.21
1995	0.03	0.005	0.04	0.003	0.003	0.25
1996	0.03	0.004	0.04	0.001	0.002	0.25
1997	0.03	0.004	0.03	0.000	0.003	0.23
1998	0.04	0.007	0.02	0.009	0.028	0.20
1999	0.03	0.008	0.02	0.008	0.026	0.19
2000	0.03	0.006	0.05	0.011	0.026	0.11
2001	0.03	0.007	0.06	0.004	0.021	0.10
2002	0.03	0.006	0.05	0.012	0.020	0.09
2003	0.03	0.005	0.06	0.008	0.018	0.11
2004	0.03	0.004	0.07	0.007	0.018	0.11
2005	0.03	0.006	0.06	0.007	0.012	0.09
2006	0.03	0.006	0.07	0.006	0.015	0.10
2007	0.03	0.004	0.06	0.006	0.015	0.11
			N_2O			
1988	0.037	0.006	0.013	0.003	0.005	0.080
1989	0.038	0.007	0.014	0.002	0.006	0.063
1990	0.024	0.004	0.011	0.001	0.002	0.170
1991	0.019	0.003	0.008	0.001	0.001	0.062
1992	0.017	0.003	0.005	0.001	0.002	0.049
1993	0.023	0.004	0.004	0.000	0.001	0.051
1994	0.031	0.004	0.006	0.000	0.001	0.056
1995	0.040	0.004	0.008	0.000	0.001	0.061
1996	0.035	0.004	0.008	0.000	0.000	0.063
1997	0.037	0.004	0.007	0.000	0.001	0.077
1998	0.017	0.004	0.006	0.001	0.006	0.058
1999	0.009	0.005	0.009	0.001	0.006	0.045
2000	0.013	0.004	0.014	0.001	0.006	0.027
2001	0.015	0.004	0.016	0.001	0.004	0.027

2002	0.014	0.003	0.013	0.004	0.004	0.030
2003	0.017	0.003	0.010	0.002	0.004	0.041
2004	0.015	0.004	0.016	0.001	0.004	0.033
2005	0.013	0.003	0.013	0.001	0.003	0.031
2006	0.012	0.003	0.014	0.001	0.003	0.028
2007	0.013	0.003	0.014	0.001	0.003	0.035

CO_2 emissions from coal combustion in this sub-sector were responsible for 6% of the total GHG emissions of Bulgaria in 2007.

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 3.7.**

CO_2 emissions of non-energy fuel use are added to this sub-sector as well.

3.2.2.2. Methodology

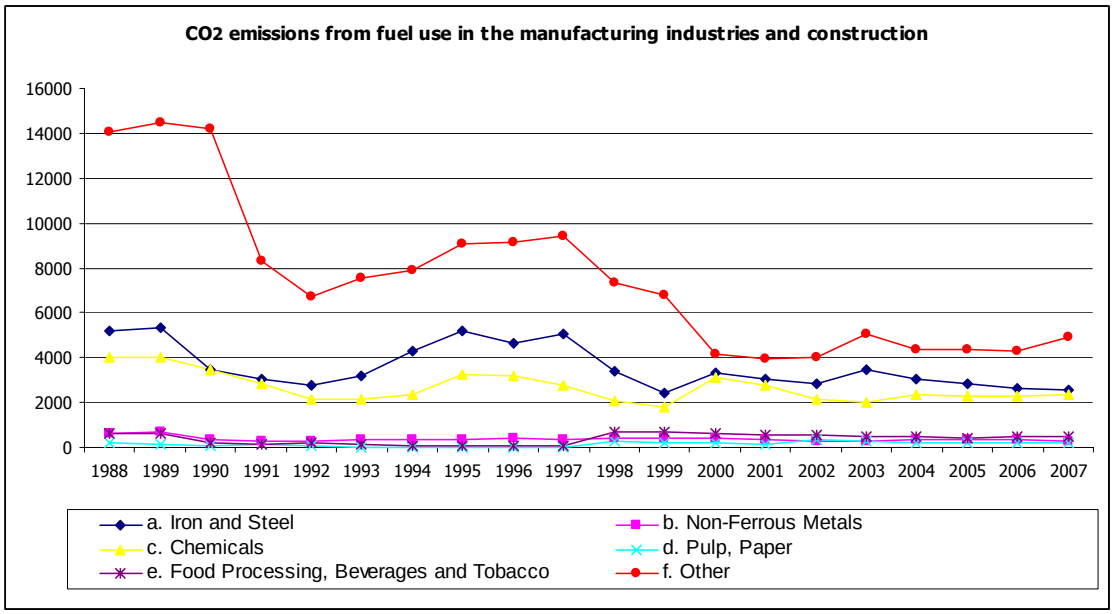
This emission source included the main facilities in the industry, combusting all basic types of fuels. CO_2 emissions are estimated by a method of the type Tier 2, using the data from the energy balance of the country, prepared by NSI. National emission factors are mainly used for the basic GHGs, as 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**.

3.2.2.3. Uncertainty and time-series consistency

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 three minimums – in 1992, 2000 and in 2002. These three 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 five years, biggest in 2003, as it reflected surmounting of the crisis.

Table 3.7 CO_2 emissions from fuel use in the Manufacturing Industries and Construction, Gg

Gas/subsource	1A2a. Iron and Steel	Feedstock	1A2b. Non-Ferrous Metals	1A2.c Chemicals	fuel combustion (Tier 1)	Feedstock	1A2d. Pulp, Paper and Print	1A2e. Food Processing, Beverages and Tobacco	1A2f. Other	Total
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
1988	5171	80	637	4049	2704	1344	196	613	14089	**24755**
1989	5308	81	682	4019	2736	1282	128	617	14461	**25215**
1990	3448	72	366	3487	2262	1225	61	228	14231	**21821**
1991	3080	37	275	2844	1498	1346	121	154	8284	**14758**
1992	2757	48	243	2115	979	1135	72	219	6688	**12093**
1993	3163	64	324	2125	1099	1027	24	131	7528	**13296**
1994	4318	74	336	2337	1354	983	29	87	7926	**15032**
1995	5198	78	366	3237	1938	1299	33	88	9102	**18023**
1996	4675	74	388	3210	1774	1436	30	53	9143	**17499**
1997	5079	82	344	2741	1482	1259	8	69	9450	**17691**
1998	3420	47	420	2079	1109	969	274	676	7348	**14217**
1999	2420	54	447	1781	882	899	201	674	6760	**12283**
2000	3332	71	399	3129	1849	1280	191	642	4175	**11868**
2001	3057	52	362	2748	1765	984	138	548	3935	**10788**
2002	2843	45	293	2145	1453	692	362	526	4029	**10198**
2003	3486	53	277	1980	1249	730	280	485	5025	**11533**
2004	3028	51	332	2369	1517	852	221	474	4393	**10818**
2005	2817	46	317	2254	1355	899	220	422	4391	**10421**
2006	2662	37	323	2266	1431	637	193	498	4322	**10264**
2007	2566	33	293	2339	1258	722	198	485	4901	**10782**

Table 3.8 shows the CO_2 emissions by basic types of fuels in the sub-sector.

Table 3.8 CO_2 emissions by main fuels type in the Manufacturing Industries and Construction, Gg

Gas/sub-source	Liquid Fuels	Solid Fuels	Gaseous Fuels	Biomass	Other Fuels	Total
	Gg	Gg	Gg	Gg	Gg	Gg
1988	7 740	9 353	7 661	55	NO	24 809
1989	7 939	9 697	7 580	52	NO	25 268
1990	2 075	14 277	5 469	56	NO	21 877
1991	3 596	6 087	5 074	37	NO	14 794
1992	2 577	5 066	4 451	43	NO	12 136
1993	2 280	6 083	4 933	22	NO	13 318
1994	2 350	7 542	5 139	25	NO	15 058
1995	3 326	8 627	6 070	27	NO	18 050
1996	3 015	8 469	6 015	23	NO	17 522

1997	3 424	9 832	4 435	17	NO	17 709
1998	4 540	5 719	3 959	95	NO	14 312
1999	4 107	5 242	2 934	100	NO	12 383
2000	3 415	5 033	3 420	118	NO	11 987
2001	3 008	4 863	2 917	177	NO	10 965
2002	3 240	4 504	2 455	192	NO	10 390
2003	3 495	5 398	2 641	242	NO	11 775
2004	3 219	4 905	2 693	260	NO	11 077
2005	2 944	4 395	3 082	190	NO	10 611
2006	2 986	4 010	3 268	193	NO	10 457
2007	3 200	4 352	3 230	132	NO	10 914

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 2007 is more than two times compared to the base year.

Table 3.9 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).

Table 3.9 Trends in CO_2 emissions by feedstock use of energy carriers according to the Reference Approach, Gg

Years/Fuels	Liquid Fuels	Solid Fuels	Gaseous Fuels	Total
1988	354	80	11 401	**11 835**
1989	297	81	11 729	**12 107**
1990	206	72	12 085	**12 363**
1991	105	37	10 158	**10 300**
1992	102	48	8 978	**9 128**
1993	123	64	8 435	**8 622**
1994	100	74	8 493	**8 667**
1995	454	78	10 293	**10 825**
1996	452	74	10 440	**10 966**
1997	415	82	8 225	**8 722**
1998	438	47	7 436	**7 921**
1999	330	54	5 978	**6 362**
2000	336	71	6 358	**6 765**
2001	50	52	5 905	**6 007**
2002	60	45	5 271	**5 376**
2003	74	53	5 475	**5 602**
2004	76	51	5 444	**5 571**
2005	68	46	6 178	**6 292**
2006	65	37	6 494	**6 596**
2007	75	33	6 504	**6 612**

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.

3.2.2.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.2.2.5 Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

3.2.2.6. Source-specific planned improvements

To improve the accuracy of the estimates.

3.2.3. Transport (CRF 1A3)

3.2.3.1. Source Category Description

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 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 3.10 shows the GHG emission trends from mobile sources for the period 1988-2007.

Table 3.10 Trends of greenhouse gas emissions from Transport sub sector, Gg

Gas/ Sub-sources	Civil Aviation	Road Transportation	Railways	Navigation	Other Transportation	Total
	1A2.a	1A2.b	1A2.c	1A2.d	1A2.e	1A2
CO_2						
1988	612	7 747	368	1088	3998	**13814**
1989	354	8 060	347	1162	3322	**13245**
1990	317	7 586	334	58	2569	**10864**
1991	270	4 418	223	4	1610	**6525**
1992	315	4 646	175	7	1293	**6435**
1993	315	5 751	178	9	1192	**7444**
1994	317	4 976	132	12	1109	**6547**
1995	276	5 390	114	13	1053	**6845**
1996	214	5 306	121	30	888	**6559**
1997	183	4 016	1	5	1079	**5285**
1998	120	5 154	131	10	1064	**6478**
1999	35	5 327	120	8	724	**6215**
2000	32	5 016	122	NO, NA	720	**5889**
2001	46	5 197	106	NO, NA	675	**6024**
2002	48	5 496	97	NO, NA	688	**6329**
2003	56	6 281	89	NO, NA	685	**7111**
2004	104	6 562	89	NO, NA	659	**7415**
2005	120	7 178	94	NO, NA	724	**8115**
2006	122	7 618	93	NO, NA	788	**8622**
2007	132	7 298	79	NO, NA	687	**8197**
CH_4						
1988	0.062	2.55	0.03	0.083	0.26	**2.97**
1989	0.034	2.68	0.03	0.089	0.25	**3.07**

1990	0.012	2.59	0.03	0.004	0.28	**2.90**
1991	0.010	1.21	0.02	0.000	0.18	**1.41**
1992	0.009	1.54	0.01	0.000	0.14	**1.70**
1993	0.009	1.78	0.01	0.001	0.13	**1.93**
1994	0.011	1.73	0.01	0.001	0.13	**1.87**
1995	0.009	1.89	0.01	0.001	0.12	**2.02**
1996	0.007	1.59	0.01	0.002	0.10	**1.70**
1997	0.006	1.13	0.00	0.000	0.12	**1.26**
1998	0.004	1.30	0.01	0.001	0.12	**1.43**
1999	0.001	1.40	0.01	0.001	0.10	**1.51**
2000	0.002	1.31	0.01	NO, NA	0.10	**1.42**
2001	0.003	1.17	0.01	NO, NA	0.09	**1.27**
2002	0.004	1.29	0.01	NO, NA	0.09	**1.39**
2003	0.003	1.34	0.01	NO, NA	0.09	**1.44**
2004	0.005	1.20	0.01	NO, NA	0.09	**1.29**
2005	0.005	1.31	0.01	NO, NA	0.09	**1.42**
2006	0.004	1.43	0.01	NO, NA	0.10	**1.54**
2007	0.005	1.40	0.01	NO, NA	0.09	**1.50**
N_2O						
1988	0.00070	0.16	0.009	0.0273	0.13	**0.33**
1989	0.00037	0.16	0.009	0.0292	0.11	**0.31**
1990	0.00004	0.15	0.008	0.0015	0.09	**0.25**
1991	0.00003	0.09	0.006	0.0001	0.06	**0.15**
1992	0.00001	0.09	0.004	0.0002	0.05	**0.14**
1993	0.00001	0.12	0.004	0.0002	0.04	**0.17**
1994	0.00003	0.10	0.003	0.0003	0.04	**0.14**
1995	0.00002	0.10	0.003	0.0003	0.04	**0.14**
1996	0.00001	0.11	0.003	0.0008	0.03	**0.14**
1997	0.00001	0.08	0.000	0.0001	0.03	**0.12**
1998	0.00002	0.10	0.003	0.0002	0.03	**0.13**
1999	0.00000	0.11	0.003	0.0002	0.02	**0.13**
2000	0.00002	0.11	0.003	NO, NA	0.02	**0.13**
2001	0.00003	0.12	0.003	NO, NA	0.02	**0.14**
2002	0.00004	0.13	0.002	NO, NA	0.02	**0.15**
2003	0.00003	0.15	0.002	NO, NA	0.02	**0.17**
2004	0.00003	0.16	0.002	NO, NA	0.02	**0.18**
2005	0.00002	0.18	0.002	NO, NA	0.02	**0.20**
2006	0.00001	0.19	0.002	NO, NA	0.02	**0.21**
2007	0.00002	0.19	0.002	NO, NA	0.02	**0.20**

CO_2 emissions from **road transport** were key source of GHG emissions. These emissions were 9.6% of the overall country emissions in 2007. Another key source was the CO_2 emissions from **other transport**, with 0.9% share in the overall emissions.

The road transport was the largest emission source of main GHGs in sub-sector Transport - 89% of the CO_2 emissions, 93% of methane emissions, and 91% 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 air transport emissions were spitted between domestic and international transport based on expert assessment. The overall quantities of the used kerosene 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.

The reason for the sharp leap of the fuels for the international marine bunkering in 1999 is the change of the methods for their collection and processing in the National

Statistics. A new method is applied, following the EUROSTAT, according to which the marine bunkering includes only fuels, bunkered in Bulgaria by all flags.

Table 3.11 shows GHG-precursors emissions with the higher 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 decreased by 4.9% in 2007 compared to the preceding year. This was due to decreased diesel fuel consumption in the road transport.

Table 3.11 GHG-precursors emissions from Mobile sources, Gg

Year/GHG-precursors	NOx	CO	NMVOC	SO_2
	Gg	Gg	Gg	Gg
1988	115.56	454.37	67.08	57.85
1989	114.61	468.72	70.18	49.32
1990	97.80	434.83	66.25	17.99
1991	57.59	215.97	34.24	10.53
1992	51.75	260.37	39.11	9.59
1993	56.03	303.98	45.88	11.02
1994	48.86	296.86	44.01	9.07
1995	49.38	327.58	48.22	8.82
1996	45.29	267.54	40.57	9.44
1997	41.77	189.96	29.90	7.80
1998	48.44	241.04	39.29	8.35
1999	45.23	239.01	38.53	8.00
2000	47.29	221.28	36.37	7.09
2001	48.06	202.20	34.57	7.30
2002	51.47	220.02	37.42	7.47
2003	56.19	221.69	38.46	8.78
2004	50.59	205.46	36.89	9.52
2005	60.54	218.44	38.04	10.54
2006	64.47	231.95	40.42	11.21
2007	49.91	229.94	37.72	9.81

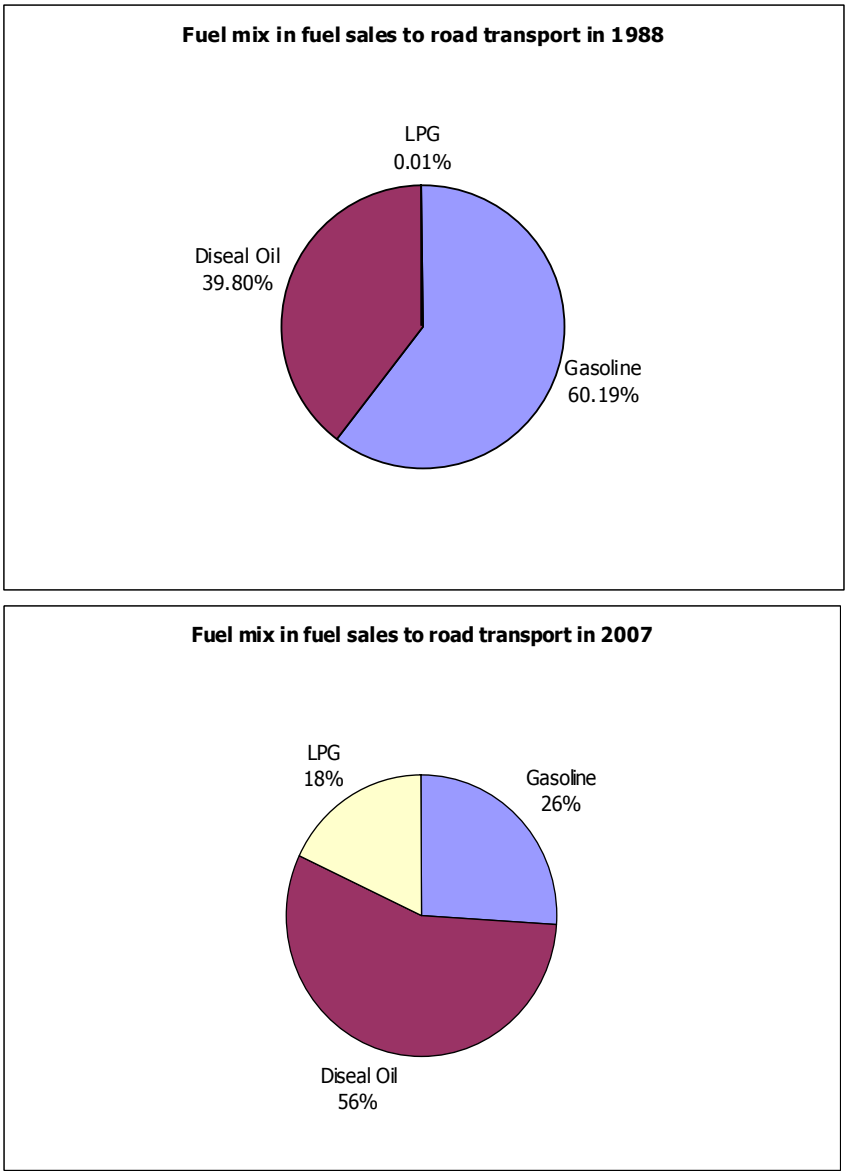
Table 3.12 shows the trend of fuel quantities, used by the road transport. It shows a stable growth after 1997.

Table 3.12 Fuels for Road Transportation, TJ

Year/Fuel Consumption	Gasoline	Diesel Oil	LPG	Total
	TJ	TJ	TJ	TJ
1988	63 235	41 817	11.544	**105 063**
1989	67 409	41 966	9.464	**109 385**
1990	61 643	42 455	0.89889	**104 098**
1991	28 955	30 959	1.2	**59 915**
1992	36 908	27 490	0.14	**64 399**
1993	43 176	35 914	1.7	**79 092**
1994	43 572	26 138	5.6	**69 716**
1995	48 050	26 839	4.4	**74 893**
1996	40 431	33 191	15	**73 637**
1997	26 780	27 337	27.6	**54 145**
1998	35 168	31 821	3057	**70 046**
1999	34 564	33 761	4156.35	**72 481**
2000	29 019	30 204	9842.25	**69 065**
2001	24 928	33 794	13061	**71 783**
2002	26 795	34 296	15045.55	**76 137**
2003	25 762	44 112	16825	**86 699**
2004	24 554	50 006	15558	**90 117**
2005	23 920	56 580	18096.65	**98 597**
2006	26 603	59 156	18905.77	**104 665**
2007	26 234	55 975	18087.27	**100 296**

Figure 3.2 shows the change in the fuel sales in 2007, 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 2007.

Figure 3.2



The fuel sales, shown on **Figure 3.2** and **Table 3.12** and GHG emissions in **Table 3.10** should be estimated on the basis of more than a double increase of number of automobiles (cars, trucks, buses) in 2007, compared to the base year.

3.2.3.2. 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, 2006. 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 2007 more new cars are imported, which means a rise of 22% compared to 2006. There was also a growth of second-hand car sales.

3.2.3.3. Uncertainty and time-series consistency

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.

3.2.3.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.2.3.5 Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

3.2.3.6. Source-specific planned improvements

To improve the accuracy of the estimates.

3.2.4. Other Sectors (CRF 1A4)

3.2.4.1. Source Category Description

Sub-sector Other sectors include the groups:

- Commercial/Institutional (1A4a);
- Residential (1A4b);
- Agriculture/Forestry/Fisheries (1A4c).

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 3.13 shows the main GHG emissions in the sub-sector.

Table 3.13 Trends of greenhouse gas emissions from Other sectors, Gg

Gas/ Sub-sources	Commercial/ Institutional	Residential	Agriculture/Forestry/ Fisheries
	1A2.a	1A2.b	1A2.c
CO_2			
1988	1067.55	6653.90	1218.80
1989	773.10	6609.10	1256.39
1990	171.97	4786.61	422.01
1991	123.78	3632.74	329.74
1992	106.55	4354.46	149.45
1993	113.77	3889.58	113.67
1994	96.25	2961.94	266.56
1995	63.74	2455.73	101.54
1996	113.97	3095.46	28.24
1997	45.94	2632.34	NO
1998	288.38	2543.92	156.54
1999	502.91	1794.56	193.96
2000	329.68	1361.91	204.49
2001	574.27	883.89	179.65
2002	388.33	1511.46	174.31
2003	286.65	1740.81	178.13
2004	199.88	1353.94	204.25
2005	224.09	1241.19	234.92
2006	382.75	1295.49	219.02
2007	322.61	1092.55	199.31
CH_4			
1988	0.32	1.23	0.10
1989	0.29	1.22	0.10
1990	0.08	0.95	0.09
1991	0.06	0.71	0.06
1992	0.07	0.88	0.07
1993	0.05	0.81	0.01
1994	0.05	0.93	0.04
1995	0.05	1.27	0.01
1996	0.03	1.55	0.00
1997	0.03	1.58	NO
1998	0.39	3.14	0.01
1999	0.23	3.15	0.10
2000	0.16	4.42	0.13
2001	0.14	4.28	0.02
2002	0.13	5.15	0.02
2003	0.21	5.34	0.03
2004	0.14	5.57	0.03
2005	0.22	5.28	0.05
2006	0.29	5.59	0.03
2007	0.24	5.34	0.02

N_2O			
1988	0.018	0.13	0.012
1989	0.014	0.13	0.012
1990	0.003	0.09	0.006
1991	0.002	0.07	0.004
1992	0.002	0.08	0.003
1993	0.002	0.07	0.001
1994	0.002	0.06	0.003
1995	0.002	0.06	0.001
1996	0.003	0.07	0.000
1997	0.001	0.07	NO
1998	0.007	0.10	0.002
1999	0.008	0.09	0.004
2000	0.005	0.11	0.005
2001	0.007	0.10	0.002
2002	0.006	0.13	0.003
2003	0.006	0.13	0.003
2004	0.005	0.13	0.003
2005	0.006	0.12	0.004
2006	0.009	0.13	0.003
2007	0.008	0.12	0.004

The analysis of **Table 3.13** showed that the sub-sector **Residential** had a predominating role. More than 80% of CO_2 emissions, 95% of CH_4 emissions and 91% of N_2O emissions were emitted from this category.

The CO_2 emissions from stationary combustion processes – **other sectors – coal** produced 1.3% of the overall emissions of the country in 2007.

The consumption of fuels in the sub-sector **Residential** 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 2007 were 2 287 Gg, which shows decrease by 4.4% compared to the previous year. It breaks the trend of growth in the last ten years.

3.2.4.2. 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.

3.2.4.3. Uncertainty and time-series consistency

The uncertainty of this source category was 9% for CO_2 emissions and 50% for CH_4 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.

3.2.4.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.2.4.5 Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

3.2.4.6. Source-specific planned improvements

To improve the accuracy of the estimates.

3.2.5. Other (CRF 1A5)

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 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 2007 were 560 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 3.14 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 3.47% for 2007.

Emission trend as per the two approaches for the period 1988-2007 is practically the same – reduction by around - 40%. CO_2 emission reduction was biggest with the liquid fuels – 61%, followed by gaseous - 43% and solid fuels - 22%.

Table 3.14 Comparison of CO_2 emissions: Reference Approach (RA) versus National Approach (NA), Gg

IPCC Sector	Reference Approach				National Approach (SA)	Difference
	Liquid Fuels	Solid Fuels	Gaseous Fuels	Total		
	Gg	Gg	Gg	Gg	Gg	%
1988	34 832	44 926	11 401	91 159	90 726	0.48
1989	34 055	44 671	11 729	90 455	90 789	-0.37
1990	28 320	40 554	12 085	80 960	78 673	2.91
1991	19 254	34 727	10 158	64 139	63 357	1.23
1992	15 300	32 758	8 978	57 036	57 197	-0.28
1993	18 317	34 722	8 435	61 474	59 682	3.00
1994	16 873	31 760	8 493	57 126	56 658	0.83
1995	16 634	32 835	10 293	59 763	59 376	0.65
1996	14 575	33 418	10 440	58 432	58 208	0.39
1997	12 068	34 897	8 225	55 190	56 703	-2.67
1998	11 412	32 541	7 436	51 389	51 235	0.30
1999	11 742	28 693	5 978	46 413	46 750	-0.72
2000	10 879	28 900	6 358	46 136	45 869	0.58
2001	10 683	31 564	5 905	48 152	47 486	1.40
2002	11 923	28 649	5 271	45 843	45 066	1.72
2003	12 198	32 151	5 475	49 825	49 180	1.31
2004	11 631	31 451	5 444	48 526	48 289	0.49
2005	13 227	30 560	6 178	49 966	48 921	2.14
2006	13 286	31 208	6 494	50 988	49 900	2.18
2007	13 505	35 233	6 504	55 242	53 389	3.47

3.2.7. Non-energy Use of Fuels

3.2.7.1. Source Category Description

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 2007 was as low as 1.1%, as this share was retained for the whole inventory period after the base year, 1988.

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.

3.2.7.2. 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.

3.2.7.3. Uncertainty and time-series consistency

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 3.15** for the main types of fuels – liquid, solid and gaseous.

The overall emissions of Bulgaria from non-energy use of fuels in 2007 dropped down by 43%, compared to the base year 1988.

Table 3.15 CO_2 emissions from non-energy use of fuels

Years/Fuels	Liquid Fuels	Solid Fuels	Gaseous Fuels	Total
1988	354	80	990	1435
1989	297	81	986	1373
1990	206	72	1019	1306
1991	105	37	1241	1391
1992	102	48	1033	1190
1993	123	64	904	1098
1994	100	74	883	1063
1995	454	78	845	1387
1996	452	74	985	1522
1997	415	82	844	1351
1998	438	47	532	1025
1999	330	54	569	960
2000	336	71	944	1360
2001	50	52	933	1042
2002	60	45	632	741
2003	74	53	656	788
2004	76	51	776	909
2005	68	46	831	950
2006	76	37	637	750
2007	69	33	722	824

3.2.8. International Bunkers (CRF 1AC)

3.2.8.1. Source category description

The International Bunkers include 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 3.16 shows the fuels (in TJ) and CO_2 emissions for the period 1988-2007.

