REPUBLIC OF NAMIBIA

NATIONAL GHG INVENTORY REPORT
2000 – 2010

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NATIONAL GHG INVENTORY REPORT OF THE REPUBLIC OF NAMIBIA 2000 - 2010

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FOREWORD

Hon. Pohamba Shifeta
Minister of Environment and Tourism

On behalf of the Government of the Republic of Namibia, it is an honour and privilege for me to present the National Greenhouse Gas (GHG) Inventory Report (NIR) to the United Nations Framework Convention on Climate Change (UNFCCC). This stand-alone inventory document accompanies the Third National Communication (TNC) to better translate Government's will and efforts in its investments towards supporting the international community in its pledge to resolve climate change threats to humankind.

Namibia ratified the Convention in 1995 and became obligated to submitting National Communications (NCs) and Biennial Update Reports (BURs). Both reports should contain a Greenhouse Gas (GHG) inventory. So far, Namibia has submitted three GHG inventories as part of its Initial National Communication (INC) in 2002, the Second National Communication (SNC) in 2011, and the first Biennial Update Report in 2014. These inventories covered the years 1994, 2000 and 2010 respectively.

This National Inventory Report (NIR) was compiled in the framework of the TNC to be submitted at COP 21 in 2015. The NIR covers the period 2000 to 2010 to provide for a consistent time series as recommended by the Convention and was compiled using the Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines and the IPCC 2006 software. The NIR covers all 4 IPCC sectors, namely, Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forest and Other Land Use (AFOLU), and Waste. Country specific activity data were used to estimate emissions.

The findings show that Namibia remained a net GHG sink throughout the inventory period. Despite this, Namibia remains committed in adopting policies and measures to further reduce its emissions and increase its sink capacity. To re-emphasize its commitment, Namibia recently launched its National Climate Change Strategy and Action Plan (NCCSAP) to implement the National Climate Change Policy (NCCP) passed in 2011. The NCCSAP sets out measures and strategies to be implemented within various sectors to adapt to, and mitigate climate change.

The NIR was developed through a consultative process with key stakeholders for activity data and also to develop a sustainable institutional arrangement for producing future inventories. A multi sectoral GHG working group was set up and trained on the IPCC guidelines and software. Further capacity building is planned within the framework for preparation of future reporting. Namibia would like to acknowledge the financial contributions made by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP) country office as implementing agency and the support provided by the consultants of CLIMAGRIC LTD for capacity building of the national working group and the compilation of the NIR.

ACKNOWLEDGEMENTS

The Ministry of Environment and Tourism, on behalf of the Government of the Republic of Namibia, was entrusted with the responsibility for computing the National Inventory of Greenhouse Gases, within the framework of the preparation of the Third National Communication to the UNFCCC, for the Republic to meet its obligations as a signatory Party to the Convention. This Ministry acknowledges the valuable financial support received from the Global Environment Facility through its implementing agency, the UNDP country office.

Namibia is grateful to all international institutions, namely IPCC and the United Nations Framework Convention on Climate Change (UNFCCC) secretariat for providing very useful handbooks and guidelines for the preparation of the Inventory.

Namibia also wishes to extend its appreciation for the contribution of the representatives of the institutions and private sector organizations, which collaborated in this work, as well as CLIMAGRIC LTD, that offered consultancy services for capacity building of the inventory team, the computation of the GHG Inventory and the preparation of this National Inventory Report.

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ABBREVIATIONS AND ACRONYMS

AD	Activity Data
ALU	Agriculture and Land Use National Greenhouse Gas Inventory Software
BCEF	Biomass Conversion and Expansion Factors
BGB	Below Ground Biomass
Bm	Biomass
BUR1	Biennial Update Report 1 of Namibia.
BUR2	Biennial Update Report 2 of Namibia.
CCU	Climate Change Unit
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-eq	Carbon dioxide equivalent
COP	Conference of Parties
CS	country specific
CSU	Colorado State University
DBH	Diameter at breast height
DE	Digestible Energy
DEA	Department of Environmental Affairs
EF	Emission Factor
FAO	Food and Agricultural Organisation
FOLU	Forestry and Other Land Use
FRA	Global Forest Resources Assessment 2010
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagram (1000 t)
GHG	Greenhouse gas
GPG	Good Practice Guidance
GWP	Global Warming Potential
HAC	High Activity Clay
HFCs	Hydrofluorocarbons
IE	Included Elsewhere
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
LAC	Low Activity Clay
MET	Ministry of Environment and Tourism
MMS	Manure Management System
MODIS	Moderate Resolution Imaging Spectroradiometer
N_2O	Nitrous oxide
NA	Not Applicable
NC4	Fourth National Communication
NDP4	Fourth National Development Plan
NE	Not Estimated
NFI	National Forest Inventory
NHIES	Namibia Household Income and Expenditure Survey

NIR	National Inventory Report
NMVOC	Non-Methane Volatile Organic Compound
NNFU	Namibian National Farmers Union
NO	Not Occurring
NO_x	Oxides of nitrogen
NPHC	Namibia Population and Housing Census
NSA	Namibia Statistics Agency
PFC	Perfluorocarbons
PRP	Pasture range and Padlock
QA	Quality assurance
QC	Quality Control
SAN	Sandy Mineral
SNC	Second National Communication
SO_2	Sulphur dioxide
TJ	Tera Joule
TNC	Third national Communication
TRD	Tropical Dry
TRMD	Tropical Montane Dry
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
X	Emission Estimated

EXECUTIVE SUMMARY

INTRODUCTION

Namibia has so far complied with the Convention with regards to national GHG inventories of greenhouse gases by submitting three inventories as components of its first and second national communications and its first Biennial Update Report. These inventories have been compiled and submitted in line with Article 4.1 (a) of the Convention whereby each party has to develop, periodically update, publish and make available to the Conference of the Parties (COPs), in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. These inventories have been produced to the extent of the country's capabilities and using recommended methodologies of the IPCC which have been agreed upon by the Conference of the Parties. This exercise of inventory preparation is the fourth one for the country.

COVERAGE (PERIOD AND SCOPE)

Namibia compiled and published GHG inventories for the years 1994, 2000 and 2010, each of these on a stand-alone basis, for the requirement of individual reports. IPCC methodologies have evolved to capture the latest scientific advances and for this fourth inventory, special efforts have been invested to create a consistent time series while using the latest IPCC 2006 software and Guidelines. Thus, the one compiled for the year 2000 has been recalculated to make it comparable and consistent with the 2010 one published in the BUR1 in 2014. Namibia has thus compiled inventories for the period 2001 to 2009 and is making these available in this present inventory in addition to the recalculated 2000 and 2010 ones.

The inventory covered the full territory of the country and the results are presented at the national level. It addressed all the IPCC sectors and categories subject to Activity Data (AD) availability. The latest IPCC 2006 Guidelines have been used to estimate emissions for the four sectors Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry, and Other Land Use (AFOLU) and Waste.

INSTITUTIONAL ARRANGEMENTS AND GHG INVENTORY SYSTEM

Namibia outsourced its first two inventories and started to invest in producing its inventories in-house with the one published in the BUR1. This capacity building exercise continued with the inventory of the TNC to further improve, implement and consolidate the GHG inventory system being put in place. The process of preparation of GHG inventories, by the newly formed team, remained a very laborious exercise as resources and human capacities continued to be limiting factors. Implementation of the different steps of the inventory cycle was staged over about two years instead of a longer period to fit the decision taken on in-house compilation of the inventory. Thus, it is obvious that there still exist shortcomings in this inventory, but the country is committed to strive to raise the quality of future GHG inventories through strengthening of the GHG inventory system and human capacity.

The Climate Change Unit (CCU) of the Ministry of Environment and Tourism has the responsibility for overlooking the production of reports to the Convention, including the GHG inventories in its capacity as National Focal Point of the Convention. The same framework adopted for the previous inventory compilation was adopted and all stakeholders agreed to pursue with sharing the responsibilities for the compilation exercise between different departments of the key ministries as for the BUR1. The previous exercise of mapping of national institutions and organizations was reviewed to identify other stakeholders that would contribute in one way or the other for the inventory compilation. Thus data

providers and possible institutions and organizations to support derivation of emission factors to suit national circumstances and enable moving to tier 2 were consolidated. It was also decided to keep on to existing collaboration streams as they are working satisfactorily and there is no need for other official formal engagements. An international consultant was appointed to further capacity building, follow and guide the team until the production of the final output, which is the National Inventory Report and its summarization into the chapter for the TNC. Capacity building of all inventory team members continued on the different steps of the inventory cycle as well as on data management, running the 2006 IPCC software, analyzing the outputs and reporting to the Convention. All members were introduced to the consistency component of the inventory as for the first time a full series covering the period 2000 to 2010 was covered, including recalculations for the years 2000 and 2010.

METHODS

Guidelines and software

The present national GHG inventory has been prepared in accordance with the *IPCC 2006 Guidelines for National Greenhouse Gas Inventories* and using the IPCC 2006 software for the compilations. As the IPCC 2006 Guidelines do not extensively cover all the GHGs, it has been supplemented with the European Monitoring and Evaluation Program/European Environment Agency (EMEP/EEA) air pollutant emission inventory guidebook for compiling estimates for nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2).

As the IPCC 2006 software do not address compilations at the Tier 2 level, the Agriculture and Land Use Software of the Colorado State University (CSU) has also been adopted to enable estimates to be made at the tier 2 level partially for the livestock and Land sectors. Thus the inventory has been compiled using a mix of tiers 1 and 2. This is good practice and improved the accuracy of the emission estimates, thus reducing the uncertainty level.

Gases

The gases covered in this inventory are the direct gases carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) and the indirect gases nitrogen oxides (NO_x), carbon monoxide (CO), non-methane organic volatile compounds (NMVOCs) and sulphur dioxide (SO_2).

AD and important information required to allow on the choice of the EFs on the carbon fluorocarbons (CFCs), hydro-fluorocarbons (HFCs) and perfluorocarbons (PFCs) were lacking and thus estimates of emissions have not been made for these gases. As well, Sulphur hexafluoride (SF6) has not been estimated since AD were not available.

GWPs

Global Warming Potentials (GWP) as recommended by the IPCC have been used to convert GHGs other than CO_2 to the latter equivalent. Based on decision 17/CP.8, the values adopted were from the IPCC Second Assessment Report for the three direct GHGs, namely;

Carbon Dioxide	**1**
Methane	**21**
Nitrous Oxide	**310**

ACTIVITY DATA

Country-specific AD pertaining to most of the socio-economic sectors are collected, quality controlled and processed to produce official national statistics reports by the National Statistics Agency (NSA) for use by government and the wider public. These data are then entered in a database and archived within the existing data archiving system. Thus, data collected at national level from numerous public and private sector institutions, organizations and companies, and archived by the NSA, provided the basis and starting point for the compilation of the inventory. Additional and/or missing data, required to meet the level of disaggregation for higher than the Tier I level, were sourced from both public and private institutions by the inventory team members and coordinators through direct contacts. Data gaps were filled through personal contacts and/or from results of surveys, scientific studies and by statistical modelling. Expert knowledge was resorted to as the last option.

In a few cases, derived data and estimates were made to fill in the gaps. These were considered reliable and sound since they were based on scientific findings and other observations. For the Land sector, remote sensing technology was used whereby maps were produced from LandSat satellite imagery for the years 2000 and 2010. These maps were then used to generate land use changes from the land covers obtained for these two time steps and then annualized for yearly values.

The methods used to generate missing AD are provided in details further in this National Inventory Report (NIR), under the section for the individual sectors.

EMISSION FACTORS

Country emission factors were derived for the Tier 2 estimation of GHGs for some animal classes for both enteric fermentation and manure management. Similarly, the same exercise was performed for the Land sector where stock factors have been derived to suit national circumstances. This is Good Practice towards enhancing the quality of the inventory and especially as these activity areas were major emitters on the basis of previous inventory results. Additionally, default IPCC EFs for the remaining source categories were screened for their appropriateness before adoption, on the basis of the situations under which they have been developed and the extent to which these were representative of national ones. More information on the country specific and default EFs are provided in the sectoral reports.

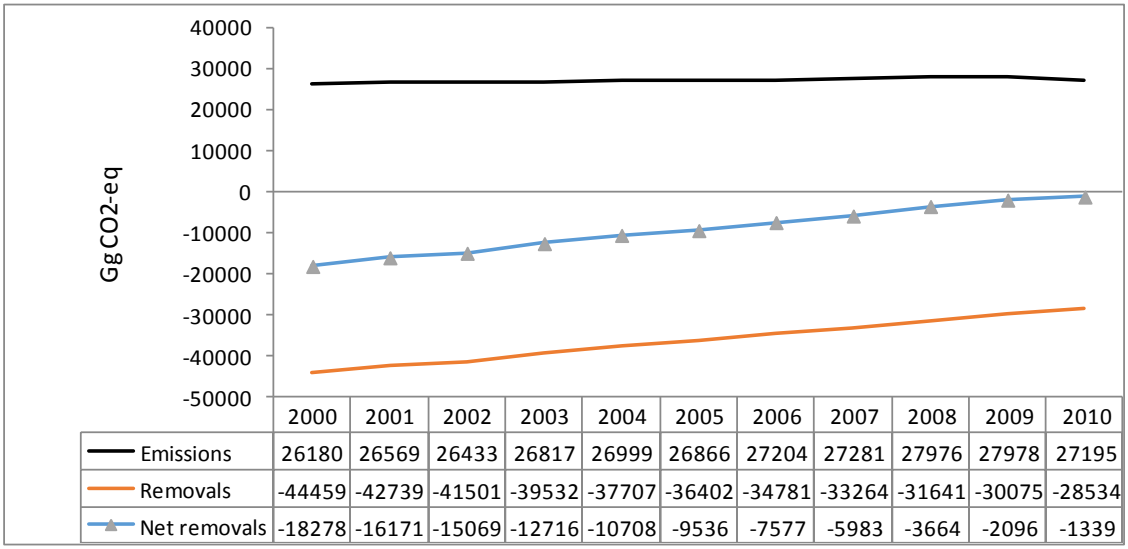
RECALCULATIONS

The inventory for the years 2000 and 2010 were recalculated to provide for a consistent series in this inventory report. The scope of the 2000 inventory has been widened to include the IPPU sector, which was not covered and as well the 2006 IPCC Guidelines has been used instead of the Revised 1996 IPCC Guidelines to be consistent with the compilation, for the period 2001 to 2010.

INVENTORY ESTIMATES

Aggregated emissions

Namibia remained a net GHG sink over the whole period 2000 to 2010 as a result of the Land sector turning out to be a sink. However, this sink capacity steadily decreased during this period and fell by 64 %. The net removal of CO_2 thus declined from 18 278 Gg to 1339 Gg as the Land removals decreased from 44 459 Gg CO_2-eq in 2000 to 28 534 Gg in 2010 (Figure 1).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Emissions	26180	26569	26433	26817	26999	26866	27204	27281	27976	27978	27195
Removals	-44459	-42739	-41501	-39532	-37707	-36402	-34781	-33264	-31641	-30075	-28534
Net removals	-18278	-16171	-15069	-12716	-10708	-9536	-7577	-5983	-3664	-2096	-1339

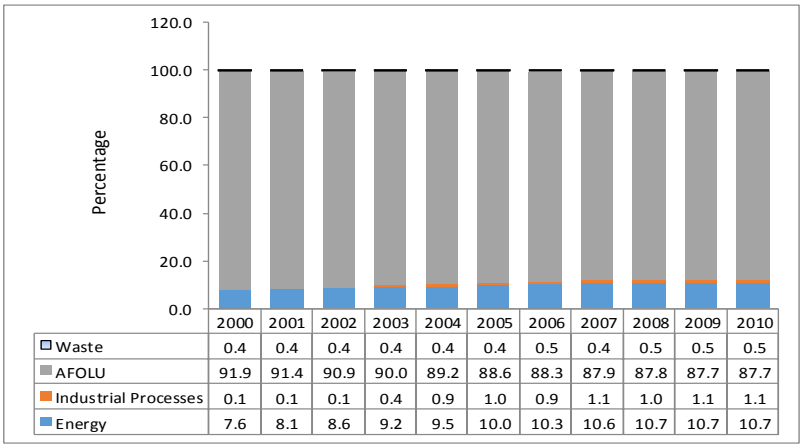
Figure 1.1 - National emissions, removals and net removals (Gg CO_2-eq) for the period 2000 to 2010

National emissions by sector is presented in Table 1 and Figure 2. Total national emissions ranged from 26 180 Gg CO_2-eq in the year 2000 to 27 195 Gg CO_2-eq in 2010, representing an increase of 3.7 % over these 11 years. The AFOLU sector remained the leading emitter throughout this period, followed by Energy, Waste and IPPU for most of the years under review. AFOLU, with an aggregated emission of around 24 000 Gg CO_2-eq over that period, accounted for nearly 92 % of the country emissions in 2000 and this declined by 4% by the year 2010.

Table 1.1 - National GHG emissions (Gg, CO_2-eq) by sector for the period 2000 to 2010

SOURCE CATEGORIES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy	1995	2157	2269	2455	2562	2695	2795	2897	2981	2986	2904
Industrial Processes	25	25	26	110	235	260	255	294	291	303	302
AFOLU	24064	24290	24038	24141	24089	23790	24030	23969	24573	24550	23843
Waste	96	98	99	110	113	120	123	121	131	139	146
Total emissions	26180	26569	26433	26817	26999	26866	27204	27281	27976	27978	27195

Energy emissions increased from 1995 Gg CO_2-eq (7.6 %) of national emissions in 2000 to 2904 Gg CO_2-eq (10.7 %) in 2010. The IPPU sector emissions is on the rise as a result of industrial development of the country and increased substantially from 25 to 302 Gg CO_2-eq. Waste on the other hand varied slightly over this period with the tendency being for a slight increase over time.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Waste	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.5
AFOLU	91.9	91.4	90.9	90.0	89.2	88.6	88.3	87.9	87.8	87.7	87.7
Industrial Processes	0.1	0.1	0.1	0.4	0.9	1.0	0.9	1.1	1.0	1.1	1.1
Energy	7.6	8.1	8.6	9.2	9.5	10.0	10.3	10.6	10.7	10.7	10.7

Figure 1.2 - Share of national emissions by sector for the period 2000 to 2010

Emissions by gas

The major gas emitted for all years remained CO_2 followed by CH_4 and N_2O (Table 2). The amount of CO_2 increased slightly from 20 197 to 21 366 Gg for an average annual increase of 0.6 %. CH_4 and N_2O varied around an average of 4584 Gg CO_2-eq and 1492 Gg CO_2-eq respectively for this period.

Table 1.2 - National GHG emissions and removals (Gg CO_2-eq) by gas for the period 2000 to 2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. annual change (%)
CO_2	20197	20359	20470	20736	20965	21121	21215	21353	21433	21449	21366	0.6
CH_4 (CO_2-eq)	4651	4694	4505	4599	4545	4319	4504	4446	4928	4899	4336	-0.5
N_2O (CO_2-eq)	1331	1516	1457	1482	1489	1425	1486	1483	1616	1630	1493	1.3
Total GHG emissions (CO_2-eq)	26180	26569	26433	26817	26999	26866	27204	27281	27976	27978	27195	0.4
Removals (CO_2)	-44459	-42739	-41501	-39532	-37707	-36402	-34781	-33264	-31641	-30075	-28534	-4.3
Net removals (CO_2-eq)	-18278	-16171	-15069	-12716	-10708	-9536	-7577	-5983	-3664	-2096	-1339	-22.0

The share of emissions by gas is given in Figure 3. CO_2 increased from 77 % of total aggregated national emissions in the year 2000 to 78.6 % in 2010. The other two gases, CH_4 and N_2O, varied at around 17 % and 5.5 % over this period of 11 years.

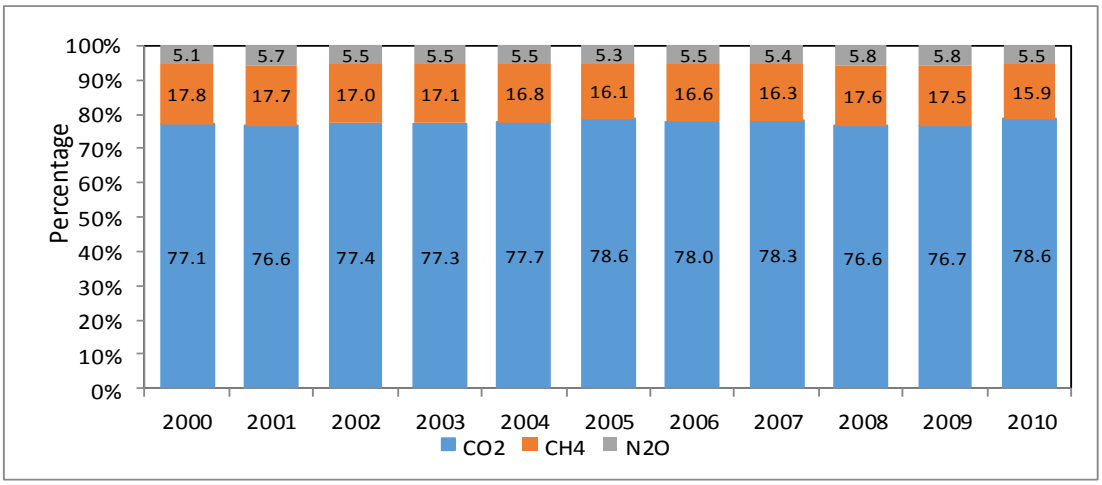
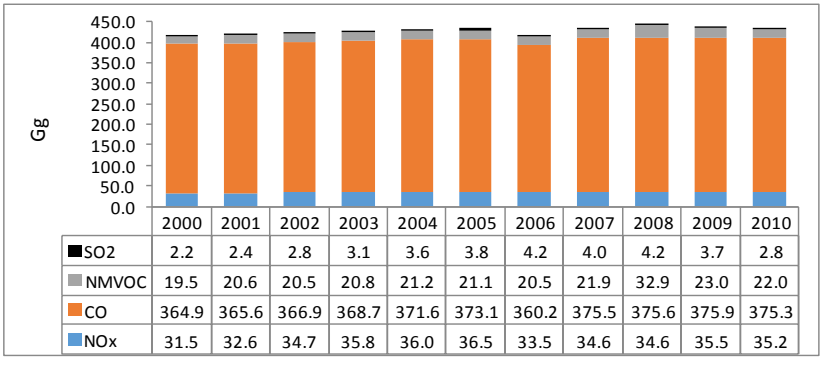


Figure 1.3 - Share of emissions (%) by gas of total aggregated emissions for the period 2000 to 2010

Among the GHG precursors, CO largely exceeded the others in emissions with an increase of 10 Gg from 365 to 375 Gg from 2000 to 2010. NMVOCs varied between 19.5 and 32.9 Gg while SO_2 dwindled between 2.2 and 4.2 Gg. NO_x increased from 31.5 Gg to 35.2 over this same period

Table 1.3 - Emissions (Gg) of GHG precursors and SO_2 during the period 2000 to 2010



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SO2	2.2	2.4	2.8	3.1	3.6	3.8	4.2	4.0	4.2	3.7	2.8
NMVOC	19.5	20.6	20.5	20.8	21.2	21.1	20.5	21.9	32.9	23.0	22.0
CO	364.9	365.6	366.9	368.7	371.6	373.1	360.2	375.5	375.6	375.9	375.3
NOx	31.5	32.6	34.7	35.8	36.0	36.5	33.5	34.6	34.6	35.5	35.2

with inter-annual variations and a peak of 36.5 in 2005. The emissions by gas and the share of each at national level are presented in Table 3.

Summary result for the year 2010

Only one year's summary result sheets from the software are presented here. The full sets are available in the appendices. Based on the 2010 compilations, most CO_2 were emitted in the AFOLU sector with some 18 000 Gg. Concurrently, this sector acted as a sink of about 28 400 Gg, to be a net sink of 10 400 Gg for the year 2010. The Energy sector came next with 2793 Gg for the year 2010.

CH_4 emanated mainly from the AFOLU sector followed by the Waste sector. Emissions were 198 Gg (96 %) and 5 Gg for the year 2010 for these two sectors respectively. The Energy sector was responsible for 3 Gg of CH_4 emissions in 2010.

N_2O emissions, 4.57 Gg, were associated with the AFOLU sector primarily and represented more than 98 % of national emissions of this gas.

Among the indirect GHGs, the AFOLU sector was the highest emitter of CO at 75 % of national emissions with 283 Gg, followed by Energy, 85 Gg and Waste with 7 Gg. Energy emitted 60 % of national NO_x emissions with 21 Gg and AFOLU was responsible for 14 Gg. The Energy and AFOLU sectors contributed 51 % and 47 % of national emissions of NMVOCs which stood at 22 Gg.

With regard to SO_2 emissions, 2.75 Gg emanated from the Energy sector out of a total of 2.76 Gg, the remainder coming from the Waste sector.

QA/QC

Namibia has its own system for quality control (QC) of data collected by the different institutions. All data are quality controlled at different stages of the collection process until the final quality assurance (QA) is done by the National Statistics Agency before archiving in national databases. The private sector also implements its own QC/QA within its data collection and archiving process.

QC and QA procedures, as defined in the *IPCC 2006 Guidelines (IPCC, 2007)* were implemented during the preparation of the inventory. Whenever there were inconsistencies or possible transcription errors, the responsible institution was queried and the problem discussed and solved. QC was implemented through:

- Routine and consistent checks to ensure data integrity, reliability and completeness;
- Routine and consistent checks to identify errors and omissions;
- Accuracy checks on data acquisition and calculations;
- The use of approved standardized procedures for emissions calculations; and
- Technical and scientific reviews of data used, methods adopted and results obtained.

QA was undertaken by independent reviewers who were not involved with the preparation of the inventory, the objective being to

- Confirm data quality and reliability;
- Review the AD and EFs adopted within each source category as a first step;
- Review and check the calculation steps in the software; and
- Ensure that the time series outputs are consistent with activity.

COMPLETENESS

A source by source category analysis was conducted before the preparation of the inventory of the BUR1 and it was reviewed and updated to be as complete as possible. Only a few categories of the IPPU sector has not been included due to lack of data.

UNCERTAINTY ANALYSIS

The uncertainty analysis has been performed using the tool available within the IPCC 2006 Software for the national inventory, excluding the Land sector. Based on the quality of the data and whether the EFs used were defaults or nationally derived, uncertainty levels were allocated for the two parameters and the combined uncertainty calculated. For the national inventory, Uncertainty, excluding the Land sector ranged from 5.6 % to 6.5 %. This is considered good and very much acceptable.

KEY CATEGORY ANALYSIS

The Key Category Analysis also was performed using the tool available within the IPCC 2006 Software for both level and trend assessment. There are five key categories in the trend assessment, four of these from the AFOLU sector, of which enteric fermentation from Livestock, three from Land category and the last one is Road Transportation from the Energy sector. The results changed slightly when considering the trend assessment. There are still 5 key categories but Road Transportation is replaced by Other Sectors-Liquid Fuels while the other four remained the same.

ARCHIVING

All raw data, collected for the inventory, have been stored in the 2006 software data base after being processed and formatted for making estimates of emissions and removals. All documentation on the data processing and formatting have been kept in soft copies in the excel sheets with the summaries reported in the NIR. These versions will be managed in electronic format in at least three copies, two stored at the Ministry of Environment and Tourism and a third copy at the National Statistics Agency.

CONSTRAINTS, GAPS AND NEEDS

Namibia, as a developing country, has its constraints and gaps that need to be addressed to improve the quality of the inventory for reporting to the Convention. Major problems encountered were related to availability of AD, appropriateness of EFs, background information on technologies associated with production and national stock factors for the estimation exercise. Additionally, lack of capacity of national experts to take over the compilation of the full inventory remained an issue of concern.