Table 3.16 International bunkers: energy consumption (TJ) and related CO_2 emissions (Gg) 1988-2007

Source	Energy consumption								CO_2 emissions							
	Marine Bunkers	Gasoline	Gas/Diesel Oil	Residual Fuel Oil	Aviation Bunkers	Jet Kerosene	Gasoline	Total	Marine Bunkers	Gasoline	Gas/Diesel Oil	Residual Fuel Oil	Aviation Bunkers	Jet Kerosene	Gasoline	Total
	TJ	TJ	TJ	TJ	TJ	TJ	TJ	TJ	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
1988	12439	NO	7659	4780	10602	10602	NO	23041	969	NO	583	385.8	749	749	NO	1718
1989	12646	NO	7292	5354	10344	10344	NO	22990	987	NO	555	432.1	731	731	NO	1719
1990	11295	1	2777	8517	12638	12377	260	23933	874	0.1	208	665.5	892	874	18	1766
1991	11430	NO	2664	8766	4536	4446	90	15966	878	NO	200	678.3	320	314	6	1198
1992	11049	NO	2725	8324	8004	7967	37	19053	873	NO	204	668.7	565	562	3	1438
1993	10589	NO	2336	8253	10464	10427	36	21053	844	NO	178	666.1	739	736	3	1583
1994	10664	NO	2240	8424	8958	8892	66	19622	850	NO	171	679.9	632	628	5	1483
1995	10684	NO	2240	8444	7782	7731	51	18466	882	NO	201	681.4	549	546	4	1432
1996	9240	NO	2240	7000	6686	6668	18	15926	732	NO	174	557.9	472	471	1	1204
1997	13624	NO	3340	10284	6056	6031	25	19680	1092	NO	262	829.9	428	426	2	1520
1998	12812	NO	2703	10109	6938	6896	42	19750	1022	NO	206	815.8	490	487	3	1512
1999	333	NO	294	39	4522	4522	NO	4855	26	NO	22.4	3.2	319	319	NO	345
2000	2696	NO	2696	NO	3822	3822	NO	6518	205	NO	205	NO	270	270	NO	475
2001	4017	NO	3975	42	5571	5571	NO	9588	306	NO	302	3.4	393	393	NO	699
2002	4416	NO	4416	NO	5654	5654	NO	10070	336	NO	336	NO	399	399	NO	735
2003	5723	NO	5723	NO	6870	6870	NO	12594	436	NO	436	NO	485	485	NO	921
2004	4813	NO	4813	NO	5741	5741	NO	10554	366	NO	366	NO	405	405	NO	772
2005	4589	NO	4589	NO	6696	6696	NO	11285	349	NO	349	NO	473	473	NO	822
2006	4443	NO	4443	NO	6859	6859	NO	11301	338	NO	338	NO	484	484	NO	822
2007	2175	NO	2175	NO	7474	7474	NO	9650	166	NO	166	NO	528	528	NO	693

The international marine bunkering emissions in 2007 dropped by 83% compared to 1988, while the air bunkering emissions dropped less, i.e. by 30%.

The main reason for that was the change of the methodology in 1999 for accounting of thankering of fuels on Bulgarian and foreign ships.

The increasing of international aviation bunkering follows the increase of international traffic due to a travel, cargo and others transportation.

3.2.8.2. 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 3.17 shows the trends of main GHG and GHG precursor's emissions.

Table 3.17 Trend in greenhouse gas emissions from International Bunkers 1988-2007, Gg

Source	Marine Bunkers	Gasoline	Gas/Diesel Oil	Residual Fuel Oil	Aviation Bunkers	Jet Kerosene	Gasoline	Total
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
CH_4								
1988	0.04	NO	0.04	NO	0.02	0.02	NO	0.06
1989	0.04	NO	0.04	NO	0.02	0.02	NO	0.06
1990	0.02	0	0.02	NO	0.04	0.02	0.02	0.06
1991	0.01	NO	0.01	NO	0.01	0.01	0.01	0.03
1992	0.01	NO	0.01	NO	0.02	0.02	0	0.03
1993	0.01	NO	0.01	NO	0.02	0.02	0	0.04
1994	0.01	NO	0.01	NO	0.02	0.02	0	0.03
1995	0.01	NO	0.01	NO	0.02	0.02	0	0.03
1996	0.01	NO	0.01	NO	0.01	0.01	0	0.03
1997	0.02	NO	0.02	NO	0.01	0.01	0	0.03
1998	0.01	NO	0.01	NO	0.02	0.01	0	0.03
1999	0	NO	0	NO	0.01	0.01	NO	0.01
2000	0.01	NO	0.01	NO	0.01	0.01	NO	0.02
2001	0.02	NO	0.02	NO	0.01	0.01	NO	0.03
2002	0.02	NO	0.02	NO	0.01	0.01	NO	0.04
2003	0.03	NO	0.03	NO	0.01	0.01	NO	0.05
2004	0.03	NO	0.03	NO	0.01	0.01	NO	0.04
2005	0.03	NO	0.03	NO	0.01	0.01	NO	0.04
2006	0.02	NO	0.02	NO	0.01	0.01	NO	0.04
2007	0.01	NO	0.01	NO	0.01	0.01	NO	0.03
N_2O								
1988	0.02	NO	0.01	0.01	NO	NO	NO	0.02
1989	0.02	NO	0.01	0.01	NO	NO	NO	0.02
1990	0.02	0	0.01	0.02	0	NO	0	0.02
1991	0.02	NO	0.01	0.02	0	NO	0	0.02
1992	0.02	NO	0.01	0.02	0	NO	0	0.02
1993	0.02	NO	0	0.02	0	NO	0	0.02
1994	0.02	NO	0	0.02	0	NO	0	0.02
1995	0.02	NO	0.01	0.02	0	NO	0	0.02
1996	0.02	NO	0	0.01	0	NO	0	0.02
1997	0.03	NO	0.01	0.02	0	NO	0	0.03
1998	0.03	NO	0.01	0.02	0	NO	0	0.03
1999	0	NO	0	0	NO	NO	NO	0
2000	0.01	NO	0.01	NO	NO	NO	NO	0.01
2001	0.01	NO	0.01	0	NO	NO	NO	0.01
2002	0.01	NO	0.01	NO	NO	NO	NO	0.01
2003	0.01	NO	0.01	NO	NO	NO	NO	0.01
2004	0.01	NO	0.01	NO	NO	NO	NO	0.01
2005	0.01	NO	0.01	NO	NO	NO	NO	0.01
2006	0.01	NO	0,01	NO	NO	NO	NO	0.01
2007	0.00	NO	0,00	NO	NO	NO	NO	0.00
NOx								
1988	22.8	NO	12.35	10.45	2.99	2.99	NO	25.78
1989	23.46	NO	11.76	11.7	2.91	2.91	NO	26.37
1990	22.44	NO	4.41	18.03	3.5	3.5	NO	25.94
1991	22.6	NO	4.23	18.37	1.26	1.26	NO	23.86
1992	22.44	NO	4.33	18.11	2.25	2.25	NO	24.69
1993	21.81	NO	3.77	18.04	2.95	2.95	NO	24.76
1994	22.03	NO	3.61	18.42	2.52	2.52	NO	24.54
1995	22.71	NO	4.25	18.46	2.19	2.19	NO	24.9
1996	18.79	NO	3.68	15.11	1.89	1.89	NO	20.68
1997	28.03	NO	5.55	22.48	1.71	1.71	NO	29.73
1998	26.46	NO	4.37	22.1	1.94	1.94	NO	28.41
1999	0.56	NO	0.47	0.09	1.28	1.28	NO	1.84
2000	4.35	NO	4.35	NO	1.08	1.08	NO	5.43
2001	6.5	NO	6.4	0.09	1.58	1.58	NO	8.07
2002	7.12	NO	7.12	NO	1.6	1.6	NO	8.72

2003	9.23	NO	9.23	NO	1.94	1.94	NO	11.17
2004	7.76	NO	7.76	NO	1.62	1.62	NO	9.38
2005	7.4	NO	7.4	NO	1.89	1.89	NO	9.29
2006	7.2	NO	7.2	NO	1.94	1.94	NO	9.10
2007	3.5	NO	3.5	NO	2.12	2.12	NO	5.62
CO								
1988	4.12	NO	3.9	0.23	1.24	1.24	NO	5.36
1989	3.97	NO	3.71	0.26	1.21	1.21	NO	5.17
1990	1.81	0.02	1.39	0.39	7.45	1.44	6.01	9.26
1991	1.74	NO	1.34	0.4	2.59	0.52	2.07	4.32
1992	1.76	NO	1.37	0.4	1.77	0.93	0.84	3.53
1993	1.58	NO	1.19	0.39	2.06	1.22	0.84	3.64
1994	1.54	NO	1.14	0.4	2.56	1.04	1.52	4.1
1995	1.75	NO	1.34	0.4	2.08	0.9	1.18	3.83
1996	1.49	NO	1.16	0.33	1.18	0.78	0.41	2.67
1997	2.24	NO	1.75	0.49	1.27	0.7	0.57	3.51
1998	1.86	NO	1.38	0.48	1.77	0.8	0.97	3.63
1999	0.15	NO	0.15	0	0.53	0.53	NO	0.68
2000	1.37	NO	1.37	NO	0.45	0.45	NO	1.82
2001	2.02	NO	2.02	0	0.65	0.65	NO	2.67
2002	2.25	NO	2.25	NO	0.66	0.66	NO	2.91
2003	2.91	NO	2.91	NO	0.8	0.8	NO	3.71
2004	2.45	NO	2.45	NO	0.67	0.67	NO	3.12
2005	2.33	NO	2.33	NO	0.78	0.78	NO	3.12
2006	2.26	NO	2.26	NO	0.80	0.80	NO	3.06
2007	1.11	NO	1.11	NO	0.87	0.87	NO	1.98

In 2007 were emitted main GHG at the amount of 693.3 Gg CO_2-eq. The sea transport emitted 24%, and the air transport - 76%. After the big drop in 1999, all GHG emissions increased more than twice in 2007.

3.2.8.3. 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.

3.2.8.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.2.8.5 Source-specific recalculations, if applicable, including changes made in response to the review process

The CH_4 emission of aviation bunkering and CH_4 and N_2O emission form marine bunkering for 2006 were recalculated in the submission 2009.

3.2.8.6. Source-specific planned improvements

To improve the accuracy of the estimates.

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

3.3.1. Source category description

The fugitive methane emissions from coal mining are one of the largest methane emission sources in Bulgaria. They are with share more than 1.7% of overall emissions for the country in 2007. The fugitive emissions from systems for gas and oil extraction and distribution are also key source and had a share of approx. 1% of overall GHG emissions.

Coal Mining (1B1)

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 amounts to 23.9 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 4.5 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 3.18 shows the fugitive methane emission trends in coal mining.

Table 3.18 CH_4 fugitive emissions from coal mining and handling 1988-2007

Source	Coal Mining and Handling					CH_4 Emissions		
	Underground Mines	Brown coal	Black coal	Anthracite coal	Surface Mines - lignite	Underground Mines	Surface Mines	Total
	kt	kt	kt	kt	kt	Gg	Gg	Gg
1988	5180	4984	131	65	29191	69.4	25.4	94.8
1989	4992	4799	130	63	29509	66.9	25.7	92.6
1990	3848	3705	100	43	27827	51.6	24.2	75.8
1991	3220	3092	86	42	25231	43.1	22.0	65.1
1992	3600	3352	203	45	26736	48.2	23.3	71.5
1993	3682	3419	222	41	25351	49.3	22.1	71.4
1994	3328	3155	144	29	25429	44.6	22.1	66.7
1995	3381	3187	170	24	27449	45.3	23.9	69.2
1996	3198	3060	119	19	28104	42.9	24.5	67.3
1997	2779	2677	88	14	26929	37.2	23.5	60.7
1998	2993	2902	78	13	27117	40.1	23.6	63.7
1999	2712	2590	122	0	22586	36.3	19.7	56.0
2000	2719	2602	118	0	23712	36.4	20.7	57.1
2001	2756	2646	98	12	23856	36.9	20.8	57.7
2002	2860	2766	83	11	23158	38.3	20.2	58.5
2003	2695	2644	43	8	24604	36.1	21.4	57.5

2004	2844	2811	33	1	23642	38.1	20.6	58.7
2005	2490	2481	9	0	22205	33.4	19.3	52.7
2006	2726	2699	27	0	22952	36.5	20.0	56.5
2007	2986	2952	35	0	25466	40.0	22.2	62.2

The fugitive methane emissions in 2007 were 1 943 Gg CO_2-eq. They marked an increase by 8% compared to the preceding year.

The fugitive methane emissions from the underground mining were about 64% of the emissions of this source, although the coal quantities from underground mining was less than 10.5% of the overall coal mining in the country, expressed in natural (mass) units - tone.

Extraction, refining, transportation and distribution of oil and natural gas (1B2)

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

Table 3.19a Activity data from oil and gas

Source	Oil				Natural Gas			Venting/ Flaring	
	Production	Transport	Refining/Storage	LPG - consumed	Production	Transmission	Distribution	Oil	Gas
	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ	PJ
1988	3.29	545.83	547.53	0.01	0.3	246.6	207.7	551	0.7
1989	3.09	550.41	558.65	0	0.3	330.8	228.7	562	0.6
1990	2.54	353.23	353.5	0	0.5	336.5	225.7	356	0.9
1991	2.45	194.8	195.87	0	0.3	330.7	193.1	198	0.7
1992	2.24	103.09	102.55	0	1.3	321.3	170.1	105	2.5
1993	1.81	242.32	242.25	0	2.3	327.8	159	244	4.6
1994	1.54	296.11	296.1	0.01	1.9	328.8	159.7	298	3.8
1995	1.82	339.98	339.98	0	1.7	381.3	191.7	342	3.3
1996	1.38	295.83	295.83	0.02	1.4	384.4	195.6	297	2.8
1997	1.18	253.72	253.72	0.03	1.2	384.5	154.6	255	2.4
1998	1.36	236.28	236.28	3.06	1	390.1	137.2	238	1.9
1999	1.83	237.48	240.47	4.16	0.9	464.8	116	242	1.8
2000	1.92	223.72	226.06	9.84	0.5	520.7	122.5	228	1
2001	1.44	219.36	219.78	13.06	0.8	539.6	114.4	221	1.5
2002	1.59	221.84	222.09	15.05	0.7	552.9	100.4	224	1.4
2003	1.29	214.76	214.28	16.83	0.5	558.1	104.4	216	1.1
2004	1.28	225.01	224.75	15.56	11.2	552.2	99.8	226	22.3
2005	1.28	257.07	263.07	18.10	16.1	621.4	102.8	264	32.2
2006	1.17	301.86	302.43	18.91	15.7	510.6	103.1	304	31
2007	1.09	302.58	301.86	18.09	9.9	577.8	115.3	303	20

Table 3.19b CH_4 fugitive emissions from oil and gas

Source	Oil					Natural Gas					Venting/Flaring			
	Oil	Production	Transport	Refining/Storage	LPG-consumed	Natural Gas	Production/Processing	Transmission	Distribution	Other Leakage	Venting/Flaring	Oil	Gas	Total
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
1988	0.8	0.01	0.4	0.4	0	60.1	0.03	3.1	NE	57.0	0.02	0.01	0.01	**60.9**
1989	0.8	0.01	0.4	0.4	0	63.9	0.03	3.4	NE	60.5	0.02	0.01	0.01	**64.8**
1990	0.5	0.01	0.3	0.3	0	28.9	0.04	3.7	NE	25.1	0.02	0.01	0.01	**29.4**
1991	0.3	0.01	0.2	0.2	0	27.3	0.03	4.1	NE	23.2	0.01	0.01	0.01	**27.6**
1992	0.2	0.01	0.1	0.1	0	23.9	0.11	4.1	0.03	19.6	0.03	0.01	0.02	**24.1**
1993	0.4	0	0.2	0.2	0	24.0	0.19	4.4	0.03	19.4	0.05	0.01	0.04	**24.5**
1994	0.5	0	0.2	0.2	0	26.6	0.16	4.8	0.03	21.6	0.04	0.01	0.03	**27.1**
1995	0.5	0	0.3	0.3	0	30.5	0.14	5.1	0.03	25.2	0.04	0.01	0.03	**31.1**
1996	0.5	0	0.2	0.2	0	31.0	0.12	5.5	0.03	25.3	0.03	0.01	0.03	**31.5**
1997	0.4	0	0.2	0.2	0	27.3	0.1	5.9	0.04	21.3	0.03	0	0.02	**27.7**
1998	0.5	0	0.2	0.2	0.1	24.7	0.08	6.0	0.06	18.5	0.02	0	0.02	**25.1**
1999	0.5	0	0.2	0.2	0.2	20.6	0.08	6.4	0.12	14.0	0.02	0.01	0.02	**21.1**
2000	0.7	0.01	0.2	0.2	0.4	27.6	0.04	6.6	0.19	20.8	0.02	0.01	0.01	**28.3**
2001	0.8	0	0.2	0.2	0.5	25.2	0.06	6.4	0.31	18.5	0.02	0	0.01	**26.0**
2002	0.9	0	0.2	0.2	0.6	22.7	0.06	6.6	0.43	15.6	0.02	0.01	0.01	**23.7**
2003	1.0	0	0.2	0.2	0.6	23.3	0.04	6.6	0.56	16.0	0.01	0	0.01	**24.2**
2004	1.0	0	0.2	0.2	0.7	25.6	0.93	6.6	0.78	17.3	0.21	0	0.2	**26.8**
2005	1.0	0	0.2	0.2	0.6	28.6	1.35	6.6	0.98	19.7	0.3	0.01	0.3	**29.9**
2006	1.1	0	0.2	0.2	0.6	27.8	1.31	5.6	0.98	19.8	0.29	0.01	0.3	**29.1**
2007	1.1	0.0	0.2	0.2	0.6	29.1	0.83	6.4	1.10	20.8	0.19	0.01	0.2	**30.3**

The CH_4 fugitive emissions from oil and gas, expressed in CO_2-eq. in 2007 were 636.88 Gg, or less than 1% of the total GHG emissions. The emission increase in 2007 was 4%, compared to 2006, 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 CH_4 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 CH_4 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.

Applying of methods that are more precise (Tier 2) 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 2007 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 3.20 shows the lengths of the natural gas distribution pipeline networks and their development since 1988.

Table 3.20 Development of the natural gas distribution pipeline network, km

Years	Length of network			
	Natural Gas - transit	Natural Gas - domestic transmission	Natural Gas - domestic distribution	Total
1988	265	969	0	1234
1989	280	1070	0	1350
1990	300	1169	0	1469
1991	350	1269	0	1619
1992	375	1269	50	1694
1993	400	1369	50	1819
1994	450	1469	50	1969
1995	475	1569	50	2094
1996	605	1600	50	2255
1997	670	1700	60	2430
1998	710	1700	100	2510
1999	840	1700	200	2740
2000	945	1700	300	2945
2001	840	1700	500	3040
2002	945	1700	700	3345
2003	945	1700	911	3556
2004	945	1700	1260	3905
2005	945	1700	1577	4222
2006	945	1700	1777	4422
2007	945	1700	1777	4422

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 from **Table 3.19a**, the broad use of LPG as a fuel for cars started in 1998, reaching 18% from the overall liquid fuel consumption in the Road Transportation (1A3b) during 2007.

Besides the fugitive CH_4 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 time-series consistency

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 2007, 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.

3.3.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

3.3.5 Source-specific recalculations, if applicable, including changes made in response to the review process

The activity data for transmission of natural gas for 2006 were recalculated in the submission 2009.

3.3.6. Source-specific planned improvements

To improve the accuracy of the estimates.

CHAPTER 4 INDUSTRIAL PROCESSES (CRF SECTOR 2)

4.1. Overview

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 subsectors according to industries: Mineral products (2.A); Chemical industry (2.B); Metal production (2.C); Other production (2.D); Production of Halocarbons and SF_6 (2.E); Consumption of Halocarbons and SF_6 (2.F) and Others (2.G).

In the Other production (2D) subsector, emissions from the Food and drink industry and Pulp and paper production are included.

In the Other (2G) subsector, emissions from gasoline transportation, refueling 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 subsectors, 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 2007 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 2007 overcomes those difficulties using NSI identified emission data according to the CORINAIR methodology.

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

Table 4.1 Trend in greenhouse gas emissions from Industrial Processes, Gg

Gas/Categories	Mineral Products	Chemical Industry	Metal Production	Other Production	Mineral Products	Chemical Industry	Metal Production	Other Production	Other	Nitric Acid Production	SF_6-Gg CO_2-eqv.
	2A	2B	2C	2D	2A	2B	2C	2D	2G	2B2	F - gases
	CH_4									N_2O	
1988	3842	1751	2473	NO	NE,NO	0.04	3.49	NO	0.36	7.81	
1989	4028	1750	2474	NO	NE,NO	0.04	3.52	NO	0.33	7.43	
1990	4020	1717	1836	NO	NE,NO	0.02	2.76	NO	0.25	7.28	
1991	2590	1415	1393	NO	NE,NO	0.01	2.05	NO	0.14	5.25	
1992	2090	1163	1312	NO	NE,NO	0.01	1.94	NO	0.14	4.27	
1993	1908	1126	1639	NO	NE,NO	0.03	2.25	NO	0.17	3.65	
1994	2292	1263	2127	NO	NE,NO	0.03	3	NO	0.18	4.32	
1995	3124	1524	2316	NO	NE,NO	0.04	3.29	NO	0.2	6.2	1.26
1996	3174	1512	2094	NO	NE,NO	0.02	3.04	NO	0.2	6.33	1.31
1997	2845	1248	2254	NO	NE,NO	0.02	3.29	NO	0.2	5.21	1.75
1998	1402	673	1866	NO	NE,NO	0.21	2.62	NO	0.18	3.12	1.83
1999	2034	481	1704	NO	NE,NO	0.46	2.23	NO	0.07	2.36	1.88
2000	2302	813	1478	NO	NE,NO	0.15	3.37	NO	NO	4.24	2.23
2001	2469	725	1419	NO	NE,NO	0.14	2.28	NO	NO	4.18	2.29
2002	2403	464	1323	NO	NE,NO	0.13	2.06	NO	NO	3.51	2.51

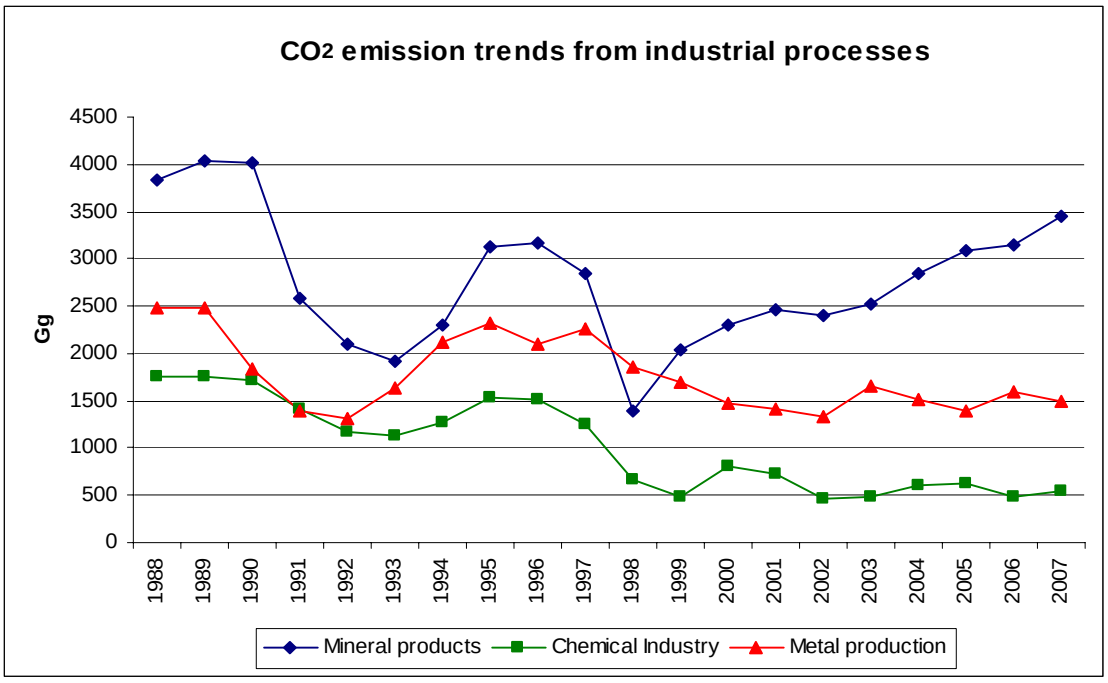
2003	2529	492	1658	NO	NE,NO	0.27	2.51	NO	NO	3.74	2.52
2004	2843	610	1522	NO	NE,NO	0.14	2.13	NO	NO	2.77	3.68
2005	3078	623	1398	NO	NE,NO	0.18	2.03	NO	NO	3.2	4.42
2006	3151	491	1592	NO	NE,NO	0.13	1.99	NO	NO	2.9	5.30
2007	3456	552	1484	NO	NE,NO	0.14	1.77	NO	NO	4.3	3.40

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 2007 has CO_2 – 77.3%, followed by N_2O with 18.6% and CH_4 with 0.6% 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.

Table 4.2 describes key categories in sector Industrial processes during 2007, drafted according to the Tier 1 method with an estimation of emissions level.

Table 4.2 Key Categories in Industrial processes sector - 2007

CRF categories	Key Category	GHG	Criteria (excluding LULUCF)	Criteria (including LULUCF)
2A1	Cement Production	CO_2	L, T	L,T

2C1	Iron and Steel Production	CO_2	L	L
2B2	Nitric Acid Production	N_2O	L	L
2A2	Lime Production	CO_2	L,T	L,T
2B1	Ammonia Production	CO_2	L,T	L,T
2F	ODS substitutes	HFCs	L,T	T

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 (CRF sector 2A)

4.2.1. Source Category Description

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

CO_2 emissions from **cement production** are 1 897 Gg in the year 2007, which is 2.5% of the aggregated GHG emissions. During the last five years, there has been a stabilization of the production with a tendency for increase. The increase of GHG emissions in 2007 is 27%, compared to 2006.

CO_2 emissions from **quick lime** production are 1 061.5 Gg in the year 2007, which is 1.4% of the aggregated GHG emissions. The increase of the CO_2 emissions in 2007 compared to 2006 is 2.2%.

CO_2 emissions from **soda ash production** are 178.39 Gg in 2007. In 2007 the CO_2 emissions from the use of soda ash are about 51% 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 1996 Guidelines of IPCC.

Data for the quantities of **soda ash production** is confidential.

4.2.3. Uncertainty and time-series consistency

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

Table 4.3 Uncertainty of sub-sector Mineral Production for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
2A1	Cement Production	CO_2	3	30	30.1
2A2	Lime Production	CO_2	5	15	15.8
2A3	Limestone and Dolomite Use	CO_2	5	15	15.8
2A4	Soda Ash	CO_2	5	20	20.6
2A7	Other	CO_2	5	20	20.6

The CO_2 emission trend for Mineral products production is given in **Table 4.4.**

Table 4.4 CO_2 emissions from Mineral products 1988-2007, Gg

Years/ Sources	Cement Production	Lime Production	Lime-stone and Dolomite Use	Soda Ash[1]	Other[2]	Total
	2A1	2A2	2A3	2A4	2A7	
1988	2006	1118	458	233	27	**3842**
1989	2203	1136	409	259	21	**4028**
1990	2070	1222	482	222	24	**4020**
1991	1225	812	340	199	14	**2590**
1992	1062	572	314	131	11	**2090**
1993	1116	417	284	79	13	**1908**
1994	1395	522	244	114	17	**2292**
1995	1926	747	261	170	19	**3124**
1996	1897	778	296	181	22	**3174**
1997	1649	692	309	178	18	**2845**
1998	806	48	376	157	14	**1402**
1999	1051	561	312	102	8	**2034**
2000	1124	798	255	117	8	**2302**
2001	1166	918	246	130	9	**2469**
2002	1157	855	233	119	40	**2403**
2003	1211	921	205	129	62	**2529**
2004	1376	956	297	139	75	**2843**
2005	1552	996	314	146	70	**3078**
2006	1488	1038	329	163	132	**3151**
2007	1897	1061	141	178	178	**3456**

1 - Soda ash includes 2A4.1 Soda Ash Production and 2A4.2 Soda Ash Use
2 - Other includes Glass Production and Desulphurized Emissions

The analysis of **Table 4.4** shows a stable trend of the GHG emissions from the two main sources – cement and lime production.

4.2.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

4.2.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

4.2.6. Source-specific planned improvements

To improve the accuracy of the estimates.

4.3. Chemical Industry (CRF sector 2B)

4.3.1. Source Category Description

N_2O emissions from **nitric acid production** expressed in CO_2-eq. were 1324 Gg for the year 2007. The emission increase in 2007 is some 47.2% compared to 2006 as the current level remains higher than the level in 1999.

CO_2 emissions from **ammonia production** were 532.10 Gg for the year 2007. The increase of emissions in 2007 is some 13.8% compared to 2006.

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

4.3.2. Methodology

The emission factors for the calculation of N_2O emission from **nitric acid production** 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.

Data for **calcium carbide** is confidential.

4.3.3. Uncertainty and time-series consistency

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%.

Table 4.5 Uncertainty of sub-sector Chemical Production for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
2B1	Ammonia Production	CO_2	5	20	20.6
2B2	Nitric Acid Production	N_2O	10	200	200.2
2B4.2	Calcium Carbide	CO_2	5	20	20.6
2B5	Other (please specify)	CH_4	5	50	50.2

The analysis of the trends of GHG emissions for this subsector that are given in **Table 4.6,** shows a trend of significant reduction of GHG emissions in the year 2007 compared to 1988 – about three times for the ammonia.

Table 4.6 GHG emissions from Chemical industry processes, Gg

Sources	Ammonia Production	Calcium Carbide	Nitric Acid Production
	CO_2		N_2O
1988	1662	89.3	7.8
1989	1642	108.7	7.4
1990	1620	96.5	7.3
1991	1353	61.8	5.2
1992	1120	43.2	4.3
1993	1095	30.3	3.7
1994	1232	30.6	4.3
1995	1490	34.6	6.2
1996	1479	33.4	6.3
1997	1216	31.4	5.2
1998	652	20.2	3.1
1999	468	12.3	2.4
2000	802	11.9	4.2
2001	718	6.8	4.2
2002	457	7.6	3.5
2003	484	8.3	3.7
2004	586	24.4	2.8
2005	597	26.3	3.2
2006	467	23.1	2.9
2007	532	19.8	4.3

4.3.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

4.3.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

4.3.6. Source-specific planned improvements

To improve the accuracy of the estimates.