NATIONAL INVENTORY IMPROVEMENT PLAN (NIIP)

Based on the constraints and gaps and other challenges encountered during the preparation of the inventory, a list of the priority improvements have been identified. The main issues are listed below and will be addressed during the preparation of the NC4 and the BUR2 inventories.

- Adequate and proper data capture to facilitate the compilation of future inventories;
- Further build capacity and strengthen the existing institutional framework;
- Develop appropriate emission factors (EFs) more representative of the national context;
- Implement fully the QA/QC system to reduce uncertainty and improve inventory quality;
- Implement new forest inventories to supplement available data on the Forestry category; and
- Produce new maps to refine land use change data.

1. INTRODUCTION

1.1 NATIONAL CIRCUMSTANCES

The Republic of Namibia is situated in South-Western Africa. It has a total land area of 825 418 km^2. Its population was nearly 2.3 million in 2014. Namibia is situated between latitudes 17° and 29°S and longitudes 11° and 26°E. The land surface ascends from the Namib Desert to the mountains of the continental border range, with peaks at 2 606 metres above mean sea level. To the east and north, the country then descends into the Kalahari basin with a mean altitude of 1000 metres above mean sea level.

Namibia's climate is characterized by high climatic variability in the form of persistent droughts, unpredictable and variable rainfall patterns, variability in temperatures and scarcity of water. Natural resources are under increasing stress. Rainfall ranges from an average of 25 mm in the west to over 600 mm in the northeast. Apart from the coastal zone, there is a marked seasonal temperature regime, with the highest temperatures occurring just before the wet season in the wetter areas or during the wet season in the drier areas. The lowest temperatures occur during the dry season months of June to August. Mean monthly minimum temperatures do not, on average, fall below 0°C. High solar radiation, low humidity and high temperature lead to very high evaporation rates, which vary between 3 800 mm per annum in the south to 2600 mm per annum in the north. Over most of the country, potential evaporation is at least five times greater than rainfall. Thus only about 1 % of rainfall ends up replenishing the groundwater aquifers. Lack of water is the key limitation factor to Namibia's development.

The services sector is the highest contributor to GDP with 63 % in the year 2013. Agriculture, fisheries and forestry accounted for 8 % and the industrial the remaining 29 %. The primary sector agriculture, is one of the foundations of Namibia's economy, as it is a vital source of livelihood for most rural families in term of food generation with approximately 48 % of Namibia's rural households depending on subsistence agriculture (NDP4).
Mining contributed about 12 % to the country's Gross Domestic Product (GDP) in 2013. The manufacturing sector, a priority sector under the NDP4, is estimated to have recorded a constant growth of 1.2 % in 2011 and 2012. Namibia is highly dependent on imports to meet its energy requirements. The domestic economy is estimated to have expanded by 5.0 % during 2012, compared to 5.7 % in 2011 (NSA, 2013). The primary and tertiary industries on the other hand recorded increases of 12.8 % and 6.4 % in value added, respectively.

1.2 COMMITMENTS UNDER THE CONVENTION

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992 at the UN Conference on Environment and Sustainable Development in Rio de Janeiro, Brazil. The Convention came into force on 21 March 1994. The Republic of Namibia ratified the Convention on 16 May 1995 as a Non-Annex 1 Party and this decision came into effect on 14 August 1995.

Under Article 4.1 (a) of the Convention, each party has to develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the

Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties.

These elements include amongst others:

a. A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases (GHG) not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties (COP);
b. A general description of steps taken or envisaged by the Party to implement the Convention; and
c. Any other information that the Party considers relevant to the achievement of the objective of the convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculations of global emission trends

In order to meet its reporting obligations, Namibia has submitted two national communications (NCs); the initial national communication in 2002 and the second national communication in 2011 with support from the GEF through UNDP. The Republic of Namibia was the first developing country to submit its Biennial Update Report in 2014. Thus, Namibia has to-date submitted three GHG inventories detailing its emissions and sinks as components of these documents.

2. THE INVENTORY PROCESS

2.1 OVERVIEW OF GHG INVENTORIES

The process of preparation of the present inventory started in 2013. It took nearly 3 years to implement and complete the different steps of the inventory cycle as depicted in the flowchart below. Funding under the climate change programme of the Global Environment Facility through its implementing agency, the United Nations Development Programme (UNDP), provided the framework for the preparation of an improved national GHG inventory. UNDP provided the financial and technical support for the preparation of the Initial and Second National Communications of the Republic of Namibia, which included the National Inventory of greenhouse gases. These inventories were undertaken for base years 1994 and 2000, with the results presented in the National Communications of Namibia to the United Nations Framework Convention on Climate Change. This inventory and the second one were compiled using the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1997). These inventories have all been compiled using the sectoral bottom-up approach, Tier level 1, and the GHG Inventory software. The reference approach has also been used for the energy sector, to enable comparison of the two methods. The gases addressed were Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Oxides of Nitrogen (NO_x), Sulphur Dioxide (SO_2), Non-Methane Volatile Organic Compounds (NMVOCs) and the precursor Carbon Monoxide (CO). A third Inventory has been compiled using a mix of Tiers 1 and 2 for the First Biennial Report and submitted to the UNFCCC in 2014. The IPCC 2006 Guidelines and software was used for preparation of this inventory.

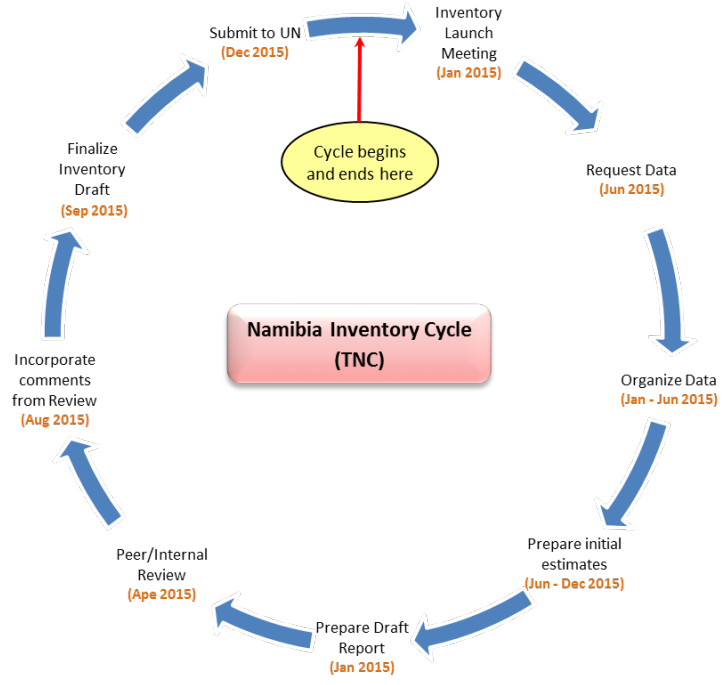


Figure 2.1 - The Inventory cycle of Namibia

The present GHG inventory report is submitted on a stand-alone basis as an accompanying document to the Third National Communication. It provides data on GHG emissions by sources and removals by sinks for a full time series for the period 2000 to 2010. This inventory is exhaustive, covering all source categories, at a detailed level. Once again, a mix of Tiers 1 and 2 has been adopted.

2.2 INSTITUTIONAL ARRANGEMENTS AND INVENTORY PREPARATION

Namibia outsourced its first and second inventory and started to invest in producing its inventories in-house with the one published in the BUR1, with the support of an external consultant for capacity building. This exercise continued with the inventory of the TNC to further improve, implement and consolidate the GHG inventory system being put in place. The process of preparation of GHG inventories by the newly constituted team remained a very laborious exercise as resources and human capacities continued to be limiting factors. Thus, it is obvious that there still exists shortcomings in this inventory but the country is committed to strive to raise the quality of future GHG inventories through further strengthening of the GHG inventory system.

The Climate Change Unit (CCU) of the Ministry of Environment and Tourism has the responsibility for overlooking the production of reports to the Convention, including the GHG inventories in its capacity as National Focal Point of the Convention. The same framework adopted for the previous inventory compilation was followed and all stakeholders agreed to pursue with sharing the responsibilities for the compilation exercise between different departments of the key ministries as for the BUR1. The exercise of mapping of national institutions and organizations was reviewed to identify additional stakeholders that would contribute in one way or the other for the inventory compilation. Thus data providers and possible institutions and organizations to support derivation of emission factors to suit national circumstances and enable moving to tier 2 were consolidated. It was also decided to keep on to existing collaboration streams as it is working satisfactorily and there is no need for other official formal engagements such as MOUs. Capacity building of all inventory team members continued on the different steps of the inventory cycle as well as on data management, running the 2006 IPCC software and analyzing the outputs. All members were introduced to the consistency component as a full series over the period 2000 to 2010 was being covered for the first time, including recalculations for the years 2000 and 2010.

The responsibilities arrived at within the institutional arrangements were:

- The CCU of Ministry of Environment and Tourism for inventory coordination, compilation and submission;
- Ministry of Mines and Energy for the Energy sector;
- Ministry of Trade, Industry for the Industrial and Production and Product Use sector;
- Ministry of Agriculture Water Affairs and Forestry for Agriculture, Forest and Other Land Use sector;
- City Council of Windhoek for the Waste sector;
- Namibia National Statistics Agency for Archiving, including provision of quality controlled activity data;
- The CCU of Ministry of Environment and Tourism for coordinating QA/QC;
- External consultant for QA;
- The CCU of Ministry of Environment and Tourism for coordinating Uncertainty Analysis; and
- The CCU of Ministry of Environment and Tourism to act as GHG inventory specialist to track capacity building needs, the IPCC process and COP decisions for application.

The institutional arrangement for the compilation of the inventory and reporting for the different sectors are shown in Figure 2.2.

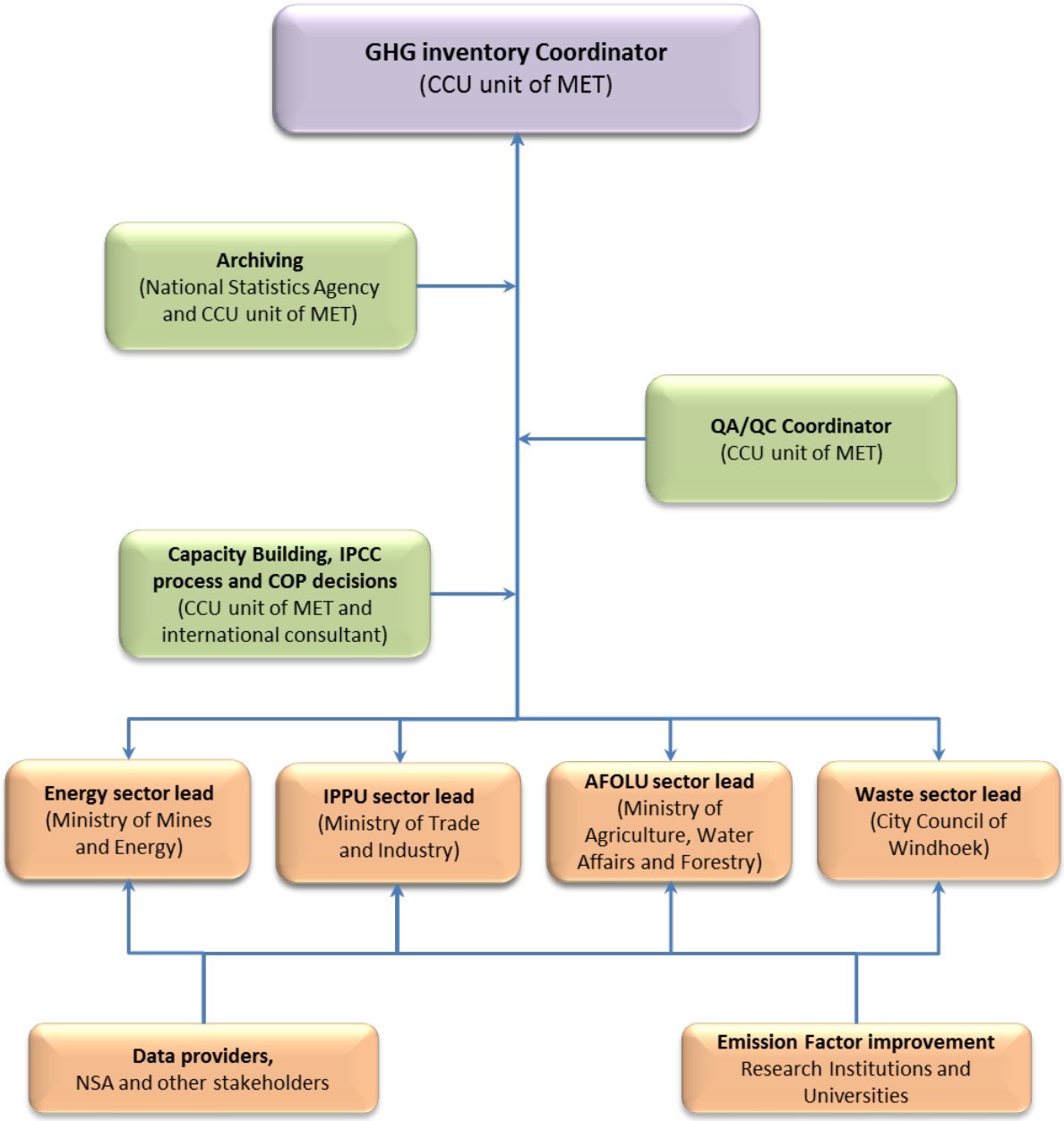


Figure 2.2 - Institutional arrangements for the GHG inventory preparation

The inventory preparation started in January 2013. A workplan with timeframe and responsibilities was drawn for the preparation of the Inventory using the mix of Tiers 1 and 2. After AD were collected and processed, sectoral experts of the inventory team calculated emissions and performed recalculations. The 2006 IPCC Guidelines *for National Greenhouse Gas Inventories* (IPCC, 2006) were used with the most appropriate IPCC default EFs. Data availability and appropriateness for higher Tiers were scrutinized and further data collected and processing done anew. Default EFs were likewise assessed and these were derived or amended in some cases to reflect national circumstances and conditions, with the objective of calculating emissions as accurately as possible. The results were reviewed during regular working sessions for identifying improvement areas relative to data availability and quality, appropriateness of EFs, gaps and constraints. Drawbacks and shortcomings were addressed to maintain smooth implementation of the inventory cycle. The different steps adopted for the preparation of the inventory can be summarized as follows:

- Drawing up of workplan with timeline and deliverables;
- Allocation of tasks to sectoral experts;
- Collection, quality control and validation of activity data;
- Selection of Tier level within each category and sub-category;
- Selection of emission factors (EFs) and Derivation of local EFs wherever possible;
- Designing of appropriate MS Excel worksheets for detailed calculations;
- Computation of GHG emissions;
- Uncertainty analysis;
- Implementing QA/QC activities;
- Assessment of completeness;
- Recalculations;
- Trend analysis;
- Gaps, constraints, needs and improvements; and
- Report writing.

2.3 KEY SOURCE CATEGORY ANALYSIS

Key Source Category Analysis gives the characteristics of the emission sources and sinks. According to the *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000), key categories are those which contribute 95 % of the total annual emissions, when ranked from the largest to the smallest emitter. Alternatively, a key source is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHGs in terms of the absolute level of emissions, the trend in emissions, or both (IPCC, 2000). Thus, it is a good practice to identify key categories, as it helps prioritize efforts and improve the overall quality of the national inventory.

The Key Category Analysis was performed using the tool available within the IPCC 2006 Software for both level and trend assessment. The results for the level assessment for the year 2010 are presented in Table 2.1 and the trend assessment in Table 2.2.

There are five key categories in the trend assessment, four of these from the AFOLU sector, of which enteric fermentation from Agriculture, the other three from FOLU and the last one is Road Transportation from the Energy sector.

Table 2.1 - Key Category Analysis for the year 2010 - Approach 1 - Level Assessment

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	GHG	"2010 Ex,t (Gg CO_2 Eq)"	"|Ex,t| (Gg CO_2 Eq)"	Lx,t	Cumulative Total of Column F
3.B.1.a	Forest land Remaining Forest land	CO_2	-27362.6	41817.1	0.59	0.594
3.B.3.b	Land Converted to Grassland	CO_2	17999.1	18254.6	0.26	0.853
3.A.1	Enteric Fermentation	CH_4	3805.2	3805.2	0.05	0.907
1.A.3.b	Road Transportation	CO_2	2136.7	2136.7	0.03	0.937
3.B.1.b	Land Converted to Forest land	CO_2	-1066.0	1066.4	0.02	0.952

The results changes slightly when considering the trend assessment. There are still 5 key categories but Road Transportation is replaced by Other Sectors-Liquid Fuels while the other four remained the same.

Table 2.2 - Key Category Analysis for the year 2010 - Approach 1 - Trend Assessment

A	B	C	D	E	F	G	H
IPCC Category code	IPCC Category	GHG	2000 Year Estimate Ex0 (Gg CO_2 Eq)	2010 Year Estimate Ext (Gg CO_2 Eq)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
3.B.1.a	Forest land Remaining Forest land	CO_2	-43137.9	-27362.6	0.42	0.58	0.575
3.B.3.b	Land Converted to Grassland	CO_2	17999.1	17999.1	0.21	0.28	0.860
3.A.1	Enteric Fermentation	CO_2	4163.7	3805.2	0.05	0.07	0.931
3.B.1.b	Land Converted to Forest land	CO_2	-1066.0	-1066.0	0.01	0.02	0.947
1.A.4	Other Sectors - Liquid Fuels	CO_2	416.0	320.4	0.01	0.01	0.955

2.4 METHODOLOGICAL ISSUES

This section gives an overview of the methodologies adopted for all sectors and sub-sectors addressed in the inventory process. These procedures are described in detail in the respective section covering the individual IPCC Key Source Categories.

Generally, the method adopted to compute emissions involved multiplying activity data (AD) by the relevant appropriate emission factor (EF), as shown below:

Emissions (E) = Activity Data (AD) x Emission Factor (EF)

All the methodologies and tools recommended by IPCC within the inventory cycle have been used and followed to be in line with Good Practices.

As the IPCC 2006 Guidelines do not address compilations at the Tier 2 level, the Agriculture and Land Use Software of the Colorado State University (CSU) has also been adopted to enable estimates to be made at the tier 2 level partially for the livestock and LAND sectors. Thus the inventory has been compiled using a mix of tiers 1 and 2. This is good practice and improved the accuracy of the emission estimates and thus reduced the uncertainty level.

Global Warming Potentials (GWP) as recommended by the IPCC have been used to convert GHGs other than CO_2 to the latter equivalent. Based on decision 17/CP.8, the values adopted were those from the IPCC Second Assessment Report for the three direct GHGs, namely carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) (Table 2.3). Additional gases, known as (indirect gases), affect global warming, namely oxides of nitrogen (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2), have also been computed and reported in the inventory.

Table 2.3 - Global warming potential

Gas		Global Warming Potential
Carbon Dioxide	(CO_2)	1
Methane	(CH_4)	21
Nitrous Oxide	(N_2O)	310

Default EFs were assessed for their appropriateness prior to being used; namely on the basis of the situations under which they have been developed and the extent to which these were representative of

national ones. Country specific EFs have been derived for the livestock sector since the default ones did not reflect the national context and data available allowed for their computation.

Country-specific AD are readily available as a good statistical system exists whereby data pertaining to most of the socio-economic sectors are collected, verified and processed to produce official national statistics reports. Additional and/or missing data required to meet the level of disaggregation for higher than the Tier I level, were sourced directly from both public and private sector operators by the team members and coordinators. Data gaps were filled through personal efforts of the experts and/or from results of surveys, scientific studies and by statistical modelling. All the data and information collected during the inventory process have been stored in the software database.

In a few isolated cases, due to the restricted timeframe and lack of a declared National framework for data collection and archiving to meet the requirements for preparing GHG inventories, derived data and estimates were used to fill in the gaps. These were considered reliable and sound since they were based on scientific findings and other observations. Estimates used included fuel use for navigation, domestic aviation, food consumption and forest areas by type.

2.5 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Namibia has its own system for quality control (QC) of data being collected within the different institutions. All data are quality controlled at different stages of the process until the final quality assurance (QA) is made by the National Statistics Agency before archiving in national databases. The private sector also implements its own QC/QA within its data collection and archiving process. Thus the initial phases of the control system remains beyond the GHG inventory compiler and the process starts as from the time the AD are received.

QC and QA procedures, as defined in the *IPCC 2006 Guidelines (IPCC, 2007)* have been implemented during the preparation of the inventory. Whenever there were inconsistencies or possible transcription errors, the responsible institution was queried and the problem discussed and solved. QC was implemented through:

- Routine and consistent checks to ensure data integrity, reliability and completeness;
- Routine and consistent checks to identify errors and omissions;
- Accuracy checks on data acquisition and calculations and the use of approved standardized procedures for emissions calculations; and
- Technical and scientific reviews of data used, methods adopted and results obtained.

QA was undertaken by independent reviewers who were not involved with the preparation of the inventory, the main objectives being to:

- Confirm data quality and reliability from different sources wherever possible;
- Review the AD and EFs adopted within each source category as a first step; and
- Review and check the calculation steps in the software to ensure accuracy.

Even if QA/QC procedures have been followed throughout the inventory process, systematic records as per the *IPCC 2006 Guidelines* still have to be developed. This resulted from the lack of personnel, insufficient capacity and since the inventory management system is still being implemented in the country.

2.6 UNCERTAINTY ASSESSMENT

Uncertainty estimation is an essential element of a complete greenhouse gas emissions and removals Inventory. The purpose of estimating the uncertainty attached to emission estimates is principally to provide information on where inventory resources should be allocated to maximise the future improvements to inventory quality. Inventories prepared in accordance with IPCC guidelines (IPCC, 2006d) will typically contain a wide range of emission estimates, varying from carefully measured and demonstrably complete data on emissions to order-of-magnitude estimates of highly variable emissions such as N_2O fluxes from soils and waterways.

For this Inventory, a Tier 1 uncertainty analysis of the aggregated figures as required by the Climate Change Convention Inventory guidelines (UNFCCC, 2013) and IPCC good practice guidance (IPCC, 2006d) was performed. Based on the quality of the data and whether the EFs used were defaults or nationally derived, uncertainty levels were allocated for the two parameters and the combined uncertainty calculated. In most instances, the uncertainty values are determined by analysis of emission factors or activity data using expert judgement from sectoral or industry experts, or by referring to uncertainty ranges provided in the IPCC guidelines. The uncertainty for CH_4 emissions from enteric fermentation was calculated by expressing the coefficient of variation according to the standard error of the methane yield. The uncertainty analysis has been performed using the tool available within the IPCC 2006 Software for the national inventory excluding the Land sector. The uncertainty in total emissions (excluding emissions and removals from the LAND sector) is in the range of 6.5 % (year 2000) and 5.7 % (Year 2010). Uncertainty surrounding estimates are typically low. In general, there is a gradual decrease in uncertainty, reflecting a gradual inherent upgrading of data quality and treatment.

Table 2.4 - Overall uncertainty (%) excluding the LAND sector

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Uncertainty	6.5	6.4	6.4	6.2	6.1	5.9	5.8	5.6	5.7	5.8	5.7

2.7 ASSESSMENT OF COMPLETENESS

An assessment of the completeness of the inventory was made for individual activity areas within each source category and the results are presented within the sections covering the individual sectors. The methodology adopted was according to the *IPCC 2006 Guidelines (IPCC 2007)* with the following notation keys used:

- X Estimated
- NA Not Applicable
- NO Not Occurring
- NE Not Estimated
- EE Estimated Elsewhere

The level of completeness depicting the scope of the inventory is provided in Table 2.5. Rows where activity is not occurring have been deleted for ease of presentation and understanding.

Table 2.5 - Completeness of the 2000 to 2010 inventories

1.A - Fuel Combustion Activities	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
1.A.1 - Energy Industries	X	X	X	X	X	X	X
1.A.2 - Manufacturing Industries and Construction	X	X	X	X	X	X	X
1.A.3 - Transport	X	X	X	X	X	X	X
1.A.4 - Other Sectors	X	X	X	X	X	X	X
1.A.5 - Non-Specified	X	X	X	X	X	X	X
1.B - Fugitive emissions from fuels	NO	NO	NO	NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO
2 - Industrial Processes and Product Use							
2.A - Mineral Industry							
2.A.2 - Lime production	X	NA	NA	NA	NA	NA	NA
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry							
2.C.6 - Zinc Production	X	NA	NA	NA	NA	NA	NA
2.D - Non-Energy Products from Fuels and Solvent Use							
2.D.1 - Lubricant Use	X	NA	NA	NA	NA	NA	NA
2.D.2 - Paraffin Wax Use	X	NA	NA	NA	NA	NA	NA
2.D.3 - Solvent Use	NE	NE	NE	NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances							
2.F.1 - Refrigeration and Air Conditioning	NE	NE	NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents	NO	NO	NO	NO	NO	NO	NO
2.F.3 - Fire Protection	NE	NE	NE	NE	NE	NE	NE
2.F.4 - Aerosols	NE	NE	NE	NE	NE	NE	NE
2.F.5 - Solvents	NE	NE	NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify)	NO	NO	NO	NO	NO	NO	NO
2.G - Other Product Manufacture and Use							
2.G.1 - Electrical Equipment	NE	NE	NE	NE	NE	NE	NE
2.G.2 - SF_6 and PFCs from Other Product Uses	NO	NO	NO	NO	NO	NO	NO
2.G.3 - N_2O from Product Uses	NE	NE	NE	NE	NE	NE	NE
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO
2.H - Other							
2.H.2 - Food and Beverages Industry	NE	NE	NE	NE	NE	NE	NE
3 - Agriculture, Forestry, and Other Land Use							
3.A - Livestock							
3.A.1 - Enteric Fermentation	NA	X	NA	NA	NA	NA	NA
3.A.2 - Manure Management	NA	X	X	NA	NA	X	NA
3.B - Land							
3.B.1 - Forest land	X	NA	NA	NA	NA	NA	NA
3.B.2 - Cropland	X	NA	NA	NA	NA	NA	NA
3.B.3 - Grassland	X	NA	NA	NA	NA	NA	NA
3.B.4 - Wetlands	NE	NE	NE	NE	NE	NE	NE
3.B.5 - Settlements	NE	NE	NE	NE	NE	NE	NE
3.B.6 - Other Land	NO	NO	NO	NO	NO	NO	NO

Table 2.5 - Completeness of the 2000 to 2010 inventories

1.A - Fuel Combustion Activities	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
3.C - Aggregate sources and non-CO_2 emissions sources on land							
3.C.1 - Emissions from biomass burning	NA	X	X	X	X	NA	NA
3.C.3 - Urea application	NA	X	X	X	NA	NA	NA
3.C.4 - Direct N_2O Emissions from managed soils	NA	NA	X	NA	NA	NA	NA
3.C.5 - Indirect N_2O Emissions from managed soils	NA	NA	X	NA	NA	NA	NA
3.C.6 - Indirect N_2O Emissions from manure management	NA	NA	X	NA	NA	NA	NA
3.D - Other							
3.D.1 - Harvested Wood Products	NE	NE	NE	NE	NE	NE	NE
4 - Waste							
4.A - Solid Waste Disposal	NO	X	NA	NA	NA	X	NO
4.C - Incineration and Open Burning of Waste	X	X	X	X	X	X	X
4.D - Wastewater Treatment and Discharge	NO	X	X	NA	NA	NA	NA
5 - Other							
Memo Items (5)							
International Bunkers							
1.A.3.a.i - International Aviation (International Bunkers)	X	X	X	X	X	X	X
1.A.3.d.i - International water-borne navigation (International bunkers)	X	X	X	X	X	X	X
1.A.5.c - Multilateral Operations	NO	NO	NO	NO	NO	NO	NO

X = Estimated, NA = Not Applicable, NO = Not Occurring, NE = Not Estimated, EE = Estimated Elsewhere

2.8 RECALCULATIONS

The inventory for the years 2000 and 2010 were recalculated to provide for a consistent series in this inventory report. Recalculations are normally carried out if AD and/or EFs are revised or if new updated methodologies are applied. The present National GHG Inventory Report, being an exhaustive one, also reports on recalculations made. The scope of the 2000 inventory has been widened to include sectors which were not covered such as IPPU and as well, the 2006 IPCC Guidelines has been used instead of the Revised 1996 IPCC Guidelines to be consistent with the compilation for the period 2001 to 2010. The latter was also recalculated as inadvertently some categories, namely the metal industry, were included as activity areas when they did not occur in the country. Moreover, when importing the database, the emissions in the LAND sector doubled in the IPCC 2006 software and resulted in an overestimation of the sink capacity of the country. This problem has been reported to the IPCC Technical Supporting Unit for appropriate action.

2.9 TIME SERIES CONSISTENCY

This inventory covers the period 2000 to 2010 and AD within each of the source categories covered were abstracted from the same sources for all years (Table 2.5). The same EFs have been used and the QA/QC procedures were kept constant for the whole inventory period. This enabled a consistent time series to be built with a good level of confidence in the trends of the emissions.

Table 2.6 - Summary of data sources

Category	Fuel type	Data source
International marine bunkers	Diesel	2010 data from marine surveyor. 2000 data from the Second National Communication (SNC). Interpolation between 2000 data from SNC and 2010 data of BUR1.
	Gasoline	No data was available and thus the data (622 tonnes) used in 2010 was adopted for period 2000 to 2009.
	Residual fuel oil	Interpolation between average (1999 to 2001) data from SNC and 2010 data from BUR1.

Table 2.6 - Summary of data sources (contd)

Category	Fuel type	Data source
International aviation bunkers	Jet kerosene	2010 data from Airport profile information as those available for the period 2000 to 2009 from ECB varied widely. Average of ECB data from 2000 to 2009 taken as median for year 2004 and 1 % variation applied for the remaining years.
Domestic aviation	Aviation Gasoline	Net of import and export for period 2006 to 2009. An average volume of 3200 for the period 2006 to 2009 is assumed for 2000 to 2005. Airport profile data available from September 2009 to 2011.
	Jet kerosene	Data for 2000 to 2009 from UNSD are high compared to airport profile data 2010. Same allocation of 10 % for domestic use applied for period 2000 to 2009 as for year 2010.
Energy industries	Fuel oil	Data from Nampower.
	Coal	Data from Nampower.
Manufacturing, Mining and Other manufacturing	Gasoline/Diesel	Data from ECB report.
	Gasoline/Diesel	Official data provided by Ministry of Trade and Industry for industries used, excluding mining.
Road Transport	Gasoline/Diesel	Gasoline and diesel estimated from vehicles fleet and fuel consumption indicators.
	LPG	Difference from net import and export with 1100 allocated for residential sector from SNC.
Railways	Diesel/residual	Data from TransNamib.
Residential	Kerosene	Kerosene for years 2007 and 2008 taken from net of import and export. Data inconsistent for remaining years. For the period 2000 to 2006, a uniform increase of 1 % was adopted in line with urbanisation rate as it is considered that people moving to the cities consumed electricity *in lieu* of kerosene.
	LPG	Taken from imports.
	Wax candles	Amount produced locally plus balance from net of import and export.
	Wood fuel	Derived from census data on the basis of % households using this energy source.
Agriculture/ fishing	Gasoline	A nominal allocation to balance import and export data. Interpolation for year 2000 taken from SNC and 2001 to 2009 interpolated using AD for years 2000 and 2010.
	Diesel	Consumption of diesel derived from fish catch data from (SNC).

2.10 GAPS, CONSTRAINTS AND NEEDS

In order to reduce uncertainties and to further the adoption of higher Tier levels in future inventories, more disaggregated data for the various sectors as well as country-specific EFs will be needed. The evaluation of the completed inventory enabled the identification of areas that will have to be reviewed and improved in terms of data collection, as well as research to be undertaken for developing EFs. The development of specific sectoral databases for GHG inventory purposes will prove useful.

Adoption of Tier 2 level, which is more demanding with regard to time and the in-depth knowledge of the processes within each sector, further complicated the process. Thus, there is need to develop an improved institutional arrangement that will ensure a smoother flow during future inventory preparations. This remains an intricate process requiring not only the basic scientific knowledge of the GHG emitting activity, but also the impact of the latest technologies being adopted, and their contribution within the process for more accuracy.

Namibia, as a developing country, has its constraints and gaps that need to be addressed to produce better quality reports to the Convention. The following problems were encountered during the preparation of the national inventory of GHG emissions:

- Information required for the inventory had to be obtained from various sources as no institution has been endorsed with the responsibility for collection of specific activity data (AD) needed for the estimation of emissions according to UNFCCC;

- Almost all of the AD, including those from the NSA, were not in the required format for feeding in the software to make the emission estimates;
- End-use consumption data for some of the sectors and categories were not readily available and had to be generated on the basis of scientific and consumption parameters;
- Reliable biomass data such as timber, fuelwood, wood waste and charcoal consumed or produced were not available and had to be derived using statistical modelling;
- There were frequent inconsistencies when data were collected from different sources;
- Information on the technologies associated with production in the different industries were not available and this could lead to overestimation of emissions as technologies with highest EFs were chosen as good practice;
- Lack of solid waste characterization data, amount generated and wastewater generated from the industrial sector were not available and had to be derived on the basis of production and demographic data amongst others;
- Lack of EFs to better represent national circumstances and provide for accurate estimates;
- Emissions for a few categories have not been estimated due to lack of AD; and
- Capacity of national experts to take over the inventory compilation despite one round of training on running the IPCC 2006 software.

2.11 NATIONAL INVENTORY IMPROVEMENT PLAN (NIIP)

Based on the constraints and gaps and other challenges encountered during the preparation of the inventory, a list of the most urgent improvements have been identified. This is listed below and will be addressed during the preparation of the NC4 and BUR2 inventories.

- Adequate and proper data capture, QC, validation, storage and retrieval mechanism are required and need to be established to facilitate the compilation of future inventories;
- There is a necessity to build capacity and to strengthen the existing institutional framework to provide improved coordinated action for reliable data collection and accessibility;
- Develop improved emission factors (EFs) more representative of the national context;
- Implement fully the QA/QC system in order to reduce uncertainty and improve inventory quality;
- Establish a GHG inventory unit within DEA to be responsible for inventory compilation and coordination;
- Institutionalize the archiving system;
- Collect information on production technology used in the IPPU sector;
- Start data collection for categories not covered in this exercise;
- Implement new forest inventories to supplement available data on the LAND sector;
- Review and correct inconsistencies existing for the recent land cover maps with additional overlays with previous maps and ground referencing;
- Produce new maps for 2005 to refine land use change data over 5 years as opposed to the decadal one available now;
- Refine data collection for determining country specific (CS) weights for dairy cows, sheep and goats;
- Develop the digestible energy (DE) factor for livestock as country specific data is better than the default IPCC value to address this key category fully at tier 2.

3. TRENDS IN GREENHOUSE GAS EMISSIONS

3.1 OVERVIEW

The trends of GHG emissions for the Republic of Namibia cover the period 2000 to 2010. Availability of more disaggregated data enabled the adoption of higher Tier methods, namely a combination of Tiers 1 and 2 for compiling this inventory. The period 2000 to 2010 included additional sectors and sub-sectors that were not covered previously.

3.2 THE PERIOD 2000 TO 2010

Namibia remained a net GHG sink over the whole period 2000 to 2010 as a result of the Land sector turning out to be a sink. However, this sink capacity steadily decreased during this period and fell by 64 %. The net removal of CO_2 thus declined from 18 278 Gg to 1339 Gg as the Land removals decreased from 44 459 Gg CO_2-eq in 2000 to 28 534 Gg in 2010. The trend for the period 2000 to 2010 indicates that the net GHG emissions increased from 26 180 Gg CO_2-eq in 2000 to 27 195 Gg CO_2-eq in 2010 (Table 3.1). Per capita removals of GHG decreased from 17.4 to 5.7 t CO_2-eq during the period 2000 to 2010 (Figure 3.1). The GHG emission intensity index decreased from 100 in 2000 to 24 in 2010 (Table 3.1) and (Figure 3.2).

Table 3.1 - GHG emissions (Gg CO_2-eq) characteristics for the period 2000 to 2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total emissions	26180	26569	26433	26817	26999	26866	27204	27281	27976	27978	27195
AFOLU - removals	-44459	-42739	-41501	-39532	-37707	-36402	-34781	-33264	-31641	-30075	-28534
Net removals	-18278	-16171	-15068	-12716	-10708	-9536	-7577	-5983	-3664	-2096	-1339
Per capita emission (t)	-17.4	-15.8	-14.8	-13.2	-11.9	-11.0	-9.7	-8.6	-7.2	-6.2	-5.7
Per GDP emission (t/M N$)	-1.2	-1.1	-0.9	-0.8	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	-0.1
GHG emission intensity index (2000=100)	100.0	91.4	83.1	72.2	58.5	53.4	44.7	38.3	31.4	27.8	24.1

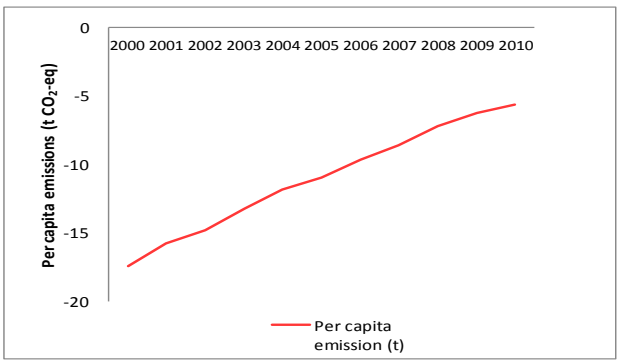


Figure 3.1 - Per capita GHG emissions (2000 - 2010)

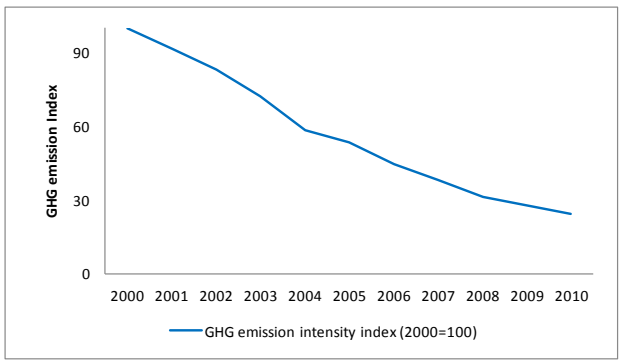


Figure 3.2 - GHG emissions intensity index (2000 - 2010)

3.3 TREND OF EMISSIONS BY SOURCE CATEGORY

Total national emissions increased by 3.7 % over these 11 years. The AFOLU sector remained the leading emitter throughout this period followed by Energy, Waste and IPPU for most of the years under review. Emissions from the AOLU sector declined slightly from 24 064 Gg CO_2-eq in 2000 to 23 843 Gg CO_2-eq in 2010, representing a decrease of 1 % from the 2000 level. In 2010, the share of GHG emissions from

AFOLU amounted to 87.7 % of total national emissions. The removals from the AFOLU sector represented 91.9 % of the total national emissions in 2000. AFOLU removals decreased from 44 459 Gg CO_2-eq to 28 534 Gg CO_2-eq during the period 2000 to 2010.

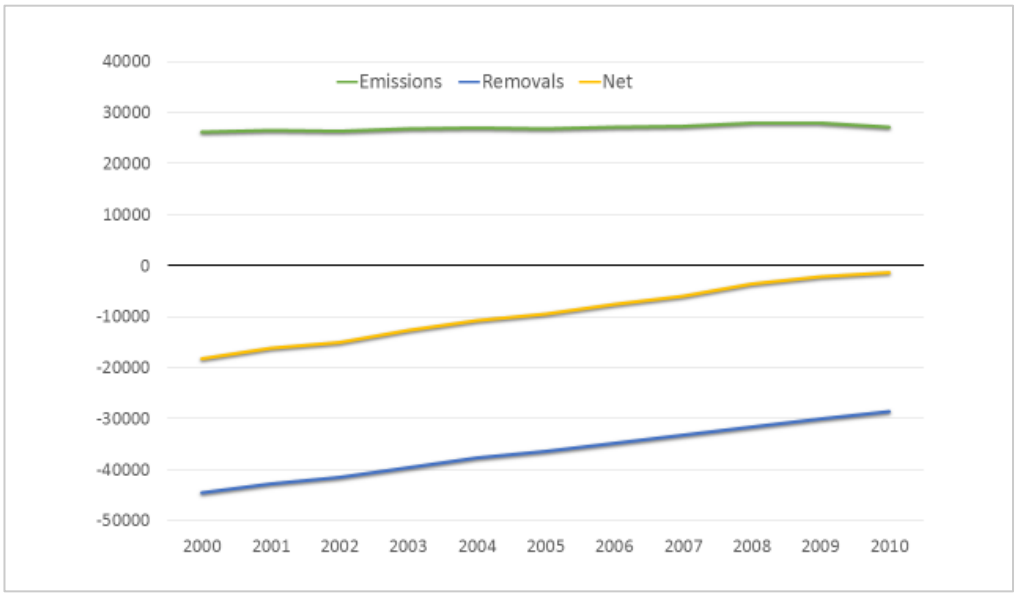


Figure 3.3 - Evolution of emissions and removals (Gg CO_2-eq), for the period 2000 to 2010

Energy emissions increased from 1995 Gg CO_2-eq (7.6 %) of national emissions in 2000 to 2904 Gg CO_2-eq (10.7 %) in 2010 as depicted in Table 3.2. During the period 2000 to 2010, the average annual increase of GHG emissions was 3.9 %.

IPPU contributed 0.1 % of total national emissions in 2010. Emissions from this source increased significantly from 25 Gg CO_2-eq in 2000 to 302 Gg CO_2-eq in 2010 (Table 3.2). On average, the GHG emissions from the industrial processes sector increased by 46.7 % annually.

Waste emissions on the other hand varied slightly over this period with the tendency being for a slight increase over time. Emissions from the waste sector increased from the 2000 level of 96 Gg CO_2-eq to 146 Gg CO_2-eq in 2010, representing a 52 % increase.

Table 3.2 - National GHG emissions (Gg, CO_2-eq) by sector for the period 2000 to 2010.

Source Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy	1995	2157	2269	2455	2562	2695	2795	2897	2981	2986	2904
Industrial Processes	25	25	26	110	235	260	255	294	291	303	302
AFOLU	24064	24290	24038	24141	24089	23790	24030	23969	24573	24550	23843
Waste	96	98	99	110	113	120	123	121	131	139	146
Total emissions	26180	26569	26433	26817	26999	26866	27204	27281	27976	27978	27195

3.4 TREND IN EMISSIONS OF DIRECT GHGs

The share of emissions by gas has not changed during the period 2000 to 2010. The main contributor to the national GHG emissions remained CO_2 followed by CH_4 and N_2O. In 2010, the share of the GHG emissions was as follows: 78.6 % CO_2, 9 % CH_4 and 5.5 % N_2O. The trend of the aggregated emissions and removals by gas is given in Table 3.3 and Figure 3.4. The share of CO_2 and N_2O has increased while that of CH_4 has decreased over the period 2000 to 2010.

Table 3.3 - Aggregated emissions and removals (Gg) by gas (2000 - 2010)

GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. annual change (%)
CO_2	20197.3	20359.0	20470.7	20736.3	20965.1	21121.0	21214.6	21353.0	21433.0	21449.1	21366.4	0.6
CH_4 (CO_2-eq)	4651.5	4693.9	4505.5	4598.6	4544.6	4319.4	4503.8	4445.8	4927.6	4898.8	4335.7	-0.5
N_2O (CO_2-eq)	1331.4	1515.8	1456.7	1481.6	1489.1	1425.2	1485.6	1482.6	1615.8	1630.4	1493.0	1.3
Total GHG emissions (CO_2-eq)	26180.2	26568.7	26432.9	26816.6	26998.8	26865.6	27204.0	27281.4	27976.4	27978.3	27195.1	0.4
Removals (CO_2) (CO_2-eq)	-44458.7	-42739.4	-41501.3	-39532.2	-37707.0	-36401.7	-34781.2	-33264.3	-31640.6	-30074.6	-28534.4	-4.3
Net removals (CO_2-eq)	-18278.5	-16170.7	-15068.4	-12715.6	-10708.2	-9536.1	-7577.2	-5982.9	-3664.2	-2096.3	-1339.3	-22.0

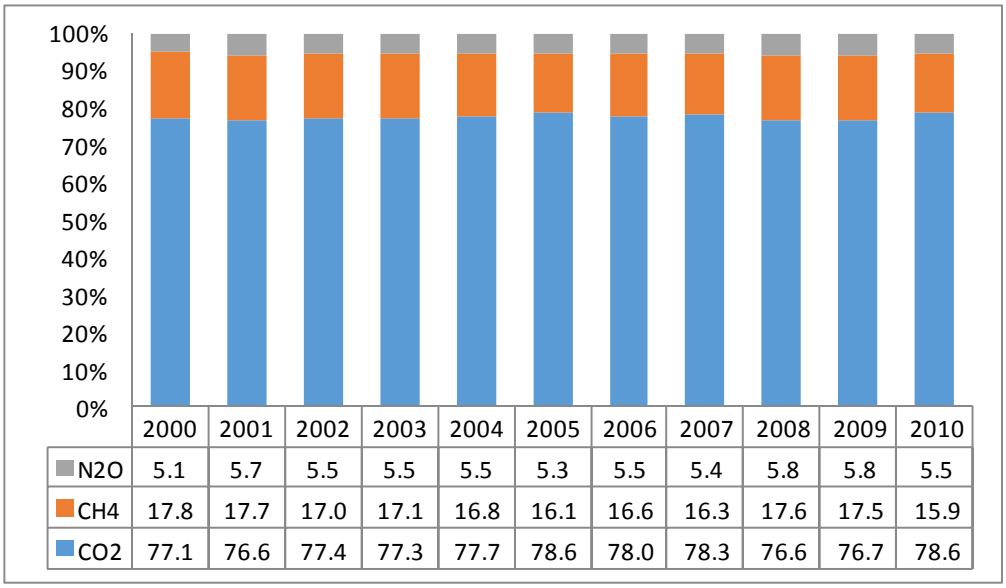


Figure 3.4 - Share of aggregated emissions (Gg CO_2-eq) by gas (2000 - 2010)

3.4.1 Carbon dioxide (CO_2)

The most significant anthropogenic GHG was CO_2. In 2010, it contributed the largest share of national emissions at 21 366 Gg (78.6 %). CO_2 emissions increased by 1169 Gg from the 2000 level of 20 197 Gg (Table 3.3) to 21 366 Gg in 2010. The sector that emitted the highest amount of CO_2 was AFOLU followed by Energy (Table 3.4).

Table 3.4 - CO_2 emissions (Gg) by source category (2000 - 2010)

Source Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total emissions	20197.3	20359.0	20470.5	20736.3	20965.1	21121.0	21214.6	21353.0	21433.0	21449.1	21366.4
Total net removals	-24261.4	-22380.4	-21030.8	-18795.9	-16741.9	-15280.7	-13566.6	-11911.3	-10207.6	-8625.5	-7168.1
Energy	1902.2	2061.6	2172.3	2355.4	2459.3	2590.5	2689.3	2788.2	2871.4	2875.9	2793.4
Industrial Processes	25.0	24.6	26.3	110.2	235.2	260.3	255.1	294.3	291.1	302.5	302.3
AFOLU - emissions	18268.6	18271.1	18270.1	18268.9	18268.7	18268.3	18268.2	18268.3	18268.1	18268.2	18268.2
AFOLU - removals	-44458.7	-42739.4	-41501.3	-39532.2	-37707.0	-36401.7	-34781.2	-33264.3	-31640.6	-30074.6	-28534.4
Waste	1.6	1.7	1.7	1.8	1.9	1.9	2.1	2.1	2.3	2.3	2.5

3.4.2 Methane (CH_4)

Methane was the next contributor in national emissions after CO_2. It contributed 4336 Gg CO_2-eq (16 %) of the total emissions of 2010. Methane emissions decreased by 315.8 Gg CO_2-eq from the 2000 level of 4651 Gg CO_2-eq (Table 3.5). AFOLU contributed most of these emissions followed by the Waste sector.

Table 3.5 - CH_4 emissions (Gg) by source category (2000 - 2010)

Source Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total (Gg CO_2-eq)	4651.5	4693.9	4505.5	4598.6	4544.6	4319.4	4503.8	4445.8	4927.6	4898.8	4335.7	-0.5
Total	221.5	223.5	214.5	219.0	216.4	205.7	214.5	211.7	234.6	233.3	206.5	-0.5
Energy	2.9	2.9	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	0.7
AFOLU - emissions	215.3	217.3	208.2	212.1	209.4	198.4	207.0	204.3	226.8	225.1	198.0	-0.7
Waste	3.3	3.3	3.4	3.9	4.0	4.3	4.4	4.3	4.7	5.1	5.4	5.1

3.4.3 Nitrous Oxide (N_2O)

Nitrous oxide emissions at 1493 Gg CO_2-eq represented 3.8 % of national emissions in 2010. Emissions increased by 162 Gg CO_2-eq in the year 2000 to 1331 Gg CO_2-eq (Table 3.) in 2010. The AFOLU sector was the highest emitter of N_2O.

Table 3.6 - N_2O emissions (Gg) by source category (2000 - 2010)

Source Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total (Gg CO_2-eq)	1331.41	1515.76	1456.72	1481.63	1489.07	1425.21	1485.60	1482.62	1615.78	1630.43	1493.01	1.3
Total	4.29	4.89	4.70	4.78	4.80	4.60	4.79	4.78	5.21	5.26	4.82	1.3
Energy	0.10	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.14	0.15	0.15	3.6
AFOLU - emissions	4.11	4.70	4.50	4.57	4.59	4.38	4.56	4.55	4.97	5.02	4.57	1.3
Waste	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10	1.8

3.5 TRENDS FOR INDIRECT GHGs AND SO_2

Emissions of indirect GHGs SO_2, CO, NO_x and NMVOC have also been estimated and reported in the inventory. Indirect GHGs have not been included in national total emissions. Emissions of these gases for the period 2000 to 2010 are given in Table 3.7 and Figure 3.5.

Table 3.7 - Emissions (Gg) of indirect GHGs and SO_2 (2000 - 2010)

Gases	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
NO_x	31.5	32.6	34.7	35.8	36.0	36.5	35.2	34.6	34.6	35.5	35.2	1.1
CO	364.9	365.6	366.9	368.7	371.6	373.1	373.8	375.5	375.6	375.9	375.3	0.3
NMVOC	19.5	20.6	20.5	20.8	21.2	21.1	21.8	21.9	22.9	23.0	22.0	1.2
SO_2	2.2	2.4	2.8	3.1	3.6	3.8	4.2	4.0	4.2	3.7	2.8	3.0

Emissions of NO_x increased from 31.5 Gg in the year 2000 to 35.2 Gg in 2010. Carbon monoxide emissions increased by 0.3 % from 364.9 Gg in 2000 to 375.3 in 2010. Emissions of NMVOC increased slightly from 19.5 Gg in 2000 to 22.0 Gg in 2010, whilst emissions of SO_2 increased from 2.2 Gg in 2000 to 4.2 Gg in 2008 and thereafter decreased to 2.8 Gg in 2010.

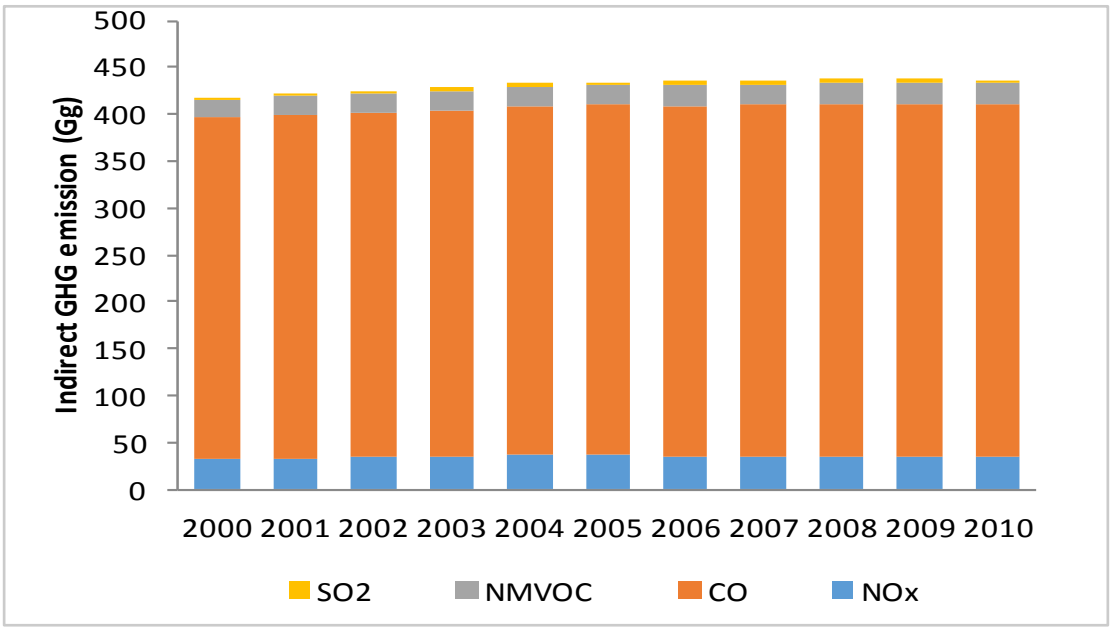


Figure 3.5 - Share of Indirect GHG emissions (Gg CO_2-eq) for the period 2000 - 2010

3.5.1 NO_x

Emissions of NO_x increased by an annual average of 1.1 % over the inventory period from 31.5 Gg in the year 2000 to 35.2 Gg in 2010 (Table 3.8). The two main sources of NO_x emissions were the Energy and AFOLU sectors. The energy sector contributed 60 % of total national emissions in 2010.

Table 3.8 - NO_x emissions (Gg) by source category for the period 2000 to 2010

Source category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total emissions	31.5	32.6	34.7	35.8	36.0	36.5	35.2	34.6	34.6	35.5	35.2	1.1
Energy	17.5	18.6	20.7	21.8	22.0	22.4	21.1	20.5	20.5	21.5	21.1	2.0
AFOLU	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	-0.03
Waste	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	4.7

3.5.2 CO

The two main contributors of CO were the AFOLU and Energy sectors (Table 3.9). National CO emissions increased by 0.3 % on average during the inventory period 2000 to 2010. In 2010, 75 % of the total CO emissions originated from the AFOLU sector with the Energy sector contributing 23 %. The Waste sector contributed 1.8 % of total CO emissions in 2010 compared to 1.2 % in 2000.

Table 3.9 - CO emissions (Gg) by source category (2000 - 2010)

Source category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total emissions	364.9	365.6	366.9	368.7	371.6	373.1	373.8	375.5	375.6	375.9	375.3	0.3
Energy	70.4	71.6	73.4	75.7	79.2	81.3	82.3	84.6	85.0	85.8	85.6	2.0
Industrial Processes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFOLU	290.2	289.5	288.7	288.0	287.2	286.5	285.8	285.0	284.3	283.6	282.8	-0.3
Waste	4.3	4.6	4.8	5.0	5.2	5.4	5.8	5.9	6.3	6.5	6.9	4.7

3.5.3 NMVOC

In 2010, NMVOC emissions increased by 13 % compared to the 2000 level. The two main emission sources were the Energy and AFOLU (Table 3.10) sectors. NMVOC emissions varied throughout the inventory period for these two sectors. Emissions from the Waste sector increased from 0.2 Gg to 0.4 Gg during the inventory period.