4.4. Metal Production (CRF sector 2C)

4.4.1. Source Category Description

CO_2 process emissions from the **steel production** are a key source contributing 2% of the total GHG emissions in the year 2007 – 1 440 Gg. This is one of the biggest sources of GHG emissions in the Industrial Processes sector.

These are emissions from production of pig iron, sinter and coke.

Non-energy emissions from fuel use in this subsector 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 steel, coke and pig iron is confidential.

4.4.3. Uncertainty and time-series consistency

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%.

Table 4.7 Uncertainty of sub-sector Metal Production for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
2C	Metal Production	CH_4	5	20	20.6
2C1	Iron and Steel Production	CO_2	3	10	10.4
2C2	Ferroalloys Production	CO_2	5	25	25.5
2F	ODS substitutes	HFCs	10	50	51.0
2F8	Electrical Equipment	SF_6	10	50	51.0

The trends of GHG emissions in this subsector are given in **Table 4.8**

The analysis of **Table 4.8** reveals significant decrease of GHG emissions in the year 2007 compared to 1988 – 39% for steel production, 64% for coke and 26.8% for pig iron.

The 2007 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, HFC-227ea and C_3F_8. 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.

Table 4.8 GHG emissions from Metal industry processes Gg

Sources	Steel	Ferroalloys Production	Pig Iron	Sinter	Coke	HFCs - potential	PFCs - potential	SF6 - potential
	CO_2		CH_4			F-gases		
1988	2360	113	1.29	1.46	0.73			
1989	2380	94	1.37	1.37	0.78			
1990	1793	43	1.03	1.04	0.69			
1991	1326	67	0.85	0.84	0.37			
1992	1273	38	0.75	0.77	0.42			

1993	1594	46	0.9	0.9	0.46			
1994	2045	82	1.3	1.15	0.56			
1995	2236	79	1.42	1.25	0.62	62.2	NO	NO
1996	2017	77	1.33	1.13	0.58	109.3	NO	NO
1997	2158	96	1.45	1.22	0.62	188.1	NO	NO
1998	1837	29	1.25	0.97	0.4	576.6	NO	NO
1999	1668	36	1.04	0.93	0.27	102.8	NO	NO
2000	1458	20	1.99	0.9	0.47	96	NO	29.4
2001	1391	28	1.01	0.88	0.4	97.5	NO	2.39
2002	1305	18	0.97	0.71	0.38	89.6	NO	2.39
2003	1640	18	1.21	0.88	0.42	120.6	NO	6.36
2004	1505	17	1.01	0.71	0.42	217.3	NO	0
2005	1376	22	0.97	0.68	0.37	386.8	NO	0.96
2006	1548	44	1.01	0.65	0.33	610.7	0.04	4.83
2007	1440	44	0.95	0.56	0.26	246.6	NO	NO

4.4.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

4.4.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

4.4.6. Source-specific planned improvements

To improve the accuracy of the estimates.

4.5. Production of Halocarbon and SF_6 Production (CRF sector 2E)

F-gases have not been produced in Bulgaria.

4.6. Consumption of Halocarbon and SF_6 (CRF sector 2F)

4.6.1. Source Category 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 2007 is 3.40 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.).

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.

4.7. Other industrial processes

4.7.1. Source Category Description

This source includes CO_2 emissions from glass and ferroalloys production and from desulphurization. The emissions for the year 2007 are 222.3 Gg. They increase by 26% compared to 2006 due to the increased emissions from the desulphurization process in the MARITZA IZTOK power stations.

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.

4.7.3. Uncertainty and time-series consistency

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

CHAPTER 5 SOLVENT AND OTHER PRODUCT USE (CRF SECTOR 3)

5.1. Overview

GHG emissions in the **Solvent and Other Product 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 anesthesia. The emissions from this sector are mainly of NMVOCs and N_2O.

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

N_2O and CO_2 emissions for category 3D are calculated using recommended Swiss methodology.

5.2. Source Categories 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 8.03 Gg. which is 10% of the emissions of this gas in Bulgaria.

5.3. Methodology

NMVOCs emissions are calculated with emission factors given in the approved in Bulgaria methodology for the calculation with balancing methods of the emissions of harmful substances, emitted in the ambient air (approved with Order RD 77 from 03.02.2006 of MOEW). 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.

5.4. Uncertainty of time-series consistency

NMVOCs emissions from Solvent and Other Product Use (CRF sector 3A, 3B, 3C and 3D)

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

Table 5.1 Trends in NMVOCs emissions from solvent and other product use, Gg

Gas/sub source	A.Paint Application	B.Degreasing and Dry Cleaning	C.Chemical Products. Manufacturing and Processing	D. Other			Total
				Vegetable oil production	Use of lacquers and solvents	Pharmacy	
1988	0.14	0.00	1.25	3.11	8.99	0.13	**13.62**
1989	0.16	0.00	1.30	3.20	8.99	0.13	**13.77**
1990	0.13	0.00	0.83	2.51	8.67	0.12	**12.25**
1991	0.06	0.00	0.35	1.92	8.60	0.12	**11.04**
1992	0.08	0.00	0.35	2.32	8.48	0.12	**11.36**
1993	0.12	0.00	0.27	2.72	8.46	0.12	**11.69**
1994	0.16	0.00	0.28	2.54	8.43	0.12	**11.53**
1995	0.18	0.00	0.38	3.43	8.38	0.12	**12.49**
1996	0.21	0.00	0.45	2.88	8.34	0.12	**11.99**
1997	0.17	0.00	0.45	2.80	8.28	0.12	**11.82**
1998	1.09	0.00	4.95	1.88	8.23	0.12	**16.26**
1999	2.43	0.336	4.12	1.83	2.00	0.11	**10.83**
2000	0.52	0.035	0.70	1.84	7.48	0.11	**10.69**
2001	0.69	0.286	11.98	1.61	2.43	0.11	**17.10**
2002	0.59	0.014	11.96	1.22	3.24	0.11	**17.13**
2003	0.90	0.010	10.70	1.39	1.43	0.11	**14.54**
2004	1.17	0.005	18.60	1.24	2.54	0.11	**23.65**
2005	1.63	0.006	24.05	1.49	3.06	0.11	**30.34**
2006	1.64	0.003	28.22	1.49	3.91	0.11	**35.37**
2007	2.94	0.000	0.06	1.48	3.44	0.11	**8.03**

The analysis of **Table 5.1** shows violation of the consistency of time series after 1997.

N_2O emissions from Solvent and Other Product Use (CRF sector 3D1 and 3D3)

Calculation of N_2O emissions from sub-category 3D (without NMVOCs emissions from vegetable oil) is used data from Switzerland's methodology. The estimates are based on the assumption that 60% of the operations that are reported for Switzerland are carried out in Bulgaria.

N_2O emissions from aerosol cans sub-category are estimated on the assumption, that the intensity of using aerosols is the same as in Switzerland (10 grimes per person per year of N_2O emissions).

Table 5.2 Trends in N_2O emissions from solvent and other product use during 1988-2007. Gg

Years	3D1.Use of N_2O for Anaesthesia	3D3.N_2O from Aerosol Cans	Population
	N_2O		1000 number
1988	0.08	0.09	8986.60
1989	0.08	0.09	8992.30
1990	0.08	0.09	8669.27
1991	0.08	0.09	8595.50
1992	0.08	0.08	8484.90
1993	0.08	0.08	8459.80
1994	0.08	0.08	8427.40
1995	0.08	0.08	8384.72
1996	0.08	0.08	8340.94
1997	0.07	0.08	8283.20
1998	0.07	0.08	8230.37

1999	0.07	0.08	8190.88
2000	0.07	0.08	8149.47
2001	0.07	0.08	7929.48
2002	0.07	0.08	7845.50
2003	0.07	0.08	7801.27
2004	0.07	0.08	7761.05
2005	0.07	0.08	7718.70
2006	0.07	0.08	7679.29
2007	0.07	0.08	7659.76

CO_2 emissions from Solvent and Other Product Use (CRF sector 3D5)

The estimates for CO_2 emissions from pharmacy sub-category where derived based on the conversion of non-methane volatile organic compounds (NMVOCs) applying the Swiss conversion coefficient (2.53 $GgCO_2$/Gg NMVOCs).

The CO_2 emissions estimates from the use of lacquers and solvent sub-category are based on the same conversion coefficient from NMVOCs to CO_2.

Table 5.3 Trends in CO_2 emissions from solvent and other product use during 1988-2007, Gg

Years	3D5. Use of lacquers and solvents	3D5. Pharmacy	TOTAL
	CO_2		Gg
1988	22.74	0.32	23.05
1989	22.75	0.32	23.07
1990	21.93	0.31	22.24
1991	21.75	0.30	22.05
1992	21.47	0.30	21.77
1993	21.40	0.30	21.70
1994	21.32	0.30	21.62
1995	21.21	0.30	21.51
1996	21.10	0.30	21.40
1997	20.96	0.29	21.25
1998	20.82	0.29	21.11
1999	5.06	0.29	5.35
2000	18.92	0.29	19.21
2001	6.16	0.28	6.44
2002	8.19	0.28	8.47
2003	3.63	0.28	3.90
2004	6.42	0.27	6.69
2005	7.73	0.27	8.01
2006	9.90	0.27	10.17
2007	8.71	0.27	8.98

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

Table 5.4 Uncertainty of sector Solvents and Other product use, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty

3	Solvents	CO_2	10	30	31.6
3	Solvents	N_2O	100	0	100

5.5. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

5.6. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

5.7. Source-specific planned improvements

To improve the accuracy of the estimates.

CHAPTER 6 AGRICULTURE (CRF SECTOR 4)

6.1. Overview

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 (CH_4 emissions);
- Manure management (CH_4 and N_2O emissions);
- Rice cultivation (CH_4 emissions);
- Agricultural soils (N_2O emissions);
- Field burning of agricultural residues (CH_4, N_2O, NO_X and CO emissions).

The processes and activities from the subsectors 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.

Table 6.1 describes key categories in sector Agriculture during 2007, drafted according to the Tier 1 method with an estimation of emissions level.

Table 6.1 Key Categories in Agriculture sector - 2007

CRF categories	Key Category	GHG	Criteria (excluding LULUCF)	Criteria (including LULUCF)
4D1	Direct soil emissions	N_2O	L,T	L,T
4D3	Indirect Emissions	N_2O	L,T	L,T
4A1	Cattle	CH_4	L,T	T
4D2	Pasture, Range and Paddock Manure	N_2O	L,T	L,T
4B	N_2O emission from Manure Management	N_2O	L,T	L,T
4A.3	Sheep	CH_4	L,T	T
4B.8	Swine	CH_4	T	T

GHG emissions trends from the sector are given in **Table 6.2**.

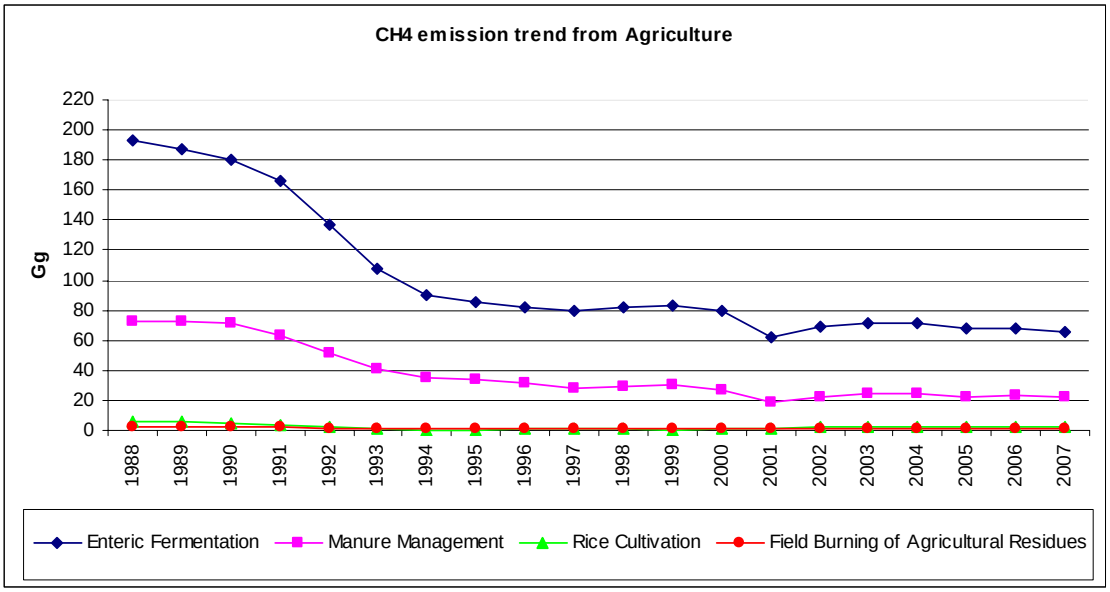
The biggest CH_4 emission source in the sector is the subsector Enteric Fermentation from domestic livestock.

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

Table 6.2 Trend in greenhouse gas emissions from Agriculture, Gg

IPCC Sources	Enteric Fermentation	Manure Management	Rice Cultivation	Field Burning of Agricultural Residues	Manure Management	Agricultural Soils	Direct Soil Emissions	Animal Production	Indirect Emissions	Field Burning of Agricultural Residues
	4A	4B	4C	4F	4B	4D	4D1	4D2	4D3	4F
	CH_4				N_2O					
1988	192.79	72.55	5.68	2.21	3.41	27.68	13.24	5.33	9.11	0.05
1989	187.57	73.11	5.49	2.66	3.41	25.18	11.88	5.14	8.16	0.06
1990	180.17	71.49	4.26	2.20	3.32	23.08	10.58	4.96	7.53	0.05
1991	165.99	62.81	3.30	2.32	2.97	16.41	6.61	4.62	5.18	0.05
1992	137.48	51.10	1.82	1.62	2.45	13.04	5.06	3.83	4.15	0.04
1993	107.19	40.90	1.26	1.33	1.96	11.89	4.98	3.08	3.82	0.02
1994	90.13	34.72	0.33	1.40	1.64	12.13	5.48	2.76	3.89	0.03
1995	85.27	34.52	0.56	1.46	1.60	10.14	4.25	2.71	3.18	0.03
1996	82.38	31.60	1.05	0.81	1.49	9.83	3.99	2.65	3.20	0.02
1997	79.48	27.93	1.53	1.34	1.36	10.06	4.33	2.56	3.17	0.03
1998	81.77	29.64	1.61	1.19	1.46	8.59	3.34	2.55	2.70	0.02
1999	82.95	30.30	0.57	1.30	1.51	9.80	4.19	2.50	3.11	0.03
2000	79.28	27.08	1.44	1.15	1.38	9.43	4.07	2.34	3.02	0.02
2001	62.20	19.30	1.57	1.30	1.03	8.75	4.36	1.61	2.78	0.02
2002	68.97	22.42	2.11	1.50	1.19	8.90	4.36	1.74	2.80	0.03
2003	71.52	24.38	2.27	0.91	1.27	8.37	3.89	1.75	2.73	0.02
2004	70.95	24.05	2.30	1.61	1.26	9.34	4.66	1.73	2.94	0.03
2005	67.34	22.75	1.89	1.29	1.19	8.84	4.35	1.67	2.82	0.02
2006	67.33	23.08	2.05	1.24	1.18	8.49	4.17	1.68	2.64	0.02
2007	65.31	22.51	2.60	0.77	1.15	8.88	4.34	1.59	2.95	0.01

Figure 6.1



Methane emission trends are given in **Figure 6.1**. They form 38% 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 88% in the year 2007 and for the entire period 1988-2003, the share is in the range of 82-87%. N_2O emissions from manure management and field burning of agricultural residues are of an order of magnitude smaller and in total are about 11.6% from the aggregated N_2O emissions of the sector.

In total, the N_2O emissions, expressed in CO_2-eq. for 2007, are 61% of the total emissions in the sector in CO_2-eq.

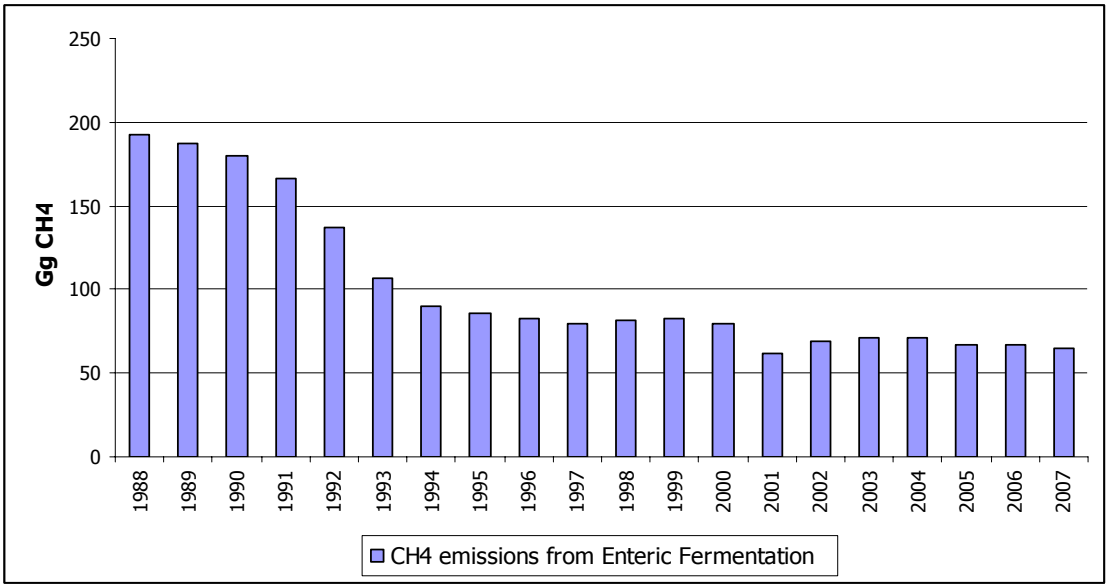
6.2. Enteric Fermentation (CRF sector 4A)

6.2.1. Source Category 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 1 371.4 Gg in the year 2007. A decrease in the year 2007 was 3.0% compared to 2006 and is due to a distribution of the basic type of animals.

Figure 6.2 Enteric Fermentation from domestic livestock – CH_4 emissions, Gg



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 of time-series consistency

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

Table 6.3 Uncertainty of sub-sector Enteric Fermentation for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
4A1	Cattle	CH_4	2	50	50.0
4A.2	Buffalo	CH_4	2	50	50.0
4A.3	Sheep	CH_4	2	50	50.0
4A.4	Goats	CH_4	2	50	50.0
4A.6	Horses	CH_4	2	50	50.0
4A.7	Mules and Asses	CH_4	2	50	50.0
4A.8	Swine	CH_4	2	50	50.0
4A.9	Poultry	CH_4	2	50	50.0

The methane emissions from the enteric fermentation of domestic livestock are given in **Table 6.4**.

The analysis of **Table 6.4** shows a steady trend of the emission growth after 2001. It is evident that the drop of 65% compared to 1988 can't be easily overcome in the next 10 years at such temps of rising.

Table 6.4 CH_4 emissions due to enteric fermentation for 1988-2007, Gg

Animal type	Dairy Cattle	Non-Dairy Cattle	Buffalo	Sheep	Goats	Horses	Mules and Asses	Swine	Poultry	Total
	4A1	4A1	4A2	4A3	4A4	4A6	4A7	4A8	4A9	4A
1988	50.93	56.12	1.31	69.98	2.16	2.20	3.55	6.11	0.42	**192.79**
1989	50.15	54.60	1.28	66.96	2.17	2.17	3.52	6.34	0.39	**187.57**
1990	48.70	51.23	1.33	64.27	2.33	2.11	3.49	6.39	0.32	**180.17**
1991	47.41	44.71	1.39	58.57	2.63	2.07	3.48	5.50	0.25	**165.99**
1992	42.96	34.26	1.30	46.07	2.91	2.05	3.36	4.37	0.21	**137.48**
1993	36.68	22.92	1.08	34.31	3.22	2.04	3.22	3.56	0.16	**107.19**
1994	31.11	17.37	0.85	28.64	3.68	2.22	3.06	3.04	0.16	**90.13**
1995	29.12	15.43	0.75	27.12	4.07	2.55	2.95	3.09	0.19	**85.27**
1996	29.42	13.65	0.69	25.61	4.21	2.89	3.01	2.73	0.17	**82.38**
1997	30.12	12.60	0.60	23.47	4.54	2.87	2.89	2.24	0.15	**79.48**
1998	32.74	13.29	0.58	22.48	5.03	2.54	2.55	2.40	0.15	**81.77**
1999	34.52	14.02	0.54	21.29	5.23	2.47	2.30	2.43	0.15	**82.95**
2000	34.31	13.28	0.47	19.34	5.04	2.53	2.16	1.99	0.15	**79.28**
2001	27.57	13.13	0.37	12.10	3.14	2.62	2.03	1.08	0.16	**62.20**
2002	29.38	16.81	0.39	13.20	3.57	2.38	1.72	1.34	0.18	**68.97**
2003	29.16	19.59	0.42	13.31	3.70	2.16	1.46	1.52	0.20	**71.52**
2004	29.59	18.74	0.44	13.16	3.61	2.29	1.44	1.47	0.21	**70.95**
2005	29.02	16.15	0.44	13.18	3.32	2.23	1.40	1.41	0.20	**67.34**
2006	28.26	15.46	0.45	12.95	2.89	3.80	1.84	1.47	0.20	**67.33**
2007	27.78	15.24	0.47	12.65	2.61	3.10	1.83	1.43	0.19	**65.31**

(*) Change from the base to the latest reported year

The average number of animals per year is given in **Table 6.5**.

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

Table 6.5 Number of animals 1988-2007 (1 000 head)

Animal type	Dairy Cattle	Non-Dairy Cattle	Buffalo	Sheep	Goats	Horses	Mules and Asses	Swine	Poultry
	4A1	4A1	4A2	4A3	4A4	4A6	4A7	4A8	4A9
1988	629	1002	24	8747	432	122	355	4076	41614
1989	619	975	23	8370	434	120	352	4225	39071
1990	601	915	24	8034	465	117	349	4259	32168
1991	585	798	25	7321	525	115	348	3664	24853
1992	530	612	24	5759	582	114	336	2911	20790
1993	453	409	20	4289	644	113	322	2376	16185
1994	384	310	15	3580	736	123	306	2029	15812
1995	360	275	14	3390	814	142	295	2063	18868
1996	363	244	13	3201	841	160	301	1820	17418
1997	372	225	11	2934	907	159	289	1490	15497
1998	404	237	10	2811	1007	141	255	1601	15226
1999	426	250	10	2661	1047	137	230	1617	15324
2000	424	237	9	2418	1008	141	216	1328	14977
2001	340	234	7	1512	629	146	203	718	16498
2002	363	300	7	1650	715	132	172	893	18072
2003	360	350	8	1663	740	120	146	1014	20036
2004	365	335	8	1646	722	127	144	982	20723
2005	358	288	8	1647	663	124	140	937	19514
2006	349	276	8	1619	579	211	184	978	19836
2007	343	272	9	1581	522	172	183	951	19427

(*) Change from the base to the latest reported year

6.2.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

6.2.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

6.2.6. Source-specific planned improvements

To improve the accuracy of the estimates.

6.3. Manure Management (CRF sector 4B)

6.3.1. Source Category Description

CH_4 emissions expressed in CO_2-eq. were 472.7 Gg for the year 2007. Their decrease compared to the year 2006 is 2.5%, 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 357.2 Gg during the year 2007. The emissions decrease is 2.5% compared to 2006.

N_2O emissions from this subsector 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.

6.3.3. Uncertainty of time-series consistency

The uncertainty of CH_4 emissions from this source is 50% and of N_2O emissions - 300%.

Table 6.6 Uncertainty of sub-sector Manure Management for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty, %	Emission factor uncertainty, %	Combined uncertainty, %
4B	N_2O emission from Manure Management	N_2O	2	300	300.0
4B1	Cattle	CH_4	2	50	50.0
4B.2	Buffalo	CH_4	2	50	50.0
4B.3	Sheep	CH_4	2	50	50.0
4B.4	Goats	CH_4	2	50	50.0
4B.6	Horses	CH_4	2	50	50.0
4B.7	Mules and Asses	CH_4	2	50	50.0
4B.8	Swine	CH_4	2	50	50.0
4B.9	Poultry	CH_4	2	50	50.0

The CH_4 and N_2O emissions from manure management are given in **Table 6.7**.

Table 6.7 Trend in GHG emissions from Manure management 1988 –2007, Gg

Animal type	Dairy cattle	Non-Dairy cattle	Buffalo	Sheep	Coats	Horses	Mules and Asses	Swine	Poultry	Total	Manure management
	4B.1	4B.2	4B.2	4B.3	4B.4	4B.6	4B.7	4B.8	4B.9	4B	4B
	CH_4										N_2O
1988	11.51	12.23	0.22	2.45	0.08	0.25	0.41	40.54	4.87	**72.55**	**3.41**
1989	11.33	11.90	0.21	2.34	0.08	0.25	0.40	42.02	4.57	**73.11**	**3.41**
1990	11.00	11.17	0.22	2.25	0.08	0.24	0.40	42.36	3.76	**71.49**	**3.32**
1991	10.71	9.75	0.23	2.05	0.09	0.24	0.40	36.44	2.91	**62.81**	**2.97**
1992	9.71	7.47	0.21	1.61	0.10	0.24	0.38	28.95	2.43	**51.10**	**2.45**
1993	8.29	5.00	0.18	1.20	0.12	0.24	0.37	23.63	1.89	**40.90**	**1.96**
1994	7.03	3.79	0.14	1.00	0.13	0.26	0.35	20.18	1.85	**34.72**	**1.64**
1995	6.58	3.36	0.12	0.95	0.15	0.29	0.34	20.52	2.21	**34.52**	**1.60**
1996	6.65	2.97	0.11	0.90	0.15	0.33	0.34	18.10	2.04	**31.60**	**1.49**
1997	6.80	2.75	0.10	0.82	0.16	0.33	0.33	14.82	1.81	**27.93**	**1.36**
1998	7.40	2.90	0.09	0.79	0.18	0.29	0.29	15.92	1.78	**29.64**	**1.46**
1999	7.80	3.06	0.09	0.75	0.19	0.29	0.26	16.08	1.79	**30.30**	**1.51**
2000	7.75	2.89	0.08	0.68	0.18	0.29	0.25	13.21	1.75	**27.08**	**1.38**
2001	6.23	2.86	0.06	0.42	0.11	0.30	0.23	7.14	1.93	**19.30**	**1.03**
2002	6.64	3.66	0.06	0.46	0.13	0.28	0.20	8.88	2.11	**22.42**	**1.19**
2003	6.59	4.27	0.07	0.47	0.13	0.25	0.17	10.09	2.34	**24.38**	**1.27**
2004	6.68	4.09	0.07	0.46	0.13	0.26	0.16	9.77	2.42	**24.05**	**1.26**
2005	6.56	3.52	0.07	0.46	0.12	0.26	0.16	9.32	2.28	**22.75**	**1.19**
2006	6.39	3.37	0.07	0.45	0.10	0.44	0.21	9.73	2.32	**23.08**	**1.18**
2007	6.28	3.32	0.08	0.44	0.09	0.36	0.21	9.45	2.27	**22.51**	**1.15**

The analysis of **Table 6.7** shows decrease of CH_4 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. 67% reduction.

6.3.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

6.3.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

6.3.6. Source-specific planned improvements

To improve the accuracy of the estimates.

6.4. Rice Cultivation (CRF sector 4C)

6.4.1. Source Category Description

Rice cultivation is a traditional Bulgarian agricultural activity. During the structural reforms, rice crop areas decreased from 14 100 ha in 1988 to 1 417 ha in 1999. There has been a restoration of rice crop areas after 1999, reaching 6 454 ha in 2007.

54.6 Gg CH_4 CO_2-eq. has been emitted in 2007. The emission increase of 27% compared to the year 2006 is due to the extent of the areas of rice crops.

6.4.2. Methodology

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.

6.4.3. Uncertainty of time-series consistency

The uncertainty of methane emissions from this source is 84%

6.4.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

6.4.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

6.4.6. Source-specific planned improvements

To improve the accuracy of the estimates.

6.5. Agricultural Soils (CRF sector 4D)

6.5.1. Source Category Description

The emissions from this subsector include the following main categories N_2O emissions:

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

These three categories above are key sources in the year 2007.

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.

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 is not subject of the inventory.

Direct N_2O emissions were 1 346.4 Gg CO2-eq. in 2007, which is more than 1.8% of the aggregated GHG emissions during the year. The emission increase in 2007 compared to 2006 is about 4.2% due to the smallest quantities of synthetic nitrogenous fertilizers.

Table 6.8 N_2O emissions from Agricultural soils, Gg

Nitrogen flows (t N/yr)	Direct soil emissions	Use of synthetic fertilizers	Nitrogen input from manure applied to soils	N- fixing Crops	Crop Residue	Cultivation of histosols	N excretion on pasture range and paddock	Indirect soil emissions	Total
1988	13.24	9.57	2.40	0.12	1.15	0.003	5.33	9.11	**27.68**
1989	11.88	7.93	2.41	0.15	1.39	0.003	5.14	8.16	**25.18**
1990	10.58	7.00	2.32	0.11	1.15	0.003	4.96	7.53	**23.08**
1991	6.61	3.27	2.02	0.11	1.21	0.003	4.62	5.18	**16.41**
1992	5.06	2.47	1.65	0.09	0.85	0.003	3.83	4.15	**13.04**
1993	4.98	2.92	1.31	0.06	0.69	0.003	3.08	3.82	**11.89**
1994	5.48	3.59	1.10	0.06	0.73	0.003	2.76	3.89	**12.13**
1995	4.25	2.29	1.10	0.09	0.77	0.003	2.71	3.18	**10.14**
1996	3.99	2.51	1.00	0.05	0.42	0.003	2.65	3.20	**9.83**
1997	4.33	2.70	0.88	0.05	0.69	0.003	2.56	3.17	**10.06**
1998	3.34	1.72	0.95	0.05	0.62	0.003	2.55	2.70	**8.59**
1999	4.19	2.48	0.99	0.04	0.67	0.003	2.50	3.11	**9.80**
2000	4.07	2.56	0.90	0.02	0.59	0.003	2.34	3.02	**9.43**
2001	4.36	2.97	0.70	0.02	0.67	0.003	1.61	2.78	**8.75**
2002	4.36	2.75	0.82	0.02	0.77	0.003	1.74	2.80	**8.90**
2003	3.89	2.49	0.90	0.02	0.47	0.003	1.75	2.73	**8.37**
2004	4.66	2.92	0.90	0.02	0.83	0.003	1.73	2.94	**9.34**
2005	4.35	2.82	0.84	0.02	0.66	0.003	1.67	2.82	**8.84**
2006	4.17	2.70	0.81	0.01	0.64	0.003	1.68	2.64	**8.49**
2007	4.34	3.15	0.78	0.02	0.40	0.003	1.59	2.95	**8.88**

Indirect N_2O emissions were 915.5 Gg CO_2-eq. in 2007. These category emissions increases with a little more than 11.8% compared to 2006.

The emissions from pasture animals decrease by 5.4% compared to 2006.

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 Food Supplies.

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%.

Table 6.9 Uncertainty of sub-sector Manure Management for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
4D1	Direct soil emissions	N_2O	3	250	250.0
4D2	Pasture, Range and Paddock Manure	N_2O	3	250	250.0
4D3	Indirect Emissions	N_2O	3	500	500.0

N_2O emissions from this source for all categories in the subsector are given in **Table 6.8**.

The consistency of time series for the source categories given in **Table 6.8** is provided due to lack of changes in the methodology and in the source of data.

6.5.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

6.5.5. Source-specific recalculations, if applicable, including changes made in response to the review process

During the 2008 centralized review of the greenhouse gas inventories of Bulgaria submitted in 2007 and 2008 were formulated the following potential problems:

- Bulgaria reports 0.01 kg N_2O-N/kg N as the value of N_2O implied emission factors (IEFs) for synthetic fertilizer application and animal manure applied to soils categories for the complete time series (1988-2006). These IEFs are lower than the IPCC default value (0.0125 kg N_2O-N/kg N).

After the recommendation of ERT, Bulgaria revised its calculations using the IPCC default emission factor of 0.0125 kg N_2O-N/kg N to estimate emissions from synthetic fertilizer application and manure applied to soils.

- The value reported by Bulgaria for N_2O implied emission factors for N-fixing crops (0.0003 kg N_2O-N/kg N) and for N in crop residues returned to soils (0.00007 kg N_2O-N/kg N) for the complete time series (1988-2006) are much lower than the IPCC default emission factor (0.0125 kg N_2O-N/kg N) which is applied for both N-fixing crops and N in crop residues.

After the recommendation of ERT, Bulgaria revised its calculations using the IPCC default emission factor (0.0125 kg N_2O-N/kg N) and ensure that correct activity data is reported in the CRF tables.

6.5.6. Source-specific planned improvements

To improve the accuracy of the estimates.

6.6. Field Burning of Agricultural Residues (CRF sector 4F)

6.6.1. Source Category Description

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.

20.3 Gg CO_2-eq. aggregated GHGs have been emitted in 2007. The decrease is 39.4%, compared to the year 2006, on the assumption that 10% of the vegetal residues, left on the fields after yielding crop, are burned.

6.6.2. Methodology

The crop residues quantities are calculated under the default methodology of IPCC based on data from MAFS (Ministry of Agriculture and Food Supplies) for the quantities of vegetable crop yields.

6.6.3. Uncertainty of time-series consistency

The uncertainty of methane emissions from this source is 55.9% and of N_2O emissions – 201.6%.

6.6.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

6.6.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

6.6.6. Source-specific planned improvements

To improve the accuracy of the estimates.

CHAPTER 7 LAND USE, LAND-USE CHANGE AND FORESTRY (CRF SECTOR 5)

7.1. Overview

The Land-Use Change and Forestry sector covers the processes of CO_2 exchange between the biomass sources (forests, grass and other stands, 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 1996 IPCC Guidelines define several subsectors, 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 for LULUCF, 2003, especially for this sector, conditions appeared for better covering of the emission sources. For this purpose CRF tables of new types have been invented, which are united in a new general format for reporting.

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:

– Forests;

– 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** forests or respectively crop fields and others, and lands which distinguish from forests, but are **converted** to forests (plant areas, meadows and others). In this way, all the possible changes of lands and the 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, and 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.

7.2. CO_2 sinks from Forestry

7.2.1. Source Category 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 37% of the territory of the country. The terrain varies and presumes the presence of big forest lands in the mountain and semi mountain areas of Central and Southern Bulgaria.

In 2007 the total forests area in Bulgaria (deciduous and coniferous) was 4 108.5 thousand ha. More than 75.45% of the forests are state property, 11.5% are municipal and 9.6% are private property. The forest areas for timbering and site formation are 68.1%, the protective and recreational forests – 19.8% and protected forest and territories – 12%.

The wood stock is more than 590.78 millions m^3 with an average annual growth of 14 100 100.0 m^3. The volume of cut wood was 6 785 008 m^3 in 2007.

Essential characteristics of the Bulgarian forests are:

- Average volume per 1 ha – 164 m^3;

- Average increment per 1 ha – 40 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.

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 of time-series consistency

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 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 7.1** for the entire GHGs inventory period (1988-2007).

Table 7.1 CO_2 emission/removals from changes in forest and other woody biomass stocks, [Gg]

CO_2,Gg	Carbon uptake increment	Carbon release	Carbon net uptake	Net CO_2 removals
1988	2761.0	-1361.2	1399.8	**-5132.6**
1989	2861.5	-1326.2	1535.3	**-5629.3**
1990	2961.9	-1282.7	1679.2	**-6157.0**

1991	3062.3	-979.9	2082.5	**-7635.7**
1992	3162.8	-1141.3	2021.5	**-7412.0**
1993	3263.2	-1224.4	2038.8	**-7475.8**
1994	3321.0	-1329.6	1991.4	**-7301.7**
1995	3361.5	-1309.4	2052.1	**-7524.5**
1996	3361.5	-1584.0	1777.5	**-6517.5**
1997	3361.5	-1487.4	1874.1	**-6871.5**
1998	3361.5	-1490.5	1871.0	**-6860.5**
1999	3361.5	-1397.9	1963.6	**-7199.8**
2000	3697.7	-1249.6	2448.1	**-8976.2**
2001	3697.7	-1115.7	2581.9	**-9467.1**
2002	3697.7	-1429.1	2268.6	**-8318.1**
2003	3697.7	-1773.3	1924.4	**-7056.0**
2004	4110.4	-1938.1	2172.3	**-7965.2**
2005	3812.5	-1904.4	1908.0	**-6996.0**
2006	3812.5	-1904.4	1908.0	**-6996.0**
2007	3839.9	-1932.7	1907.2	**-6992.9**

The quantity of CO_2 removals was 6992.9 Gg in 2007. The reduction of the removals in 2007 was about 0.04 % compared to 2006.

7.2.4. Source specific QA/QC and verification

The responsible body for ensuring the QA/QC of the activity data is the State Forestry Agency. It should provide disaggregated forest data to MOEW (and GHG inventory team of ExEA) with written documentation on methodology.

7.2.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

7.2.6. Source-specific planned improvements

To improve the accuracy of the estimates during 2009 will be elaborated a national methodology for estimating emission and removals from LULUCF sector according to the GPG-LULUCF, which will answer to the requirements of UNFCCC and KP reporting in this sector.

CHAPTER 8 WASTE (CRF SECTOR 6)

8.1. Overview

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:

- CH_4 emissions from Solid Waste Disposal Sites;
- CH_4 and N_2O emissions from 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.

Table 8.1 Trend in GHG emissions from Waste by sub-sectors for 1988-2007, Gg

IPCC Sources	Solid waste disposal on Land	Waste water handling	Waste incineration	Waste water handling
	6A	6B	6C	6B
	CH_4			N_2O
1988	504.2	102.2	NE	1
1989	508.1	91.7	NE	0.96
1990	510.1	80.4	NE	0.72
1991	505.5	65.4	NE	0.65
1992	499.6	60.8	NE	0.65
1993	491.2	53.6	NE	0.62
1994	481.3	50.7	NE	0.59
1995	469.5	62.7	NE	0.54
1996	455.3	60.2	NE	0.52
1997	439.4	53.0	NE	0.46
1998	421.4	47.5	NE	0.52
1999	405.5	43.2	NE	0.53
2000	391.7	41.3	NE	0.5
2001	378.8	35.6	NE	0.48
2002	367.0	34.3	NE	0.49
2003	356.4	70.9	NE	0.49
2004	346.1	71.1	NE	0.48
2005	337.2	43.4	NE	0.47
2006	326.0	39.8	NE	0.47
2007	317.8	40.0	NE	0.47

Table 8.2 describes key categories in sector Waste during 2007:

Table 8.2 Key Categories, Waste sector - 2007

CRF categories	Key Category	GHG	Criteria (excluding LULUCF)	Criteria (including LULUCF)
6A	Solid waste disposal on Land	CH_4	L, T	L,T
6B	Waste water handling	CH_4	L,T	L,T
6B	Waste water handling	N_2O	T	

8.2. Solid Waste Disposal on Land (CRF sector 6.A)

8.2.1. Source Category Description

Anaerobic decomposition of organic matter by methanogenic bacteria in Solid Waste Disposal Sites (SWDS) results in the release of CH_4 to the atmosphere. Municipal Solid Waste typically contains significant quantities of degradable organic matter.

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 the disposed solid waste.

As mentioned above, the emissions from this source are key sources for the level and trend assessment in the total GHG emissions (see Annex 1).

The emissions from this source are ranked first amongst the methane emissions in Bulgaria in 2007, and ranked second amongst all sources of GHG emissions in the country.

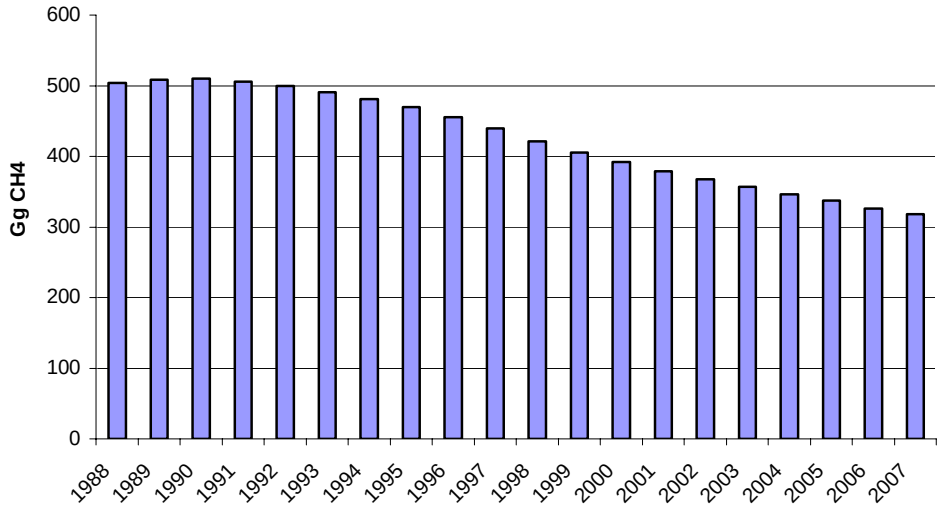
In accordance to certain criteria like:

- 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 1996 IPCC Guidelines gives us grounds to classify all controlled depots to the "managed SWD" category.

The trend analysis shows that CH_4 emissions from solid waste disposal on Land decrease almost linearly from 504.2 in 1988 to 317.8 Gg in 2007.

Figure 8.1 CH_4 emissions from SWDS for 1988 – 2007, Gg



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

The parameters used in Bulgaria were given in Table 8.3, also parameters necessary for the Tier 2 methodology are included. The two main parameters Lo and k was calculated with maximum accounting of the specific county conditions and practice.

The degradable organic carbon (DOC) in MSW was calculated, according to the equation 5.4 from page 5.9 of IPCC GPG.

Table 8.3 Parameters used in the IPCC Tier 2 method for Solid Waste handling

	Description								Composition of landfilled wastes, %					
	Waste generation rate (kg/capita/day)	Fraction of MSW disposed to SWDS	Fraction of DOC in MSW	Fraction of wastes incinerated	Fraction of wastes recycled	CH_4 fraction in landfill gas	CH4 generation rate, constant (k)	Time delay, years	Paper and paperboard	Food and garden waste	Plastics	Glass	Textiles	Other
1988	2.36	0.95	0.25	NO	NO	0.5	0.1	28	NA	NA	NA	NA	NA	NA
1989	2.17	0.95	0.25	NO	NO	0.5	0.1	29	NA	NA	NA	NA	NA	NA
1990	2.44	0.95	0.25	NO	NO	0.5	0.1	30	NA	NA	NA	NA	NA	NA
1991	2.59	0.95	0.25	NO	NO	0.5	0.1	31	NA	NA	NA	NA	NA	NA
1992	2.59	0.95	0.25	NO	NO	0.5	0.1	32	NA	NA	NA	NA	NA	NA
1993	2.37	0.95	0.25	NO	NO	0.5	0.1	33	NA	NA	NA	NA	NA	NA
1994	1.92	0.95	0.25	NO	NO	0.5	0.1	34	NA	NA	NA	NA	NA	NA
1995	1.47	0.99	0.25	NO	NO	0.5	0.1	35	NA	NA	NA	NA	NA	NA
1996	1.32	0.99	0.25	NO	NO	0.5	0.1	36	NA	NA	NA	NA	NA	NA
1997	1.2	0.97	0.25	NO	NO	0.5	0.1	37	NA	NA	NA	NA	NA	NA
1998	1.06	0.99	0.25	NO	NO	0.5	0.1	38	NA	NA	NA	NA	NA	NA
1999	1.07	0.99	0.25	NO	NO	0.5	0.1	39	NA	NA	NA	NA	NA	NA
2000	1.12	0.99	0.25	NO	NO	0.5	0.1	40	9	40	9	5	3	34
2001	1.11	1	0.25	NO	NO	0.5	0.1	41	10	39	9	5	4	33
2002	1.12	1	0.25	NO	0	0.5	0.1	42	11.1	39.5	11.1	5.3	3.8	29.2
2003	1.13	1	0.25	NO	0.01	0.5	0.1	43	10.3	39.58	11.7	5.01	4.1	29.3
2004	1.09	1	0.25	NO	0.01	0.5	0.1	44	10.14	37.8	13.58	5.59	4.35	26.06
2005	1.15	0.97	0.25	NO	0.01	0.5	0.1	45	5.91	47.83	7.59	3.19	2.53	32.95
2006	0.98	0.97	0.25	NO	0.01	0.5	0.1	46	4.07	52.94	6.67	3.1	1.93	31.29
2007	1.07	0.97	0.25	NO	0.01	0.5	0.1	47	7.15	51.77	8.51	4.87	2.3	25.4

8.2.3. Uncertainty and time-series consistency

The culminated uncertainty of the emissions from this source is estimated at 104%.

8.2.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

8.2.5. Source-specific recalculations, if applicable, including changes made in response to the review process

There is not recalculation data in this sub-sector during submission 2009.

8.2.6. Source-specific planned improvements

To improve the accuracy of the estimates.

8.3. Wastewater Handling (CRF sector 6B)

8.3.1. Source Category Description

This sector includes CH_4 emissions from domestic and industrial wastewater handling and N_2O emissions from human sewage.

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.

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 times less.

Figure 8.2 CH_4 emissions from Industrial wastewater for 1988 – 2007, Gg

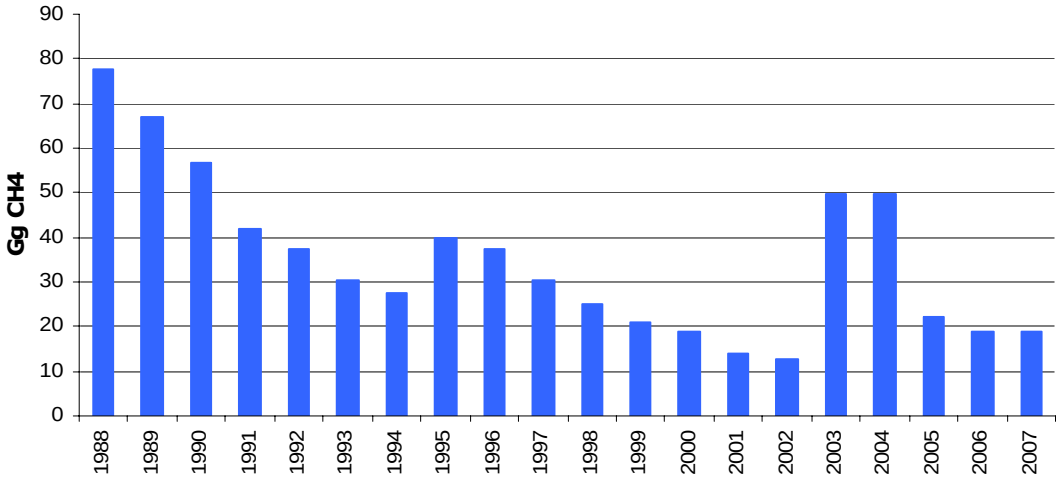
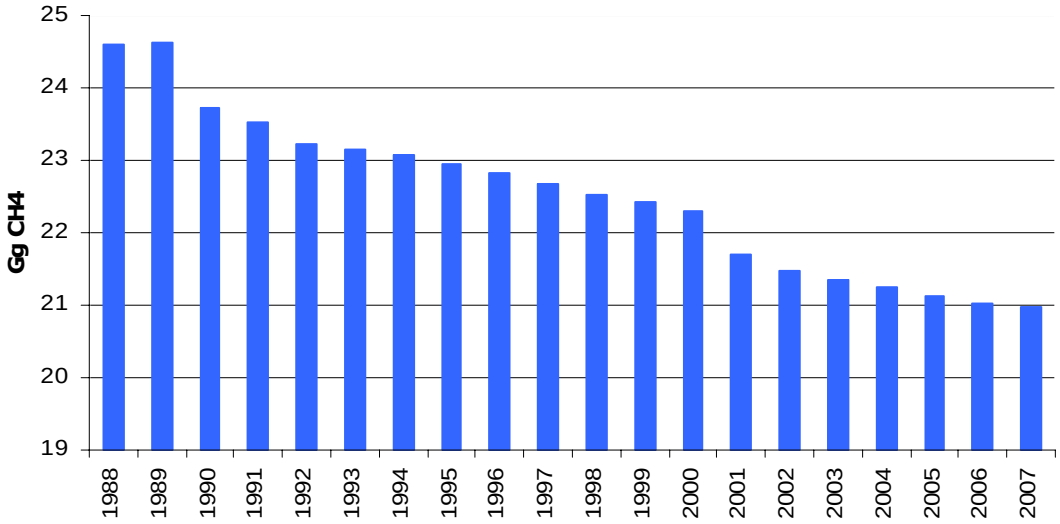
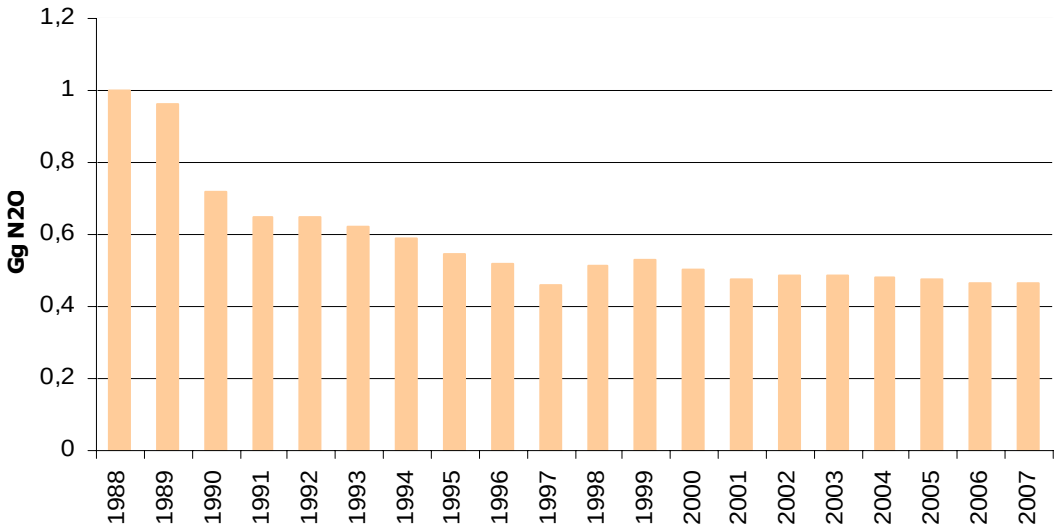


Figure 8.3 CH_4 emissions from Domestic/Commercial wastewater for 1988 – 2007, Gg



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 144 Gg in 2007. The decrease is 0.3% compared to 2006. It reflects not only the decrease of population, which is 0.25%, but also the decreased consumption of some foods (bread, milk, sugar, vegetables and others).

Figure 8.4 N_2O emissions from human sewage for 1988 – 2007, Gg



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.

Default method is used for calculating CH_4 emissions from domestic and industrial wastewater.

The default value of 0.6 kg CH_4/kg BOD (Biochemical Oxygen Demand) is used for calculating CH_4 emissions from domestic wastewater according to IPCC GPG 2000.

The default value of 0.25 kg CH_4/kg COD (Chemical Oxygen Demand) is used for calculating CH_4 emissions from industrial wastewater according to IPCC GPG 2000.

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.

The IPCC default methodology is used for calculating N_2O emissions from human sewage based on annual per capita protein intake.

For calculation of nitrous oxide emissions from human sewage, the equation 15 from page 6.28 of Revised 1996 IPCC Guidelines was used. Parameters used to calculate emission factor from Human Sewage are Fraction of Nitrogen in Protein $Frac_{NPR}$ in g

N/kg protein - 0.16 kg N/kg protein - IPCC default value, and emission factor - 0.01 - IPCC default value.

8.3.3. Uncertainty and time-series consistency

Table 8.4 Uncertainty of sub-sector Waste water handling for 2007, %

CRF categories	Key Category	GHG	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty
6B	Wastewater handling	CH_4	30	80	85.4
6B	Wastewater handling	N_2O	30	100	104.4

8.3.4. Source specific QA/QC and verification

All activities regarding QC as described in QA/QC System have been undertaken.

8.3.5. Source-specific recalculations, if applicable, including changes made in response to the review process

After recommendations of the 2008 centralized review of the greenhouse gas inventories of Bulgaria submitted in 2007 and 2008, Bulgaria revised calculations of CH_4 emissions from Domestic and Commercial Wastewater and Sludge (6.B) using the default values for Bo provided in IPCC good practice guidance 0.6 kg CH_4/kg BOD instead of 0.25 kg CH4/kg BOD used in previous submission.

Table 8.5 Recalculation in sub-sector Domestic/Commercial wastewater

Years	Submission 2007	Submission 2008	Difference
	CH4, Gg	CH4,Gg	%
1988	9.74	23.37	140
1989	9.74	23.39	140
1990	9.39	22.55	140
1991	9.31	22.35	140
1992	9.19	22.07	140
1993	9.17	22.00	140
1994	9.13	21.92	140
1995	9.09	21.81	140
1996	9.04	21.69	140
1997	8.98	21.54	140
1998	8.92	21.40	140
1999	8.88	21.30	140
2000	8.83	21.19	140
2001	8.59	20.62	140
2002	8.50	20.40	140
2003	8.45	20.29	140
2004	8.41	20.18	140
2005	8.36	20.07	140
2006	8.32	19.97	140

8.2.6. Source-specific planned improvements

To improve the accuracy of the estimates.

8.4. Waste Incineration (CRF sector 6.C)

Bulgaria has no solid waste incineration for energy production.

CHAPTER 9 OTHER (CRF SECTOR 7)

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.

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. Explanations and justifications for recalculations

The GHG emission recalculation for the period 1988-2007, was made because of changes, made in some of the elements of the inventory (data, emission factors and others) for each sector as follows:

Agriculture

- Direct Soil Emissions (4D1);

Waste

- Wastewater treatment (6B).

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.

Agriculture

During the 2008 centralized review of the greenhouse gas inventories of Bulgaria submitted in 2007 and 2008 were formulated the following potential problems:

(1) Direct Soil Emissions (4D1)

4.D.1.1 Synthetic fertilizers – N_2O

4.D.1.2 Animal manure applied to soils – N_2O

Bulgaria reports 0.01 kg N_2O-N/kg N as the value of N_2O implied emission factors (IEFs) for synthetic fertilizer application and animal manure applied to soils categories for the complete time series (1988-2006). These IEFs are lower than the IPCC default value (0.0125 kg N_2O-N/kg N).

After the recommendation of ERT, Bulgaria revised its calculations using the IPCC default emission factor of 0.0125 kg N_2O-N/kg N to estimate emissions from synthetic fertilizer application and manure applied to soils.

(2) Direct Soil Emissions (4D1)

4.D.1.3 N-fixing crops – N_2O

4.D.1.4 Crop residue – N_2O

The value reported by Bulgaria for N_2O implied emission factors for N-fixing crops (0.0003 kg N_2O-N/kg N) and for N in crop residues returned to soils (0.00007 kg N_2O-N/kg N) for the complete time series (1988-2006) are much lower than the IPCC default emission factor (0.0125 kg N_2O-N/kg N) which is applied for both N-fixing crops and N in crop residues.

After the recommendation of ERT, Bulgaria revised its calculations using the IPCC default emission factor (0.0125 kg N_2O-N/kg N) and ensures that correct activity data is reported in the CRF tables.

Waste sector

6.B Wastewater handling: maximum methane producing capacity (Bo)

After recommendations of the 2008 centralized review of the greenhouse gas inventories of Bulgaria submitted in 2007 and 2008, Bulgaria revised calculations of CH_4 emissions from Domestic and Commercial Wastewater and Sludge (6.B) using the default values for Bo provided in IPCC good practice guidance 0.6 kg CH_4/kg BOD instead of 0.25 kg CH_4/kg BOD used in previous submission.

10.2. Implications for emission levels

Emissions of the above-mentioned sources have been recalculated on the basis of the new emission factors, thus emission data for 1988 to 2006, which are submitted this year differ from data reported previous year.

There is no difference between CO_2 emissions in NIR 2008 and NIR 2009 for 1988-2006 due to recalculation.

Table 10.1 Differences between CH_4 emissions in NIR 2008 and NIR 2009 for 1988-2006 due to recalculation

Year	NIR 2008	NIR 2009	Difference
	Gg CO_2-eq.	Gg CO_2-eq.	%
1988	21 685	21 986	-1.39
1989	21 493	21 795	-1.40
1990	19 947	20 238	-1.46
1991	18 724	19 012	-1.54
1992	17 678	17 962	-1.61
1993	16 494	16 778	-1.72
1994	15 697	15 979	-1.80
1995	15 757	16 038	-1.78
1996	15 242	15 521	-1.84
1997	14 422	14 700	-1.93
1998	14 052	14 328	-1.96
1999	13 396	13 670	-2.05
2000	13 148	13 421	-2.08
2001	12 180	12 446	-2.18
2002	12 118	12 381	-2.17
2003	12 758	13 020	-2.05
2004	12 618	12 878	-2.06
2005	11 666	11 925	-2.22
2006	11 430	11 693	-2.30

The reason for the increase of reported methane emissions in the whole time series (1988-2007) is the update of default values for Bo provided in IPCC good practice guidance 0.6 kg CH_4/kg BOD instead of 0.25 kg CH_4/kg BOD.

Table 10.2 Differences between N_2O emissions in NIR 2008 and NIR 2009 for 1988-2006 due to recalculation

Year	NIR 2008	NIR 2009	Difference
	Gg CO_2-eq.	Gg CO_2-eq.	%
1988	12 114	12 946	-6.86
1989	11 292	12 041	-6.63
1990	10 501	11 166	-6.33
1991	7 843	8 262	-5.34
1992	6 426	6 748	-5.01
1993	5 720	6 034	-5.48
1994	5 855	6 199	-5.89
1995	5 887	6 158	-4.60
1996	5 806	6 057	-4.33
1997	5 453	5 726	-5.00
1998	4 451	4 662	-4.75
1999	4 524	4 788	-5.82
2000	4 966	5 221	-5.12
2001	4 624	4 896	-5.88
2002	4 500	4 772	-6.05
2003	4 492	4 735	-5.40
2004	4 439	4 730	-6.55
2005	4 411	4 682	-6.14
2006	4 230	4 483	-5.97

The reason for the increase of reported N_2O emissions in the whole time series (1988-2007) is the changes of emission factors of subsector Direct Soil missions.