Table 3.10 - NMVOC emissions (Gg) by source category (2000 to 2010)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total emission	19.5	20.6	20.5	20.8	21.2	21.1	21.8	21.9	22.9	23.0	22.0	1.2
Energy	9.4	9.6	9.8	10.1	10.5	10.8	10.9	11.1	11.2	11.3	11.2	1.8
Industrial Processes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFOLU	9.9	10.8	10.4	10.4	10.5	10.0	10.6	10.4	11.4	11.3	10.3	0.5
Waste	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	7.6

3.5.4 SO_2

The energy sector was the main contributor of SO_2 (Table 3.11). Emissions fluctuated during the inventory period 2000 to 2010. SO_2 emission increased from 2.2 Gg in 2000 to 4.2 Gg in 2006 and 2008 and then declined to 2.8 Gg in 2010. Average annual change in the Waste sector was at 4.6 % compared to 3 % for that of the Energy sector.

Table 3.11 - SO_2 emissions (Gg) by source category (2000 - 2010)

Source Category	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Avg. Annual change (%)
Total emission	2.2	2.4	2.8	3.1	3.6	3.8	4.2	4.0	4.2	3.7	2.8	3.0
Energy	2.2	2.4	2.8	3.0	3.6	3.8	4.2	4.0	4.2	3.7	2.7	3.0
Waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	4.6

4. ENERGY

4.1 ENERGY CATEGORY AND SUB-CATEGORIES

1.A. - Fuel Combustion Activities

1.A.1 - Energy Industries

This sub-category is confined to the production of electricity from a mix of liquid and solid fossil fuels. The amount used is however minimal in the energy balance since the country generates a high proportion of its production from hydro and approximately 64 % of Namibia's electrical energy was imported from South Africa, the South African Power Pool (SAPP) and Zimbabwe to meet the demand in 2010. The demand reached a peak of 534 MW in 2012 (*http://africa-energy-forum.com/webfm_send/2013).*

Namibia's total installed electricity generation capacity in 2010 was about 384 MW for a peak demand of some 500 MW. Hydro contributed for about 240 MW out of this. The fossil fuel generation plants are mainly used to supplement the imports and hydro production during peak demand time. Solar and wind potential exists but are tapped only marginally at the moment.

1.A.2 - Manufacturing Industries and Construction

Fossil fuel inputs are primarily used for generating process heat within the mining sector but not intensively. The two main companies imported electricity directly from the neighbouring countries. The construction industry is highly diversified and detailed information was not available.

1.A.3 - Transport

The transport sector comprised domestic aviation, road transportation, railways and domestic water-borne navigation. All four sub-categories have been covered in the inventory as well as fuel combusted for international bunkering.

1.A.4 - Other Sectors

Sub-categories covered under Other Sectors included Residential and Fishing as AD were not available for Commercial/Institutional, Stationary combustion and, Off-road vehicles and other machinery within the Agriculture and Forestry sectors.

The main sources of energy used within the residential sector by households for cooking purposes are wood/charcoal (54 %) and electricity (33 %), the remainder being LPG. The main sources of energy used for lighting are paraffin and waxes (50 %) and electricity (43 %). Nearly 50 % of households utilize wood/charcoal for heating purposes and 30 % have recourse to electricity.

Fishing is an important activity in Namibia with a fleet of 160 fishing vessels (*Ministry of Works and Transport, Maritime Affairs, 2010*) operating out of a registered total of 208. Thus special attention was given to this sub-category to collect AD and make estimates of emissions.

Memo items

International bunkers cover international aviation and navigation according to the IPCC Guidelines. Both activity areas were covered as they consume significant amounts of fossil fuel imported in the country and the emissions have been compiled and reported in this inventory.

4.2 Methodology

It is Good Practice to estimate emissions by the Reference and Sectoral approaches. During this exercise, estimates were compiled using both approaches. The top down Reference approach was carried out using import, export, production and stock change data for making the energy balance of the country. The Sectoral Approach is a bottom up one and generally involves determining fuel consumption from end use data by the different sector source categories and using the IPCC conversion and emission factors to determine GHG emissions. The Sectoral approach covered all the IPCC source categories.
The basic equations used to estimate GHG emissions are given below:

$$\textbf{Emissions}_{GHG\ fuel} = \textbf{Fuel Consumption}_{fuel} \times \textbf{Emission Factor}_{GHG\ fuel}$$

where

Emissions $_{GHG, fuel}$	= emissions of a given GHG by type of fuel (kg GHG)
Fuel Consumption $_{fuel}$	= amount of fuel combusted (TJ)
Emission Factor $_{GHG, fuel}$	= default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO_2, it includes the carbon oxidation factor, assumed to be 1.

4.2.1 Activity Data

AD for working out the reference approach was obtained from the energy database of the NSA on imports and exports of energy products. For the bottom up sectoral approach, AD were sourced from the end-users of fossil fuels. Data on biomass used were derived from data on consumption of different fuels by households collected in the censuses conducted by the NSA. The same approach was used to determine the amount of charcoal used. The data collection covered all solid, liquid and gaseous fossil fuels, fuelwood and charcoal.

AD were not always available and in the format required as well as at the level of disaggregation needed. Gaps were filled using statistical methods such as trend analysis and extrapolation as appropriate. In some cases, fuels had to be allocated or determined according to the activity area such as amount of fuel used in the fishing sector being directly related to fishing vessel campaigns. Fuel use for sectors like agriculture, forestry and institutional amongst others could not be traced and even generated. Thus, fuels from these sectors were eventually allocated in different sectors based on distributed and consumed amounts.

4.2.2 Emission factors

In the absence of national emission factors the greenhouse gas emissions were computed on the basis of IPCC default emission factors (Table 4.1).

Table 4.1 - List of emission factors (kg/TJ) used in the Energy sector

	Emission Factor			Source		
Fuel	**CO_2**	**CH_4**	**N_2O**	**CO_2**	**CH_4**	**N_2O**
Motor gasoline	69300	3.0	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
""	""	3.3	3.2	Vol. 2, table 2.2	Vol. 2, table 2.2.3	Vol. 2, table 2.2.3
""	""	10.0	0.6	Vol. 2, table 3.5.2	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3
Aviation gasoline	69300	0.5	2.0	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Jet kerosene	71500	0.5	2.0	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Other kerosene	71900	10.0	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Gas/Diesel oil	74100	3.0	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
""	""	3.9	3.9	Vol. 2, table 3.2.2	Vol. 2, table 2.2.3	Vol. 2, table 2.2.3
""	""	7.0	2.0	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3
""	""	10.0	0.6	Vol. 2, table 3.5.2	Vol. 2, table 3.5.3	Vol. 2, table 3.5.3
Residual fuel oil	77400	3.0	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Liquefied petroleum gases	63100	5.0	0.1	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Paraffin waxes	73300	10.0	0.6	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Other bituminous coal	94600	1.0	1.5	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
""	""	10.0	1.5	Vol. 2, table 2.2	Vol. 2, table 3.4.1	Vol. 2, table 3.4.1
Waste oils	73300	30.0	4.0	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Wood	112000	300.0	4.0	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2
Charcoal	112000	200.0	1.0	Vol. 2, table 2.2	Vol. 2, table 2.2	Vol. 2, table 2.2

4.2.3 Emission estimates

Reference approach

Comparison of the Sectoral approach (SA) with the Reference approach (RA)

Estimates of emissions of CO_2 made under the RA compared very well with those generated from the SA (Table 4.2). Slightly higher estimates are obtained under the SA for all the years of the period under review. The difference between the two approaches stands at a marginal 0.3 to 0.5 % less for the whole period except for 2000 when it reached 4.7 %. The results are thus very consistent under both approaches.

Table 4.2 - Comparison of the Reference and Sectoral Approaches for period 2000 to 2010 (Gg CO_2)

Approach	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Reference Approach	1812.6	2051.8	2162.6	2345.3	2449.2	2580.2	2678.9	2777.6	2861.0	2867.6	2779.4
Sectoral Approach	1902.2	2061.6	2172.4	2355.4	2459.3	2590.5	2689.3	2788.2	2871.4	2875.9	2793.4
Difference (%)	-4.7	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.5

Sectoral approach

Total aggregated emissions are given in Table 4.3 while the share of emissions by category is depicted in Figure 4.1 below for the five IPCC source categories for the years 2000 to 2010. Total emissions from Fuel Combustion Activities amounted to 1995 Gg CO_2-eq in 2000 and reached 2904 Gg CO_2-eq in 2010.

Table 4.3 - Emissions for Fuel Combustion Activities (Gg CO_2-eq) for period 2000 to 2010

Source of emission	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Fuel combustion activities	1994.8	2156.7	2269.1	2455.1	2561.6	2695.1	2795.5	2896.7	2981.0	2986.2	2904.1
Energy Industries	7.3	9.2	0.5	21.5	2.2	53.9	164.9	196.0	236.9	143.4	35.7
Manufacturing Industries and Construction	79.1	156.5	123.0	157.5	168.7	155.7	165.1	174.4	170.4	179.6	187.8
Transport	1394.0	1442.7	1521.2	1634.4	1770.5	1890.8	1955.9	2076.3	2128.5	2187.0	2255.1
Other Sectors	479.3	510.0	584.4	600.0	576.6	550.9	465.4	405.7	401.4	434.1	384.0
Non-Specified	35.0	38.3	40.0	41.7	43.6	43.8	44.2	44.3	43.8	42.2	41.5

Other sectors: include Residential and Fishing
Non-Specified: includes Special vehicles for transport

Transport contributed the major share of these emissions, between 70 and 78 % for the period 2000 to 2010. Emissions from transport increased by 62 % over these 11 years while that from Other Sectors declined by 20 %, from 479 Gg CO_2-eq in the year 2000 to 384 Gg CO_2-eq in 2010. Emissions from Manufacturing Industries and Construction stayed at around 6 % of the Energy sector emissions. Energy Industries emissions varied widely because local electricity generation is only to supplement import deficits. Emissions hit a maximum of 8 % in 2008.

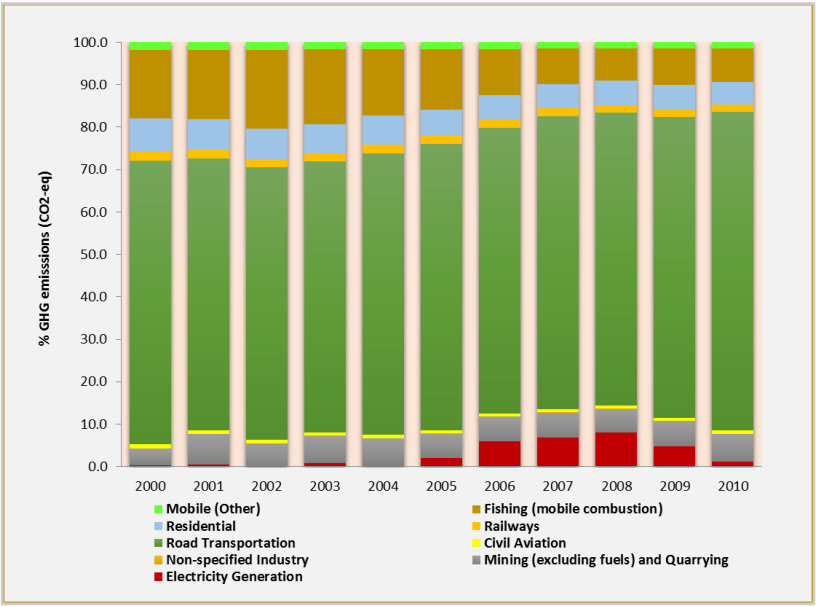


Figure 4.1 - Share of GHG emissions by Energy sub-category for the period 2000 - 2010

From Table 4.4 below, it is clear that of the nine sub-categories, road transport contributed the major share of these emissions, expressed in terms of Gg CO_2-eq, followed by Fishing, Residential and Mining. Emissions from the road transportation sub-category increased from 1334 Gg CO_2-eq in 2000 to reach a peak of 2181 Gg CO_2-eq in 2010.

Table 4.4 - GHG emissions (Gg CO_2-eq) by Energy sub-category for period 2000 to 2010

Fuel Combustion Activities-Energy sub-categories	Emission expressed in CO_2-eq										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy (Total)	1994.8	2156.7	2269.1	2455.1	2561.6	2695.1	2795.5	2896.7	2981.0	2986.2	2904.1
Electricity Generation	7.3	9.2	0.5	21.5	2.2	53.9	164.9	196.0	236.9	143.4	35.7
Mining (excluding fuels) and Quarrying	77.4	154.8	121.4	155.6	166.7	153.8	163.1	172.4	168.4	177.5	185.6
Non-specified Industry	1.7	1.7	1.7	1.9	2.0	2.0	2.0	2.0	2.0	2.1	2.2
Civil Aviation	19.1	19.3	19.5	19.7	19.9	20.1	20.3	20.7	20.5	20.6	22.1
Road Transportation	1333.7	1379.9	1456.0	1566.7	1700.3	1818.1	1881.9	2000.6	2056.7	2116.2	2181.0
Railways	41.2	43.5	45.8	48.0	50.3	52.5	53.7	55.0	51.2	50.2	51.9
Residential	155.2	156.5	163.1	165.4	176.8	166.5	161.5	161.5	176.5	177.3	153.3
Fishing (mobile combustion)	324.1	353.5	421.3	434.6	399.9	384.4	303.9	244.2	224.8	256.8	230.7
Mobile (Other)	35.0	38.3	40.0	41.7	43.6	43.8	44.2	44.3	43.8	42.2	41.5

The evolution in emissions of all gases in the Energy sector is presented in Table 4.5. CO_2 remained the leading gas emitted during the whole period 2000 to 2010 followed by CH_4 and N_2O. Among the indirect gases, CO was the main gas emitted over the whole period of time followed by NO_x and NMVOCs. The emissions increased over time for most gases due to more intense activity.

Table 4.5 - Emissions by gas for the Energy sector for the period 2000 to 2010 (Gg)

GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CO_2	1902.2	2061.6	2172.6	2355.4	2459.3	2590.5	2689.3	2788.2	2871.4	2875.9	2793.4
CH_4	2.9	2.9	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1
N_2O	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
NO_x	17.5	18.6	20.7	21.8	22.0	22.4	21.1	20.5	20.5	21.5	21.1
CO	70.4	71.6	73.4	75.7	79.2	81.3	82.3	84.6	85.0	85.8	85.6
NMVOC	9.4	9.6	9.8	10.1	10.5	10.8	10.9	11.1	11.2	11.3	11.2
SO_2	2.2	2.4	2.8	3.0	3.6	3.8	4.2	4.0	4.2	3.7	2.7

Figure 4.2 - Share emissions by gas (%) for the Energy sector for the period 2000 to 2010

4.2.4 Evolution of emissions by gas (Gg) in the Energy Sector (2000 to 2010)

Within the Energy Category, a constant increase in emissions of CO_2 is observed from 2000 until 2009, with 1902 and 2876 Gg respectively, with an average emission of 2505 Gg over the period. A slight decrease in emissions is observed in 2010. However, nearly a 50 % increase in CO_2 emissions is noted from 2000 to 2010.

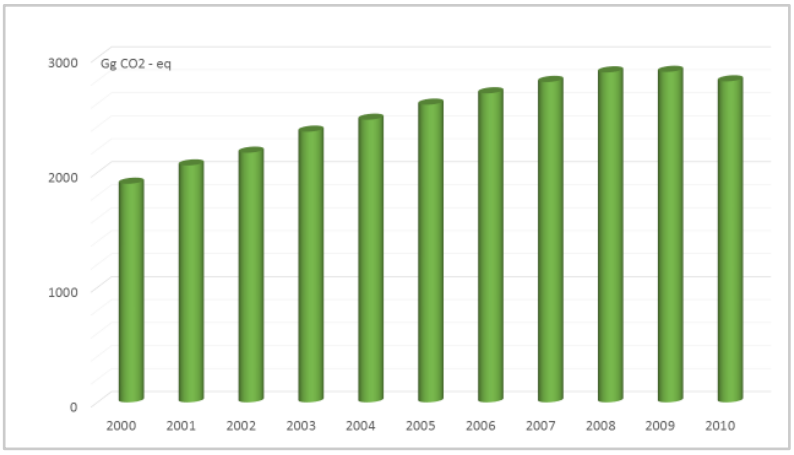


Figure 4.3 - Evolution of CO_2 emissions (Gg) in the Energy Sector for the period 2000 to 2010

With regard to Methane, emissions stood at 2.9 Gg in 2000 compared to 3.1 Gg in 2010 (Figure 4.4), with a gradual increase observed over the inventory period.

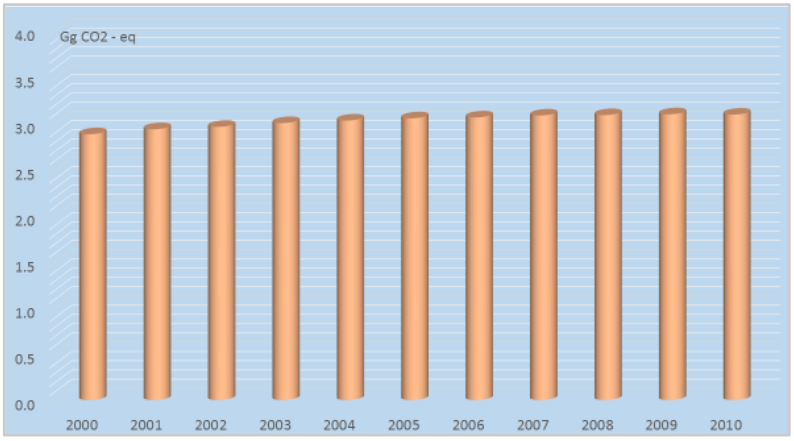


Figure 4.4 - Evolution of CH_4 emissions (Gg) in the Energy Sector for the period 2000 to 2010

Emissions of N_2O increased from 0.10 to 0.15 Gg (Figure 4.5) over the period 2000 to 2010.

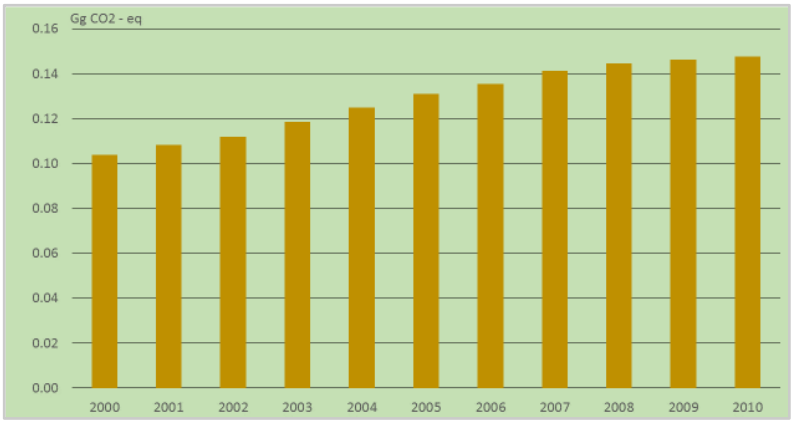


Figure 4.5 - Evolution of N_2O emissions (Gg) in the Energy Sector for the period 2000 to 2010

Emissions of NO_x varied from 17.5 Gg in 2000 to 22.4 Gg in 2005 (Figure 4.6), with the average emissions being 20.7 Gg over the period 2000 to 2010.

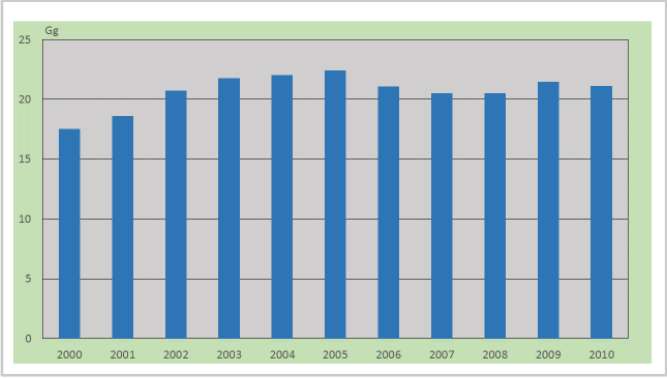


Figure 4.6 - Evolution of NO_x emissions (Gg) in the Energy Sector for the period 2000 to 2010

Emissions of CO averaged 79.6 Gg over the period, starting at 70.4 Gg in year 2000 to reach a peak of 85.8 Gg in 2009, representing a 20 % increase (Figure 4.7).

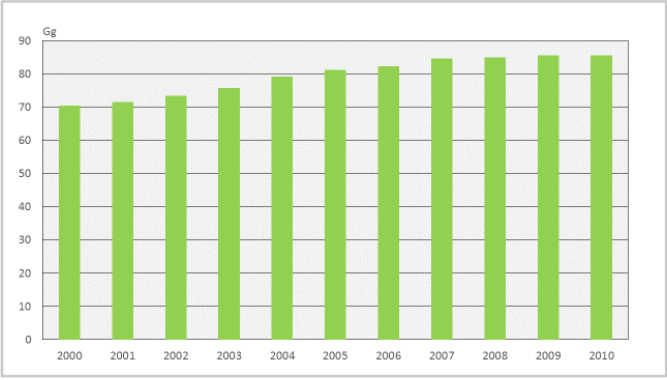
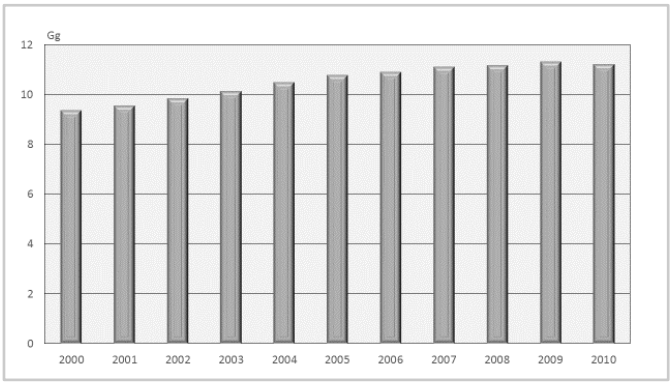
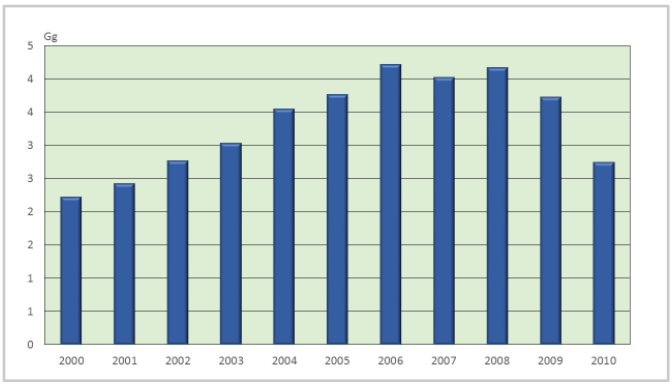


Figure 4.7 - Evolution of CO emissions (Gg) in the Energy Sector for the period 2000 to 2010



NMVOCs emissions increased by nearly 20 % over the inventory period 2000 to 2010, starting at 9.4 Gg in 2000 to 11.2 Gg in year 2010 (Figure 4.8), with the peak in 2009.

Figure 4.8 - Evolution of NMVOC emissions (Gg) in the Energy Sector for the period 2000 to 2010



SO_2 emissions increased from 2.2 Gg in 2000 to reach a peak of 4.2 Gg in 2006, representing a 98 % increase. However, emissions decreased to 2.75 Gg in 2010 (Figure 4.9).

Figure 4.9 - Evolution of SO_2 emissions (Gg) in the Energy Sector for the period 2000 to 2010

Table 4.6 - Energy Sector emissions in 2010

Inventory Year: 2010

	Emissions(Gg)						
Categories	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
1 - Energy	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.A - Fuel Combustion Activities	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.A.1 - Energy Industries	35.5	5E-04	5E-04	8E-02	4E-03	4E-04	0.3
1.A.1.a - Main Activity Electricity and Heat Productio	35.5	5E-04	5E-04	8E-02	4E-03	4E-04	0.3
1.A.1.a.i - Electricity Generation	35.5	5E-04	5E-04	8E-02	4E-03	4E-04	0.3
1.A.2 - Manufacturing Industries and Construction	186.4	2E-02	3E-03	0.7	1.1	0.2	0.9
1.A.2.i - Mining (excluding fuels) and Quarrying	184.2	2E-02	3E-03	0.7	1.1	0.2	0.9
1.A.2.m - Non-specified Industry	2.2	9E-05	2E-05	2E-02	2E-03	8E-04	1E-03
1.A.3 - Transport	2210.4	0.6	0.1	13.9	48.9	5.1	2E-02
1.A.3.a - Civil Aviation	21.9	2E-04	6E-04	5E-02	4.3	7E-02	7E-03
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.a.ii - Domestic Aviation	21.9	2E-04	6E-04	0.1	4.3	7E-02	7E-03
1.A.3.b - Road Transportation	2136.7	0.5	0.1	13.0	44.4	4.9	2E-02
1.A.3.b.i - Cars	507.5	0.2	2E-02	1.6	11.6	1.4	6E-03
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	163.9	7E-02	8E-03	0.5	3.8	0.5	2E-03
1.A.3.b.i.2 - Passenger cars without 3-way catalys	343.7	0.1	2E-02	1.1	7.9	0.9	4E-03
1.A.3.b.ii - Light-duty trucks	928.2	0.3	4E-02	4.1	30.7	3.0	9E-03
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalyst	696.1	0.2	3E-02	3.1	23.1	2.3	7E-03
1.A.3.b.ii.2 - Light-duty trucks without 3-way catal	232.0	8E-02	1E-02	1.0	7.7	0.8	2E-03
1.A.3.b.iii - Heavy-duty trucks and buses	698.7	4E-02	4E-02	7.3	1.7	0.4	2E-03
1.A.3.b.iv - Motorcycles	2.3	1E-03	1E-04	5E-03	0.4	0.1	0
1.A.3.c - Railways	51.8	2E-03	4E-04	0.9	0.2	8E-02	1E-04
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.4 - Other Sectors	320.4	2.5	4E-02	6.0	35.5	5.9	1.5
1.A.4.b - Residential	90.9	2.5	3E-02	0.7	32.2	4.8	9E-02
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	229.5	3E-02	2E-03	5.3	3.4	1.1	1.4
1.A.4.c.iii - Fishing (mobile combustion)	229.5	3E-02	2E-03	5.3	3.4	1.1	1.4
1.A.5 - Non-Specified	40.8	2E-03	2E-03	0.4	0.1	2E-02	2E-04
1.A.5.b - Mobile	40.8	2E-03	2E-03	0.4	0.1	2E-02	2E-04
1.A.5.b.iii - Mobile (Other)	40.8	2E-03	2E-03	0.4	0.1	2E-02	2E-04
1.B.2 - Oil and Natural Gas				0.0	0.0	0.0	0.0
1.B.3 - Other emissions from Energy Production				0.0	0.0	0.0	0.0
1.C - Carbon dioxide Transport and Storage	0.0			0.0	0.0	0.0	0.0

	Emissions(Gg)						
Categories	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
Memo Items (3)							
International Bunkers	252.3	1E-02	7E-03	4.2	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers)	98.1	7E-04	3E-03	0.4	3E-02	2E-02	3E-02
1.A.3.d.i - International water-borne navigation (Interna	154.2	1E-02	4E-03	3.8	0.7	0.2	1.0
1.A.5.c - Multilateral Operations (1)(2)				0.0	0.0	0.0	0.0
Information Items							
CO2 from Biomass Combustion for Energy Production	933.7						

4.2.5 Emissions by gas by category across the period 2000 to 2010

CO_2 emissions

Emissions (Gg) of CO_2 for the years 2000 to 2010 are summarized in Tables 4.7. Total CO_2 emission for the Fuel combustion category increased from 1902 Gg in 2000 to 2876 in 2009 and declined to 2793 Gg in 2010. For the Transport category, CO_2 emissions increased from 1366 Gg in 2000 to peak at 2210 Gg in 2010, whilst for Energy Industries, it increased from 7.3 Gg in 2000, to 235.7 Gg in 2008, and thereafter decreased to 35.5 Gg in 2010. Emissions from the Other sectors sub-category increased from 416 Gg as from the year 2000 up to 2003 to decrease thereafter to 320 Gg. The Non-specified sub-category emissions increased from 34 Gg to 44 in 2007 and declined to 41 by 2010.