Reported emissions of F-gases have not been recalculated in submission 2009.

Table 10.3 presents the recalculation differences of national total GHG emissions for all years.

Table 10.3 Differences between NIR 2008 and NIR 2009 for 1988-2006 due to recalculation

Year	NIR 2008	NIR 2009	Difference
	Gg CO_2-eq.	Gg CO_2-eq.	%
1988	132 614	133 747	-0.85
1989	131 848	132 899	-0.80
1990	116 716	117 672	-0.82
1991	95 344	96 051	-0.74
1992	85 889	86 495	-0.71
1993	86 591	87 188	-0.69
1994	83 913	84 540	-0.75
1995	88 009	88 561	-0.63
1996	86 167	86 699	-0.62
1997	83 136	83 686	-0.66
1998	74 277	74 765	-0.66
1999	68 998	69 536	-0.78
2000	68 695	69 223	-0.77
2001	69 009	69 547	-0.78

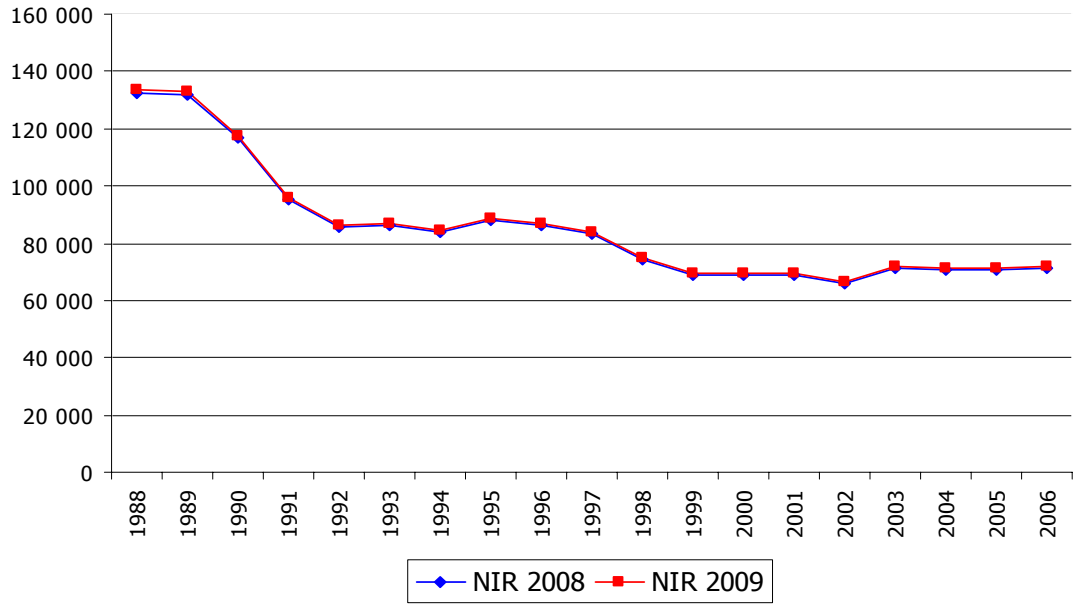
2002	65 975	66 510	-0.81
2003	71 237	71 741	-0.71
2004	70 548	71 100	-0.78
2005	70 497	71 027	-0.75
2006	71 343	71 936	-0.83

10.3 Implications for emission trends

The greenhouse gas emissions in the submission 2009 are slightly different than the emissions reported last year due to recalculation for the base year they are 0.85% higher and for the year 2006 – 0.83% higher too.

Figure10.1

Difference in trends between NIR 2008 and NIR 2009



10.4 Plan improvements

The purpose of the Bulgaria's GHG inventory is to fulfil the UNFCCC reporting obligations and the IPCC Guidelines.

The improvements will turn on the following:

(a) Continue to improve the QA/QC system;

(b) Improve the completeness of the GHG inventory by estimating and documenting emissions/removals from LULUCF;

(c) Continue to improve the transparency of the estimates in the NIR;

(d) Continue to improve the accuracy of the estimates.

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.

1.2 Tier 1 method for Assessment of Key Sources.

The following tables present results from key source analysis:
Table A1.1 presents results from the Level Assessment of the key category analysis excluding LULUCF
Table A1.2 present results from the Trend Assessment of the key category analysis excluding LULUCF
Table A1.3 presents results from the Level Assessment of the key category analysis including LULUCF
Table A1.4 presents results from the Trend Assessment of the key category analysis including LULUCF.

Table A1.1

Rank	IPCC Source Categories		GHGs	Unit	BY	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31317.79	23.43%	23.43%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10587.86	7.92%	31.35%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9352.857	7.00%	38.34%
4	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8520.307	6.37%	44.72%
5	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7740.271	5.79%	50.51%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7661.43	5.73%	56.24%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	4562.805	3.41%	59.65%
8	1A4b	Residential - Solid fuels	CO2	Gg	4495.56	3.36%	63.01%
9	4D1	Direct soil emissions	N2O	CO2-eq.Gg	4104.28	3.07%	66.08%
10	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3940.738	2.95%	69.03%
11	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3378.799	2.53%	71.56%
12	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3183.961	2.38%	73.94%
13	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2824.661	2.11%	76.05%
14	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2421.72	1.81%	77.87%
15	2C1	Iron and Steel Production	CO2	Gg	2360.375	1.77%	79.63%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2248	1.68%	81.31%
17	1A4b	Residential - Liquid fuels	CO2	Gg	2158.344	1.61%	82.93%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	2146.286	1.61%	84.53%
19	2A1	Cement Production	CO2	Gg	2006.253	1.50%	86.03%
20	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1991.585	1.49%	87.52%

Rank	IPCC Source Categories		GHGs	Unit	1989	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31737.83	23.89%	23.89%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10669.4	8.03%	31.92%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9696.968	7.30%	39.22%
4	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8177.602	6.16%	45.38%
5	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7938.625	5.98%	51.35%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7579.619	5.71%	57.06%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	4864.021	3.66%	60.72%
8	1A4b	Residential - Solid fuels	CO2	Gg	4590.17	3.46%	64.17%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3774.514	2.84%	67.02%
10	4D1	Direct soil emissions	N2O	CO2-eq.Gg	3683.194	2.77%	69.79%
11	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3279.63	2.47%	72.26%
12	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3195.339	2.41%	74.66%
13	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2531.105	1.91%	76.57%
14	2C1	Iron and Steel Production	CO2	Gg	2380.079	1.79%	78.36%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2304.54	1.73%	80.09%
16	2A1	Cement Production	CO2	Gg	2202.933	1.66%	81.75%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2199.714	1.66%	83.41%
18	1A4b	Residential - Liquid fuels	CO2	Gg	2018.935	1.52%	84.93%
19	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1944.498	1.46%	86.39%
20	6B	Waste Water Handling	CH4	CO2-eq.Gg	1926.358	1.45%	87.84%
21	2B1	Ammonia Production	CO2	Gg	1641.507	1.24%	89.08%
22	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1592.066	1.20%	90.27%
23	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1406.1	1.06%	91.33%
24	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	1359.79	1.02%	92.36%
25	1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO2	Gg	1191.663	0.90%	93.25%
26	1A3d	Navigation - Liquid fuels	CO2	Gg	1162.243	0.87%	94.13%
27	2A2	Lime Production	CO2	Gg	1135.895	0.86%	94.98%

Rank	IPCC Source Categories		GHGs	Unit	1990	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	21740.36	18.48%	18.48%
2	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	14277.06	12.14%	30.62%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10711.62	9.11%	39.73%
4	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	9835.16	8.36%	48.09%
5	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	6363.841	5.41%	53.50%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5469.125	4.65%	58.15%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	4461.875	3.79%	61.95%
8	4D1	Direct soil emissions	N2O	CO2-eq.Gg	3279.509	2.79%	64.74%
9	1A4b	Residential - Solid fuels	CO2	Gg	3209.295	2.73%	67.46%
10	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3123.599	2.66%	70.12%
11	1A3e	Other Transportation - Liquid fuels	CO2	Gg	2520.194	2.14%	72.26%
12	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2334.98	1.99%	74.25%
13	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2255.499	1.92%	76.17%
14	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2098.472	1.78%	77.95%
15	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2075.203	1.76%	79.71%
16	2A1	Cement Production	CO2	Gg	2070.023	1.76%	81.47%
17	2C1	Iron and Steel Production	CO2	Gg	1793.064	1.52%	83.00%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	1687.541	1.43%	84.43%
19	2B1	Ammonia Production	CO2	Gg	1620.283	1.38%	85.81%
20	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1591.811	1.35%	87.17%
21	1A4b	Residential - Liquid fuels	CO2	Gg	1577.311	1.34%	88.51%
22	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1538.773	1.31%	89.81%
23	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1349.742	1.15%	90.96%
24	2A2	Lime Production	CO2	Gg	1222.245	1.04%	92.00%
25	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	1030.416	0.88%	92.88%
26	1A5	Other - Stationary	CO2	Gg	1005.934	0.86%	93.73%
27	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	889.623	0.76%	94.49%
28	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	852.6399	0.72%	95.21%

Rank	IPCC Source Categories		GHGs	Unit	1991	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25363.85	26.41%	26.41%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10614.92	11.05%	37.47%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	6087.01	6.34%	43.81%
4	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	5643.409	5.88%	49.69%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5074.168	5.28%	54.97%
6	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	4816.055	5.02%	59.99%
7	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3596.497	3.75%	63.73%
8	1A4b	Residential - Solid fuels	CO2	Gg	3088.662	3.22%	66.95%
9	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2277.804	2.37%	69.32%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	2139.819	2.23%	71.55%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	2050.153	2.14%	73.68%
12	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1934.493	2.01%	75.70%
13	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1626.077	1.69%	77.39%
14	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1605.476	1.67%	79.06%
15	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1584.662	1.65%	80.71%
16	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1431.542	1.49%	82.21%
17	6B	Waste Water Handling	CH4	CO2-eq.Gg	1373.382	1.43%	83.64%
18	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1367.608	1.42%	85.06%
19	2B1	Ammonia Production	CO2	Gg	1353.112	1.41%	86.47%
20	2C1	Iron and Steel Production	CO2	Gg	1325.915	1.38%	87.85%
21	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1229.88	1.28%	89.13%
22	2A1	Cement Production	CO2	Gg	1225.201	1.28%	90.41%
23	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	921.2204	0.96%	91.37%
24	1A5	Other - Stationary	CO2	Gg	881.8909	0.92%	92.29%
25	2A2	Lime Production	CO2	Gg	811.69	0.85%	93.13%
26	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	765.285	0.80%	93.93%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	667.8795	0.70%	94.62%
28	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	579.2695	0.60%	95.23%

Rank	IPCC Source Categories		GHGs	Unit	1992	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24.155.9	27.94%	27.94%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10.492.2	12.13%	40.07%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5.065.5	5.86%	45.93%
4	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	4.553.2	5.27%	51.19%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	4.451.2	5.15%	56.34%
6	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	4.172.7	4.83%	61.17%
7	1A4b	Residential - Solid fuels	CO2	Gg	4.025.5	4.66%	65.82%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	2.623.2	3.03%	68.86%
9	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2.576.7	2.98%	71.84%
10	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2.022.6	2.34%	74.18%
11	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1.621.5	1.88%	76.05%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1.569.2	1.81%	77.87%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1.502.1	1.74%	79.60%
14	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1.323.7	1.53%	81.13%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1.285.8	1.49%	82.62%
16	6B	Waste Water Handling	CH4	CO2-eq.Gg	1.276.8	1.48%	84.10%
17	2C1	Iron and Steel Production	CO2	Gg	1.273.4	1.47%	85.57%
18	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1.271.4	1.47%	87.04%
19	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1.188.4	1.37%	88.41%
20	2B1	Ammonia Production	CO2	Gg	1.120.3	1.30%	89.71%
21	2A1	Cement Production	CO2	Gg	1.062.3	1.23%	90.94%
22	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	967.5	1.12%	92.06%
23	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	759.6	0.88%	92.94%
24	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	607.9	0.70%	93.64%
25	2A2	Lime Production	CO2	Gg	572.3	0.66%	94.30%
26	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	549.9	0.64%	94.94%

Rank	IPCC Source Categories		GHGs	Unit	1993	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25606.12	29.38%	29.38%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10314.28	11.83%	41.21%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	6082.964	6.98%	48.19%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	4932.786	5.66%	53.85%
5	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	4325.355	4.96%	58.81%
6	1A4b	Residential - Solid fuels	CO2	Gg	3752.325	4.31%	63.12%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	3108.414	3.57%	66.68%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3037.953	3.49%	70.17%
9	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2642.396	3.03%	73.20%
10	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2280.275	2.62%	75.82%
11	2C1	Iron and Steel Production	CO2	Gg	1593.561	1.83%	77.65%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1544.438	1.77%	79.42%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1499.81	1.72%	81.14%
14	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1251.5	1.44%	82.57%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1185.719	1.36%	83.93%
16	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1168.484	1.34%	85.28%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1132.694	1.30%	86.58%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	1126.221	1.29%	87.87%
19	2A1	Cement Production	CO2	Gg	1115.758	1.28%	89.15%
20	2B1	Ammonia Production	CO2	Gg	1095.491	1.26%	90.40%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	955.3986	1.10%	91.50%
22	1A5	Other - Stationary	CO2	Gg	733.1143	0.84%	92.34%
23	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	720.511	0.83%	93.17%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	663.8728	0.76%	93.93%
25	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	606.366	0.70%	94.63%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	513.615	0.59%	95.21%

Rank	IPCC Source Categories		GHGs	Unit	1994	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23408.33	27.69%	27.69%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10106.52	11.96%	39.65%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	7542.261	8.92%	48.58%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5139.449	6.08%	54.66%
5	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	3618.127	4.28%	58.94%
6	1A3b	Road Transportation - Gasoline	CO2	Gg	3053.012	3.61%	62.55%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2803.742	3.32%	65.87%
8	1A4b	Residential - Solid fuels	CO2	Gg	2768.576	3.28%	69.14%
9	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2350.48	2.78%	71.92%
10	2C1	Iron and Steel Production	CO2	Gg	2045.111	2.42%	74.34%
11	1A3b	Road Transportation - Diesel Oil	CO2	Gg	1923.132	2.28%	76.62%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1699.286	2.01%	78.63%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1401.621	1.66%	80.29%
14	2A1	Cement Production	CO2	Gg	1395.139	1.65%	81.94%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1337.991	1.58%	83.52%
16	2B1	Ammonia Production	CO2	Gg	1232.081	1.46%	84.98%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1206.334	1.43%	86.40%
18	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1095.102	1.30%	87.70%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	1065.586	1.26%	88.96%
20	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1018.174	1.20%	90.17%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	854.5267	1.01%	91.18%
22	1A5	Other - Stationary	CO2	Gg	809.6122	0.96%	92.13%
23	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	669.8994	0.79%	92.93%
24	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	601.509	0.71%	93.64%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	568.2257	0.67%	94.31%
26	2A2	Lime Production	CO2	Gg	522.025	0.62%	94.93%

Rank	IPCC Source Categories		GHGs	Unit	1995	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23465.54	26.50%	26.50%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9860.461	11.14%	37.64%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	8626.629	9.74%	47.38%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	6070.453	6.86%	54.24%
5	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3687.473	4.16%	58.40%
6	1A3b	Road Transportation - Gasoline	CO2	Gg	3414.747	3.86%	62.26%
7	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3326.109	3.76%	66.01%
8	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	3197.138	3.61%	69.62%
9	1A4b	Residential - Solid fuels	CO2	Gg	2256.494	2.55%	72.17%
10	2C1	Iron and Steel Production	CO2	Gg	2236.404	2.53%	74.70%
11	1A3b	Road Transportation - Diesel Oil	CO2	Gg	1974.673	2.23%	76.93%
12	2A1	Cement Production	CO2	Gg	1925.993	2.18%	79.10%
13	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1921.082	2.17%	81.27%
14	2B1	Ammonia Production	CO2	Gg	1489.527	1.68%	82.96%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1453.483	1.64%	84.60%
16	6B	Waste Water Handling	CH4	CO2-eq.Gg	1317.421	1.49%	86.09%
17	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1317.396	1.49%	87.57%
18	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1037.979	1.17%	88.75%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	984.6547	1.11%	89.86%
20	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	935.4968	1.06%	90.91%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	841.2452	0.95%	91.86%
22	2A2	Lime Production	CO2	Gg	747.32	0.84%	92.71%
23	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	739.3794	0.84%	93.54%
24	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	652.0953	0.74%	94.28%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	569.5741	0.64%	94.92%

Rank	IPCC Source Categories		GHGs	Unit	1996	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23087.1	26.63%	26.63%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9561.571	11.03%	37.66%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	8469.159	9.77%	47.43%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	6014.809	6.94%	54.37%
5	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3529.666	4.07%	58.44%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3014.751	3.48%	61.92%
7	1A4b	Residential - Solid fuels	CO2	Gg	2910.076	3.36%	65.28%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	2862.689	3.30%	68.58%
9	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	2853.55	3.29%	71.87%
10	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2442.008	2.82%	74.69%
11	2C1	Iron and Steel Production	CO2	Gg	2017.197	2.33%	77.02%
12	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1962.267	2.26%	79.28%
13	2A1	Cement Production	CO2	Gg	1897.109	2.19%	81.47%
14	2B1	Ammonia Production	CO2	Gg	1478.912	1.71%	83.17%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1413.967	1.63%	84.80%
16	6B	Waste Water Handling	CH4	CO2-eq.Gg	1263.678	1.46%	86.26%
17	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1235.543	1.43%	87.69%
18	4D3	Indirect Emissions	N2O	CO2-eq.Gg	990.9016	1.14%	88.83%
19	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	904.394	1.04%	89.87%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	878.6227	1.01%	90.89%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	821.7601	0.95%	91.84%
22	2A2	Lime Production	CO2	Gg	777.935	0.90%	92.73%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	660.4169	0.76%	93.49%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	637.2172	0.74%	94.23%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	537.8213	0.62%	94.85%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	461.3305	0.53%	95.38%

Rank	IPCC Source Categories		GHGs	Unit	1997	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24407.34	29.17%	29.17%
2	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9832.395	11.75%	40.92%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9227.266	11.03%	51.95%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	4435.159	5.30%	57.25%
5	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3502.795	4.19%	61.43%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3423.71	4.09%	65.53%
7	1A4b	Residential - Solid fuels	CO2	Gg	2398.127	2.87%	68.39%
8	2C1	Iron and Steel Production	CO2	Gg	2157.588	2.58%	70.97%
9	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2081.429	2.49%	73.46%
10	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	2018.685	2.41%	75.87%
11	1A3b	Road Transportation - Gasoline	CO2	Gg	1932.367	2.31%	78.18%
12	2A1	Cement Production	CO2	Gg	1648.562	1.97%	80.15%
13	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1614.48	1.93%	82.08%
14	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1341.031	1.60%	83.68%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1274.569	1.52%	85.21%
16	2B1	Ammonia Production	CO2	Gg	1216.431	1.45%	86.66%
17	6B	Waste Water Handling	CH4	CO2-eq.Gg	1113.331	1.33%	87.99%
18	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1069.718	1.28%	89.27%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	983.5555	1.18%	90.44%
20	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	897.1607	1.07%	91.52%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	792.7066	0.95%	92.46%
22	2A2	Lime Production	CO2	Gg	691.585	0.83%	93.29%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	582.0227	0.70%	93.99%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	538.0847	0.64%	94.63%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	492.8388	0.59%	95.22%

Rank	IPCC Source Categories		GHGs	Unit	1998	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23321.45	31.19%	31.19%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8850.005	11.84%	43.03%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5719.143	7.65%	50.68%
4	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	4539.645	6.07%	56.75%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3958.513	5.29%	62.05%
6	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2584.578	3.46%	65.50%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	2537.6	3.39%	68.90%
8	1A4b	Residential - Solid fuels	CO2	Gg	2501.992	3.35%	72.24%
9	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2422.88	3.24%	75.48%
10	2C1	Iron and Steel Production	CO2	Gg	1837.24	2.46%	77.94%
11	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1338.282	1.79%	79.73%
12	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1063.781	1.42%	81.15%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1036.902	1.39%	82.54%
14	6B	Waste Water Handling	CH4	CO2-eq.Gg	996.8692	1.33%	83.87%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	968.489	1.30%	85.17%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	966.6872	1.29%	86.46%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	836.9631	1.12%	87.58%
18	2A1	Cement Production	CO2	Gg	806.2129	1.08%	88.66%
19	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	789.5409	1.06%	89.72%
20	2B1	Ammonia Production	CO2	Gg	652.4769	0.87%	90.59%
21	2F	ODS substitutes	HFCs	CO2-eq.Gg	576.6588	0.77%	91.36%
22	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	551.7155	0.74%	92.10%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	528.0345	0.71%	92.81%
24	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	472.1834	0.63%	93.44%
25	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	468.1698	0.63%	94.06%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	451.8306	0.60%	94.67%
27	2A3	Limestone and Dolomite Use	CO2	Gg	376.3773	0.50%	95.17%

Rank	IPCC Source Categories		GHGs	Unit	1999	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	21619	31.09%	31.09%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8515.385	12.25%	43.34%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5242.341	7.54%	50.88%
4	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	4106.833	5.91%	56.78%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2933.823	4.22%	61.00%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2570.552	3.70%	64.70%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	2494.005	3.59%	68.28%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2491.972	3.58%	71.87%
9	1A4b	Residential - Solid fuels	CO2	Gg	1741.035	2.50%	74.37%
10	2C1	Iron and Steel Production	CO2	Gg	1668.19	2.40%	76.77%
11	4D1	Direct soil emissions	N2O	CO2eq.Gg	1299.644	1.87%	78.64%
12	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1176.235	1.69%	80.33%
13	2A1	Cement Production	CO2	Gg	1050.653	1.51%	81.84%
14	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1019.344	1.47%	83.31%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	963.4701	1.39%	84.69%
16	6B	Waste Water Handling	CH4	CO2-eq.Gg	906.8986	1.30%	86.00%
17	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	773.7803	1.11%	87.11%
18	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	732.4624	1.05%	88.16%
19	1A3e	Other Transportation - Liquid fuels	CO2	Gg	723.8157	1.04%	89.21%
20	2A2	Lime Production	CO2	Gg	561.0254	0.81%	90.01%
21	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	515.1886	0.74%	90.75%
22	2B1	Ammonia Production	CO2	Gg	468.4247	0.67%	91.43%
23	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	466.5875	0.67%	92.10%
24	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	447.0972	0.64%	92.74%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	443.7012	0.64%	93.38%
26	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	387.7557	0.56%	93.94%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	369.8075	0.53%	94.47%
28	1A4a	Commercial/Institutional-Liquid fuels	CO2	Gg	366.2588	0.53%	95.00%
29	4B.8	Manure Management - Swine	CH4	CO2eq.Gg	337.7197	0.49%	95.48%

Rank	IPCC Source Categories		GHGs	Unit	2000	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	22424.54	32.40%	32.40%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8226.601	11.88%	44.28%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5032.701	7.27%	51.55%
4	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3420.466	4.94%	56.49%
5	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3415.015	4.93%	61.42%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2299.76	3.32%	64.75%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2188.591	3.16%	67.91%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	2093.881	3.02%	70.93%
9	2C1	Iron and Steel Production	CO2	Gg	1457.796	2.11%	73.04%
10	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1314.425	1.90%	74.94%
11	1A4b	Residential - Solid fuels	CO2	Gg	1311.311	1.89%	76.83%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1263.089	1.82%	78.66%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1198.981	1.73%	80.39%
14	2A1	Cement Production	CO2	Gg	1124.305	1.62%	82.01%
15	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	999.4177	1.44%	83.46%
16	4D3	Indirect Emissions	N2O	CO2-eq.Gg	936.114	1.35%	84.81%
17	6B	Waste Water Handling	CH4	CO2-eq.Gg	866.9513	1.25%	86.06%
18	2B1	Ammonia Production	CO2	Gg	801.5215	1.16%	87.22%
19	2A2	Lime Production	CO2	Gg	797.9282	1.15%	88.37%
20	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	725.5809	1.05%	89.42%
21	1A3e	Other Transportation - Liquid fuels	CO2	Gg	719.8137	1.04%	90.46%
22	1A3b	Road Transportation - LPG	CO2	Gg	622.0302	0.90%	91.36%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	594.9915	0.86%	92.22%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	564.8426	0.82%	93.03%
25	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	454.8126	0.66%	93.69%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	429.2872	0.62%	94.31%
27	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	406.1644	0.59%	94.90%
28	1A4a	Commercial/Institutional-Liquid fuels	CO2	Gg	286.5147	0.41%	95.31%

Rank	IPCC Source Categories		GHGs	Unit	2001	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25412.35	36.54%	36.54%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7954.078	11.44%	47.98%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4863.184	6.99%	54.97%
4	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3008.382	4.33%	59.30%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2916.546	4.19%	63.49%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2573.075	3.70%	67.19%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2141.311	3.08%	70.27%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	1798.737	2.59%	72.86%
9	2C1	Iron and Steel Production	CO2	Gg	1391.415	2.00%	74.86%
10	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1352.048	1.94%	76.80%
11	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1295.161	1.86%	78.66%
12	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1211.793	1.74%	80.41%
13	2A1	Cement Production	CO2	Gg	1165.638	1.68%	82.08%
14	2A2	Lime Production	CO2	Gg	917.5473	1.32%	83.40%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	861.8643	1.24%	84.64%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	854.5976	1.23%	85.87%
17	1A4b	Residential - Solid fuels	CO2	Gg	831.0618	1.20%	87.06%
18	1A3b	Road Transportation - LPG	CO2	Gg	825.4552	1.19%	88.25%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	747.4962	1.07%	89.33%
20	2B1	Ammonia Production	CO2	Gg	718.0693	1.03%	90.36%
21	1A3e	Other Transportation - Liquid fuels	CO2	Gg	674.6857	0.97%	91.33%
22	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	546.7545	0.79%	92.12%
23	1A4a	Commercial/Institutional - Liquid fuels	CO2	Gg	517.3571	0.74%	92.86%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	501.0403	0.72%	93.58%
25	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	500.0604	0.72%	94.30%
26	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	490.0692	0.70%	95.00%

Rank	IPCC Source Categories		GHGs	Unit	2002	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	22935.65	34.49%	34.49%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7706.939	11.59%	46.07%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4503.709	6.77%	52.85%
4	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3239.685	4.87%	57.72%
5	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2611.305	3.93%	61.64%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2454.667	3.69%	65.33%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2034.918	3.06%	68.39%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	1933.467	2.91%	71.30%
9	1A4b	Residential - Solid fuels	CO2	Gg	1449.783	2.18%	73.48%
10	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1353.018	2.03%	75.51%
11	2C1	Iron and Steel Production	CO2	Gg	1304.624	1.96%	77.48%
12	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1228.43	1.85%	79.32%
13	2A1	Cement Production	CO2	Gg	1156.62	1.74%	81.06%
14	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1088.824	1.64%	82.70%
15	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	969.971	1.46%	84.16%
16	1A3b	Road Transportation - LPG	CO2	Gg	950.8788	1.43%	85.59%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	867.9883	1.31%	86.89%
18	2A2	Lime Production	CO2	Gg	855.2913	1.29%	88.18%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	720.6247	1.08%	89.26%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	687.7651	1.03%	90.30%
21	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	554.9072	0.83%	91.13%
22	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	539.1042	0.81%	91.94%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	496.7606	0.75%	92.69%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	478.2658	0.72%	93.41%
25	2B1	Ammonia Production	CO2	Gg	456.564	0.69%	94.09%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	368.3076	0.55%	94.65%
27	1A4a	Commercial/Institutional - Liquid fuels	CO2	Gg	323.4254	0.49%	95.13%

Rank	IPCC Source Categories		GHGs	Unit	2003	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24859.16	34.65%	34.65%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7485.391	10.43%	45.09%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5397.833	7.52%	52.61%
4	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3494.675	4.87%	57.48%
5	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3358.736	4.68%	62.17%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2640.964	3.68%	65.85%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2131.71	2.97%	68.82%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	1858.869	2.59%	71.41%
9	1A4b	Residential - Solid fuels	CO2	Gg	1657.405	2.31%	73.72%
10	2C1	Iron and Steel Production	CO2	Gg	1640.271	2.29%	76.01%
11	6B	Waste Water Handling	CH4	CO2-eq.Gg	1489.692	2.08%	78.08%
12	2A1	Cement Production	CO2	Gg	1211.253	1.69%	79.77%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1208.324	1.68%	81.46%
14	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1205.102	1.68%	83.14%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1159.385	1.62%	84.75%
16	1A3b	Road Transportation - LPG	CO2	Gg	1063.34	1.48%	86.24%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1023.694	1.43%	87.66%
18	2A2	Lime Production	CO2	Gg	921.1708	1.28%	88.95%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	845.4878	1.18%	90.13%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	684.9762	0.95%	91.08%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	543.8282	0.76%	91.84%
22	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	509.0668	0.71%	92.55%
23	2B1	Ammonia Production	CO2	Gg	483.8304	0.67%	93.22%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	463.6561	0.65%	93.87%
25	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	394.5568	0.55%	94.42%
26	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	368.412	0.51%	94.93%
27	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	279.4643	0.39%	95.32%

Rank	IPCC Source Categories		GHGs	Unit	2004	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24889.82	35.01%	35.01%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7268.475	10.22%	45.24%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4905.309	6.90%	52.14%
4	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3807.458	5.36%	57.50%
5	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3219.055	4.53%	62.02%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2693.4	3.79%	65.81%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1918.645	2.70%	68.51%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	1771.7	2.49%	71.00%
9	2C1	Iron and Steel Production	CO2	Gg	1504.734	2.12%	73.12%
10	6B	Waste Water Handling	CH4	CO2-eq.Gg	1493.335	2.10%	75.22%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1446.01	2.03%	77.26%
12	2A1	Cement Production	CO2	Gg	1376.278	1.94%	79.19%
13	1A4b	Residential - Solid fuels	CO2	Gg	1268.037	1.78%	80.98%
14	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1232.714	1.73%	82.71%
15	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1014.923	1.43%	84.14%
16	1A3b	Road Transportation - LPG	CO2	Gg	983.2656	1.38%	85.52%
17	2A2	Lime Production	CO2	Gg	955.5954	1.34%	86.86%
18	4D3	Indirect Emissions	N2O	CO2-eq.Gg	911.5529	1.28%	88.15%
19	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	858.1147	1.21%	89.35%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	659.4375	0.93%	90.28%
21	2B1	Ammonia Production	CO2	Gg	585.5534	0.82%	91.11%
22	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	562.5785	0.79%	91.90%
23	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	537.4554	0.76%	92.65%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	508.6212	0.72%	93.37%
25	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	500.1472	0.70%	94.07%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	390.3872	0.55%	94.62%
27	2A3	Limestone and Dolomite Use	CO2	Gg	297.0937	0.42%	95.04%
28	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	276.4493	0.39%	95.43%

Rank	IPCC Source Categories		GHGs	Unit	2005	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24947.77	35.14%	35.14%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7081.988	9.98%	45.12%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4394.886	6.19%	51.31%
4	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4308.041	6.07%	57.38%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3081.68	4.34%	61.72%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2944.385	4.15%	65.86%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1980.326	2.79%	68.65%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	1726.01	2.43%	71.08%
9	2A1	Cement Production	CO2	Gg	1551.8	2.19%	73.27%
10	2C1	Iron and Steel Production	CO2	Gg	1376.301	1.94%	75.21%
11	4D1	Direct soil emissions	N2O	CO2eq.Gg	1347.338	1.90%	77.11%
12	1A3b	Road Transportation - LPG	CO2	Gg	1143.569	1.61%	78.72%
13	1A4b	Residential - Solid fuels	CO2	Gg	1137.964	1.60%	80.32%
14	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1106.737	1.56%	81.88%
15	2A2	Lime Production	CO2	Gg	996.1289	1.40%	83.28%
16	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	992.1649	1.40%	84.68%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	948.5793	1.34%	86.02%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	911.8358	1.28%	87.30%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	875.0427	1.23%	88.53%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	723.9374	1.02%	89.55%
21	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	656.499	0.92%	90.48%
22	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	628.7407	0.89%	91.36%
23	2B1	Ammonia Production	CO2	Gg	596.9189	0.84%	92.20%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	538.8191	0.76%	92.96%
25	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	516.9648	0.73%	93.69%
26	2F	ODS substitutes	HFCs	CO2-eq.Gg	386.8416	0.54%	94.24%
27	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	369.4026	0.52%	94.76%
28	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	334.4231	0.47%	95.23%

Rank	IPCC Source Categories		GHGs	Unit	2006	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25447.07	35.40%	35.40%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	6847.033	9.53%	44.93%
3	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4504.102	6.27%	51.19%
4	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4010.287	5.58%	56.77%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3267.68	4.55%	61.32%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2985.923	4.15%	65.47%
7	1A3b	Road Transportation - Gasoline	CO2	Gg	1919.708	2.67%	68.15%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1906.42	2.65%	70.80%
9	2C1	Iron and Steel Production	CO2	Gg	1547.985	2.15%	72.95%
10	2A1	Cement Production	CO2	Gg	1488.39	2.07%	75.02%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1291.966	1.80%	76.82%
12	1A3b	Road Transportation - LPG	CO2	Gg	1194.656	1.66%	78.48%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1187.025	1.65%	80.13%
14	1A4b	Residential - Solid fuels	CO2	Gg	1163.905	1.62%	81.75%
15	2A2	Lime Production	CO2	Gg	1038.406	1.44%	83.20%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	918.2382	1.28%	84.47%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	899.7211	1.25%	85.73%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	835.4033	1.16%	86.89%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	818.7842	1.14%	88.03%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	787.881	1.10%	89.12%
21	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	706.6438	0.98%	90.11%
22	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	697.5267	0.97%	91.08%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	611.598	0.85%	91.93%
24	2F	ODS substitutes	HFCs	CO2-eq.Gg	610.6793	0.85%	92.78%
25	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	520.4704	0.72%	93.50%
26	2B1	Ammonia Production	CO2	Gg	467.4539	0.65%	94.15%
27	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	366.2517	0.51%	94.66%
28	2A3	Limestone and Dolomite Use	CO2	Gg	329.4666	0.46%	95.12%

Rank	IPCC Source Categories		GHGs	Unit	2007	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	28981.39	38.28%	38.28%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	6674.478	8.82%	47.09%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4352.229	5.75%	52.84%
4	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4261.958	5.63%	58.47%
5	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3229.546	4.27%	62.73%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3200.373	4.23%	66.96%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1910.551	2.52%	69.48%
8	2A1	Cement Production	CO2	Gg	1896.98	2.51%	71.99%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	1892.961	2.50%	74.49%
10	2C1	Iron and Steel Production	CO2	Gg	1440.06	1.90%	76.39%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1346.397	1.78%	78.17%
12	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1324.009	1.75%	79.92%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1306.189	1.73%	81.64%
14	1A3b	Road Transportation - LPG	CO2	Gg	1142.977	1.51%	83.15%
15	2A2	Lime Production	CO2	Gg	1061.466	1.40%	84.55%
16	1A4b	Residential - Solid fuels	CO2	Gg	946.7465	1.25%	85.80%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	915.4612	1.21%	87.01%
18	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	903.5152	1.19%	88.21%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	838.967	1.11%	89.32%
20	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	777.9633	1.03%	90.34%
21	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	706.5982	0.93%	91.28%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	687.3236	0.91%	92.18%
23	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	636.8765	0.84%	93.02%
24	2B1	Ammonia Production	CO2	Gg	532.1041	0.70%	93.73%
25	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	492.1944	0.65%	94.38%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	357.2556	0.47%	94.85%
27	1A1	Energy Industries	N2O	CO2-eq.Gg	286.1086	0.38%	95.23%

A1.2

Rank	IPCC Source Categories		GHG	Unit	BY	2007	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31317.79	28981.39	38.28%	0.262	28.89%	28.89%
2	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8520.31	210.94	0.28%	0.108	11.86%	40.75%
3	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3183.96	4261.96	5.63%	0.042	4.63%	45.38%
4	1A4b	Residential - Solid fuels	CO2	Gg	4495.56	946.75	1.25%	0.037	4.11%	49.49%
5	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3940.74	687.32	0.91%	0.036	3.97%	53.46%
6	6B	Waste Water Handling	CH4	CO2-eq.Gg	2146.29	838.97	1.11%	0.028	3.12%	56.58%
7	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7740.27	3200.37	4.23%	0.028	3.04%	59.62%
8	1A4b	Residential - Liquid fuels	CO2	Gg	2158.34	69.30	0.09%	0.027	2.96%	62.59%
9	1A3b	Road Transportation - LPG	CO2	Gg	0.73	1142.98	1.51%	0.027	2.94%	65.52%
10	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7661.43	3229.55	4.27%	0.026	2.85%	68.37%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	4104.28	1346.40	1.78%	0.023	2.51%	70.89%
12	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9352.86	4352.23	5.75%	0.022	2.43%	73.31%
13	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	0.00	777.96	1.03%	0.018	2.00%	75.31%
14	2A1	Cement Production	CO2	Gg	2006.25	1896.98	2.51%	0.018	1.95%	77.27%
15	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	0.00	706.60	0.93%	0.016	1.82%	79.08%
16	1A3b	Road Transportation - Gasoline	CO2	Gg	4562.80	1892.96	2.50%	0.016	1.78%	80.86%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2824.66	915.46	1.21%	0.016	1.76%	82.62%
18	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10587.86	6674.48	8.82%	0.016	1.74%	84.36%
19	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1469.57	265.59	0.35%	0.013	1.46%	85.82%
20	1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO2	Gg	1095.09	88.37	0.12%	0.012	1.37%	87.18%
21	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	1652.29	492.19	0.65%	0.010	1.14%	88.32%
22	2A2	Lime Production	CO2	Gg	1117.84	1061.47	1.40%	0.010	1.10%	89.42%
23	2B1	Ammonia Production	CO2	Gg	1662.13	532.10	0.70%	0.010	1.05%	90.47%
24	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2248.00	903.52	1.19%	0.009	0.95%	91.42%
25	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	851.44	198.55	0.26%	0.007	0.73%	92.15%
26	2F	ODS substitutes	HFCs	CO2-eq.Gg	2.95	246.61	0.33%	0.006	0.63%	92.78%
27	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	1056.05	357.26	0.47%	0.006	0.62%	93.40%
28	1A3a	Civil Aviation - Liquid fuels	CO2	Gg	611.59	133.15	0.18%	0.005	0.55%	93.95%

29	1A4a	Commercial/Institutional - Solid fuels	CO2	Gg	345.59	13.69	0.02%	0.004	0.47%	94.42%
30	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1991.58	1306.19	1.73%	0.004	0.46%	94.87%
31	6B	Waste Water Handling	N2O	CO2-eq.Gg	310.49	144.44	0.19%	0.004	0.45%	95.33%

A1.3

Rank	IPCC Source Categories		GHG	Unit	BY	BY ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31317.79	31.317.8	19.53%	19.53%
2	5B1	Cropland remaining Cropland	CO2	Gg	-20944.67	20.944.7	13.06%	32.59%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10587.86	10.587.9	6.60%	39.19%
4	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9352.86	9.352.9	5.83%	45.03%
5	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8520.31	8.520.3	5.31%	50.34%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7740.27	7.740.3	4.83%	55.17%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7661.43	7.661.4	4.78%	59.95%
8	5A1	Forest Land remaining Forest Land	CO2	Gg	-5132.63	5.132.6	3.20%	63.15%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	4562.80	4.562.8	2.85%	65.99%
10	1A4b	Residential - Solid fuels	CO2	Gg	4495.56	4.495.6	2.80%	68.80%
11	4D1	Direct soil emissions	N2O	CO2-eq.Gg	4104.28	4.104.3	2.56%	71.36%
12	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3940.74	3.940.7	2.46%	73.81%
13	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3378.80	3.378.8	2.11%	75.92%
14	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3183.96	3.184.0	1.99%	77.91%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2824.66	2.824.7	1.76%	79.67%
16	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2421.72	2.421.7	1.51%	81.18%30
17	2C1	Iron and Steel Production	CO2	Gg	2360.38	2.360.4	1.47%	82.65%
18	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2248.00	2.248.0	1.40%	84.05%
19	1A4b	Residential - Liquid fuels	CO2	Gg	2158.34	2.158.3	1.35%	85.40%
20	6B	Waste Water Handling	CH4	CO2-eq.Gg	2146.29	2.146.3	1.34%	86.74%
21	2A1	Cement Production	CO2	Gg	2006.25	2.006.3	1.25%	87.99%
22	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1991.58	1.991.6	1.24%	89.23%
23	2B1	Ammonia Production	CO2	Gg	1662.13	1.662.1	1.04%	90.27%
24	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1652.29	1.652.3	1.03%	91.30%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1469.57	1.469.6	0.92%	92.21%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	1278.97	1.279.0	0.80%	93.01%
27	2A2	Lime Production	CO2	Gg	1117.84	1.117.8	0.70%	93.71%
28	1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO2	Gg	1095.09	1.095.1	0.68%	94.39%
29	1A3d	Navigation - Liquid fuels	CO2	Gg	1088.46	1.088.5	0.68%	95.07%

Rank	IPCC Source Categories		GHG	Unit	1989	1989 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31737.83	31.737.8	19.83%	19.83%
2	5B1	Cropland remaining Cropland	CO2	Gg	-20937.48	20.937.5	13.09%	32.92%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10669.40	10.669.4	6.67%	39.59%
4	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9696.97	9.697.0	6.06%	45.65%
5	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8177.60	8.177.6	5.11%	50.76%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7938.63	7.938.6	4.96%	55.72%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7579.62	7.579.6	4.74%	60.46%
8	5A1	Forest Land remaining Forest Land	CO2	Gg	-5629.32	5.629.3	3.52%	63.98%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	4864.02	4.864.0	3.04%	67.02%
10	1A4b	Residential - Solid fuels	CO2	Gg	4590.17	4.590.2	2.87%	69.88%
11	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3774.51	3.774.5	2.36%	72.24%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	3683.19	3.683.2	2.30%	74.54%
13	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3279.63	3.279.6	2.05%	76.59%
14	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3195.34	3.195.3	2.00%	78.59%
15	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2531.10	2.531.1	1.58%	80.17%
16	2C1	Iron and Steel Production	CO2	Gg	2380.08	2.380.1	1.49%	81.66%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2304.54	2304.5	1.44%	83.10%
18	2A1	Cement Production	CO2	Gg	2202.93	2.202.9	1.38%	84.48%
19	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2199.71	2.199.7	1.37%	85.85%
20	1A4b	Residential - Liquid fuels	CO2	Gg	2018.94	2.018.9	1.26%	87.11%
21	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1944.50	1.944.5	1.22%	88.33%
22	6B	Waste Water Handling	CH4	CO2-eq.Gg	1926.36	1.926.4	1.20%	89.53%
23	2B1	Ammonia Production	CO2	Gg	1641.51	1.641.5	1.03%	90.56%
24	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1592.07	1.592.1	0.99%	91.55%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1406.10	1.406.1	0.88%	92.43%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	1359.79	1.359.8	0.85%	93.28%
27	1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO2	Gg	1191.66	1.191.7	0.74%	94.03%
28	1A3d	Navigation - Liquid fuels	CO2	Gg	1162.24	1.162.2	0.73%	94.75%

Rank	IPCC Source Categories		GHG	Unit	1990	1990 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	21740.36	21.740.4	14.98%	14.98%
2	5B1	Cropland remaining Cropland	CO2	Gg	-20789.61	20.789.6	14.32%	29.30%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	14277.06	14.277.1	9.84%	39.13%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10711.62	10.711.6	7.38%	46.51%
5	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	9835.16	9.835.2	6.78%	53.29%
6	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	6363.84	6.363.8	4.38%	57.67%
7	5A1	Forest Land remaining Forest Land	CO2	Gg	-6156.99	6.157.0	4.24%	61.91%
8	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5469.13	5.469.1	3.77%	65.68%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	4461.87	4.461.9	3.07%	68.75%
10	4D1	Direct soil emissions	N2O	CO2-eq.Gg	3279.51	3.279.5	2.26%	71.01%
11	1A4b	Residential - Solid fuels	CO2	Gg	3209.29	3.209.3	2.21%	73.22%
12	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3123.60	3.123.6	2.15%	75.38%
13	1A3e	Other Transportation - Liquid fuels	CO2	Gg	2520.19	2.520.2	1.74%	77.11%
14	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2334.98	2.335.0	1.61%	78.72%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	2255.50	2.255.5	1.55%	80.27%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2098.47	2.098.5	1.45%	81.72%
17	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2075.20	2.075.2	1.43%	83.15%
18	2A1	Cement Production	CO2	Gg	2070.02	2.070.0	1.43%	84.58%
19	2C1	Iron and Steel Production	CO2	Gg	1793.06	1.793.1	1.24%	85.81%
20	6B	Waste Water Handling	CH4	CO2-eq.Gg	1687.54	1.687.5	1.16%	86.97%
21	2B1	Ammonia Production	CO2	Gg	1620.28	1.620.3	1.12%	88.09%
22	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1591.81	1.591.8	1.10%	89.19%
23	1A4b	Residential - Liquid fuels	CO2	Gg	1577.31	1.577.3	1.09%	90.27%
24	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	1538.77	1.538.8	1.06%	91.33%
25	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1349.74	1.349.7	0.93%	92.26%
26	2A2	Lime Production	CO2	Gg	1222.25	1.222.2	0.84%	93.10%
27	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	1030.42	1.030.4	0.71%	93.81%
28	1A5	Other - Stationary	CO2	Gg	1005.93	1.005.9	0.69%	94.51%
29	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	889.62	889.6	0.61%	95.12%

Rank	IPCC Source Categories		GHG	Unit	1991	1991 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25363.85	25.363.8	20.08%	20.08%
2	5B1	Cropland remaining Cropland	CO2	Gg	-22061.9	22.061.9	17.47%	37.55%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10614.92	10.614.9	8.40%	45.95%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-7635.7	7.635.7	6.05%	52.00%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	6087.01	6.087.0	4.82%	56.81%
6	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	5643.409	5.643.4	4.47%	61.28%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5074.168	5.074.2	4.02%	65.30%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	4816.055	4.816.1	3.81%	69.11%
9	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3596.497	3.596.5	2.85%	71.96%
10	1A4b	Residential - Solid fuels	CO2	Gg	3088.662	3.088.7	2.45%	74.40%
11	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2277.804	2.277.8	1.80%	76.21%
12	1A3b	Road Transportation - Gasoline	CO2	Gg	2139.819	2.139.8	1.69%	77.90%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	2050.153	2.050.2	1.62%	79.52%
14	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1934.493	1.934.5	1.53%	81.06%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1626.077	1.626.1	1.29%	82.34%
16	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1605.476	1.605.5	1.27%	83.61%
17	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1584.662	1.584.7	1.25%	84.87%
18	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	1431.542	1.431.5	1.13%	86.00%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	1373.382	1.373.4	1.09%	87.09%
20	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1367.608	1.367.6	1.08%	88.17%
21	2B1	Ammonia Production	CO2	Gg	1353.112	1.353.1	1.07%	89.24%
22	2C1	Iron and Steel Production	CO2	Gg	1325.915	1.325.9	1.05%	90.29%
23	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1229.88	1.229.9	0.97%	91.27%
24	2A1	Cement Production	CO2	Gg	1225.201	1.225.2	0.97%	92.24%
25	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	921.2204	921.2	0.73%	92.97%
26	1A5	Other - Stationary	CO2	Gg	881.8909	881.9	0.70%	93.66%
27	2A2	Lime Production	CO2	Gg	811.69	811.7	0.64%	94.31%
28	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	765.285	765.3	0.61%	94.91%
29	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	667.8795	667.9	0.53%	95.44%

Rank	IPCC Source Categories		GHG	Unit	1992	1992 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24155.89	24.155.9	21.98%	21.98%
2	5B1	Cropland remaining Cropland	CO2	Gg	-15411.08	15.411.1	14.02%	36.00%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10492.18	10.492.2	9.55%	45.55%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-7412.03	7.412.0	6.74%	52.30%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5065.54	5.065.5	4.61%	56.91%
6	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	4553.15	4.553.2	4.14%	61.05%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	4451.16	4.451.2	4.05%	65.10%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	4172.75	4.172.7	3.80%	68.90%
9	1A4b	Residential - Solid fuels	CO2	Gg	4025.51	4.025.5	3.66%	72.56%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	2623.24	2.623.2	2.39%	74.95%
11	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2576.71	2.576.7	2.34%	77.29%
12	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2022.61	2.022.6	1.84%	79.13%
13	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1621.52	1.621.5	1.48%	80.61%
14	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1569.22	1.569.2	1.43%	82.04%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1502.07	1.502.1	1.37%	83.40%
16	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1323.66	1.323.7	1.20%	84.61%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1285.75	1.285.8	1.17%	85.78%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	1276.84	1.276.8	1.16%	86.94%
19	2C1	Iron and Steel Production	CO2	Gg	1273.37	1.273.4	1.16%	88.10%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1271.40	1.271.4	1.16%	89.25%
21	4D2	Pasture, Range and Paddock Manure	N2O	CO2-eq.Gg	1188.42	1.188.4	1.08%	90.34%
22	2B1	Ammonia Production	CO2	Gg	1120.29	1.120.3	1.02%	91.35%
23	2A1	Cement Production	CO2	Gg	1062.30	1.062.3	0.97%	92.32%
24	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	967.48	967.5	0.88%	93.20%
25	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	759.58	759.6	0.69%	93.89%
26	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	607.90	607.9	0.55%	94.45%
27	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.55%	94.99%

Rank	IPCC Source Categories		GHG	Unit	1994	1994 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23408.33	23.408.3	22.20%	22.20%
2	5B1	Cropland remaining Cropland	CO2	Gg	-13022.88	13.022.9	12.35%	34.55%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10106.52	10.106.5	9.58%	44.13%
4	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	7542.26	7.542.3	7.15%	51.29%
5	5A1	Forest Land remaining Forest Land	CO2	Gg	-7301.67	7.301.7	6.92%	58.21%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	5139.45	5.139.4	4.87%	63.08%
7	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	3618.13	3.618.1	3.43%	66.51%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	3053.01	3.053.0	2.90%	69.41%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2803.74	2.803.7	2.66%	72.07%
10	1A4b	Residential - Solid fuels	CO2	Gg	2768.58	2.768.6	2.63%	74.69%
11	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2350.48	2.350.5	2.23%	76.92%
12	2C1	Iron and Steel Production	CO2	Gg	2045.11	2.045.1	1.94%	78.86%
13	1A3b	Road Transportation - Diesel Oil	CO2	Gg	1923.13	1.923.1	1.82%	80.69%
14	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1699.29	1.699.3	1.61%	82.30%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1401.62	1.401.6	1.33%	83.63%
16	2A1	Cement Production	CO2	Gg	1395.14	1.395.1	1.32%	84.95%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1337.99	1.338.0	1.27%	86.22%
18	2B1	Ammonia Production	CO2	Gg	1232.08	1.232.1	1.17%	87.39%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	1206.33	1.206.3	1.14%	88.53%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1095.10	1.095.1	1.04%	89.57%
21	6B	Waste Water Handling	CH4	CO2-eq.Gg	1065.59	1.065.6	1.01%	90.58%
22	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1018.17	1.018.2	0.97%	91.55%
23	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	854.53	854.5	0.81%	92.36%
24	1A5	Other - Stationary	CO2	Gg	809.61	809.6	0.77%	93.12%
25	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	669.90	669.9	0.64%	93.76%
26	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.57%	94.33%
27	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	601.51	601.5	0.57%	94.90%
28	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	568.23	568.2	0.54%	95.44%

Rank	IPCC Source Categories		GHG	Unit	1995	1995 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23465.54	23.465.5	21.28%	21.28%
2	5B1	Cropland remaining Cropland	CO2	Gg	-13622.32	13.622.3	12.35%	33.63%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9860.46	9.860.5	8.94%	42.57%
4	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	8626.63	8.626.6	7.82%	50.39%
5	5A1	Forest Land remaining Forest Land	CO2	Gg	-7524.48	7.524.5	6.82%	57.21%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	6070.45	6.070.5	5.50%	62.71%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3687.47	3.687.5	3.34%	66.06%
8	1A3b	Road Transportation - Gasoline	CO2	Gg	3414.75	3.414.7	3.10%	69.15%
9	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3326.11	3.326.1	3.02%	72.17%
10	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	3197.14	3.197.1	2.90%	75.07%
11	1A4b	Residential - Solid fuels	CO2	Gg	2256.49	2.256.5	2.05%	77.11%
12	2C1	Iron and Steel Production	CO2	Gg	2236.40	2.236.4	2.03%	79.14%
13	1A3b	Road Transportation - Diesel Oil	CO2	Gg	1974.67	1.974.7	1.79%	80.93%
14	2A1	Cement Production	CO2	Gg	1925.99	1.926.0	1.75%	82.68%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1921.08	1.921.1	1.74%	84.42%
16	2B1	Ammonia Production	CO2	Gg	1489.53	1.489.5	1.35%	85.77%
17	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1453.48	1.453.5	1.32%	87.09%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	1317.42	1.317.4	1.19%	88.28%
19	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1317.40	1.317.4	1.19%	89.48%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1037.98	1.038.0	0.94%	90.42%
21	4D3	Indirect Emissions	N2O	CO2-eq.Gg	984.65	984.7	0.89%	91.31%
22	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	935.50	935.5	0.85%	92.16%
23	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	841.25	841.2	0.76%	92.92%
24	2A2	Lime Production	CO2	Gg	747.32	747.3	0.68%	93.60%
25	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	739.38	739.4	0.67%	94.27%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	652.10	652.1	0.59%	94.86%
27	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.55%	95.41%

Rank	IPCC Source Categories		GHG	Unit	1996	1996 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23087.10	23.087.1	22.74%	22.74%
2	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9561.57	9.561.6	9.42%	32.15%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	8469.16	8.469.2	8.34%	40.49%
4	5B1	Cropland remaining Cropland	CO2	Gg	-7733.23	7.733.2	7.62%	48.11%
5	5A1	Forest Land remaining Forest Land	CO2	Gg	-6517.45	6.517.5	6.42%	54.53%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	6014.81	6.014.8	5.92%	60.45%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3529.67	3.529.7	3.48%	63.93%
8	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3014.75	3.014.8	2.97%	66.90%
9	1A4b	Residential - Solid fuels	CO2	Gg	2910.08	2.910.1	2.87%	69.76%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	2862.69	2.862.7	2.82%	72.58%
11	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	2853.55	2.853.6	2.81%	75.39%
12	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2442.01	2.442.0	2.40%	77.80%
13	2C1	Iron and Steel Production	CO2	Gg	2017.20	2.017.2	1.99%	79.78%
14	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1962.27	1.962.3	1.93%	81.72%
15	2A1	Cement Production	CO2	Gg	1897.11	1.897.1	1.87%	83.58%
16	2B1	Ammonia Production	CO2	Gg	1478.91	1.478.9	1.46%	85.04%
17	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1413.97	1.414.0	1.39%	86.43%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	1263.68	1.263.7	1.24%	87.68%
19	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1235.54	1.235.5	1.22%	88.89%
20	4D3	Indirect Emissions	N2O	CO2-eq.Gg	990.90	990.9	0.98%	89.87%
21	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	904.39	904.4	0.89%	90.76%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	878.62	878.6	0.87%	91.63%
23	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	821.76	821.8	0.81%	92.44%
24	2A2	Lime Production	CO2	Gg	777.94	777.9	0.77%	93.20%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	660.42	660.4	0.65%	93.85%
26	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	637.22	637.2	0.63%	94.48%
27	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.59%	95.07%

Rank	IPCC Source Categories		GHG	Unit	1997	1997 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24407.34	24.407.3	23.55%	23.55%
2	5B1	Cropland remaining Cropland	CO2	Gg	-12480.69	12.480.7	12.04%	35.60%
3	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9832.39	9.832.4	9.49%	45.08%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	9227.27	9.227.3	8.90%	53.99%
5	5A1	Forest Land remaining Forest Land	CO2	Gg	-6871.54	6.871.5	6.63%	60.62%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	4435.16	4.435.2	4.28%	64.90%
7	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	3502.80	3.502.8	3.38%	68.28%
8	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3423.71	3.423.7	3.30%	71.58%
9	1A4b	Residential - Solid fuels	CO2	Gg	2398.13	2.398.1	2.31%	73.90%
10	2C1	Iron and Steel Production	CO2	Gg	2157.59	2.157.6	2.08%	75.98%
11	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2081.43	2.081.4	2.01%	77.99%
12	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	2018.69	2.018.7	1.95%	79.94%
13	1A3b	Road Transportation - Gasoline	CO2	Gg	1932.37	1.932.4	1.86%	81.80%
14	2A1	Cement Production	CO2	Gg	1648.56	1.648.6	1.59%	83.39%
15	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1614.48	1.614.5	1.56%	84.95%
16	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1341.03	1.341.0	1.29%	86.24%
17	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1274.57	1.274.6	1.23%	87.47%
18	2B1	Ammonia Production	CO2	Gg	1216.43	1.216.4	1.17%	88.65%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	1113.33	1.113.3	1.07%	89.72%
20	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1069.72	1.069.7	1.03%	90.75%
21	4D3	Indirect Emissions	N2O	CO2-eq.Gg	983.56	983.6	0.95%	91.70%
22	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	897.16	897.2	0.87%	92.57%
23	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	792.71	792.7	0.76%	93.33%
24	2A2	Lime Production	CO2	Gg	691.59	691.6	0.67%	94.00%
25	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.58%	94.58%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	582.02	582.0	0.56%	95.14%