Table 4.7 - CO_2 emissions for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	1902.2	7.3	78.4	1366.0	416.0	34.4
2001	2061.6	9.2	155.3	1413.8	445.7	37.6
2002	2172.6	0.5	122.3	1490.8	519.7	39.3
2003	2355.4	21.3	156.3	1601.7	535.1	41.0
2004	2459.3	2.2	167.4	1735.1	511.8	42.8
2005	2590.5	53.6	154.5	1853.0	486.2	43.1
2006	2689.3	164.1	163.8	1916.9	401.0	43.4
2007	2788.2	195.0	173.1	2034.9	341.7	43.6
2008	2871.4	235.7	169.2	2086.1	337.5	43.0
2009	2875.9	142.6	178.3	2143.5	370.1	41.4
2010	2793.4	35.5	186.4	2210.4	320.4	40.8

CH_4 emissions

A total of 3.1 Gg of methane (CH_4) was emitted from the Energy industries category in 2010, followed by 2.5 Gg from the fishing sub-category, within the Other Sectors sub-category, (Table 4.8). Road transportation accounted for 0.55 Gg of emission. Total emissions from the Energy Industries sub-category varied between 0.82 Gg (2000) and 0.0025 Gg in 2010.

Table 4.8 - CH_4 emissions for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	2.9	8.2E-05	9.4E-03	0.37	2.5	1.8E-03
2001	2.9	1.1E-04	1.8E-02	0.38	2.5	2.0E-03
2002	3.0	1.6E-05	1.5E-02	0.40	2.5	2.1E-03
2003	3.0	2.8E-04	1.8E-02	0.43	2.5	2.2E-03
2004	3.0	3.4E-05	1.9E-02	0.46	2.5	2.3E-03
2005	3.0	6.8E-04	1.8E-02	0.49	2.5	2.3E-03
2006	3.1	2.0E-03	1.9E-02	0.50	2.5	2.3E-03
2007	3.1	2.3E-03	1.9E-02	0.53	2.5	2.3E-03
2008	3.1	2.5E-03	1.8E-02	0.54	2.5	2.3E-03
2009	3.1	1.6E-03	2.0E-02	0.54	2.5	2.2E-03
2010	3.1	4.7E-04	2.1E-02	0.55	2.5	2.1E-03

N_2O emissions

Total emissions varied between 0.10 Gg (2000) to 0.15 Gg in 2010 (Table 4.9). In general, the highest emission was noted in the Road transportation sub-category which accounted for 0.11 Gg in 2010 compared to 0.06 Gg in 2000. A total of 0.00053 Gg of N_2O was emitted from the Energy Industries sub-category in 2010, compared to 0.00011 Gg in 2000.

Table 4.9 - N_2O emissions for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	0.10	1.1E-04	0.001	0.06	0.035	1.8E-03
2001	0.11	1.4E-04	0.003	0.07	0.036	2.0E-03
2002	0.11	3.9E-06	0.002	0.07	0.037	2.1E-03
2003	0.12	3.2E-04	0.003	0.08	0.037	2.2E-03
2004	0.12	3.1E-05	0.003	0.08	0.037	2.3E-03
2005	0.13	8.2E-04	0.003	0.09	0.036	2.3E-03
2006	0.14	2.5E-03	0.003	0.09	0.036	2.3E-03
2007	0.14	3.0E-03	0.003	0.10	0.035	2.3E-03
2008	0.14	3.7E-03	0.003	0.10	0.035	2.3E-03
2009	0.15	2.2E-03	0.003	0.10	0.035	2.2E-03
2010	0.15	5.3E-04	0.003	0.11	0.035	2.1E-03

NO_x emissions

Emissions (Gg) of NO_x increased from 18 Gg in 2000 to 21 Gg in 2010, contributed mainly by Transport and Other Sectors (mainly fishing) sub-categories, followed by the Manufacturing Industries and Construction, and Non-Specified sectors (Table 4.10). Emissions from the Other Sectors sub-category increased from 8 Gg in 2000 to 11 Gg in 2003 followed by a decrease of nearly 50 % from 2003 to 2010.

Table 4.10 - NO_x emissions for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	17.5	0.02	0.38	8.4	8.4	0.36
2001	18.6	0.02	0.34	8.7	9.1	0.39
2002	20.7	0.00	0.33	9.2	10.8	0.41
2003	21.8	0.05	0.35	9.9	11.1	0.43
2004	22.0	0.00	0.59	10.8	10.2	0.45
2005	22.4	0.12	0.56	11.5	9.8	0.45
2006	21.2	0.36	0.62	11.9	7.8	0.46
2007	20.5	0.43	0.73	12.5	6.4	0.46
2008	20.5	0.52	0.76	12.9	5.9	0.45
2009	21.5	0.31	0.73	13.3	6.6	0.43
2010	21.1	0.08	0.73	13.9	6.0	0.43

CO emissions

CO emissions originate mainly from the Other Sectors and Transport sub-categories, accounting for nearly 98 % of emissions (Table 4.11). CO emissions for the Energy sector evolved from 70 Gg in 2000 to 86 Gg in 2010, representing a 23 % increase.

Table 4.11 - CO emissions for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	70.4	7.0E-04	0.17	34.7	35.5	0.08
2001	71.6	9.0E-04	0.15	35.3	36.0	0.09
2002	73.4	1.0E-04	0.16	36.8	36.4	0.09
2003	75.7	2.2E-03	0.17	38.9	36.5	0.10
2004	79.2	2.0E-04	1.10	41.4	36.5	0.10
2005	81.3	5.3E-03	0.98	43.4	36.7	0.10
2006	82.3	3.6E-01	1.00	44.6	36.6	0.46
2007	84.6	4.3E-01	0.90	47.0	36.6	0.46
2008	85.0	2.2E-02	0.82	47.4	36.6	0.10
2009	85.8	1.3E-02	0.98	48.0	36.7	0.10
2010	85.6	3.6E-03	1.10	48.9	35.5	0.10

NMVOC emissions

NMVOCs originated mainly from the Other Sectors and Transport sub-categories, accounting for nearly 98 % of emissions (Table 4.12). NMVOCs emissions increased from 9 Gg in 2000 to 11 Gg in 2010 in the Energy sector.

Table 4.12 - Emissions of NMVOCs for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	9.4	1.0E-04	0.07	3.5	5.8	0.02
2001	9.6	1.0E-04	0.07	3.6	5.9	0.02
2002	9.8	0	0.08	3.7	6.0	0.02
2003	10.1	3.0E-04	0.08	4.0	6.1	0.02
2004	10.5	0	0.18	4.2	6.1	0.03
2005	10.8	6.0E-04	0.17	4.5	6.1	0.03
2006	10.9	0.002	0.18	4.6	6.1	0.03
2007	11.1	0.002	0.18	4.9	6.0	0.03
2008	11.2	0.003	0.17	4.9	6.0	0.03
2009	11.3	0.002	0.18	5.0	6.1	0.02
2010	11.2	4.0E-04	0.20	5.1	5.9	0.02

SO_2 emissions

Emissions (Gg) of SO_2 across the time period were more important in the Other Sectors sub-category followed by the Manufacturing Industries and Construction sub-category (Table 4.13). Total SO_2 emissions increased from 2.0 Gg in 2000 to peak at 4.2 in the years 2006 and 2008. Thereafter, emissions decreased to 2.7 Gg.

Table 4.13 - Emissions of SO_2 for the period 2000 to 2010 (Gg)

Year	Total	Energy Industries	Manufacturing Industries and Construction	Transport	Other Sectors	Non-Specified
2000	2.2	0.06	0.03	0.02	2.1	2.0.E-04
2001	2.4	0.08	0.03	0.02	2.3	2.0.E-04
2002	2.8	0.00	0.03	0.02	2.7	2.0.E-04
2003	3.0	0.18	0.03	0.02	2.8	2.0.E-04
2004	3.6	0.02	0.92	0.02	2.6	2.0.E-04
2005	3.8	0.46	0.80	0.02	2.5	2.0.E-04
2006	4.2	1.40	0.81	0.02	2.0	2.0.E-04
2007	4.0	1.67	0.72	0.02	1.6	2.0.E-04
2008	4.2	2.04	0.62	0.02	1.5	2.0.E-04
2009	3.7	1.23	0.78	0.02	1.7	2.0.E-04
2010	2.7	0.30	0.89	0.02	1.5	2.0.E-04

Across the reporting period the share of emissions from the five sub-categories, expressed as a % of total emissions on a CO_2-eq basis, is characterized by the highest emissions from the Transport sub-category, which increased from 70 % in 2000 to 78 % in 2010 (Figure 4.10). Emissions from the Manufacturing Industries and Construction sub-category increased from 4 % in 2000 to 6 % in 2010, whilst the Energy Industries sub-category emissions increased from 0.4 % in 2000 to peak at 8 % in 2008 and thereafter decreased to 1 % of the total.

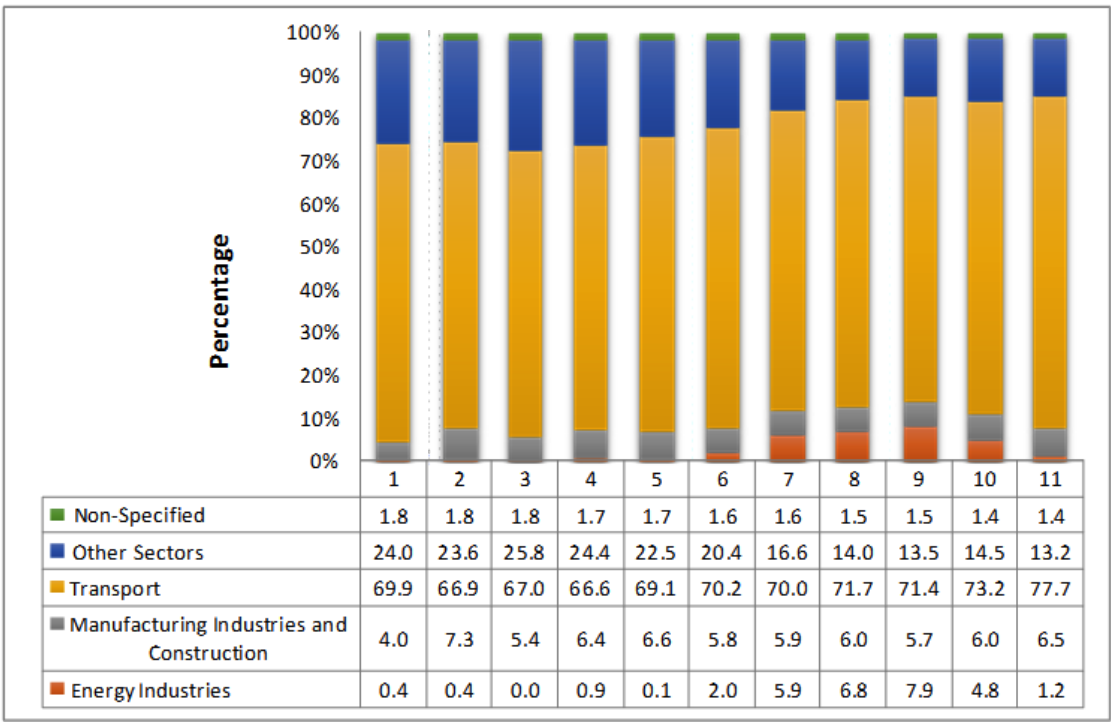


Figure 4.10 - Share of emissions Energy sector sub-categories (CO_2-eq) for the period 2000 to 2010

4.2.5.1 Emissions (Gg) by gas from Energy Generation

Within the Energy Generation sub-category, GHG emissions, in Gg CO_2-eq, increased from 7 Gg in 2000 to reach a peak at 237 Gg in 2008 and then decreased to 36 Gg in 2010 (Table 4.14). The largest share of emission came from CO_2.

Table 4.14 - Emissions (Gg) by gas from energy generation

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	7.3	7.3	1.1.E-04	1.E-04	0.02	7.0.E-04	1.0E-04	0.06
2001	9.2	9.2	1.4.E-04	1.E-04	0.02	9.0.E-04	1.0E-04	0.08
2002	0.5	0.5	3.9.E-06	4.E-06	0.001	1.0.E-04	0	0.003
2003	21.5	21.3	3.2.E-04	3.E-04	0.05	2.2.E-03	3.0E-04	0.18
2004	2.2	2.2	3.1.E-05	3.E-05	0.00	2.0.E-04	0.0E+00	0.02
2005	53.9	53.6	8.2.E-04	8.E-04	0.12	5.3.E-03	6.0E-04	0.46
2006	164.9	164.1	2.5.E-03	3.E-03	0.36	3.6.E-01	1.9E-03	1.40
2007	196.0	195.0	3.0.E-03	3.E-03	0.43	4.3.E-01	2.2E-03	1.67
2008	236.9	235.7	3.7.E-03	4.E-03	0.52	2.2.E-02	2.5E-03	2.04
2009	143.4	142.6	2.2.E-03	2.E-03	0.31	1.3.E-02	1.6E-03	1.23
2010	35.7	35.5	5.3.E-04	5.E-04	0.08	3.6.E-03	4.0E-04	0.30

4.2.5.2 Emissions (Gg) by gas from Mining and Quarrying

Within the Mining and Quarrying sub-category, GHG emissions, expressed as Gg CO_2-eq, increased from 77 Gg in 2000 to peak at 186 Gg in 2010 (Table 4.15), with nearly all emissions (99 %) stemming from CO_2. Emissions increased by 140 % when compared with the year 2000.

Table 4.15 - Emissions (Gg) by gas from the Mining and Quarrying sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	77.4	76.7	9.E-03	1.E-03	0.37	0.2	0.07	0.03
2001	154.8	153.6	2.E-02	3.E-03	0.33	0.1	0.07	0.03
2002	121.4	120.4	1.E-02	2.E-03	0.32	0.2	0.08	0.03
2003	155.6	154.4	2.E-02	3.E-03	0.34	0.2	0.08	0.03
2004	166.7	165.4	2.E-02	3.E-03	0.58	1.1	0.18	0.92
2005	153.8	152.5	2.E-02	3.E-03	0.55	1.0	0.17	0.79
2006	163.1	161.8	2.E-02	3.E-03	0.61	0.6	0.17	0.81
2007	172.4	171.1	2.E-02	3.E-03	0.72	0.7	0.18	0.71
2008	168.4	167.2	2.E-02	3.E-03	0.75	0.8	0.17	0.62
2009	177.5	176.2	2.E-02	3.E-03	0.72	1.0	0.18	0.78
2010	185.6	184.2	2.E-02	3.E-03	0.71	1.1	0.19	0.89

4.2.5.3 Emissions (Gg) by gas from Non-specified Industry

GHG emissions (Gg CO_2-eq) in the Non-specified Industry sub-category (Table 4.16) increased from the year 2000 (1.7) to 2010 (2.2), representing a 30 % increase, with nearly all emissions (99 %) from CO_2.

Table 4.16 - Emissions (Gg) by gas from the Non-Specified Industry sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	1.7	1.7	7.0.E-05	1.4.E-05	1.2.E-02	1.5.E-03	6.0.E-04	1.1.E-03
2001	1.7	1.7	7.0.E-05	1.4.E-05	1.2.E-02	1.5.E-03	6.0.E-04	1.1.E-03
2002	1.7	1.7	7.0.E-05	1.4.E-05	1.2.E-02	1.5.E-03	6.0.E-04	1.1.E-03
2003	1.9	1.9	7.7.E-05	1.5.E-05	1.3.E-02	1.7.E-03	6.0.E-04	1.2.E-03
2004	2.0	2.0	8.3.E-05	1.7.E-05	1.4.E-02	1.8.E-03	7.0.E-04	1.3.E-03
2005	2.0	2.0	8.2.E-05	1.6.E-05	1.4.E-02	1.8.E-03	7.0.E-04	1.3.E-03
2006	2.0	2.0	8.3.E-05	1.7.E-05	1.4.E-02	1.4.E-02	7.0.E-04	1.3.E-03
2007	2.0	2.0	8.3.E-05	1.7.E-05	1.4.E-02	1.4.E-02	7.0.E-04	1.3.E-03
2008	2.0	2.0	8.3.E-05	1.7.E-05	1.4.E-02	1.8.E-03	7.0.E-04	1.3.E-03
2009	2.1	2.1	8.8.E-05	1.8.E-05	1.5.E-02	1.9.E-03	7.0.E-04	1.4.E-03
2010	2.2	2.2	9.1.E-05	1.8.E-05	1.6.E-02	2.0.E-03	8.0.E-04	1.4.E-03

4.2.5.4 Emissions (Gg) by gas from Civil Aviation

The two main gases emitted in the Civil Aviation sub-category were CO_2 (19 Gg in 2000 compared to 22 Gg in 2010) and CO (3.6 Gg in 2000 compared to 4.3 Gg in 2010), with a gradual increase in emissions from 2000 to 2010 (Table 4.17).

Table 4.17 - Emissions (Gg) by gas from the Civil Aviation sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	19.1	18.9	1.3.E-04	5.4.E-04	4.4.E-02	3.6	5.8.E-02	6.1.E-03
2001	19.3	19.1	1.4.E-04	5.4.E-04	4.4.E-02	3.7	5.8.E-02	6.1.E-03
2002	19.5	19.3	1.4.E-04	5.5.E-04	4.5.E-02	3.7	5.9.E-02	6.2.E-03
2003	19.7	19.5	1.4.E-04	5.5.E-04	4.5.E-02	3.7	5.9.E-02	6.3.E-03
2004	19.9	19.7	1.4.E-04	5.6.E-04	4.6.E-02	3.8	6.0.E-02	6.3.E-03
2005	20.1	19.9	1.4.E-04	5.7.E-04	4.6.E-02	3.8	6.1.E-02	6.4.E-03
2006	20.3	20.1	1.4.E-04	5.7.E-04	4.7.E-02	3.9	6.1.E-02	6.5.E-03
2007	20.7	20.5	1.5.E-04	5.8.E-04	4.7.E-02	3.9	6.3.E-02	6.6.E-03
2008	20.5	20.4	1.4.E-04	5.8.E-04	4.7.E-02	3.9	6.1.E-02	6.5.E-03
2009	20.6	20.5	1.5.E-04	5.8.E-04	4.8.E-02	3.9	6.1.E-02	6.6.E-03
2010	22.1	21.9	1.6.E-04	6.2.E-04	5.0.E-02	4.3	6.9.E-02	7.1.E-03

4.2.5.5 Emissions (Gg) by gas from Road Transportation

The Road Transportation sub-category (Table 4.18) sub-category emissions, emitted 1334 Gg CO_2-eq in 2000 compared to 2181 Gg CO_2-eq in 2010. Emissions of NO_x increased from 8 Gg in 2000 to reach 13 Gg in 2010, representing a 70 % increase. CO and NMVOCs emissions increased over the time period, from 31 Gg to 44 Gg for CO and from 3.4 Gg to 4.9 Gg for NMVOCs for the years 2000 and 2010 respectively.

Table 4.18 - Emissions (Gg) by gas from the Road Transportation sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	1333.7	1306.0	0.37	0.06	7.7	30.9	3.4	1.E-02
2001	1379.9	1351.3	0.38	0.07	8.0	31.5	3.4	1.E-02
2002	1456.0	1425.9	0.40	0.07	8.4	32.9	3.6	1.E-02
2003	1566.7	1534.4	0.43	0.08	9.1	35.0	3.8	1.E-02
2004	1700.3	1665.3	0.46	0.08	9.9	37.5	4.1	1.E-02
2005	1818.1	1780.8	0.48	0.09	10.6	39.5	4.3	1.E-02
2006	1881.9	1843.2	0.50	0.09	11.0	40.5	4.5	2.E-02
2007	2000.6	1959.6	0.53	0.10	11.6	42.3	4.7	2.E-02
2008	2056.7	2014.6	0.54	0.10	12.0	43.4	4.8	2.E-02
2009	2116.2	2073.0	0.54	0.10	12.5	44.0	4.9	2.E-02
2010	2181.0	2136.7	0.55	0.11	13.0	44.4	4.9	2.E-02

4.2.5.6 Emissions (Gg) by gas from Railways

Within the Railways sub-category, GHG emissions (Gg CO_2-eq), increased by nearly 25 % over the time period, from 41 Gg in 2000 to 52 Gg in 2010 (Table 4.19), with the largest share of emission from CO_2.

Table 4.19 - Emissions (Gg) by gas from the Railways sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	41.2	41.1	1.7.E-03	3.3.E-04	0.68	0.14	6.1.E-02	1.0.E-04
2001	43.5	43.4	1.8.E-03	3.5.E-04	0.71	0.15	6.4.E-02	1.0.E-04
2002	45.8	45.6	1.8.E-03	3.7.E-04	0.75	0.15	6.7.E-02	1.0.E-04
2003	48.0	47.9	1.9.E-03	3.9.E-04	0.79	0.16	7.1.E-02	1.0.E-04
2004	50.3	50.1	2.0.E-03	4.1.E-04	0.82	0.17	7.4.E-02	1.0.E-04
2005	52.5	52.4	2.1.E-03	4.2.E-04	0.86	0.18	7.7.E-02	1.0.E-04
2006	53.7	53.6	2.2.E-03	4.3.E-04	0.88	0.18	7.9.E-02	1.0.E-04
2007	55.0	54.8	2.2.E-03	4.4.E-04	0.90	0.18	8.1.E-02	1.0.E-04
2008	51.2	51.1	2.1.E-03	4.1.E-04	0.84	0.17	7.5.E-02	1.0.E-04
2009	50.2	50.1	2.0.E-03	4.1.E-04	0.82	0.17	7.4.E-02	1.0.E-04
2010	51.9	51.8	2.0.E-03	4.1.E-04	0.86	0.18	7.7.E-02	1.0.E-04

4.2.5.7 Emissions (Gg) by gas from the Residential sub-category

Emissions in the Residential sub-category (Gg CO_2-eq) increased from 155 in year 2000 to reach a peak of 177 in 2009 (Table 4.20) to decrease to 153 Gg CO_2-eq in 2010. Emissions of NO_x and CO did not change much over the period 2000 to 2010.

Table 4.20 - Emissions (Gg) by gas from the Residential sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	155.2	93.6	2.4	3.3.E-02	0.67	32.9	4.9	9.0.E-02
2001	156.5	94.1	2.5	3.3.E-02	0.67	33.2	5.0	9.1.E-02
2002	163.1	100.7	2.5	3.3.E-02	0.68	33.4	5.0	9.2.E-02
2003	165.4	102.8	2.5	3.3.E-02	0.68	33.4	5.0	9.2.E-02
2004	176.8	114.1	2.5	3.3.E-02	0.68	33.4	5.0	9.2.E-02
2005	166.5	103.9	2.5	3.3.E-02	0.68	33.5	5.0	9.2.E-02
2006	161.5	98.8	2.5	3.3.E-02	0.68	33.5	5.0	9.2.E-02
2007	161.5	98.9	2.5	3.3.E-02	0.68	33.5	5.0	9.2.E-02
2008	176.5	113.8	2.5	3.3.E-02	0.68	33.4	5.0	9.2.E-02
2009	177.3	114.7	2.5	3.3.E-02	0.67	33.4	5.0	9.2.E-02
2010	153.3	90.9	2.5	3.3.E-02	0.65	32.2	4.8	8.9.E-02

4.2.5.8 Emissions (Gg) by gas from Fishing (mobile combustion) sub-category

Total GHG emission from the Fishing sub-category increased from 324 Gg CO_2-eq in 2000 to 435 Gg CO_2-eq in 2003 and then decreased to 231 Gg CO_2-eq (Table 4.21) in the year 2010. The largest share of emissions was CO_2. SO_2 emissions are relatively more important when compared with the other sub-categories. NO_x emissions, as well, increased from 8 Gg to reach a peak of 10 Gg in 2003 before gradually decreasing to 5 Gg in 2010.

Table 4.21 - Emissions (Gg) by gas from the Fishing sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	324.1	322.4	0.04	0.00	7.7	2.6	0.87	2.0
2001	353.5	351.6	0.05	0.00	8.4	2.8	0.93	2.2
2002	421.3	419.0	0.06	0.00	10.1	3.0	1.02	2.6
2003	434.6	432.3	0.06	0.00	10.4	3.2	1.06	2.7
2004	399.9	397.8	0.05	0.00	9.5	3.2	1.06	2.5
2005	384.4	382.4	0.05	0.00	9.1	3.2	1.08	2.4
2006	303.9	302.3	0.04	0.00	7.2	3.2	1.04	1.9
2007	244.2	242.9	0.03	0.00	5.7	3.1	1.02	1.5
2008	224.8	223.6	0.03	0.00	5.2	3.2	1.03	1.4
2009	256.8	255.4	0.03	0.00	6.0	3.3	1.09	1.6
2010	230.7	229.5	0.03	0.00	5.3	3.4	1.10	1.4

4.2.5.9 Emissions (Gg) by gas from Non-Specified subcategory

Emissions from this sub-category are mainly from mobile sources. Total emissions (CO_2-eq) increased gradually from 35 in the year 2000 to peak at 44 in year 2007 (Table 4.22), decreasing thereafter.

Table 4.22 - Emissions (Gg) by gas from the Non-Specified sub-category

Year	CO_2-eq	CO_2	CH_4	N_2O	NO_x	CO	NMVOCs	SO_2
2000	35.0	34.4	1.8.E-03	1.8.E-03	0.36	0.08	2.1.E-02	2.0.E-04
2001	38.3	37.6	2.0.E-03	2.0.E-03	0.39	0.09	2.2.E-02	2.0.E-04
2002	40.0	39.3	2.1.E-03	2.1.E-03	0.41	0.09	2.3.E-02	2.0.E-04
2003	41.7	41.0	2.2.E-03	2.2.E-03	0.43	0.10	2.4.E-02	2.0.E-04
2004	43.6	42.8	2.3.E-03	2.3.E-03	0.45	0.10	2.6.E-02	2.0.E-04
2005	43.8	43.1	2.3.E-03	2.3.E-03	0.45	0.10	2.6.E-02	2.0.E-04
2006	44.2	43.4	2.3.E-03	2.3.E-03	0.46	0.46	2.6.E-02	2.0.E-04
2007	44.3	43.6	2.3.E-03	2.3.E-03	0.46	0.46	2.6.E-02	2.0.E-04
2008	43.8	43.0	2.3.E-03	2.3.E-03	0.45	0.10	2.6.E-02	2.0.E-04
2009	42.2	41.4	2.2.E-03	2.2.E-03	0.43	0.10	2.5.E-02	2.0.E-04
2010	41.5	40.8	2.1.E-03	2.1.E-03	0.43	0.10	2.4.E-02	2.0.E-04

5. INDUSTRIAL PROCESSES AND PRODUCT USE

5.1 Description of IPPU sector

Greenhouse gas emissions are produced in the production process of a wide variety of industrial activities. Emissions arise mainly from industrial processes during the chemical or physical transformation of materials (for example, in the blast furnace in the iron and steel industry, ammonia and other chemical products manufactured from fossil fuels used as chemical feedstock. The cement industry is another notable example of an industrial process that releases a significant amount of CO_2. During these processes, many different greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), can be produced; (IPCC 2006 Guidelines V3_1, Ch 1). Other gases are also emitted in different sub categories, including SF_6 and NMVOC.

Activities occurred in two out of the eight categories regrouped under the IPPU sector and emissions were estimated for these two source categories, namely lime production under mineral industry, and zinc production under metal industry, as well as lubricants and paraffin wax use under non-energy products from fuel and solvents use.

Quite a number of activity areas have not been included as activity data were not available to calculate the estimates. These sources are.

- **Product used as substitutes for ozone depleting substances**
  - Refrigeration and air conditioning
  - Fire protection
  - Aerosols
  - Solvents
- **Other products manufacture and use**
  - Disposal of electric equipment
  - SF_6 in military applications
  - N_2O from medical applications and propellant for pressure and aerosol products.
- **Food and beverage industry**
  - Beer manufacture
  - Bread production
  - Fishmeal production

5.2 Methods

The method adopted is from the IPCC 2006 Guidelines, at the Tier 1 level, due to unavailability of reliable information on the technologies used in the production processes for moving to higher Tiers. Only the three main GHGs CO_2, CH_4 and N_2O were estimated through compilations made in the IPCC 2006 software. Other gases are not emitted in the reported categories.

5.3 Activity Data

Activity data for the IPPU sector were obtained mainly from the NSA. Outputs from the production units and the annual report of the Chamber of Mines were used to supplement the import and export AD from the NSA. All AD from the different sources were compared and quality controlled to identify the most reliable sets which were then used in the software for generating emissions. AD for lubricants and paraffin wax use were derived from the mass balance of import and export data.

5.4 Emission factors

In the absence of information on technology used, all EFs used were IPCC defaults, with those giving the highest emissions adopted as per Good Practice. When the choice was linked to the country's development level, the factor associated with developing countries was adopted. The EFs used for the different source categories are listed in Table 5.1 below.

Table 5.1 - References for EFs for the IPPU sector

Category	IPPC Guideline volume	Table and page
Liming	V3_2_Ch2 Mineral Industry	Table 2.4 Page 2.22
Zinc	V3_4_Ch4 Metal Industry	Table 4.24 Page 4.80
Lubricant	V3_5_Ch5 Non Energy Products	Table 5.2 Page 5.9
Paraffin wax	V3_5_Ch5 Non Energy Products	Chapter 5.3.2.2 Page 5.12

5.5 Results

Total aggregated emissions and estimates by sub-category is given in Table 5.2. Aggregated emissions for the IPPU sector amounted to 25.0 Gg CO_2-eq in the year 2000, increased sharply in 2003 and 2004 when zinc production started and steadily thereafter to reach 302.3 Gg CO_2-eq in 2010. The Metal Industry category then became the highest emitter of this sector and contributed 86.3 % in 2010. Use of paraffin wax followed with emissions ranging between 16.1 to 21.2 Gg CO_2-eq during that period. The remaining two sources are lime production and lubricant use which stood in 2010 at 15.2 and 8.2 Gg CO_2-eq respectively. These represented 2.7 % and 5.0 % of the sector emissions for the year 2010.

Table 5.2 - Aggregated emissions by IPPU source category (CO_2-eq)

SOURCE CATEGORY	GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
TOTAL	CO_2-eq	25.0	24.6	26.3	110.2	235.2	260.3	255.1	294.3	291.1	302.5	302.3
2.A.2 - Lime production	CO_2	7.1	8.3	8.6	9.5	9.7	10.0	10.4	11.2	11.9	13.6	15.2
2.C.6 - Zinc Production	CO_2	0.0	0.0	0.1	81.6	205.0	228.4	223.4	259.4	250.1	258.7	260.9
2.D - Non-Energy Products from Fuels	CO_2	17.9	16.4	17.6	19.1	20.5	21.8	21.2	23.8	29.2	30.3	26.2
2.D.1 - Lubricant Use	CO_2	0.6	0.3	0.2	1.2	0.3	3.7	4.1	6.6	8.8	9.1	8.2
2.D.2 - Paraffin Wax U	CO_2	17.3	16.1	17.4	17.9	20.2	18.1	17.1	17.2	20.4	21.2	18.0

6. AGRICULTURE, FOREST AND OTHER LAND USE (AFOLU)

6.1 Description of sector

The AFOLU sector comprises activities responsible for GHG emissions and removals linked to Agriculture (crops and livestock), changes in land use among and between the 6 IPCC land use categories, soil organic matter dynamics, fertilizer use and management of land categories. Emissions and removals were estimated for activity areas falling under the four IPCC categories of this sector.

Country specific emission and stock factors derived for the country and used in the BUR1 report for the livestock and land categories were adopted while some additional amendments have been made to better represent the land sub-categories within the national context.

Various activities in the AFOLU sector occur in Namibia with different intensities. The country has both commercial and communal systems of production in the livestock and crop sectors. Land use changes due to human activities mainly in forestland, woodland, grassland and cropland were significant contributors to emissions while also acting as sinks.

6.1.1 Emission estimates for the AFOLU sector

Overall, the AFOLU sector remained a net sink over the full inventory period on account of the land sub-category. However, the net removals decreased constantly over this period from 20 394 Gg CO_2-eq in the year 2000 to 4691 in 2010. This is a fivefold reduction on account of deforestation and wood removals notably. Emissions from livestock remained more or less constant while a small increase is observed for aggregate sources and non-CO_2 emissions from land. The land sub-category removed 26 191 Gg CO_2 in 2000 and this potential fell to 10 266 Gg in 2010 (Table 6.1 and Figure 6.1).

Table 6.1 - Aggregated emissions (CO_2-eq) from the AFOLU sector

Source and sink Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
3 - Agriculture, Forestry, and Other Land Use	-20,394.4	-18,449.8	-17,463.5	-15,391.2	-13,618.1	-12,611.4	-10,750.9	-9,295.0	-7,067.3	-5,524.6	-4,691.3
3.A - Livestock	4,513.5	4,598.0	4,390.1	4,477.6	4,419.9	4,172.1	4,367.0	4,309.2	4,819.7	4,785.0	4,181.5
3.A.1 - Enteric Fermentation	4,163.7	4,191.2	4,005.8	4,086.4	4,031.1	3,806.7	3,983.6	3,930.4	4,391.1	4,356.7	3,805.2
3.A.2 - Manure Management	349.8	406.8	384.3	391.2	388.8	365.4	383.5	378.9	428.5	428.3	376.3
3.B - Land	-26,190.6	-24,471.3	-23,233.2	-21,264.1	-19,438.9	-18,133.6	-16,513.2	-14,996.3	-13,372.5	-11,806.5	-10,266.4
3.C - Aggregate sources and non-CO2 emissions sources on land	1,282.8	1,423.5	1,379.7	1,395.4	1,400.9	1,350.1	1,395.2	1,392.0	1,485.5	1,497.0	1,393.5

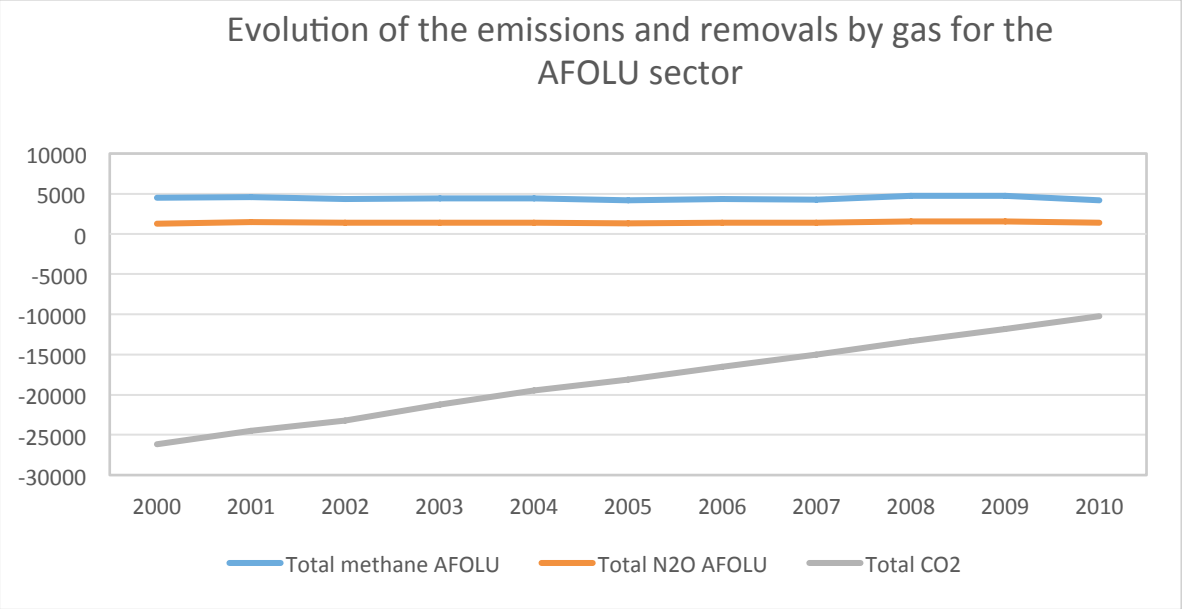


Figure 6.1- Emissions by gas (CO_2-eq) in the AFOLU sector

6.2 Livestock

Livestock rearing is an important activity in Namibia on account of its dry climate. Cattle rearing is the dominant component of the livestock sector followed by the smaller ruminants like goats and sheep. This activity occurs at the commercial and communal levels under different management conditions. Commercial chicken production is in its infancy while farmers are phasing out ostrich farming.

6.3 Methods

Tier 2 level has been adopted for cattle and dairy cows for both enteric fermentation and manure management while Tier 1 has been applied for all remaining animal groups. Available country specific data on live weight, pregnancy and other parameters were collected and used. Missing data were generated as described in the EF section later in this chapter. Derivation of methane EFs were done with the ALU software that uses the same IPCC principles and methods while the computation of nitrogen excretion rates for the different animal groups has been done using an Excel spreadsheet and the formula provided in the IPCC 2006 Guidelines.

6.3.1 Activity Data

Information from the NSA and annual surveys done by the Ministry of Agriculture was used. The data is considered of good quality and the few missing data points were generated using statistical modeling techniques, interpolation or trend analysis. Table 6.2 shows the number of animals for the years 2000, 2005 and 2010.

The number of dairy cows did not vary from 1500 over the full inventory period according to communications from the single dairy farm, Namibia Super Dairies, operating in the country. The remaining cattle in the commercial and communal sector was sub-divided into mature bulls, mature females, mature male castrates, young intact males and young females following a split of respectively 36 %, 4 %, 16 %, 20 % and 24 % based on information from a study on farming practices (NNFU 2006). This split on gender and age was available for communal animals only and assumed to be the same for the commercial sector also in the absence of AD.

Table 6.2 - Number of animals in 2000, 2005 and 2010

	2000	2005	2010
Total cattle	2,504,930	2,219,330	2,389,891
Sheep	2,446,146	2,663,795	1,378,861
Goats	1,849,569	2,043,479	1,690,467
Horses	61,885	47,429	49,852
Mules and asses	167,548	140,291	141,588
Swine	23,148	55,931	63,498
Poultry	476,331	998,278	777,480
Camels	54	63	43

Average live weights for the non-dairy cattle sub-categories have been derived from slaughterhouse data of Meatco Namibia and animals auctioned by group, similar to those adopted for the segregation of the cattle for the inventory purposes. The live weight for dairy cows has been assumed the same as for commercial cows being slaughtered. Daily weight gain was derived from the live weight and age of the different animal groups.

For tier 2 estimations, it is necessary to also assign a typical mature weight for each animal group and these values, for commercial and communal animal groups, were again derived from the weight of animals slaughtered or sold by auction. For dairy and non-dairy commercial cattle, the mature animal weight of 464 kg/head and for communal cattle, a typical mature weight of 451 kg was adopted.

6.3.2 Emission factors

The management of the animals includes the feeding system, daily work, lactation and pregnancy, feeding situation and the manure management system. These factors have an influence on both the enteric fermentation and manure management EFs. The emissions for cattle are calculated following a tier 2 approach as specified by IPCC methodologies reproduced in the ALU software. For the other animal groups, the default factor (1996 IPCC GL, Table 4-3 to 4-5, p. 4.10 -4.12, developing countries) has been used to compute the EFs for enteric and manure methane emissions.

The EFs for enteric and manure CH_4 have been derived with the use of the ALU software while manure N_2O was obtained using the live weights and default nitrogen excretion rates in the IPCC 2006 software. Country specific values were thus calculated for emission estimates.

The datasets enumerated above were used to calculate the maximum methane production capacity for the cattle sub-groups while default EFs from the IPCC 2006 Guidelines were used for the other animal groups.

The feeding situation is based on information available from the census and surveys while manure management system (MMS) for cattle are based on country expert judgment and on information in the farming system guide (NNFU, 2006). Manure from dairy cows was assigned to the liquid slurry MMS while the manure from other cattle sub-categories were subdivided with 50 % under pasture/range/paddock, 49 % as solid storage and 1 % used for construction (assigned to burning in the software as this process does not exist therein). For swine, liquid slurry was the MMS adopted, while for poultry, manure with bedding (60 %) and manure without bedding (40 %) was the case. PRP was assigned as the MMS for the remaining animal groups.

Pregnancy is derived from the number of young females in the population and intact males was allocated a percentage of the cattle population needed for crossing purposes. It is assumed that the young animals are sold annually as there exists no carrying capacity above a critical total number of heads of livestock. Moreover, data available on young animals being sold in auctions supported this assumption, which is further backed by the number of young animals sold, and slaughtered annually.

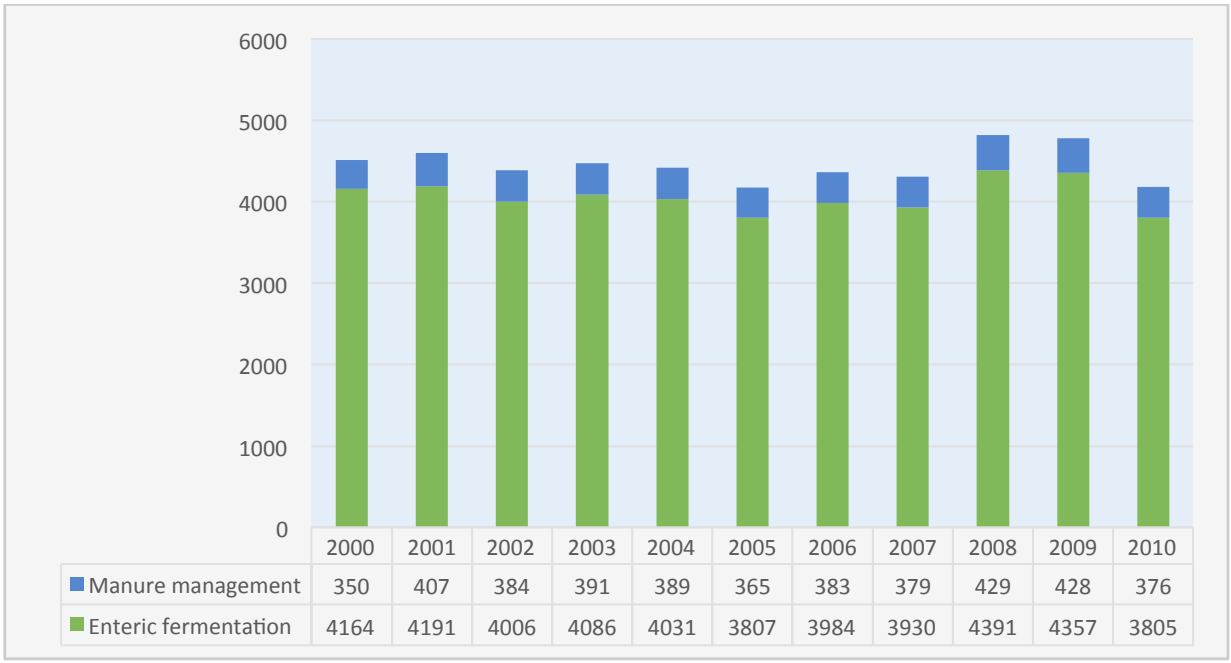
The lactation period of dairy cows is assumed to be over a period of 4 months after birth, based on expert judgment. Therefore lactation was taken as the number of animals pregnant divided by 3 to bring it in line with the animal population on an annual basis.

The digestible energy is taken from IPCC 2006, Chapter 10 annex Table 10A2 for animals in large grazing areas and based on feed characteristics obtained from Feed Master Ltd, the sole company producing feeds in the country for dairy cows.

The average daily work for commercial and communal cattle has been assumed as 6 hours/day for the whole year, based on expert judgment of members of the Namibian GHG inventory team for mature male castrates only, as the other animal groups do not perform any work.

6.4 Results - Emission estimates

Aggregated emission estimates from enteric fermentation and manure management are presented in Figure 6.2.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Manure management	350	407	384	391	389	365	383	379	429	428	376
Enteric fermentation	4164	4191	4006	4086	4031	3807	3984	3930	4391	4357	3805

Figure 6.2 - Emissions from enteric fermentation and manure management of livestock (Gg CO_2-eq)

Enteric fermentation remained the highest contributor to emissions and varied as a function of the number of animals recorded in that year. Enteric fermentation contributed about 4000 Gg CO_2-eq representing about 91 % and manure management the difference.

The evolution of emissions of the three gases methane, nitrous oxide and NMVOCs emitted by the Livestock category is given in Table 6.3.

Table 6.3 - Emissions by gas for Livestock (Gg)

GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CH_4	204.1	206.1	197.0	201.0	198.3	187.3	196.0	193.3	215.9	214.2	187.1
N_2O	0.7	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8
NMVOCs	9.9	10.8	10.4	10.4	10.5	10.0	10.6	10.4	11.4	11.3	10.3

Methane varied in the range 187.3 to 215.9 Gg while nitrous oxide varied between 0.7 and 0.9 Gg. NMVOCS dwindled around 10 Gg annually.

A typical summary report from the software for the emissions for the year 2010 with the contribution from each sub-category and animal group is presented in Table 6.4.

Table 6.4 - Summary of emissions from livestock

Inventory Year: 2010					
Categories	(Gg)				
	Emissions				
	CH4	N2O	NOx	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	198.0	4.6	13.7	282.8	10.3
3.A - Livestock	187.1	0.8	0	0	10.3
3.A.1 - Enteric Fermentation	181.2	0	0	0	0
3.A.1.a - Cattle	163.5	0	0	0	0
3.A.1.a.i - Dairy Cows	0.1				
3.A.1.a.ii - Other Cattle	163.3				
3.A.1.b - Buffalo	0				
3.A.1.c - Sheep	6.9				
3.A.1.d - Goats	8.5				
3.A.1.e - Camels	2.E-03				
3.A.1.f - Horses	0.9				
3.A.1.g - Mules and Asses	1.4				
3.A.1.h - Swine	6.E-02				
3.A.1.j - Other (please specify)	0				
3.A.2 - Manure Management (1)	5.9	0.8	0	0	10.3
3.A.2.a - Cattle	4.8	0.8	0	0	8.6
3.A.2.a.i - Dairy cows	0.1	1.E-03	0	0	1.E-02
3.A.2.a.ii - Other cattle	4.7	0.8	0	0	8.6
3.A.2.b - Buffalo	0	0	0	0	0
3.A.2.c - Sheep	0.3	0	0	0	0.2
3.A.2.d - Goats	0.4	0	0	0	0.9
3.A.2.e - Camels	1.E-04	0	0	0	1.E-05
3.A.2.f - Horses	0.1	0	0	0	0.2
3.A.2.g - Mules and Asses	0.2	0	0	0	0.2
3.A.2.h - Swine	0.1	0	0	0	3.E-02
3.A.2.i - Poultry	2.E-02	7.E-04	0	0	8.E-02
3.A.2.j - Other (please specify)	0	0	0	0	0

6.5 LAND

All lands within the Namibian territory have been classified under the six IPCC land categories and have been treated in this inventory as managed land. Thus, they have all been accounted for in the compilation of emissions and removals. Activities within the six IPCC land classes and between the classes were taken into consideration. Land use has been derived from the land covers attributed on the maps generated from satellite imagery.

The six land categories are:

- 3.B.1 Forestland
- 3.B.2 Cropland
- 3.B.3 Grassland
- 3.B.4 Wetlands
- 3.B.5 Settlements
- 3.B.6 Other land

6.5.1 Methods

Estimation of emissions by source and removals by sink for the LAND sector has been done using Approach 2 with a mix of tier 1 and tier 2 levels. The latter has been applied for the categories falling under LAND as some of these were amongst the key source categories in the last inventory. Most of the stock factors have been derived from past forest inventories data and other available in-country resources.

6.5.2 Activity Data

AD used for the LAND categories are summarized in this section, together with assumptions and sources of information. AD for the land use changes have been generated from geospatial maps produced for two time steps, the years 2000 and 2010, and then annualized as described in more details further down.

Land representation and changes

Maps were generated from LandSat satellite imagery, 30m resolution for the years 2000 and 2010. Both maps provided for the area within the six IPCC land classes. Climate and soil maps of the country were overlaid on the land cover land use maps to generate the combined Climate-Soil-Land classifications according to IPCC requirements.

The data comprised two climate and four soil types, reclassified to fit IPCC climates and soils as follows:

- Tropical Dry (TRD) and Tropical Montane Dry (TRMD)
- High Activity Clay (HAC), Low Activity Clay (LAC), Sandy Mineral (SAN) and Wet Mineral (WET)

Deriving land use from land cover maps using the remote sensing technology has been a major challenge. Some land use changes between classes were not obvious at all such as settlements being converted to Forestland or still Cropland. As these did not reflect the reality, adjustments were made a first time to cater for these inconsistencies as reported in the BUR1. Moreover, some of the areas allocated to some classes did not match with existing data from previous mapping exercises and land surveys. These are still being looked into. This exercise is thus still on-going to further refine land representation from these maps with the objective of raising the quality of future inventories. It is also planned to generate maps for 2005 to evaluate and calculate land use changes over shorter timespans, to further improve accuracy of the inventory, as now land use has been derived over a period of 10 years and then annualized. The initial areas from the maps have been adjusted to be in line with other resources such as annual agricultural surveys that are done to determine the extent under cultivation

for food security purposes and to remove inconsistencies mentioned previously. Initial areas for the years 2000 and 2010 and annual change used in land matrices are given in Table 6.5.

Table 6.5 - Total land use adjusted area and annual change used in land matrix

Land Type category	Area (ha)			
	Year 2000	Year 2010	Annual gain	Annual loss
Forestland	8,404,206	6,791,276	321,475	482,768
Cropland	403,178	283,818	23,067	35,003
Grassland	60,731,438	62,463,728	306,489	133,260
Wetlands	657,613	657,613	-	-
Settlements	31,163	31,163	-	-
Other land	11,682,154	11,682,154	-	-

It was not possible to account for land use changes in Wetlands, Settlements and Other Land categories because of the mapping issues previously mentioned. Furthermore, due to the mapping inconsistencies mentioned previously, it was assumed that no changes between the land type categories in the minor soil types by climate combinations TRDLAC, TRDWET, TRMDHAC and TRMDSAN which represent altogether less than 3 % of the territory for this inventory series and in the recalculations of the 2010 inventory.

Deforestation

The deforestation rate from the initial maps was estimated to be 275 703 ha annually and such a rate will result in no more forest existing in the country within a decade or even less when considering the use made of forests by the communities. A QC exercise done with the areas and deforestation rates from the FAO database revealed the incorrectness of the maps. Adjustments were made to the initial areas and a more realistic deforestation rate of 161 293 ha/year was obtained. This rate is still high compared to FRA 2010 report where deforestation rate is estimated at 74 000 ha/year. Nevertheless, it is still considered sustainable, and was thus adopted for the purpose of this inventory pending reviewed maps with better estimates of areas and land cover.

Forest land stratification

Forests were divided in two sub-categories and the definitions adopted for the interpretation of the maps are provided below:

- Forest-Forests (FL): tree height of 5 m and a canopy cover of more than 20 %; and
- Forest-Woodlands (WD): tree height of 5 m and a canopy cover between 10 % and 20 %.

The forest category is further subdivided by age classes using non-spatial datasets. It was calculated from the forest inventories that 45 % of the trees are <20 years and 55 % are >20 years. These age classes have been derived on the basis of the diameter at breast height (dbh) of the most abundant species (Mendelson and Obeid, Forests and woodlands of Namibia, 2007). Based on this, the area of forestland was classified as 45 % less than 20 years and the remainder more than 20 years. For woodland the area was classified as 40 % less than 20 years and the remainder more than 20 years on a similar basis.

Description of growth rates

In Namibia fuel wood is harvested in forestland and grassland and comprises live and deadwood. For the inventory it was assumed that 20 % of the total fuelwood is collected deadwood (expert knowledge). Deadwood has not been accounted for in this inventory estimates because only emissions

from the living biomass pool are considered whereas deadwood is a constituent of the litter pool. For the remaining 80 % fuel wood, 100 % removal has been allocated to forestland, which included biomass from grassland since no wood removal can be applied in the Grassland sub-category in the 2006 IPCC software. Fuelwood collection is assumed to occur only in the climate and soil combinations TRDHAC and TRDSAN where the communities usually have recourse to this activity. A density of 0.7 t dm/m3 for fuelwood was used. BCEF default values provided in the IPCC table (Vol 4, chapter 04, p 4.51) has been used, namely 0.89 for growing stock level of 41-60 m^3, 2.11 for 21-40 m^3 and 5.55 for 10-20 m^3.

Fuelwood, including charcoal and timber removal volumes have been calculated from data obtained in censuses made by the NSA and from other reports. The volume of fuelwood was calculated from the amount used by households in the rural and urban areas (NHIES main report 2009-2010 from NSA) and fuelwood production (woodchips in Namibia). Charcoal exported was estimated from the mass balance of imports and exports, plus a fixed national consumption of 8000t from 2000 to 2002, 9000 t from 2003 to 2005 and 10 000 tons onwards annually over the inventory period (2000 - 2010). Volume of poles, representing timber harvested, was based on the report on low cost dwellings in Namibia (Iteaa M, 2010) to calculate use per household, frequency as well as the amount used for kraals in relation to the number of households from the NHIES report.

Timber is harvested especially in the North of the country in forest and woodland areas. Collection of timber is assumed to only occur in woodland aged more than 20 years in the ratio 75:25 in the climate and soil combinations TRD HAC and TRD SAN since it is associated with the rural population in the north, mainly where TRD HAC occurs.
Figure 6.3 gives an overview of the final volumes extracted from forestland and woodland for fuelwood and poles.