Rank	IPCC Source Categories		GHG	Unit	1998	1998 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	23321.45	23.321.5	24.94%	24.94%
2	5B1	Cropland remaining Cropland	CO2	Gg	-11273.49	11.273.5	12.06%	37.00%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8850.00	8.850.0	9.47%	46.46%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-6860.50	6.860.5	7.34%	53.80%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5719.14	5.719.1	6.12%	59.92%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	4539.65	4.539.6	4.86%	64.77%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3958.51	3.958.5	4.23%	69.01%
8	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2584.58	2.584.6	2.76%	71.77%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	2537.60	2.537.6	2.71%	74.49%
10	1A4b	Residential - Solid fuels	CO2	Gg	2501.99	2.502.0	2.68%	77.16%
11	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2422.88	2.422.9	2.59%	79.75%
12	2C1	Iron and Steel Production	CO2	Gg	1837.24	1.837.2	1.96%	81.72%
13	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1338.28	1.338.3	1.43%	83.15%
14	1A3e	Other Transportation - Liquid fuels	CO2	Gg	1063.78	1.063.8	1.14%	84.29%
15	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1036.90	1.036.9	1.11%	85.40%
16	6B	Waste Water Handling	CH4	CO2-eq.Gg	996.87	996.9	1.07%	86.46%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	968.49	968.5	1.04%	87.50%
18	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	966.69	966.7	1.03%	88.53%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	836.96	837.0	0.90%	89.43%
20	2A1	Cement Production	CO2	Gg	806.21	806.2	0.86%	90.29%
21	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	789.54	789.5	0.84%	91.13%
22	2B1	Ammonia Production	CO2	Gg	652.48	652.5	0.70%	91.83%
23	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.64%	92.48%
24	2F	ODS substitutes	HFCs	CO2-eq.Gg	576.66	576.7	0.62%	93.09%
25	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	551.72	551.7	0.59%	93.68%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	528.03	528.0	0.56%	94.25%
27	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	472.18	472.2	0.51%	94.75%
28	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	468.17	468.2	0.50%	95.25%

Rank	IPCC Source Categories		GHG	Unit	1999	1999 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	21619.00	21.619.0	24.10%	24.10%
2	5B1	Cropland remaining Cropland	CO2	Gg	-12368.87	12.368.9	13.79%	37.89%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8515.39	8.515.4	9.49%	47.38%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-7199.77	7.199.8	8.03%	55.41%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5242.34	5.242.3	5.84%	61.25%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	4106.83	4.106.8	4.58%	65.83%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2933.82	2.933.8	3.27%	69.10%
8	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2570.55	2.570.6	2.87%	71.96%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	2494.00	2.494.0	2.78%	74.74%
10	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2491.97	2.492.0	2.78%	77.52%
11	1A4b	Residential - Solid fuels	CO2	Gg	1741.03	1.741.0	1.94%	79.46%
12	2C1	Iron and Steel Production	CO2	Gg	1668.19	1.668.2	1.86%	81.32%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1299.64	1.299.6	1.45%	82.77%
14	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1176.24	1.176.2	1.31%	84.08%
15	2A1	Cement Production	CO2	Gg	1050.65	1.050.7	1.17%	85.25%
16	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1019.34	1.019.3	1.14%	86.39%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	963.47	963.5	1.07%	87.46%
18	6B	Waste Water Handling	CH4	CO2-eq.Gg	906.90	906.9	1.01%	88.47%
19	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	773.78	773.8	0.86%	89.34%
20	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	732.46	732.5	0.82%	90.15%
21	1A3e	Other Transportation - Liquid fuels	CO2	Gg	723.82	723.8	0.81%	90.96%
22	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.67%	91.63%
23	2A2	Lime Production	CO2	Gg	561.03	561.0	0.63%	92.26%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	515.19	515.2	0.57%	92.83%
25	2B1	Ammonia Production	CO2	Gg	468.42	468.4	0.52%	93.35%
26	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	466.59	466.6	0.52%	93.87%
27	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	447.10	447.1	0.50%	94.37%
28	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	443.70	443.7	0.49%	94.87%
29	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	387.76	387.8	0.43%	95.30%

Rank	IPCC Source Categories		GHG	Unit	2000	2000 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	22424.54	22.424.5	25.02%	25.02%
2	5B1	Cropland remaining Cropland	CO2	Gg	-10836.44	10.836.4	12.09%	37.11%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-8976.23	8.976.2	10.01%	47.12%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	8226.60	8.226.6	9.18%	56.30%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5032.70	5.032.7	5.61%	61.91%
6	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3420.47	3.420.5	3.82%	65.73%
7	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3415.01	3.415.0	3.81%	69.54%
8	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2299.76	2.299.8	2.57%	72.10%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2188.59	2.188.6	2.44%	74.55%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	2093.88	2.093.9	2.34%	76.88%
11	2C1	Iron and Steel Production	CO2	Gg	1457.80	1.457.8	1.63%	78.51%
12	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1314.42	1.314.4	1.47%	79.97%
13	1A4b	Residential - Solid fuels	CO2	Gg	1311.31	1.311.3	1.46%	81.44%
14	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1263.09	1.263.1	1.41%	82.85%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1198.98	1.199.0	1.34%	84.18%
16	2A1	Cement Production	CO2	Gg	1124.30	1.124.3	1.25%	85.44%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	999.42	999.4	1.11%	86.55%
18	4D3	Indirect Emissions	N2O	CO2-eq.Gg	936.11	936.1	1.04%	87.60%
19	6B	Waste Water Handling	CH4	CO2-eq.Gg	866.95	867.0	0.97%	88.56%
20	2B1	Ammonia Production	CO2	Gg	801.52	801.5	0.89%	89.46%
21	2A2	Lime Production	CO2	Gg	797.93	797.9	0.89%	90.35%
22	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	725.58	725.6	0.81%	91.16%
23	1A3e	Other Transportation - Liquid fuels	CO2	Gg	719.81	719.8	0.80%	91.96%
24	1A3b	Road Transportation - LPG	CO2	Gg	622.03	622.0	0.69%	92.65%
25	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.67%	93.33%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	594.99	595.0	0.66%	93.99%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	564.84	564.8	0.63%	94.62%
28	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	454.81	454.8	0.51%	95.13%

Rank	IPCC Source Categories		GHG	Unit	2001	2001 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25412.35	25.412.4	26.86%	26.86%
2	5B1	Cropland remaining Cropland	CO2	Gg	-14985.63	14.985.6	15.84%	42.70%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-9467.15	9.467.1	10.01%	52.71%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7954.08	7.954.1	8.41%	61.12%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4863.18	4.863.2	5.14%	66.26%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3008.38	3.008.4	3.18%	69.44%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2916.55	2.916.5	3.08%	72.52%
8	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2573.08	2.573.1	2.72%	75.24%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2141.31	2.141.3	2.26%	77.51%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	1798.74	1.798.7	1.90%	79.41%
11	2C1	Iron and Steel Production	CO2	Gg	1391.42	1.391.4	1.47%	80.88%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1352.05	1.352.0	1.43%	82.31%
13	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1295.16	1.295.2	1.37%	83.68%
14	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1211.79	1.211.8	1.28%	84.96%
15	2A1	Cement Production	CO2	Gg	1165.64	1.165.6	1.23%	86.19%
16	2A2	Lime Production	CO2	Gg	917.55	917.5	0.97%	87.16%
17	4D3	Indirect Emissions	N2O	CO2-eq.Gg	861.86	861.9	0.91%	88.07%
18	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	854.60	854.6	0.90%	88.97%
19	1A4b	Residential - Solid fuels	CO2	Gg	831.06	831.1	0.88%	89.85%
20	1A3b	Road Transportation - LPG	CO2	Gg	825.46	825.5	0.87%	90.73%
21	6B	Waste Water Handling	CH4	CO2-eq.Gg	747.50	747.5	0.79%	91.52%
22	2B1	Ammonia Production	CO2	Gg	718.07	718.1	0.76%	92.28%
23	1A3e	Other Transportation - Liquid fuels	CO2	Gg	674.69	674.7	0.71%	92.99%
24	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.64%	93.63%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	546.75	546.8	0.58%	94.20%
26	1A4a	Commercial/Institutional - Liquid fuels	CO2	Gg	517.36	517.4	0.55%	94.75%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	501.04	501.0	0.53%	95.28%

Rank	IPCC Source Categories		GHG	Unit	2002	2002 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	22935.65	22.935.6	25.66%	25.66%
2	5B1	Cropland remaining Cropland	CO2	Gg	-13942.69	13.942.7	15.60%	41.26%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-8318.06	8.318.1	9.31%	50.57%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7706.94	7.706.9	8.62%	59.20%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4503.71	4.503.7	5.04%	64.23%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3239.69	3.239.7	3.62%	67.86%
7	1A3b	Road Transportation - Diesel Oil	CO2	Gg	2611.31	2.611.3	2.92%	70.78%
8	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2454.67	2.454.7	2.75%	73.53%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2034.92	2.034.9	2.28%	75.80%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	1933.47	1.933.5	2.16%	77.97%
11	1A4b	Residential - Solid fuels	CO2	Gg	1449.78	1.449.8	1.62%	79.59%
12	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1353.02	1.353.0	1.51%	81.10%
13	2C1	Iron and Steel Production	CO2	Gg	1304.62	1.304.6	1.46%	82.56%
14	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1228.43	1.228.4	1.37%	83.94%
15	2A1	Cement Production	CO2	Gg	1156.62	1.156.6	1.29%	85.23%
16	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1088.82	1.088.8	1.22%	86.45%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	969.97	970.0	1.09%	87.54%
18	1A3b	Road Transportation - LPG	CO2	Gg	950.88	950.9	1.06%	88.60%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	867.99	868.0	0.97%	89.57%
20	2A2	Lime Production	CO2	Gg	855.29	855.3	0.96%	90.53%
21	6B	Waste Water Handling	CH4	CO2-eq.Gg	720.62	720.6	0.81%	91.34%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	687.77	687.8	0.77%	92.10%
23	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.67%	92.78%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	554.91	554.9	0.62%	93.40%
25	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	539.10	539.1	0.60%	94.00%
26	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	496.76	496.8	0.56%	94.56%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	478.27	478.3	0.54%	95.09%

Rank	IPCC Source Categories		GHG	Unit	2003	2003 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24859.16	24.859.2	28.24%	28.24%
2	5B1	Cropland remaining Cropland	CO2	Gg	-8642.92	8.642.9	9.82%	38.05%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7485.39	7.485.4	8.50%	46.56%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-7055.98	7.056.0	8.01%	54.57%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	5397.83	5.397.8	6.13%	60.70%
6	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3494.68	3.494.7	3.97%	64.67%
7	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3358.74	3.358.7	3.82%	68.49%
8	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2640.96	2.641.0	3.00%	71.49%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	2131.71	2.131.7	2.42%	73.91%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	1858.87	1.858.9	2.11%	76.02%
11	1A4b	Residential - Solid fuels	CO2	Gg	1657.40	1.657.4	1.88%	77.90%
12	2C1	Iron and Steel Production	CO2	Gg	1640.27	1.640.3	1.86%	79.77%
13	6B	Waste Water Handling	CH4	CO2-eq.Gg	1489.69	1.489.7	1.69%	81.46%
14	2A1	Cement Production	CO2	Gg	1211.25	1.211.3	1.38%	82.83%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1208.32	1.208.3	1.37%	84.21%
16	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1205.10	1.205.1	1.37%	85.58%
17	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1159.38	1.159.4	1.32%	86.89%
18	1A3b	Road Transportation - LPG	CO2	Gg	1063.34	1.063.3	1.21%	88.10%
19	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1023.69	1.023.7	1.16%	89.26%
20	2A2	Lime Production	CO2	Gg	921.17	921.2	1.05%	90.31%
21	4D3	Indirect Emissions	N2O	CO2-eq.Gg	845.49	845.5	0.96%	91.27%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	684.98	685.0	0.78%	92.05%
23	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.68%	92.73%
24	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	543.83	543.8	0.62%	93.35%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	509.07	509.1	0.58%	93.93%
26	2B1	Ammonia Production	CO2	Gg	483.83	483.8	0.55%	94.48%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	463.66	463.7	0.53%	95.00%

Rank	IPCC Source Categories		GHG	Unit	2004	2004 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24889.82	24.889.8	26.32%	26.32%
2	5B1	Cropland remaining Cropland	CO2	Gg	-14911.70	14.911.7	15.77%	42.09%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-7965.21	7.965.2	8.42%	50.51%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7268.48	7.268.5	7.69%	58.20%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4905.31	4.905.3	5.19%	63.39%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3807.46	3.807.5	4.03%	67.41%
7	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3219.05	3.219.1	3.40%	70.82%
8	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	2693.40	2.693.4	2.85%	73.66%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1918.65	1.918.6	2.03%	75.69%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	1771.70	1.771.7	1.87%	77.57%
11	2C1	Iron and Steel Production	CO2	Gg	1504.73	1.504.7	1.59%	79.16%
12	6B	Waste Water Handling	CH4	CO2-eq.Gg	1493.33	1.493.3	1.58%	80.74%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1446.01	1.446.0	1.53%	82.27%
14	2A1	Cement Production	CO2	Gg	1376.28	1.376.3	1.46%	83.72%
15	1A4b	Residential - Solid fuels	CO2	Gg	1268.04	1.268.0	1.34%	85.06%
16	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1232.71	1.232.7	1.30%	86.37%
17	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	1014.92	1.014.9	1.07%	87.44%
18	1A3b	Road Transportation - LPG	CO2	Gg	983.27	983.3	1.04%	88.48%
19	2A2	Lime Production	CO2	Gg	955.60	955.6	1.01%	89.49%
20	4D3	Indirect Emissions	N2O	CO2-eq.Gg	911.55	911.6	0.96%	90.45%
21	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	858.11	858.1	0.91%	91.36%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	659.44	659.4	0.70%	92.06%
23	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.64%	92.69%
24	2B1	Ammonia Production	CO2	Gg	585.55	585.6	0.62%	93.31%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	562.58	562.6	0.59%	93.91%
26	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	537.46	537.5	0.57%	94.48%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	508.62	508.6	0.54%	95.02%

Rank	IPCC Source Categories		GHG	Unit	2005	2005 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	24947.77	24.947.8	27.55%	27.55%
2	5B1	Cropland remaining Cropland	CO2	Gg	-11968.27	11.968.3	13.22%	40.76%
3	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	7081.99	7.082.0	7.82%	48.58%
4	5A1	Forest Land remaining Forest Land	CO2	Gg	-6996.04	6.996.0	7.73%	56.31%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4394.89	4.394.9	4.85%	61.16%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4308.04	4.308.0	4.76%	65.92%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3081.68	3.081.7	3.40%	69.32%
8	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2944.39	2.944.4	3.25%	72.57%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1980.33	1.980.3	2.19%	74.76%
10	1A3b	Road Transportation - Gasoline	CO2	Gg	1726.01	1.726.0	1.91%	76.67%
11	2A1	Cement Production	CO2	Gg	1551.80	1.551.8	1.71%	78.38%
12	2C1	Iron and Steel Production	CO2	Gg	1376.30	1.376.3	1.52%	79.90%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1347.34	1.347.3	1.49%	81.39%
14	1A3b	Road Transportation - LPG	CO2	Gg	1143.57	1.143.6	1.26%	82.65%
15	1A4b	Residential - Solid fuels	CO2	Gg	1137.96	1.138.0	1.26%	83.91%
16	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1106.74	1.106.7	1.22%	85.13%
17	2A2	Lime Production	CO2	Gg	996.13	996.1	1.10%	86.23%
18	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	992.16	992.2	1.10%	87.32%
19	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	948.58	948.6	1.05%	88.37%
20	6B	Waste Water Handling	CH4	CO2-eq.Gg	911.84	911.8	1.01%	89.38%
21	4D3	Indirect Emissions	N2O	CO2-eq.Gg	875.04	875.0	0.97%	90.34%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	723.94	723.9	0.80%	91.14%
23	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	656.50	656.5	0.72%	91.87%
24	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	628.74	628.7	0.69%	92.56%
25	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.67%	93.23%
26	2B1	Ammonia Production	CO2	Gg	596.92	596.9	0.66%	93.89%
27	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	538.82	538.8	0.59%	94.48%
28	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	516.96	517.0	0.57%	95.05%

Rank	IPCC Source Categories		GHG	Unit	2006	2006 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	25447.07	25.447.1	27.87%	27.87%
2	5B1	Cropland remaining Cropland	CO2	Gg	-11829.33	11.829.3	12.96%	40.83%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-6996.04	6.996.0	7.66%	48.49%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	6847.03	6.847.0	7.50%	55.99%
5	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4504.10	4.504.1	4.93%	60.92%
6	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4010.29	4.010.3	4.39%	65.31%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3267.68	3.267.7	3.58%	68.89%
8	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	2985.92	2.985.9	3.27%	72.16%
9	1A3b	Road Transportation - Gasoline	CO2	Gg	1919.71	1.919.7	2.10%	74.26%
10	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1906.42	1.906.4	2.09%	76.35%
11	2C1	Iron and Steel Production	CO2	Gg	1547.98	1.548.0	1.70%	78.05%
12	2A1	Cement Production	CO2	Gg	1488.39	1.488.4	1.63%	79.68%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1291.97	1.292.0	1.41%	81.09%
14	1A3b	Road Transportation - LPG	CO2	Gg	1194.66	1.194.7	1.31%	82.40%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1187.03	1.187.0	1.30%	83.70%
16	1A4b	Residential - Solid fuels	CO2	Gg	1163.90	1.163.9	1.27%	84.97%
17	2A2	Lime Production	CO2	Gg	1038.41	1.038.4	1.14%	86.11%
18	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	918.24	918.2	1.01%	87.12%
19	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	899.72	899.7	0.99%	88.10%
20	6B	Waste Water Handling	CH4	CO2-eq.Gg	835.40	835.4	0.91%	89.02%
21	4D3	Indirect Emissions	N2O	CO2-eq.Gg	818.78	818.8	0.90%	89.91%
22	1A3e	Other Transportation - Liquid fuels	CO2	Gg	787.88	787.9	0.86%	90.78%
23	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	706.64	706.6	0.77%	91.55%
24	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	697.53	697.5	0.76%	92.32%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	611.60	611.6	0.67%	92.99%
26	2F	ODS substitutes	HFCs	CO2-eq.Gg	610.68	610.7	0.67%	93.65%
27	5D1	Wetlands remaining Wetlands	CO2	Gg	602.71	602.7	0.66%	94.31%
28	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	520.47	520.5	0.57%	94.88%
29	2B1	Ammonia Production	CO2	Gg	467.45	467.5	0.51%	95.40%

Rank	IPCC Source Categories		GHG	Unit	2007	2007 ABS	Level Assessment	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	28981.39	28 981.4	30.49%	30.49%
2	5B1	Cropland remaining Cropland	CO2	Gg	-11727	11 727.0	12.34%	42.83%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-6992.98	6 993.0	7.36%	50.19%
4	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	6674.478	6 674.5	7.02%	57.21%
5	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	4352.229	4 352.2	4.58%	61.79%
6	1A3b	Road Transportation - Diesel Oil	CO2	Gg	4261.958	4 262.0	4.48%	66.28%
7	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	3229.546	3 229.5	3.40%	69.68%
8	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	3200.373	3 200.4	3.37%	73.04%
9	1A1.A	Public Electricity and Heat Production - Gaseous fuel	CO2	Gg	1910.551	1 910.6	2.01%	75.05%
10	2A1	Cement Production	CO2	Gg	1896.98	1 897.0	2.00%	77.05%
11	1A3b	Road Transportation - Gasoline	CO2	Gg	1892.961	1 893.0	1.99%	79.04%
12	2C1	Iron and Steel Production	CO2	Gg	1440.06	1 440.1	1.52%	80.56%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	1346.397	1 346.4	1.42%	81.97%
14	2B2	Nitric Acid Production	N2O	CO2-eq.Gg	1324.009	1 324.0	1.39%	83.37%
15	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1306.189	1 306.2	1.37%	84.74%
16	1A3b	Road Transportation - LPG	CO2	Gg	1142.977	1 143.0	1.20%	85.94%
17	2A2	Lime Production	CO2	Gg	1061.466	1 061.5	1.12%	87.06%
18	1A4b	Residential - Solid fuels	CO2	Gg	946.7465	946.7	1.00%	88.06%
19	4D3	Indirect Emissions	N2O	CO2-eq.Gg	915.4612	915.5	0.96%	89.02%
20	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	903.5152	903.5	0.95%	89.97%
21	6B	Waste Water Handling	CH4	CO2-eq.Gg	838.967	839.0	0.88%	90.85%
22	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	777.9633	778.0	0.82%	91.67%
23	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	706.5982	706.6	0.74%	92.42%
24	1A3e	Other Transportation - Liquid fuels	CO2	Gg	687.3236	687.3	0.72%	93.14%
25	1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH4	CO2-eq.Gg	636.8765	636.9	0.67%	93.81%
26	5D1	Wetlands remaining Wetlands	CO2	Gg	602.7133	602.7	0.63%	94.44%
27	2B1	Ammonia Production	CO2	Gg	532.1041	532.1	0.56%	95.00%

A1.4

Rank	IPCC Source Categories		GHG	Unit	BY	2007	2007 ABS	Level Assessment	Trend Assessment	Contribution to Trend	Cumulative Total
1	1A1.A	Public Electricity and Heat Production - Solid fuel	CO2	Gg	31317.79	28981.3	28.981.4	50.32%	0.401	28.22%	28.22%
2	1A1.A	Public Electricity and Heat Production - Liquid fuel	CO2	Gg	8520.307	210.94	210.9	0.37%	0.141	9.91%	38.13%
3	5A1	Forest Land remaining Forest Land	CO2	Gg	-5132.63	-6992.9	6.993.0	12.14%	0.139	9.77%	47.90%
4	1A3b	Road Transportation - Diesel Oil	CO2	Gg	3183.961	4261.96	4.262.0	7.40%	0.055	3.89%	51.79%
5	1A4b	Residential - Solid fuels	CO2	Gg	4495.56	946.75	946.7	1.64%	0.047	3.32%	55.10%
6	1A3e	Other Transportation - Liquid fuels	CO2	Gg	3940.738	687.32	687.3	1.19%	0.046	3.23%	58.34%
7	1A3b	Road Transportation - LPG	CO2	Gg	0.729581	1142.98	1.143.0	1.98%	0.037	2.62%	60.95%
8	6B	Waste Water Handling	CH4	CO2-eq.Gg	2146.286	838.97	839.0	1.46%	0.037	2.62%	63.57%
9	1A4b	Residential - Liquid fuels	CO2	Gg	2158.344	69.30	69.3	0.12%	0.035	2.48%	66.05%
10	6A	Solid Waste Disposal on Land	CH4	CO2-eq.Gg	10587.86	6674.48	6.674.5	11.59%	0.034	2.38%	68.43%
11	1A2	Manufacturing Industries and Construction - Liquid fuels	CO2	Gg	7740.271	3200.37	3.200.4	5.56%	0.030	2.11%	70.54%
12	1A2	Manufacturing Industries and Construction - Gaseous fuels	CO2	Gg	7661.43	3229.55	3.229.5	5.61%	0.028	1.95%	72.48%
13	4D1	Direct soil emissions	N2O	CO2-eq.Gg	4104.28	1346.40	1.346.4	2.34%	0.027	1.92%	74.41%
14	2A1	Cement Production	CO2	Gg	2006.253	1896.98	1.897.0	3.29%	0.027	1.90%	76.31%
15	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous fuels	CO2	Gg	0	777.96	778.0	1.35%	0.025	1.78%	78.09%
16	1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid fuel	CO2	Gg	0	706.60	706.6	1.23%	0.023	1.62%	79.71%
17	1A2	Manufacturing Industries and Construction - Solid fuels	CO2	Gg	9352.857	4352.23	4.352.2	7.56%	0.020	1.44%	81.15%
18	4D3	Indirect Emissions	N2O	CO2-eq.Gg	2824.661	915.46	915.5	1.59%	0.019	1.35%	82.50%
19	5B1	Cropland remaining Cropland	CO2	Gg	-20944.7	-11727	11.727.0	20.36%	0.019	1.32%	83.82%
20	4B	N2O emission from Manure Management	N2O	CO2-eq.Gg	1056.048	357.26	357.3	0.62%	0.018	1.29%	85.11%
21	1A3b	Road Transportation - Gasoline	CO2	Gg	4562.805	1892.96	1.893.0	3.29%	0.017	1.23%	86.34%
22	4A.3	Enteric Fermentation - Sheep	CH4	CO2-eq.Gg	1469.567	265.59	265.6	0.46%	0.017	1.18%	87.52%
23	1A4c	Agriculture/Forestry/Fisheries - Liquid fuels	CO2	Gg	1095.089	88.37	88.4	0.15%	0.016	1.13%	88.65%
24	2A2	Lime Production	CO2	Gg	1117.84	1061.47	1.061.5	1.84%	0.015	1.07%	89.72%

25	4D2	Pasture. Range and Paddock Manure	N2O	CO2-eq.Gg	1652.286	492.19	492.2	0.85%	0.013	0.89%	90.61%
26	2B1	Ammonia Production	CO2	Gg	1662.127	532.10	532.1	0.92%	0.012	0.81%	91.42%
27	4A1	Enteric Fermentation - Cattle	CH4	CO2-eq.Gg	2248	903.52	903.5	1.57%	0.010	0.67%	92.09%
28	5D1	Wetlands remaining Wetlands	CO2	Gg	594.22	602.71	602.7	1.05%	0.009	0.66%	92.75%
29	4B.8	Manure Management - Swine	CH4	CO2-eq.Gg	851.4356	198.55	198.6	0.34%	0.008	0.58%	93.33%
30	1B1	Fugitive Emissions from Fuels - Solid Fuels	CH4	CO2-eq.Gg	1991.585	1306.19	1.306.2	2.27%	0.008	0.56%	93.90%
31	2F	ODS substitutes	HFCs	CO2-eq.Gg	2.95381	246.61	246.6	0.43%	0.008	0.56%	94.46%
32	1A3a	Civil Aviation - Liquid fuels	CO2	Gg	611.5915	133.15	133.2	0.23%	0.006	0.44%	94.90%
33	2C1	Iron and Steel Production	CO2	Gg	2360.375	1440.06	1.440.1	2.50%	0.006	0.42%	95.32%

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.

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. m3	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. nm3	58	33.5	1 870	55.8

Dry gas		45.0	2 970	66.0
Coke oven gas, th. m3		17.6	827	47.0
Blast furnace gas, th. m3		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 plays a main role.

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 1996 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.

Table A2.2 Carbon storage fractions for energy carriers used as feedstock

FUEL TYPE	Fraction of carbon stored 2007
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	
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;
- 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 Ferroalloys 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.

The fugitive emissions of methane from the coal extraction and systems of extraction and transmission/distribution of gas comprise round 2.6% 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 is taken from the Good Practice Guidance and from the Revised 1996 IPCC Guidelines.

Methane emissions from the **deposing of solid waste** are the biggest GHG source in Bulgaria. They comprise 8.8% of the overall emissions in the country for the year 2007. This inventory applied of the method for their determination from type Tier 2, which meets 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 2007 – around 8.3%. The energy subsectors – electricity and heat production emit the major part of them.

Certain quantities of N_2O – 26% are emitted from the **technological processes** and more over in production of nitric acid. The sector Solvent and Other Product Use had 0.9% of the overall emissions in the country for the year 2007.

One of the most significant sources of N_2O is the **Agriculture**. The emissions of this sector are 61.7% from the overall emissions from this type GHG for the year 2007.

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 1996 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 and some PFCs 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 2007 is 4 108 494 ha, which is 37% of the country's territory. The area covered with forests is 3 704 015 ha, which defines 33% wooded territories of the country.

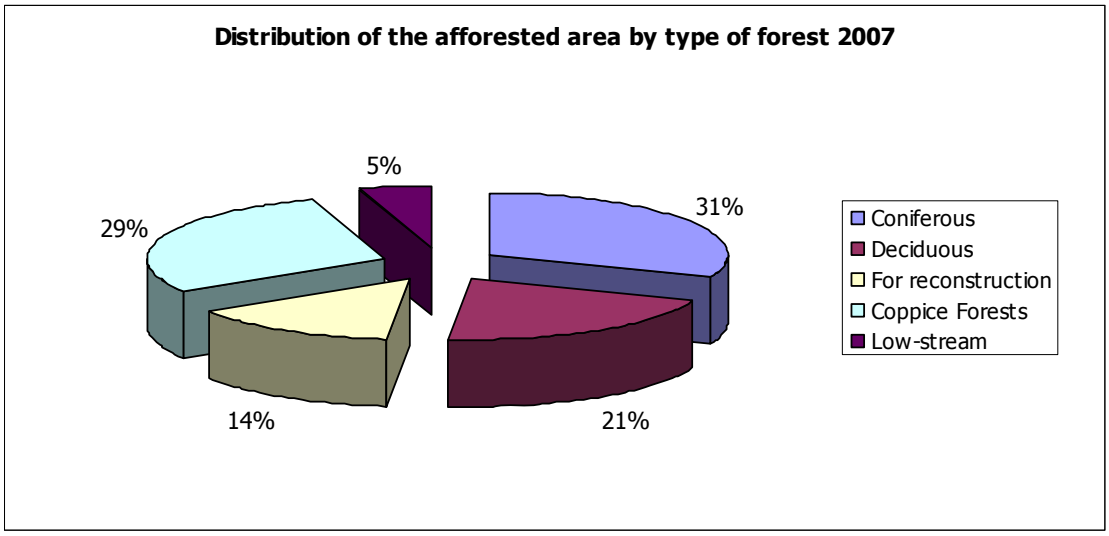
The total wooded surface (including pine-scrub) was 3 704 015 ha as a result of newly arranged forests and the completed forestations. The un-afforested area prepared for forestation was 93 081 ha.