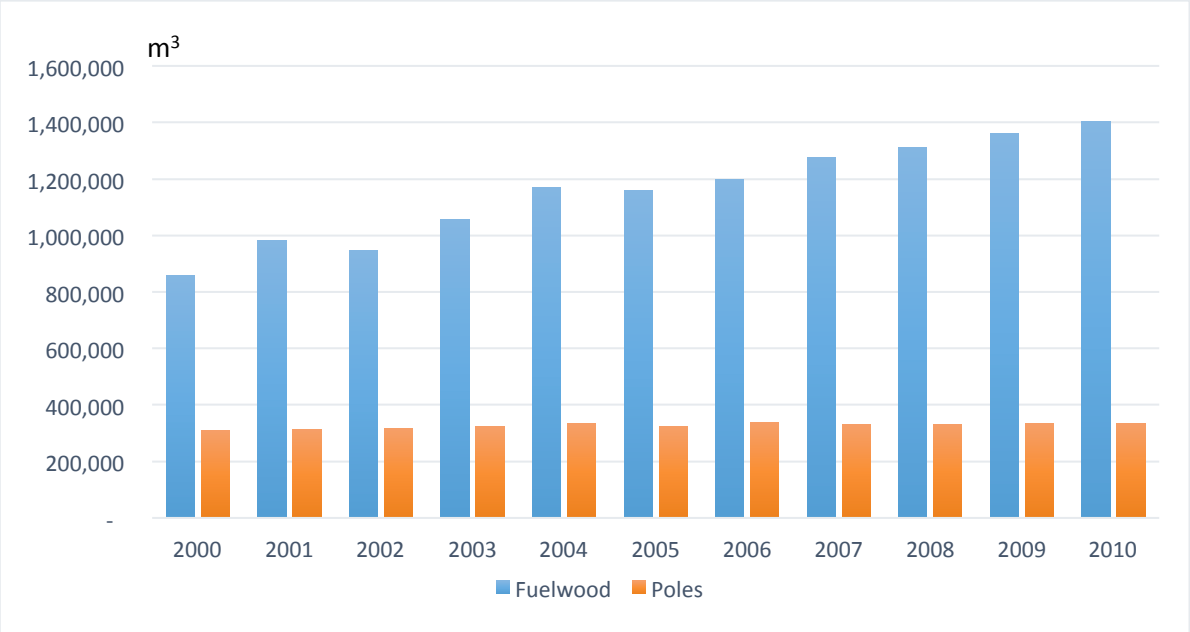


Figure 6.3 - Volume of woody biomass removed from forestland and woodland

Cropland stratification

Cropland areas were not stratified and the total area was considered as Annual Cropland since perennial crops cover a marginal area of total cropland, about 0.001 % only. The annual crop management systems assessed are wheat, millet, sorghum, and maize grown under commercial and communal set-

ups. Stock factors for annual cropland are derived on the basis of management practices of the individual crops under these two systems.

Area

Cropland area was overestimated from the maps, when compared to annual surveys undertaken for food security purposes by the Ministry of Agriculture and Water Affairs and Forestry. Thus, the areas from the surveys were adopted for the yearly inventory, along with the information on the specific crop cultivated. The annual crop survey revealed that about 50 % of the area, attributed to cropland from the maps, is not cultivated. Therefore, this area was accounted as set aside in the BUR1 inventory. The carbon sequestration by this cropland set aside was creating an overestimation of the sink capacity of the country. Thus, the area of cropland set-aside was further reduced by transferring 250 000 ha to the Other Land category in the land matrix. It has been assumed that most of the managed annual cropland are located in the soil climate-combinations HAC and SAN under TRD as it is known that these are the regions where agricultural activity takes place. Therefore, 50 % of the cropland area has been assigned to each stratum.

Grassland stratifications

Grassland, which was sub-divided into three sub-categories in the BUR1 inventory, was considered as a single land category after merging the three sub-categories. Woody biomass present on the part of the territory (shrubland) was averaged on the whole grassland area when computing estimates.

Wetlands stratification

The wetlands have not been further subdivided. It was also assumed that there was no change in this land category over the inventory period.

Settlements stratification

This land also has not been further subdivided. It was also assumed that there was no change in this land category over the inventory period.

Other Land stratification

This land was further subdivided into bare land, rock outcrops and desert sand. For the purpose of this inventory, these sub-classes were not taken into consideration as there is no activity leading to emissions or removals there. It was also assumed that there was no change in this land category over the inventory period.

6.5.3 Emission factors

This section describes how emission and other stock factors have been analyzed, screened, adopted and generated so as to be representative of circumstances of Namibia. Where an EF is not country specific, the most appropriate default value contained in the IPCC 2006 software or Guideline has been used.

Above ground biomass stock and growth

Forestland

The above ground biomass stock (Bm) (t dm/ha) and annual growth rate (Iv) (m^3/ha/year) in forests was estimated for:

- Forests younger than 20 years;
- Forests older than 20 years;
- Woodland younger than 20 years; and
- Woodland older than 20 years.

No below ground biomass (BGB) has been derived, and the default ratios between Bm and BGB has been taken from the IPCC 2006 Guidelines.
Namibia conducted an extensive assessment of its woody biomass resources, towards sustainable use of biomass by the country, during the period 2000 to 2006. Thirteen regions of the country were covered and inventories of woody biomass made. The method was the one usually adopted for making National Forest Inventories (NFI) whereby all trees with a dbh exceeding 5cm are counted for estimating woody biomass. All the trees were inventoried, by species and whether live or dead. The dbh of each tree, for all species and number of trees, was used to derive volume in the inventoried area and then brought to a per hectare basis.

Two regions, Okongo and Oshikoto were also characterized for their landcover under sub-classes Forest, Closed Woodlands, Open Woodlands, Thicket, closed Shrubland and Bushland. Above ground biomass (equation below) was then derived by multiplying the growing stock volume by the weighted average density of all species calculated from data from the NFI of Okongo forest as the dominating species are not very different in the country. Wood density was obtained from the Global Wood Density Database of Zanne *et al.* (2009) and the density of *Acacia flechii* was taken from the African wood density database (Local data for wood density ref No. 16a. http://cdm.unfccc.int/filestorage/. (ICRAF species switchboard, 2013). The average density has been computed as 0.7 t dm/m^3.

Bm (t dm/ha) = Growing Stock (m^3/ha) x Density (t dm/m^3)

Then, the above ground biomass for each age class was calculated by using a default ratio of BM>20 years/Bm<20 years of 70/30, taken from table 4.8, tropical dry forest plantation ratio for young and aged trees, and the distribution of species by dbh class. It was calculated that 45 % of the trees are <20 years and 55 % are >20 years. The Bm for forest with age <20 year was estimated at 21.44 t dm/ha and Bm for forest with age >20 year at 50.03 t dm/ha. The above ground biomass excluded herbaceous biomass. The age classes have been derived from the dbh distribution (Mendelsohn, 2007).

The biomass growth rate was estimated on the basis of the individual above ground biomasses divided by the average age for each class. These were then adjusted to account for woody biomass increase from the Grassland class. Woody biomass in grassland was estimated at 6.88 t dm on 14 M ha of shrubland and averaged over the whole grassland area. Harvest of the invasive bush was calculated for 2010 for charcoal and fuelwood use and this area was estimated to be the average yearly value harvested. From previous records, an average of 300 plants was left out of 3800 present. Regrowth of the invasive bush was estimated to occur on those harvested areas during ten years for plants to reach maturity, while a reduced growth rate over 20 years was maintained over the remaining area. For herbaceous biomass an estimation of 2 t dm/ha has been taken. A summary of Bm and Iv used for forests and woodlands in the inventory is given in Table 6.6.

Table 6.6 - Above ground biomass and growth rate by tree age classes

Sub-category	Above ground Biomass (t dm/ha)	Iv (t dm/ha/year)	Adjusted Iv (t dm/ha/year)
Forest <20y	21.44	2.14	3.18
Forest >20y	50.03	0.90	1.94
Woodlands <20	12.97	1.80	2.84
Woodlands >20	42.08	1.17	2.21

Saplings	2.00	NA	NA
Herbaceous biomass	2.00	NA	NA

Cropland

Since there are only annual crops, no woody biomass growth factors have been assigned.

Grassland

Stock factors for grassland are shown in Table 6.7.

Herbaceous biomass is taken as 2.3 t dm/ha, which is the IPCC default for grasslands. The Bm after conversion for the same year has been assumed different from the IPCC default, that is 0 t dm/ha. After conversion woody biomass is 0.18 t dm/ ha and herbaceous biomass is 2.0 t dm/ ha.

Table 6.7 - Above ground biomass for grassland (t dm/ha)

	Bm woody	Bm herbaceous	Bm woody after conversion	Bm herbaceous after conversion
Grassland	2.40	2.3	0.18	2.00

Similarly as for woody biomass stocks, annual increments cannot be accounted for in the IPCC 2006 software under Grassland remaining Grassland. All trees and woody biomass in grasslands are assumed to be between 8 and 30 years old. Annual growth of woody biomass in grasslands is derived by dividing the standing stock by the average age calculated from the forest inventory. The annual growth of shrubland was based on an annual average age of 10 years because of the regular harvest for making charcoal and providing fuelwood. Based on this, a fixed value of 1.04 t dm/ha/yr was added to the growth rate of forestland and woodland to account for this woody grassland biomass.

Disturbances

In the category forest land remaining forest land, a total of 3 % of the area is burned through disturbance every year with a fraction of biomass loss of 10 % lost based on documents published by the department of forest on burnt areas determined from scars from MODIS data. The grass layer present is also estimated to be lost through burning. The same 3 % area burned has been estimated for grassland and the herbaceous layer only is considered to be affected.

Table 6.8 - Biomass amounts burned in the different land categories and subcategories.

Land categories	Biomass (t bm/ha) lost through fire
Forestland less than 20 years	4.14
Forestland more than 20 years	6.00
Woodland less than 20 years	3.30
Woodland more than 20 years	5.21
Grassland	2.00

Management factors

For forestland, no management has been accounted for. Therefore, the land use management and input stock factors are taken as 1.

The grassland stock factors have been taken respectively as 1 and 0.67 to reflect the national status of moderate degradation obtained from expert judgement.

For croplands, the land use stock factor is 0.58 and the management and input factor is 1. For set aside, factors adopted are respectively 0.93 and 1.17 for the land use and management, and input.

Emissions and removals estimates

Estimates of emissions and removal for the LAND sector is depicted in Table 6.9. In 2010, the LAND sector acted as a net sink, with a total net removal of 10 266 Gg of CO_2. Forestland acted as a sink for 28 429 Gg CO_2 while Grassland emitted 17 999 Gg and Cropland 163 Gg. Over the inventory period 2000 to 2010, the sink capacity of forests decreased by some 16 000 Gg CO_2 from 44 204 to 28 429.

Table 6.9 - Emissions (CO_2) for the FOLU sector for period 2000 to 2010

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
3.B.1 - Forest land	-44,204	-42,386	-41,112	-39,336	-37,553	-36,213	-34,663	-33,036	-31,520	-29,960	-28,429
3.B.2 - Cropland	14	-84	-120	73	115	81	151	41	148	155	163
3.B.3 - Grassland	17,999	17999	17,999	17,999	17,999	17,999	17,999	17,999	17,999	17,999	17,999
Total net	-26,191	-24,,471	-23,233	-21,264	-19,439	-18,134	-16,513	-14,996	-13,372	-11,807	-10,266

The summary of results from the software output is provided in Table 6.10.

Table 6.10 - Emissions and removals from the land category for 2010

Inventory Year: 2010						
Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
		CH4	N2O	NOx	CO	NMVOC
3.B - Land	-10266.4	0	0	0	0	0
3.B.1 - Forest land	-28428.6	0	0	0	0	0
3.B.1.a - Forest land Remaining Forest land	-27362.6					
3.B.1.b - Land Converted to Forest land	-1066.0	0	0	0	0	0
3.B.1.b.i - Cropland converted to Forest Land	-7.3					
3.B.1.b.ii - Grassland converted to Forest Land	-1058.7					
3.B.2 - Cropland	163.1	0	0	0	0	0
3.B.2.a - Cropland Remaining Cropland	-55.7					
3.B.2.b - Land Converted to Cropland	218.7	0	0	0	0	0
3.B.2.b.i - Forest Land converted to Cropland	97.1					
3.B.2.b.ii - Grassland converted to Cropland	121.6					
3.B.3 - Grassland	17999.1	0	0	0	0	0
3.B.3.a - Grassland Remaining Grassland						
3.B.3.b - Land Converted to Grassland	17999.1	0	0	0	0	0
3.B.3.b.i - Forest Land converted to Grassland	18049.3					
3.B.3.b.ii - Cropland converted to Grassland	-50.2					
3.C - Aggregate sources and non-CO2 emissions sourc	8.E-02	10.9	3.8	13.7	282.8	0
3.C.1 - Emissions from biomass burning	0	10.9	0.8	13.7	282.8	0
3.C.1.a - Biomass burning in forest lands		4.5	0.2	2.9	102.5	
3.C.1.b - Biomass burning in croplands						
3.C.1.c - Biomass burning in grasslands		6.4	0.6	10.8	180.3	
3.C.3 - Urea application	8.E-02					
3.C.4 - Direct N2O Emissions from managed soils (3)			1.0			
3.C.5 - Indirect N2O Emissions from managed soils			1.2			
3.C.6 - Indirect N2O Emissions from manure management			1			
3.D - Other	0	0	0	0	0	0

6.6 Aggregated sources and non-CO_2 emission sources on land

6.6.1 Description of category

Aggregated sources and non-CO_2 emissions on land in Namibia covered all the IPCC categories, namely

- 3.C.1 Biomass burning;
- 3.C.4 Direct emissions from managed soils;
- 3.C.5 Indirect emissions from managed soils; and
- 3.C.6 Indirect emissions from manure management.

6.6.2 Methods

Methods are according to the IPCC 2006 Guidelines and the 2006 IPCC Software has been used to compute emissions for this sub-category.

6.6.3 Activity data

The activity data are those adopted for computing direct emissions for the land and livestock categories, which have been used by default by the software to aggregate emissions from different sources. AD for fertilizers and urea are from the mass balance of imports and exports data from the NSA. N content of a few fertilizers have been assumed in relation with the cultivated crops of the country to arrive at total N for computing N_2O emissions.

6.6.4 Emission factor

All biomass burning was estimated to occur because of wildfires. Default EFs were used for all gases in forestland including woodland and grassland burning except for the combustion factor in forestland and woodland that was considered as 0.85.

Default EFs were used for estimating emissions from urea application as well as for estimates of indirect emissions from managed soils and manure management.

6.6.5 Emissions estimates

Aggregated emissions for aggregate sources and non-CO_2 emissions on land (Table 6.11) varied between 1283 for the year 2000 to 1394 for 2010 with peaks at about 1497 for 2008 and 2009. It is considered that there has been no real increase or decrease in emissions in this category as estimates are related to activity that witnessed no major change during the inventory period.

Table 6.11 - Aggregated emissions (Gg) for aggregate sources and non-CO_2 emissions on Land

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1283	1423	1380	1395	1401	1350	1395	1392	1486	1497	1394

Emissions by gas are given in Table 6.12. The major gas emitted in this category remained CH_4 throughout the period followed by N_2O. Carbon dioxide emission was minimal for all years.

Table 6.12 - Emissions (Gg) by gas for aggregate sources and non-CO_2 emissions on Land

Gas	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CO_2	0.5	3.0	2.1	0.9	0.6	0.2	0.1	0.3	0.1	0.2	0.1
CH_4	11.3	11.2	11.18	11.14	11.1	11.1	11.0	11.0	11.0	10.9	10.9
N_2O	3.4	3.8	3.7	3.7	3.8	3.6	3.8	3.7	4.1	4.1	3.8

7. WASTE

7.1 Description of Sector

In Namibia, solid waste is generated by domestic, industrial, commercial and agricultural activities whereas waste water is generated mostly through domestic, industrial and commercial activities. As in other countries, waste generation is directly related to population growth, industrialization rate and urbanization trend, the latter being an important impacting factor. Greenhouse gas emission in the waste sector is also affected by the type of disposal mechanisms as well as the level of management exercised.

During the period under review, the waste categories from which emission data were captured were as follows:

- 4.A.3 - Solid Waste Disposal;
- 4.C.2 - Open Burning of Waste;
- 4.D.1 - Domestic Wastewater Treatment and Discharge; and
- 4.D.2 - Industrial Wastewater Treatment and Discharge.

Disposal of domestic waste/garbage

The following changes were noted with respect to the disposal of domestic waste/garbage during the period 2000 to 2010 (Table 7.1):

- The percentage of households having recourse to waste burning increased from 18.0 % to 37.8 %. This trend was more marked among the rural population where waste burning increased from 27.9 % to 66.1 % as compared with the increase from 2.8 % to 8.6 % for urban households. This gain in importance of waste burning may be explained by the fact that fewer households practiced roadside dumping combined with a decrease in the use of rubbish pits over the same period as reported below.
- Waste / Garbage collection has been improved since in 2010 waste collection was done on a regular basis for 37.2 % of Namibian households as compared with 30.9 % ten years back. Conversely, the number of households which were serviced in an irregular way decreased from 11.5 % to 5.2 % over the same period.
- Roadside dumping of waste / garbage decreased from 14.7 % to 8.9 % at country level. The trend was more marked in the rural regions where the percentage of household dumping waste / garbage decreased from 17.6 % to 10.4 % as compared with the urban region where it declined from 10.3 % to 7.4 %.
- The use of rubbish pits decreased from 20.3 % to 9.5 % at country level, the rate for both urban and rural regions being roughly similar.

Table 7.1 - Waste garbage disposal for years 2001 and 2010 partitioned between urban and rural areas

Means of waste / garbage disposal	2001	2010	2001	2010	2001	2010
	Namibia		Urban		Rural	
Irregularly collected	11.5	5.2	11.3	8	11.7	2.4
Regularly collected	30.9	37.2	65.3	70.6	8.4	4.8
Burning	18.0	37.8	2.8	8.6	27.9	66.1
Roadside dumping	14.7	8.9	10.3	7.4	17.6	10.4
Rubbish pit	20.3	9.5	8.6	5.1	28	13.9
Other	4.6	1.4	1.7	0.3	6.5	2.4

The relative importance of waste disposal methods between urban and rural populations is illustrated in Figure 7.1.

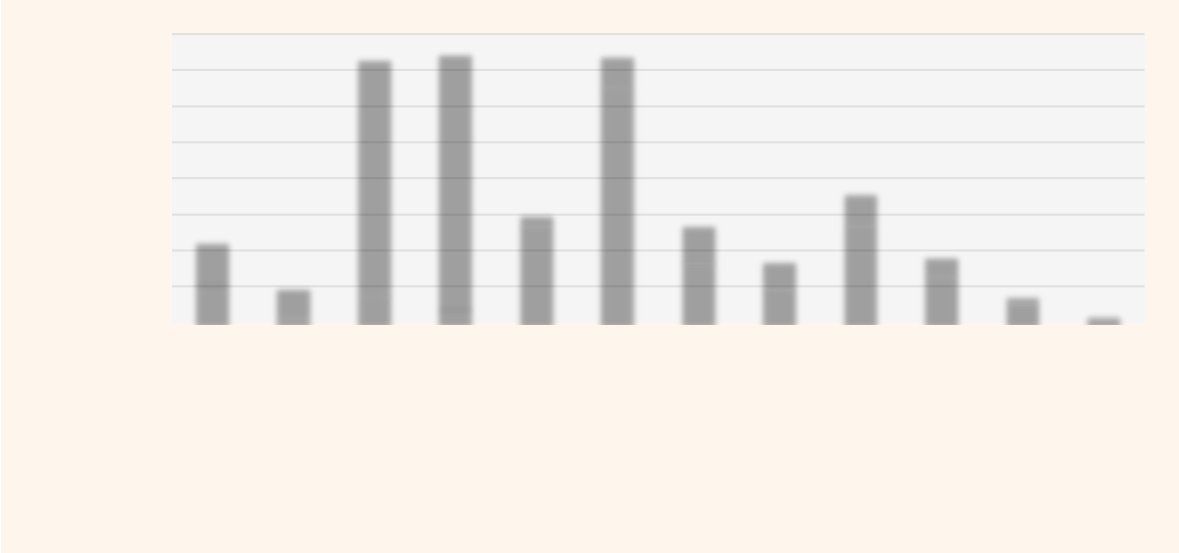


Figure 7.1 - % distribution of households by means of waste/garbage disposal

Uncategorised Waste Disposal Sites and Open Burning of Waste

There are three landfill sites in the country, one at Kupferberg in the Khomas region for the disposal of general and hazardous waste generated within the City of Windhoek area of jurisdiction, and two in the region of Erongo which receive waste from Swakopmund and Walvis Bay. The remaining collected solid waste is disposed of in open dump sites

7.1.1 Domestic Wastewater Treatment and Discharge

At the country level, a notable fact is that 48.6 % of the population does not have any toilet facility. All regions confounded, 36.5 % of the population is connected to a sewer system, 3 % dispose of waste water systems via septic tanks/ cesspools and 9.3 % use pit latrines.

Table 7.2 - Percent distribution of household by type of main toilet facility

Type of toilet facility	Namibia		Urban		Rural	
	2001	2011	2001	2011	2001	2011
Private Flush Connected to Sewer	22.5	24.8	47.5	44.4	6.1	5.8
Private Flush Connected to Septic/Cesspool		1.6		1.4		1.9
Shared Flush Connected to Sewer	11.9	11.7	25.0	21.2	3.4	2.5
Shared Flush Connected to Septic/Cesspool		1.4		1.7		1.1
Pit Latrine with Ventilation Pipe	2.0	4.3	2.1	3.6	2.0	4.9
Covered Pit Latrine without Ventilation Pipe	7.0	3.2	5.7	2.2	8.1	4.2
Uncovered Pit Latrine without Ventilation Pipe		1.8		1.4		2.2
Bucket Toilet	1.5	1.8	1.6	1.3	1.5	2.3
No Toilet Facility / Bush	54.2	48.6	17.4	22.4	78.3	74.0
Other	0.3	0.7	0.5	0.4	0.2	1.0
Households	346,839	464,839	136,909	228,955	209,546	235,884
Population	1,830,330	2,064,489	603,612	872,448	1,226,718	1,192,041

Source: Namibia 2001 Population and Housing Census Main Report

7.1.2 Industrial Wastewater Treatment and Discharge

Industrial waste water of relevance to greenhouse gas emissions originates mainly from such activities as fish processing, slaughter houses, meat conditioning, tanneries and breweries. On account of unavailable data, only the meat sector is covered in this inventory.

7.2 Methodology

GHG emissions originating from the Waste Sector were estimated following a Tier 1 methodological approach as per the IPCC 2006 Guidelines for National Greenhouse Gas Inventories and compiled using the IPCC 2006 software.

7.3 Activity Data

7.3.1 Solid waste

Data from municipal councils coupled with population census statistics were first used to estimate solid waste generation for "high-income" urban and "low-income" urban regions for 2010. The need for this categorization has been prompted by the sustained and significant population migration from rural to urban regions with the emergence of fast expanding suburbs to the main cities where the dwellers lifestyle is of the urban type with a relatively lower purchasing power.

Estimates of solid waste generation for rural regions for 2010 were subsequently worked out by discounting solid wastes which are typically generated by urban dwellers from the landfills data available on waste characterization. These solid waste generation potentials were also compared with those in the 2006 IPCC Guidelines (Volume 5: Waste, Page 2.5, Table 2.1).

Using the 2010 baseline, population census data (interpolated for non-census years) and adjusted for socio-economic factors, estimates for solid waste generation were then made for the period 2000 to 2010.

The process of calculating solid waste generation was not straightforward because of the lack of data. Furthermore, no official data was available on waste categorization which would have enabled more accurate estimations of GHG emissions.

The fraction of solid waste which is open burnt was calculated by multiplying the total solid waste estimated by the percentage of the population whose wastes are so treated, as evidenced from the NPHC 2011 statistics.

The amount of sludge generated per capita for 2010 was estimated using that year's data for Windhoek City Council. Using this factor and urban population, the amount of sludge generated for the period 1990 to 2009 was then estimated for the other urban areas.

7.3.2 Wastewater

The actual amount of domestic wastewater generated was not available at country level. However, the different types and usage levels of treatment or discharge as per the NPHC 2011 census report were used as well as the respective IPCC 2006 Guidelines (Vol 5.3 Ch 3 Table 3.1) default MCFs.

Exploitable data on industrial waste water production were available only for the meat (beef and sheep) (source Meatco factories, Agric Stats 2009, AGRA) and fish (Pilchard and Mackerel processing) (source: Ministry of Fisheries, Annual report 2005, Source for 2006 to 2010 - Preliminary census 2011 data). The

total meat industry product and the amount of waste water as provided by local authorities were used in conjunction with the respective IPCC 2006 Guidelines (Vol 5.3 Ch 3 Table 3.1) defaults for calculation of emissions. It is to be noted that an average daily protein intake of 67 g (source: World Bank, Namibia open data for Africa) per capita per day was used to feed the per capita protein consumption in the IPCC software.

7.3.3 Emission factors

In the absence of country specific emission factors, the default values provided within the IPCC 2006 software and IPCC 2006 Guidelines ((Vol 5.3 Ch 3 Table 3.3) were used for estimating GHG emissions.

7.4 Results

A comparison of the overall GHG emissions for 2000 and 2010 for the Waste Sector is provided in Table 7.3.

Table 7.3 - Overall GHG emissions (Gg) from the Waste Sector for 2000 and 2010

GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CO	4.34	4.60	4.79	4.99	5.18	5.37	5.75	5.94	6.32	6.50	6.87
CH_4	3.28	3.33	3.38	3.87	3.99	4.28	4.41	4.29	4.73	5.10	5.36
CO_2	1.56	1.65	1.72	1.79	1.86	1.93	2.07	2.14	2.27	2.34	2.47
NMVOCs	0.21	0.23	0.24	0.26	0.28	0.30	0.32	0.34	0.37	0.40	0.43
NO_x	0.25	0.26	0.27	0.28	0.29	0.31	0.33	0.34	0.36	0.37	0.39
NO_2	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.10	0.10	0.10
SO_2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Figure 7.2 illustrates the evolution of emissions for the waste sector from 2000 to 2010.

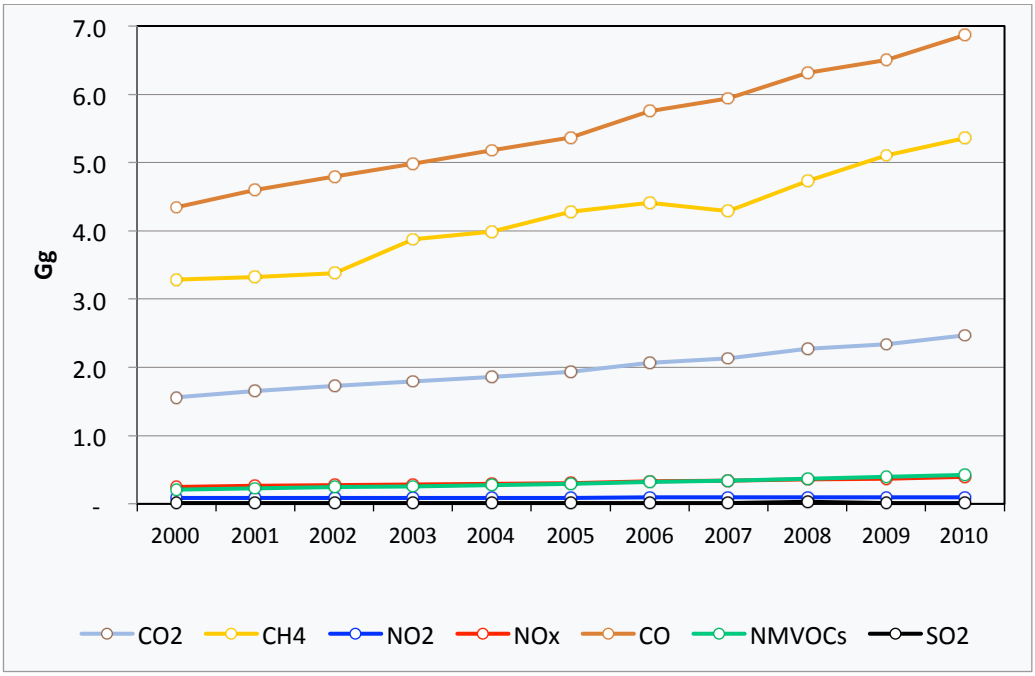


Figure 7.2 - GHG emissions (Gg) from the Waste Sector

7.4.1 CO_2, NO_x, CO and SO_2 Emissions

CO, CO_2, and NO_x emissions that have been inventoried for the Waste Sector originated from Open Burning of Waste activities Table 7.4). SO_2 emissions were inventoried from Open Burning of Waste and Waste Incineration activities.

From 2000 to 2011 the percentage increase in emissions for CO_2, NO_x, and CO was 58 % respectively and that of SO_2 was 57 %.