More than 75.45% of the forests are state property, 11.5% are municipal and 9.6% are private property. 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 591 millions m^3 within average annual increase of around 14 100 100.0 m^3 and usage of the wood – 8 316 903 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 68.1%. The forests for recreation and protection occupy 19.8% and the forests and lands at the protective territories – 12% from the country's forestry fund.

In the year 2007 have been planted 3 224.2 ha new forests. 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.

EF – ENERGY INDUSTRIES

Electricity Public Generation	Emission Factor						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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**						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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- benzine						
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/	Emission Factor

Institutional	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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
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/Forestry	Emission Factor						
	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
	kg/GJ	g/GJ	g/GJ	g/GJ	g/GJ	g/GJ	kg/GJ
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	1.50
Anthracite	101.3	0.0	1.4	179.0	3580	0.0	1.70
Black Coal	101.3	0.0	1.4	179.0	3580	0.0	1.80
Brown Coal	95.60	0.0	1.4	197.0	214.0	0.0	3.80
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	0.60
Wood, Nm^3	90	210	4.3	200.0	15000	600	0.00
BKB	100.0	11.0	1.4	248.0	205	0.0	3.7
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	10-3 Gg/106m^3	*2.8*

Natural Gas - transit	10-3 Gg/km	*2.5*
Natural Gas - domestic transmit ion	10-3 Gg/km	*2.5*
Natural Gas - domestic distribution	10-3 Gg/km	*0.62*
Natural Gas - production-flaring	10-3 Gg/106m^3	*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	t						0.3	
	Margarine and solid fats - 15.43.10.yy.zz	t						10.0	
	Animal feed - 15.71.1x.yy.zz Pets -15.72.1x.yy.zz	t						1.0	
	Bread - 15.81.11.00.00	t						8.0	
	Cakes and biscuits – 15.82.12.yy.zz 15.82.13.yy.zz 15.81.12.00.00	t						1.0	
	Sugar -15.83.12.yy.zz	t						10.0	
	Coffee roasting – 15.86.11.30.00 15.86.11.50.00	t						0.55	
	High spirits (grapes, cognacs, vodka, whiskey, liqueurs, etc.) - 15.91.10.yy.zz	th.l						0.35	
	Spirit- 15.92.1x.yy.zz	th.l						1.5	
	Wine – white - 15.93.12.11.00 15.93.12.13.00 15.93.12.15.00	th.l						0.0035	
	Whine – red - 15.93.12.17.00 15.93.12.19.00 15.93.12.30.00	th.l						0.008	
	Beer- 15.96.10.00.00	th.l						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	t	36.3 kg/GJ						
	Gasoline producing Gasoline	t						0.31	
	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	

№	Resource type	Units	CO2	CH4	N2O	CO	NOx	NMVOC	SO2
			kg	kg	kg	kg	kg	kg	kg
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					
10	**Sulphur acid** - 24.13.14.33.00	t							17.5
11	**Ammonia -** 24.15.10.75.00	t	1238.2			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 SF6**	t			NAV				
35	**Production of medicines**	g/person						14	

EF - AGRICULTURE

Enteric Fermentation	EF CH_4 (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	EF CH_4 (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 EF_3, kg N_2O - N/kg N excreted
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	0.0125
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 %	0.45
$Frac_{NCRBF}$	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 Wastewater -	0.95	
Part of sludge -	0.05	
BO, kg CH_4/kg BOD	0.6	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 1996 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 1.31 – 3.47% for the last five years under GHG inventory.

Main causes for the difference between Reference and Sectoral Approaches

Differences between 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. 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.

Table A4.1 Comparison of CO_2 emissions: Reference Approach (RA) versus Sectoral Approach (SA) - NIR 2009, Gg

Method/ Year	Reference Approach				Sectoral Approach				Difference. %			
	Liquid	Solid	Gaseous	TOTAL	Liquid	Solid	Gaseous	TOTAL	Liquid	Solid	Gaseous	TOTAL
1988	34832	44926	11401	91159	33795	45682	11249	90726	3.07	-1.65	1.35	0.48
1989	34055	44671	11729	90455	33015	46239	11535	90789	3.15	-3.39	1.68	-0.37
1990	28320	40554	12085	80960	26753	39903	12016	78673	5.86	1.63	0.57	2.91
1991	19254	34727	10158	64139	18376	34925	10055	63357	4.77	-0.57	1.03	1.23
1992	15300	32758	8978	57036	14699	33640	8858	57197	4.09	-2.62	1.35	-0.28
1993	18317	34722	8435	61474	15614	35847	8221	59682	17.31	-3.14	2.60	3.00
1994	16873	31760	8493	57126	14457	34052	8149	56658	16.71	-6.73	4.22	0.83
1995	16634	32835	10293	59763	14645	34709	10022	59376	13.58	-5.40	2.71	0.65
1996	14575	33418	10440	58432	13458	34907	9843	58208	8.30	-4.27	6.06	0.39
1997	12068	34897	8225	55190	11576	36958	8168	56703	4.26	-5.58	0.69	-2.67
1998	11412	32541	7436	51389	12503	31840	6891	51235	-8.73	2.20	7.91	0.30
1999	11742	28693	5978	46413	11909	28943	5898	46750	-1.40	-0.86	1.36	-0.72
2000	10879	28900	6358	46136	10533	29055	6281	45869	3.28	-0.53	1.22	0.58
2001	10683	31564	5905	48152	10484	31315	5687	47486	1.90	0.80	3.82	1.40
2002	11923	28649	5271	45843	10865	29103	5098	45066	9.74	-1.56	3.39	1.72
2003	12198	32151	5475	49825	11747	32138	5295	49180	3.84	0.04	3.40	1.31
2004	11631	31451	5444	48526	11700	31289	5300	48289	-0.59	0.52	2.72	0.49
2005	13227	30560	6178	49966	12250	30711	5960	48921	7.98	-0.49	3.66	2.14
2006	13286	31208	6494	50988	12859	30839	6202	49900	3.32	1.19	4.72	2.18
2007	13505	35233	6504	55242	12624	34478	6287	53389	6.98	2.19	3.45	3.47

ANNEX 5: ASSESSMENT OF COMPLETENESS OF INVENTORIES

In the 2007 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, solvents, semiconductor manufacture, etc.;
- CH_4 emissions from 1.B.1.B Solid Fuel Transformation – the activity data, emission factors and methodology are not available.

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).

Table A5.1 Explanations for the used symbols for designation of the type data in the inventory (Table 9 from CRF files)

Sources and sinks not estimated (NE)			
GHG	**Sector**	**Source/sink category**	**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	Reservoirs	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
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	Coniferous	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	Reservoirs	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	Reservoirs	No AD available
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	Coniferous	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	Coniferous	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
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 Methodology and AD available
CH_4	1 Energy	1.B.2.B.1 Exploration	No Methodology 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 Methodology and AD available
CO_2	1 Energy	1.B.1.A.1.2 Post-Mining Activities	No Methodology and AD available
CO_2	1 Energy	1.B.1.A.2.1 Mining Activities	No Methodology and AD available
CO_2	1 Energy	1.B.1.A.2.2 Post-Mining Activities	No Methodology 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 Methodology 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 Methodology and EF available
CO_2	1 Energy	1.B.2.A.4 Refining / Storage	No Methodology and EF available
CO_2	1 Energy	1.B.2.B.1 Exploration	No Methodology and EF available
CO_2	1 Energy	1.B.2.B.2 Production / Processing	No Methodology available
CO_2	1 Energy	1.B.2.B.3 Transmission	No Methodology available
CO_2	1 Energy	1.B.2.B.4 Distribution	No Methodology available
CO_2	1 Energy	1.B.2.B.5.1 at industrial plants and power stations	No Methodology available
CO_2	1 Energy	1.B.2.B.5.2 in residential and commercial sectors	No Methodology available
CO_2	1 Energy	1.B.2.C.1.1 Oil	No Methodology available
CO_2	1 Energy	1.B.2.C.1.2 Gas	No Methodology available
CO_2	1 Energy	1.B.2.C.1.3 Combined	No Methodology and AD available
CO_2	1 Energy	1.B.2.C.2.1 Oil	No Methodology available
CO_2	1 Energy	1.B.2.C.2.2 Gas	No Methodology 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 Methodology available
CO_2	2 Industrial Processes	Bricks	No EF available
CO_2	3 Solvent and Other Product Use	3.A Paint Application	No Methodology available
CO_2	3 Solvent and Other Product Use	3.B Degreasing and Dry Cleaning	No Methodology 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
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 Methodology 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	2.F.8 Electrical Equipment	No AD available

	Processes		
N_2O	1 Energy	1.B.2.A.1 Exploration	No Methodology and AD available
N_2O	1 Energy	1.B.2.C.2.1 Oil	No Methodology available
N_2O	1 Energy	1.B.2.C.2.2 Gas	No Methodology 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	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
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 Methodology available
N_2O	6 Waste	6.B.1 Industrial Wastewater	No Methodology available
N_2O	6 Waste	6.B.2.1 Domestic and Commercial (w/o human sewage)	No Methodology available
N_2O	6 Waste	6.B.2.1 Domestic and Commercial (w/o human sewage)	No Methodology 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
SF_6	2 Industrial Processes	2.F.5 Solvents	No AD available
SF_6	2 Industrial Processes	2.F.8 Electrical Equipment	No AD available
SF_6	2 Industrial Processes	2.F.P2.2 In products	No AD available
SF_6	2 Industrial Processes	Other non-specified	No AD available
Sources and sinks reported elsewhere (IE)			
GHG	**Source/sink category**	**Allocation as per IPCC Guidelines**	**Allocation used by the Party**
CH_4	4.A Enteric Fermentation	4.A	4.A (emissions are included in Goats, Horses, Mules and Asses)
CH_4	4.B Manure Management	4.B	4.B (emissions are included in Goats, Horses, Mules and Asses)
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)

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: OTHER TABLES

The Annex 7 presents the Tables 6.1 from the IPCC Good Practice Guidelines: Tier 1 Uncertainty Calculation and Reporting.

IPCC Source category		Gas	Base year emissions	Year 2007 emissions	Activity data uncertainty	Emission factor uncertainty	Combined uncertainty	Combined uncertainty as % of total national emissions in year 2007	Type A sensitivity	Type B sensitivity	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty	Uncertainty introduced into the trend in total national emissions	Uncertainty in trend in national emissions introduced by emission factor uncertainty	Uncertainty in trend in national emissions introduced by activity data uncertainty
			Input data	Input data	Input data	Input data			Note B		Note C	Note D			
			Gg CO_2 equivalent		%	%	%	%	%	%	%	%	%		
3A-D	Solvent and Other Product Use	CO_2	23.05	8.98	10	30	31.6	0.00	-0.00	0.00	-0.0009	0.0010	0.00	1	0
3A-D	Solvent and Other Product Use	N_2O	52.93	45.12	100	0	100.0	0.06	0.00	0.00	-	0.0477	0.05	1	0
1A1	Energy Industries	CH_4	17.73	10.92	5	50	50.2	0.01	0.00	0.00	0.0003	0.0006	0.00	1	0
1A1	Energy Industries	N_2O	302.11	286.11	5	200	200.1	0.76	0.00	0.00	0.1720	0.0151	0.17	1	0
1A1.A	Public Electricity and Heat Production - Gaseous fuels	CO_2	3378.80	1910.55	5	5	7.1	0.18	-0.00	0.01	-0.0001	0.1011	0.10	1	0
1A1.A	Public Electricity and Heat Production - Liquid fuels	CO_2	8520.31	210.94	5	5	7.1	0.02	-0.03	0.00	-0.1725	0.0112	0.17	1	0
1A1.A	Public Electricity and Heat Production - Solid fuels	CO_2	31317.79	28981.39	5	7	8.6	3.29	0.08	0.22	0.5873	1.5330	1.64	1	0
1A1.B	Petroleum Refining - Gaseous fuels	CO_2	0.00	59.00	5	5	7.1	0.01	0.00	0.00	0.0022	0.0031	0.00	1	0
1A1.B	Petroleum Refining - Liquid fuels	CO_2	0.00	0.00	5	5	7.1	0.00	-	0.00	-	-	0.00	1	0
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Gaseous Fuels	CO_2	0.00	777.96	5	5	7.1	0.07	0.01	0.01	0.0291	0.0412	0.05	1	0
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Liquid Fuels	CO_2	0.00	706.60	5	5	7.1	0.07	0.01	0.01	0.0264	0.0374	0.05	1	0
1A1.c	Manufacture of Solid Fuels and Other Energy Industries - Solid Fuels	CO_2	0.00	148.61	5	7	8.6	0.02	0.00	0.00	0.0078	0.0079	0.01	1	0

1A2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	7661.43	3229.55	5	5	7.1	0.30	-0.01	0.02	-0.0415	0.1708	0.18	1	0
1A2	Manufacturing Industries and Construction - Liquid Fuels	CO_2	7740.27	3200.37	5	5	7.1	0.30	-0.01	0.02	-0.0443	0.1693	0.17	1	0
1A2	Manufacturing Industries and Construction - Solid Fuels	CO_2	9352.86	4352.23	5	7	8.6	0.49	-0.01	0.03	-0.0495	0.2302	0.24	1	0
1A2	Manufacturing Industries and Construction	CH_4	11.91	4.64	5	50	50.2	0.00	-0.00	0.00	-0.0008	0.0002	0.00	1	0
1A2	Manufacturing Industries and Construction	N_2O	44.90	21.12	5	200	200.1	0.06	-0.00	0.00	-0.0065	0.0011	0.01	1	0
1A3a	Civil Aviation - Liquid Fuels	CO_2	611.59	133.15	5	5	7.1	0.01	-0.00	0.00	-0.0080	0.0070	0.01	1	0
1A3a	Civil Aviation - Liquid Fuels	CH_4	1.31	0.10	3	40	40.1	0.00	-0.00	0.00	-0.0002	0.0000	0.00	1	0
1A3a	Civil Aviation - Liquid Fuels	N_2O	0.22	0.00	3	40	40.1	0.00	-0.00	0.00	-0.0000	0.0000	0.00	1	0
1A3b	Road Transportation - Diesel Oil	CO_2	3183.96	4261.96	3	5	5.8	0.33	0.02	0.03	0.0919	0.1353	0.16	1	0
1A3b	Road Transportation - Gasoline	CO_2	4562.80	1892.96	3	5	5.8	0.15	-0.01	0.01	-0.0259	0.0601	0.07	1	0
1A3b	Road Transportation - Liquid Fuels	CH_4	53.52	29.30	3	40	40.1	0.02	-0.00	0.00	-0.0003	0.0009	0.00	1	0
1A3b	Road Transportation - Liquid Fuels	N_2O	48.28	57.39	3	40	40.1	0.03	0.00	0.00	0.0090	0.0018	0.01	1	0
1A3b	Road Transportation - LPG	CO_2	0.73	1142.98	3	5	5.8	0.09	0.01	0.01	0.0427	0.0363	0.06	1	0
1A3c	Railways - liquid fuels	CO_2	368.04	78.65	5	5	7.1	0.01	-0.00	0.00	-0.0049	0.0042	0.01	1	0
1A3c	Railways - liquid fuels	CH_4	0.57	0.13	5	100	100.1	0.00	-0.00	0.00	-0.0001	0.0000	0.00	1	0
1A3c	Railways - liquid fuels	N2O	2.86	0.61	5	150	150.1	0.00	-0.00	0.00	-0.0011	0.0000	0.00	1	0
1A3d	Navigation - Liquid Fuels	CO_2	1088.46	0.00	50	5	50.2	0.00	-0.00	0.00	-0.0231	-	0.02	1	0
1A3d	Navigation - Liquid Fuels	CH_4	1.75	0.00	50	50	70.7	0.00	-0.00	0.00	-0.0004	-	0.00	1	0
1A3d	Navigation - Liquid Fuels	N2O	8.47	0.00	50	100	111.8	0.00	-0.00	0.00	-0.0036	-	0.00	1	0
1A3e	Other Transportation - Liquid Fuels	CO_2	3940.74	687.32	5	5	7.1	0.06	-0.01	0.01	-0.0578	0.0364	0.07	1	0
1A3e	Other Transportation - Liquid Fuels	CH_4	5.32	1.87	5	100	100.1	0.00	-0.00	0.00	-0.0009	0.0001	0.00	1	0

1A3e	Other Transportation - Liquid Fuels	N_2O	29.91	5.35	5	150	150.1	0.01	-0.00	0.00	-0.0130	0.0003	0.01	1	0
1A4	Other sectors	CH_4	34.81	117.66	5	50	50.2	0.08	0.00	0.00	0.0366	0.0062	0.04	1	0
1A4	Other sectors	N_2O	49.41	41.66	5	200	200.1	0.11	0.00	0.00	0.0204	0.0022	0.02	1	0
1A4a	Commercial/Institutional - Gaseous Fuels	CO_2	197.23	157.58	5	5	7.1	0.01	0.00	0.00	0.0017	0.0083	0.01	1	0
1A4a	Commercial/Institutional - Liquid Fuels	CO_2	524.72	151.34	5	5	7.1	0.01	-0.00	0.00	-0.0055	0.0080	0.01	1	0
1A4a	Commercial/Institutional - Solid Fuels	CO_2	345.59	13.69	5	7	8.6	0.00	-0.00	0.00	-0.0095	0.0007	0.01	1	0
1A4b	Residential - Liquid Fuels	CO_2	2158.34	69.30	5	5	7.1	0.01	-0.01	0.00	-0.0431	0.0037	0.04	1	0
1A4b	Residential - Solid Fuels	CO_2	4495.56	946.75	5	7	8.6	0.11	-0.01	0.01	-0.0837	0.0501	0.10	1	0
1A4b	Residential - Gaseous Fuels	CO_2	11.44	75.78	5	5	7.1	0.01	0.00	0.00	0.0026	0.0040	0.00	1	0
1A4c	Agriculture/Forestry/Fisheries - Gaseous Fuels	CO_2	1095.09	88.37	5	5	7.1	0.01	-0.00	0.00	-0.0199	0.0047	0.02	1	0
1A4c	Agriculture/Forestry/Fisheries - Liquid Fuels	CO_2	112.27	35.15	5	7	8.6	0.00	-0.00	0.00	-0.0015	0.0019	0.00	1	0
1A4c	Agriculture/Forestry/Fisheries - Solid Fuels	CO_2	35.13	27.44	5	20	20.6	0.01	0.00	0.00	0.0011	0.0015	0.00	1	0
1A5a	Stationary - Biomass	CH_4	10.62	8.29	5	20	20.6	0.00	0.00	0.00	0.0003	0.0004	0.00	1	0
1A5a	Stationary - Biomass	N_2O	0.00	0.00	5	5	7.1	0.00	-	0.00	-	-	0.00	1	0
1A5a	Stationary	CO_2	1991.58	1306.19	10	200	200.2	3.45	0.00	0.01	0.2665	0.1382	0.30	1	0
1B1	Fugitive Emissions from Fuels - Solid Fuels	CH_4	1278.97	636.88	5	50	50.2	0.42	-0.00	0.00	-0.0327	0.0337	0.05	1	0
1B2	Fugitive Emissions from Fuels - Oil and Natural Gas	CH_4	34.81	117.66	5	50	50.2	0.08	0.00	0.00	0.0366	0.0062	0.04	1	0
2A1	Cement Production	CO_2	2006.25	1896.98	3	30	30.1	0.76	0.01	0.01	0.1707	0.0602	0.18	1	0
2A2	Lime Production	CO_2	1117.84	1061.47	5	15	15.8	0.22	0.00	0.01	0.0481	0.0561	0.07	1	0
2A3	Limestone and Dolomite Use	CO_2	457.87	140.88	5	15	15.8	0.03	-0.00	0.00	-0.0133	0.0075	0.02	1	0
2A4	Soda Ash Production and Use	CO_2	233.19	178.38	5	20	20.6	0.05	0.00	0.00	0.0069	0.0094	0.01	1	0

2A7	Other	CO_2	26.61	177.91	5	20	20.6	0.05	0.00	0.00	0.0244	0.0094	0.03	1	0
2B1	Ammonia Production	CO_2	1662.13	532.10	5	20	20.6	0.14	-0.00	0.00	-0.0612	0.0281	0.07	1	0
2B2	Nitric Acid Production	N_2O	2421.72	1324.01	10	200	200.2	3.50	-0.00	0.01	-0.0713	0.1401	0.16	1	0
2B4.2	Calcium Carbide	CO_2	89.32	19.81	5	20	20.6	0.01	-0.00	0.00	-0.0046	0.0010	0.00	1	0
2B5	Other	CH_4	0.84	2.91	5	50	50.2	0.00	0.00	0.00	0.0009	0.0002	0.00	1	0
2C	Metal Production	CH_4	73.20	37.24	5	20	20.6	0.01	-0.00	0.00	-0.0006	0.0020	0.00	1	0
2C1	Iron and Steel Production	CO_2	2360.38	1440.06	3	10	10.4	0.20	0.00	0.01	0.0077	0.0457	0.05	1	0
2C2	Ferroalloys Production	CO_2	112.80	44.38	5	25	25.5	0.01	-0.00	0.00	-0.0036	0.0023	0.00	1	0
2F	ODS substitutes	HFCs	0.00	246.61	10	50	51.0	0.17	0.00	0.00	0.0922	0.0261	0.10	1	0
2F8	Electrical Equipment	SF_6	0.00	3.40	10	50	51.0	0.00	0.00	0.00	0.0013	0.0004	0.00	1	0
2G	Other	CH_4	7.62	0.00	10	50	51.0	0.00	-0.00	0.00	-0.0016	-	0.00	1	0
4A.2	Buffalo	CH_4	27.60	9.94	2	50	50.0	0.01	-0.00	0.00	-0.0021	0.0002	0.00	1	0
4A.3	Sheep	CH_4	1469.57	265.59	2	50	50.0	0.18	-0.00	0.00	-0.2120	0.0056	0.21	1	0
4A.4	Goats	CH_4	45.36	54.84	2	50	50.0	0.04	0.00	0.00	0.0109	0.0012	0.01	1	0
4A.6	Horses	CH_4	46.27	65.16	2	50	50.0	0.04	0.00	0.00	0.0146	0.0014	0.01	1	0
4A.7	Mules and Asses	CH_4	74.61	38.38	2	50	50.0	0.03	-0.00	0.00	-0.0015	0.0008	0.00	1	0
4A.8	Swine	CH_4	128.41	29.94	2	50	50.0	0.02	-0.00	0.00	-0.0160	0.0006	0.02	1	0
4A.9	Poultry	CH_4	8.74	4.08	2	50	50.0	0.00	-0.00	0.00	-0.0003	0.0001	0.00	1	0
4A1	Cattle	CH_4	2248.00	903.52	2	50	50.0	0.60	-0.00	0.01	-0.1383	0.0191	0.14	1	0
4B	N_2O emission from Manure Management	N_2O	1056.05	357.26	2	300	300.0	1.42	-0.00	0.00	-0.5406	0.0076	0.54	1	0
4B.2	Buffalo	CH_4	4.52	1.63	2	50	50.0	0.00	-0.00	0.00	-0.0003	0.0000	0.00	1	0

4B.3	Sheep	CH_4	51.43	9.30	2	50	50.0	0.01	-0.00	0.00	-0.0074	0.0002	0.01	1	0
4B.4	Coats	CH_4	1.63	1.97	2	50	50.0	0.00	0.00	0.00	0.0004	0.0000	0.00	1	0
4B.6	Horses	CH_4	5.35	7.53	2	50	50.0	0.00	0.00	0.00	0.0017	0.0002	0.00	1	0
4B.7	Mules and Asses	CH_4	8.51	4.38	2	50	50.0	0.00	-0.00	0.00	-0.0002	0.0001	0.00	1	0
4B.8	Swine	CH_4	851.44	198.55	2	50	50.0	0.13	-0.00	0.00	-0.1061	0.0042	0.11	1	0
4B.9	Poultry	CH_4	102.25	47.73	2	50	50.0	0.03	-0.00	0.00	-0.0038	0.0010	0.00	1	0
4B1	Cattle	CH_4	498.52	201.59	2	50	50.0	0.13	-0.00	0.00	-0.0302	0.0043	0.03	1	0
4C	Rice Cultivation	CH_4	119.25	54.58	25	80	83.8	0.06	-0.00	0.00	-0.0078	0.0144	0.02	1	0
4D1	Direct soil emissions	N_2O	4104.28	1346.40	3	250	250.0	4.45	-0.01	0.01	-1.8290	0.0427	1.83	1	0
4D2	Pasture, Range and Paddock Manure	N_2O	1652.29	492.19	3	250	250.0	1.63	-0.00	0.00	-0.8296	0.0156	0.83	1	0
4D3	Indirect Emissions	N_2O	2824.66	915.46	3	500	500.0	6.05	-0.01	0.01	-2.5595	0.0291	2.56	1	0
4F	Field Burning	CH_4	46.35	16.24	25	50	55.9	0.01	-0.00	0.00	-0.0037	0.0043	0.01	1	0
4F	Field Burning	N_2O	15.10	4.05	25	200	201.6	0.01	-0.00	0.00	-0.0067	0.0011	0.01	1	0
6A	Solid Waste Disposal on Land	CH_4	10587.86	6674.48	20	100	102.0	8.99	0.01	0.05	0.5064	1.4122	1.50	1	0
6B	Waste Water Handling	CH_4	2146.29	838.97	30	80	85.4	0.95	-0.00	0.01	-0.2254	0.2663	0.35	1	0
6B	Waste Water Handling	N_2O	310.49	144.44	30	100	104.4	0.20	-0.00	0.00	-0.0235	0.0458	0.05	1	0
	National Total		**133677.9**	**75716.29**				**13.43**					**4.06**		

ANNEX 8: Supplementary information relating to Article 7.1 of the Kyoto Protocol in accordance with decision 15/CMP.1

All information is provided according to the relevant provisions of Decision 15/CMP. 1 adopting the Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol.

1) Information on emission reduction units, certified emission reductions, temporary certified emission reductions, long-term certified emission reductions, assigned amount units and removal units

The information on emission reduction units, certified emission reductions, temporary certified emission reductions, long-term certified emission reductions, assigned amount units and removal units are presented using the Standard Electronic Format (SEF).

2) Calculation of the Commitment Period Reserve

Bulgaria calculated the Commitment Period Reserve (CPR) based on the emissions level of 2007 excluding Land Use, Land Use Change and Forestry - **378 963 955 Mg CO_2 equivalent** (100% of the last inventory – Submission 2009), which is required in accordance with paragraph 18 of decision 15 CMP.1.

CPR = 1.0 x 5 x **75 792 791** = **378 963 955** Mg CO_2 equivalent

3) Changes in national systems in accordance with Article 5 paragraph 1 of the Kyoto Protocol

Description of the National Inventory System /NIS/ are described in the Introduction chapter of the NIR.
No changes have been done to the national inventory system as reported within NIR.

4) Changes in national registries

Description of the National Registry required by paragraph 30 in Decision 15/CMP.1 are described in the Introduction chapter of the NIR.

Contact information on the registry administrator
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Address: 136 "Tzar Boris III" Blvd
Telephone: + 359 02 940 64 16
Fax: + 359 02 955 90 15
e-mail: registry@nfp-bg.eionet.eu.int

5) Information on activities under Article 3.3 and 3.4 of the Kyoto Protocol

Bulgaria has chosen activities under Article 3, paragraph 3 and has not elected any activities for Article 3, paragraph 4.

Article 3.3 of the Kyoto Protocol requires Parties in meeting their emissions reduction commitments to account for Afforestation, Reforestation and Deforestation (ARD) since 1990.

For the purposes of applying the definition of "forest" every Annex 1 country shall select single minimum value of the parameters tree crown cover, tree height, minimum forest area.

The Kyoto protocol defines the following minimum value parameters:

- Tree crown cover - between 10 and 30%;
- Tree height - between 2 and 5 meters;
- Minimum forest area between 0.05 and 1 ha.

According to the Kyoto protocol "Forest" is a minimum area of land of 0.05–1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

For defining forest, in Bulgaria is used the definition in the Forest Act: *Forest is area, covered with forest tree species on area not less than 0.1 ha.*

Forest Fund in the Forest Act is territory, with main purpose to be forest and covers forests, bushes, and land for afforestation and non timber production lands, listed in the cadastre. Urbanized areas, separated settlements and agriculture lands are not included in the Forest Fund.

For reaching the targets of KP the minimal figures of the above listed parameters for tree height, tree crown cover and minimum area have been chosen:

- **Minimum forest area – 0.1 ha;**
- **Tree crown cover -10%;**
- **Tree height - 5 meters.**

The parameters chosen for the definition of forest are within the agreed values in decision 16/CPM.1 and are consistent with what Bulgaria has reported to the FAO.

The accounting of net emissions and removals for activities under Article 3, paragraph 3 will be done for entire commitment period at the end of the commitment period (2008-2012). In this way of reporting will ensure a more precise assessment of activities due to periodic character of measurements and research in this area.