Table 7.4 - CO, CO_2, NO_x and SO_2 (Gg) emissions from the Waste Sector

Waste Category	GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4.C.2 - Open Burning of Waste	CO_2	1.56	1.65	1.72	1.79	1.86	1.93	2.07	2.14	2.27	2.34	2.47
4.C.2 - Open Burning of Waste	NO_x	0.247	0.262	0.273	0.284	0.295	0.306	0.328	0.338	0.360	0.370	0.391
4.C.2 - Open Burning of Waste	CO	4.34	4.60	4.79	4.99	5.18	5.37	5.75	5.94	6.32	6.50	6.87
4.C.1 - Waste Incineration	SO_2	-	-	-	-	-	-	-	-	0.013	-	-
4.C.2 - Open Burning of Waste	SO_2	0.009	0.009	0.009	0.010	0.010	0.011	0.011	0.012	0.014	0.013	0.014

7.4.2 CH_4 Emissions

CH_4 emissions originated from Solid Waste Disposal, Open Burning of Waste, Domestic Wastewater Treatment & Discharge and Industrial Wastewater Treatment & Discharge activities (Table 7.5, Figure 7.3). The activity contributing the most towards emissions was Solid Waste Disposal. CH_4 emissions increased by 63.2 % from 3.3 Gg in 2000 to 5.4 Gg in 2010.

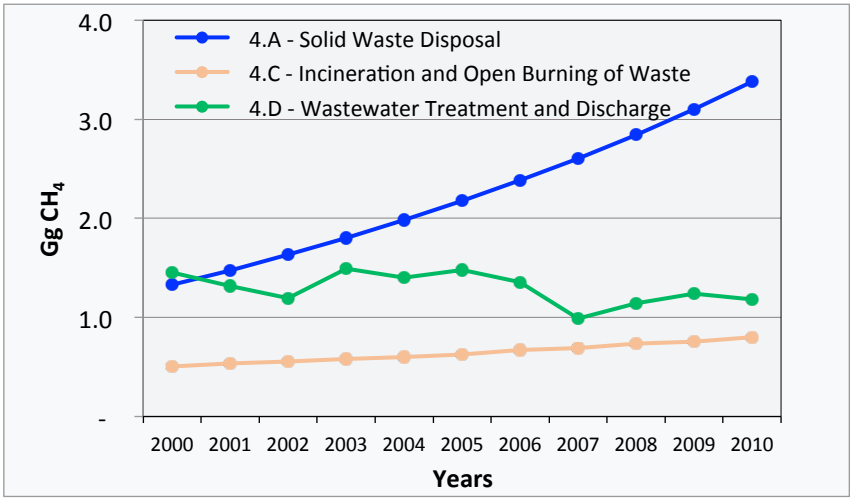


Figure 7.3 - CH_4 emissions (Gg) from different Waste categories

Table 7.5 - CH_4 emissions (Gg) from the Waste Sector

Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4 - Waste	3.285	3.327	3.382	3.874	3.985	4.280	4.408	4.287	4.725	5.101	5.360
4.A - Solid Waste Disposal	1.328	1.473	1.632	1.801	1.983	2.177	2.384	2.607	2.846	3.102	3.378
4.C - Incineration and Open Burning of Waste	0.505	0.535	0.558	0.581	0.603	0.625	0.670	0.691	0.736	0.757	0.800
4.C.2 - Open Burning of Waste	0.505	0.535	0.558	0.581	0.603	0.625	0.670	0.691	0.736	0.757	0.800
4.D - Wastewater Treatment and Discharge	1.451	1.318	1.192	1.492	1.400	1.479	1.354	0.989	1.144	1.242	1.183
4.D.1 - Domestic Wastewater Treatment and Discharge	0.371	0.355	0.359	0.374	0.389	0.406	0.407	0.440	0.455	0.474	0.489
4.D.2 - Industrial Wastewater Treatment and Discharge	1.080	0.963	0.833	1.118	1.011	1.073	0.947	0.549	0.689	0.769	0.694

7.4.3 NMVOCs Emissions

NMVOCs emissions originated from Managed Waste Disposal Sites, Open Burning of Waste, Domestic Wastewater Treatment & Discharge and Industrial Wastewater Treatment & Discharge activities (Table 7.6). The categories contributing most towards emissions in decreasing order of importance were Managed Waste Disposal Sites and Open Burning of Waste. Emissions from these two categories increased by 151.7 % and 58.4 % respectively from 2000 to 2010 (Figure 7.4).

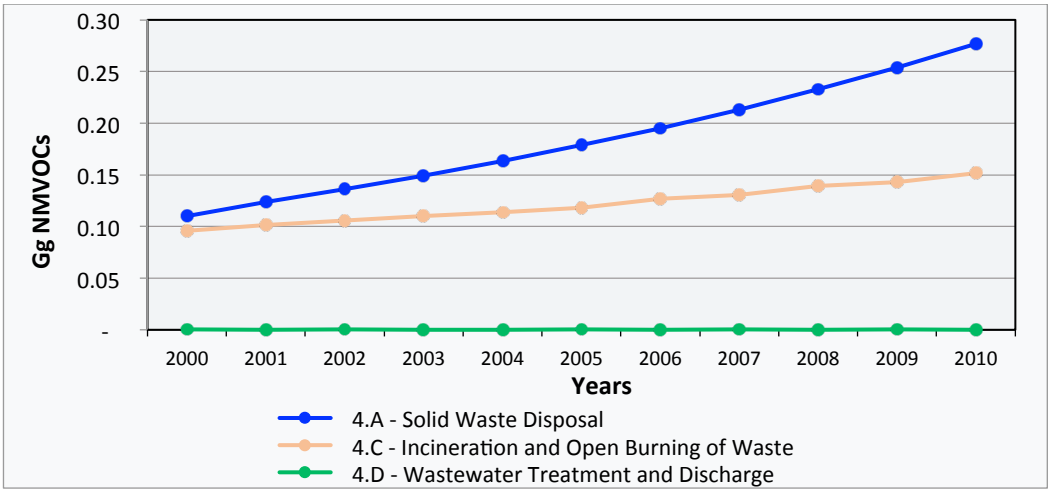


Figure 7.4 - NMVOCs emissions (Gg) from different waste categories

Table 7.6 - NMVOCs emissions (Gg) from the Waste Sector

Waste Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4 - Waste	0.21	0.23	0.24	0.26	0.28	0.30	0.32	0.34	0.37	0.40	0.43
4.A - Solid Waste Disposal	0.11	0.12	0.14	0.15	0.16	0.18	0.20	0.21	0.23	0.25	0.28
4.C - Incineration and Open Burning of Waste	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.13	0.14	0.14	0.15
4.D - Wastewater Treatment and Discharge	1.3E-06	1.3E-06	1.2E-06	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.2E-06	1.2E-06	1.2E-06	1.2E-06

7.4.4 NO_2 Emissions

NO_2 emissions originated from Open Burning of Waste and Domestic Wastewater Treatment & Discharge categories (Table 7.7). The category contributing most towards NO_2 was Wastewater Treatment and Discharge (Domestic). From 2000 to 2010, NO_2 emission increased by 19.3 % (Figure 7.5).

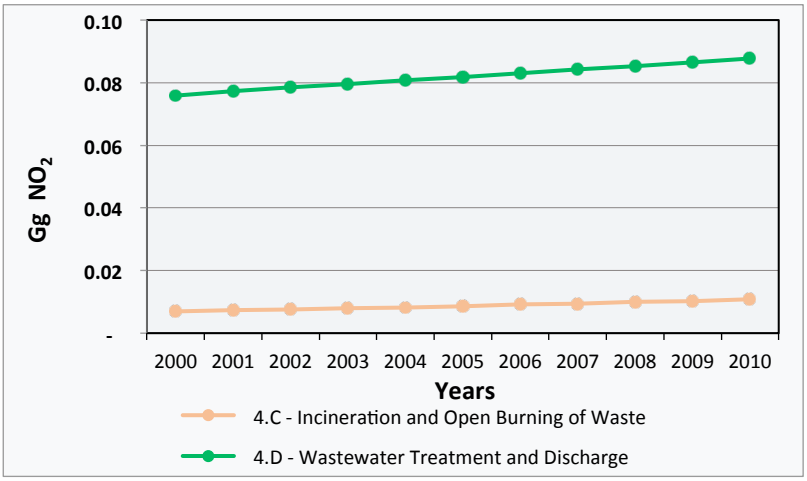


Figure 7.5 - NO_2 emission (Gg) from incineration and open burning of waste and wastewater treatment and discharge

Table 7.7 - NO_2 emissions (Gg) from Waste Sector

Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4 - Waste	0.083	0.085	0.086	0.087	0.089	0.090	0.092	0.094	0.095	0.097	0.099
4.C - Incineration and Open Burning of Waste	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.009	0.010	0.010	0.011
4.D - Wastewater Treatment and Discharge	0.076	0.077	0.078	0.080	0.081	0.082	0.083	0.084	0.085	0.087	0.088

7.4.5 Emissions in terms of CO_2 equivalent

In terms of CO_2 equivalent, the total contributions to emissions increased from 96.17 Gg in 2000 to 145.62 Gg in 2010 (Table 7.8), that is a 51.4 % increase. The gas contributing most to emissions from the waste sector was CH_4.

Table 7.8 - Aggregated emissions (Gg CO_2-eq) by gas from Waste Sector

GHG	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% Change	Avg. increase per year
CO_2	1.56	1.65	1.72	1.79	1.86	1.93	2.07	2.14	2.27	2.34	2.47	58.3	0.08
CH_4	68.98	69.86	71.02	81.35	83.69	89.89	92.57	90.04	99.23	107.12	112.57	63.2	3.96
N_2O	25.63	26.24	26.68	27.12	27.56	28.00	28.55	29.01	29.56	30.02	30.58	19.3	0.45
Total	96.17	97.76	99.42	110.26	113.12	119.82	123.19	121.18	131.06	139.48	145.62	51.4	4.50

In 2000 the major contributor to emissions from the Waste Sector was the Wastewater Treatment and Discharge category with 54.0 Gg CO_2-eq, representing 56.1 % of emission) (Table 7.9). However, in 2010 the major contributor was the Solid Waste Disposal category with 145 Gg (48.7 % of emissions).

Table 7.9 - Aggregated emissions (Gg CO_2-eq) by Category for the Waste Sector

Waste Categories	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
4 - Waste	96.2	97.8	99.4	110.3	113.1	119.8	123.2	121.2	131.1	139.5	145.6
4.A - Solid Waste Disposal	27.9	30.9	34.3	37.8	41.6	45.7	50.1	54.7	59.8	65.1	70.9
4.C - Incineration and Open Burning of Waste	14.3	15.2	15.8	16.4	17.1	17.7	19.0	19.6	20.8	21.4	22.6
4.C.2 - Open Burning of Waste	14.3	15.2	15.8	16.4	17.1	17.7	19.0	19.6	20.8	21.4	22.6
4.D - Wastewater Treatment and Discharge	54.0	51.7	49.4	56.0	54.4	56.4	54.2	46.9	50.5	52.9	52.0
4.D.1 - Domestic Wastewater Treatment and Discharge	31.3	31.4	31.9	32.5	33.2	33.9	34.3	35.3	36.0	36.8	37.5
4.D.2 - Industrial Wastewater Treatment and Discharge	22.7	20.2	17.5	23.5	21.2	22.5	19.9	11.5	14.5	16.1	14.6

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Annex 1. Summary Tables for the Year 2000

Inventory Year: 2000

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-24261.4	221.5	4.3	31.5	364.9	19.5	2.2
1 - Energy	1902.2	2.9	0.1	17.5	70.4	9.4	2.2
1.A - Fuel Combustion Activities	1902.2	2.9	0.1	17.5	70.4	9.4	2.2
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	25.0	0	0	0	0	0	0
2.A - Mineral Industry	7.1	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	17.9	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-26190.1	215.3	4.1	13.7	290.2	9.9	0
3.A - Livestock		204.1	0.7	0	0	9.9	0
3.B - Land	-26190.6		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.5	11.2	3.4	13.7	290.2	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.6	3.3	0.1	0.2	4.3	0.2	9.E-03
4.A - Solid Waste Disposal		1.3		0	0	0.1	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.6	0.5	7.E-03	0.2	4.3	1.E-01	9.E-03
4.D - Wastewater Treatment and Discharge		1.5	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	220.2	1.E-02	6.E-03	3.6	0.6	0.2	0.5
1.A.3.a.i - International Aviation (International Bunkers	87.2	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	133.0	1.E-02	4.E-03	3.3	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2000

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-24261.4	221.5	4.3	31.5	364.9	19.5	2.2
1 - Energy	1902.2	2.9	0.1	17.5	70.4	9.4	2.2
1.A - Fuel Combustion Activities	1902.2	2.9	0.1	17.5	70.4	9.4	2.2
1.A.1 - Energy Industries	7.3	8.E-05	1.E-04	2.E-02	7.E-04	1.E-04	0.1
1.A.2 - Manufacturing Industries and Construction	78.4	9.E-03	1.E-03	0.4	0.2	0.1	3.E-02
1.A.3 - Transport	1366.0	0.4	0.1	8.4	34.7	3.5	2.E-02
1.A.4 - Other Sectors	416.0	2.5	4.E-02	8.4	35.5	5.8	2.1
1.A.5 - Non-Specified	34.4	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	25.0	0	0	0	0	0	0
2.A - Mineral Industry	7.1	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	7.1			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	0			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Pdts from Fuels and Solvent Use	17.9	0	0	0	0	0	0
2.D.1 - Lubricant Use	0.6			0	0	0	0
2.D.2 - Paraffin Wax Use	17.3			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-26190.1	215.3	4.1	13.7	290.2	9.9	0
3.A - Livestock	0	204.1	0.7	0	0	9.9	0
3.A.1 - Enteric Fermentation		198.3		0	0	0	0
3.A.2 - Manure Management		5.8	0.7	0	0	9.9	0
3.B - Land	-26190.6	0	0	0	0	0	0
3.B.1 - Forest land	-44203.9			0	0	0	0
3.B.2 - Cropland	14.1			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.5	11.2	3.4	13.7	290.2	0	0
3.C.1 - Emissions from biomass burning		11.2	0.8	13.7	290.2	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.5			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.8	0	0	0	0
3.C.5 - Ind. N2O Emissions from managed soils			1.1	0	0	0	0
3.C.6 - Ind. N2O Emissions from manure management			0.7	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.6	3.3	0.1	0.2	4.3	0.2	9.E-03
4.A - Solid Waste Disposal	0	1.3	0	0	0	0.1	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.6	0.5	7.E-03	0.2	4.3	0.1	9.E-03
4.D - Wastewater Treatment and Discharge	0	1.5	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	220.2	1.E-02	6.E-03	3.6	0.6	0.2	0.5
1.A.3.a.i - International Aviation (International Bunke	87.2	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	133.0	1.E-02	4.E-03	3.3	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 2. Summary Tables for the Year 2001

Inventory Year: 2001							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-22380.4	223.5	4.9	32.6	365.6	20.6	2.4
1 - Energy	2061.6	2.9	0.1	18.6	71.6	9.6	2.4
1.A - Fuel Combustion Activities	2061.6	2.9	0.1	18.6	71.6	9.6	2.4
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	24.6	0	0	0	0	0	0
2.A - Mineral Industry	8.3	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	16.4	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-24468.3	217.3	4.7	13.7	289.5	10.8	0
3.A - Livestock		206.1	0.9	0	0	10.8	0
3.B - Land	-24471.3		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	3.0	11.2	3.8	13.7	289.5	0	0
3.D - Other	0	0	0	0	0.0	0.0	0.0
4 - Waste	1.7	3.3	0.1	0.3	4.6	0.2	9.E-03
4.A - Solid Waste Disposal		1.5		0	0	0.1	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.7	0.5	7.E-03	0.3	4.6	0.1	9.E-03
4.D - Wastewater Treatment and Discharge		1.3	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	223.2	1.E-02	6.E-03	2.3	0.6	0.2	0.5
1.A.3.a.i - International Aviation (International Bunkers	88.1	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	135.1	1.E-02	4.E-03	1.9	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 2. Summary Tables for the Year 2001 (contd)

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-22380.4	223.5	4.9	32.6	365.6	20.6	2.4
1 - Energy	2061.6	2.9	0.1	18.6	71.6	9.6	2.4
1.A - Fuel Combustion Activities	2061.6	2.9	0.1	18.6	71.6	9.6	2.4
1.A.1 - Energy Industries	9.2	1.E-04	1.E-04	2.E-02	9.E-04	1.E-04	0.1
1.A.2 - Manufacturing Industries ar	155.3	2.E-02	3.E-03	0.3	0.2	0.1	3.E-02
1.A.3 - Transport	1413.8	0.4	0.1	8.7	35.3	3.6	2.E-02
1.A.4 - Other Sectors	445.7	2.5	4.E-02	9.1	36.0	5.9	2.3
1.A.5 - Non-Specified	37.6	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and St	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Us	24.6	0	0	0	0	0	0
2.A - Mineral Industry	8.3	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	8.3			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbo	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Produc			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon B	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	0			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels	16.4	0	0	0	0	0	0
2.D.1 - Lubricant Use	0.3			0	0	0	0
2.D.2 - Paraffin Wax Use	16.1			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for (	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industr	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Lar	-24468.3	217.3	4.7	13.7	289.5	10.8	0
3.A - Livestock	0	206.1	0.9	0	0	10.8	0
3.A.1 - Enteric Fermentation		199.6		0	0	0	0
3.A.2 - Manure Management		6.5	0.9	0	0	10.8	0
3.B - Land	-24471.3	0	0	0	0	0	0
3.B.1 - Forest land	-42386.1			0	0	0	0
3.B.2 - Cropland	-84.3			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2	3.0	11.2	3.8	13.7	289.5	0	0
3.C.1 - Emissions from biomass burning		11.2	0.8	13.7	289.5	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	3.0			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.3	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure manageme			0.8	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.7	3.3	0.1	0.3	4.6	0.2	9.E-03
4.A - Solid Waste Disposal	0	1.5	0	0	0	0.1	0
4.B - Biological Treatment of Solid Wa	0	0	0	0	0	0	0
4.C - Incineration and Open Burning o	1.7	0.5	7.E-03	0.3	4.6	0.1	9.E-03
4.D - Wastewater Treatment and Dis	0	1.3	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from th	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	223.2	1.E-02	6.E-03	2.3	0.6	0.2	0.5
1.A.3.a.i - International Aviation (Int	88.1	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne	135.1	1.E-02	4.E-03	1.9	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 3. Summary Tables for the Year 2002

Inventory Year: 2002							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-21030.6	214.5	4.7	34.7	366.9	20.5	2.8
1 - Energy	2172.6	3.0	0.1	20.7	73.4	9.8	2.8
1.A - Fuel Combustion Activities	2172.6	3.0	0.1	20.7	73.4	9.8	2.8
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	26.3	0	0	0	0	0	0
2.A - Mineral Industry	8.6	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	0.1	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	17.6	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-23231.1	208.2	4.5	13.7	288.7	10.4	0
3.A - Livestock		197.0	0.8	0	0	10.4	0
3.B - Land	-23233.2		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	2.1	11.2	3.7	13.7	288.7	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.7	3.4	0.1	0.3	4.8	0.2	9.E-03
4.A - Solid Waste Disposal		1.6		0	0	0.1	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.7	0.6	8.E-03	0.3	4.8	0.1	9.E-03
4.D - Wastewater Treatment and Discharge		1.2	0.1	0	0	9E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	226.2	1.E-02	6.E-03	3.7	0.7	0.2	0.9
1.A.3.a.i - International Aviation (International Bunkers	89.0	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	137.2	1.E-02	4.E-03	3.4	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2002							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-21030.6	214.5	4.7	34.7	366.9	20.5	2.8
1 - Energy	2172.6	3.0	0.1	20.7	73.4	9.8	2.8
1.A - Fuel Combustion Activities	2172.6	3.0	0.1	20.7	73.4	9.8	2.8
1.A.1 - Energy Industries	0.5	2.E-05	4.E-06	8.E-04	1.E-04	0	3.E-03
1.A.2 - Manufacturing Industries and Construction	122.3	1.E-02	2.E-03	0.3	0.2	0.1	3.E-02
1.A.3 - Transport	1490.8	0.4	0.1	9.2	36.8	3.7	2.E-02
1.A.4 - Other Sectors	519.7	2.5	4.E-02	10.8	36.4	6.0	2.7
1.A.5 - Non-Specified	39.3	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	26.3	0	0	0	0	0	0
2.A - Mineral Industry	8.6	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	8.6			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	0			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	17.6	0	0	0	0	0	0
2.D.1 - Lubricant Use	0.2			0	0	0	0
2.D.2 - Paraffin Wax Use	17.4			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-23231.1	208.2	4.5	13.7	288.7	10.4	0
3.A - Livestock	0	197.0	0.8	0	0	10.4	0
3.A.1 - Enteric Fermentation		190.8		0	0	0	0
3.A.2 - Manure Management		6.3	0.8	0	0	10.4	0
3.B - Land	-23233.2	0	0	0	0	0	0
3.B.1 - Forest land	-41112.3			0	0	0	0
3.B.2 - Cropland	-120.1			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	2.1	11.2	3.7	13.7	288.7	0	0
3.C.1 - Emissions from biomass burning		11.2	0.8	13.7	288.7	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	2.1			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.8	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.7	3.4	0.1	0.3	4.8	0.2	9.E-03
4.A - Solid Waste Disposal	0	1.6	0	0	0	0.1	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.7	0.6	8.E-03	0.3	4.8	0.1	9.E-03
4.D - Wastewater Treatment and Discharge	0	1.2	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	226.2	1.E-02	6.E-03	3.7	0.7	0.2	0.9
1.A.3.a.i - International Aviation (International Bunkers)	89.0	6.E-04	2.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (International bunkers)	137.2	1.E-02	4.E-03	3.4	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2003							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-18795.9	219.0	4.8	35.8	368.7	20.8	3.1
1 - Energy	2355.4	3.0	0.1	21.8	75.7	10.1	3.0
1.A - Fuel Combustion Activities	2355.4	3.0	0.1	21.8	75.7	10.1	3.0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	110.2	0	0	0	0	0	0
2.A - Mineral Industry	9.5	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	81.6	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	19.1	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-21263.3	212.1	4.6	13.7	288.0	10.4	0
3.A - Livestock		201.0	0.8	0	0	10.4	0
3.B - Land	-21264.1		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.9	11.1	3.7	13.7	288.0	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.8	3.9	0.1	0.3	5.0	0.3	1.E-02
4.A - Solid Waste Disposal		1.8		0	0	0.1	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.8	0.6	8.E-03	0.3	5.0	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.5	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	229.3	1.E-02	6.E-03	2.2	0.6	0.2	0.5
1.A.3.a.i - International Aviation (International Bunkers	89.9	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	139.4	1.E-02	4.E-03	1.8	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2003							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-18795.9	219.0	4.8	35.8	368.7	20.8	3.1
1 - Energy	2355.4	3.0	0.1	21.8	75.7	10.1	3.0
1.A - Fuel Combustion Activities	2355.4	3.0	0.1	21.8	75.7	10.1	3.0
1.A.1 - Energy Industries	21.3	3.E-04	3.E-04	5.E-02	2.E-03	3.E-04	0.2
1.A.2 - Manufacturing Industries and Construction	156.3	2.E-02	3.E-03	0.4	0.2	0.1	3.E-02
1.A.3 - Transport	1601.7	0.4	0.1	9.9	38.9	4.0	2.E-02
1.A.4 - Other Sectors	535.1	2.5	4.E-02	11.1	36.5	6.1	2.8
1.A.5 - Non-Specified	41.0	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	110.2	0	0	0	0	0	0
2.A - Mineral Industry	9.5	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	9.5			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	82	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	82			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	19.1	0	0	0	0	0	0
2.D.1 - Lubricant Use	1.2			0	0	0	0
2.D.2 - Paraffin Wax Use	17.9			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-21263.3	212.1	4.6	13.7	288.0	10.4	0
3.A - Livestock	0	201.0	0.8	0	0	10.4	0
3.A.1 - Enteric Fermentation		194.6		0	0	0	0
3.A.2 - Manure Management		6.4	0.8	0	0	10.4	0
3.B - Land	-21264.1	0	0	0	0	0	0
3.B.1 - Forest land	-39336.4			0	0	0	0
3.B.2 - Cropland	73.2			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.9	11.1	3.7	13.7	288.0	0	0
3.C.1 - Emissions from biomass burning		11.1	0.8	13.7	288.0	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.9			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.3	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.8	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.8	3.9	0.1	0.3	5.0	0.3	1.E-02
4.A - Solid Waste Disposal	0	1.8	0	0	0	0.1	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.8	0.6	8.E-03	0.3	5.0	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.5	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	229.3	1.E-02	6.E-03	2.2	0.6	0.2	0.5
1.A.3.a.i - International Aviation (International Bunke	89.9	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	139.4	1.E-02	4.E-03	1.8	0.5	0.2	0.5
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2004

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-16741.9	216.4	4.8	36.0	371.6	21.2	3.6
1 - Energy	2459.3	3.0	0.1	22.0	79.2	10.5	3.6
1.A - Fuel Combustion Activities	2459.3	3.0	0.1	22.0	79.2	10.5	3.6
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	235.2	0	0	0	0	0	0
2.A - Mineral Industry	9.7	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	205.0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	20.5	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-19438.3	209.4	4.6	13.7	287.2	10.5	0
3.A - Livestock		198.3	0.8	0	0	10.5	0
3.B - Land	-19438.9		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.6	11.1	3.8	13.7	287.2	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.9	4.0	0.1	0.3	5.2	0.3	1.E-02
4.A - Solid Waste Disposal		2.0		0	0	0.2	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.9	0.6	8.E-03	0.3	5.2	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.4	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	232.3	1.E-02	6.E-03	3.9	0.7	0.2	0.9
1.A.3.a.i - International Aviation (International Bunkers	90.8	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	141.5	1.E-02	4.E-03	3.5	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2004							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-16741.9	216.4	4.8	36.0	371.6	21.2	3.6
1 - Energy	2459.3	3.0	0.1	22.0	79.2	10.5	3.6
1.A - Fuel Combustion Activities	2459.3	3.0	0.1	22.0	79.2	10.5	3.6
1.A.1 - Energy Industries	2.2	3.E-05	3.E-05	5.E-03	2.E-04	0.E+00	2.E-02
1.A.2 - Manufacturing Industries and Construction	167.4	2.E-02	3.E-03	0.6	1.1	0.2	0.9
1.A.3 - Transport	1735.1	0.5	0.1	10.8	41.4	4.2	2.E-02
1.A.4 - Other Sectors	511.8	2.5	4.E-02	1.E+01	36.5	6.1	2.6
1.A.5 - Non-Specified	42.8	2.E-03	2.E-03	0.4	0.1	3.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	235.2	0	0	0	0	0	0
2.A - Mineral Industry	9.7	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	9.7			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	205.0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	205.0			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	20.5	0	0	0	0	0	0
2.D.1 - Lubricant Use	0.3			0	0	0	0
2.D.2 - Paraffin Wax Use	20.2			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-19438.3	209.4	4.6	13.7	287.2	10.5	0
3.A - Livestock	0	198.3	0.8	0	0	10.5	0
3.A.1 - Enteric Fermentation		192.0		0	0	0	0
3.A.2 - Manure Management		6.3	0.8	0	0	10.5	0
3.B - Land	-19438.9	0	0	0	0	0	0
3.B.1 - Forest land	-37552.6			0	0	0	0
3.B.2 - Cropland	114.6			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.6	11.1	3.8	13.7	287.2	0	0
3.C.1 - Emissions from biomass burning		11.1	0.8	13.7	287.2	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.6			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.8	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.9	4.0	0.1	0.3	5.2	0.3	1.E-02
4.A - Solid Waste Disposal	0	2.0	0	0	0	0.2	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.9	0.6	8.E-03	0.3	5.2	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.4	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	232.3	1.E-02	6.E-03	3.9	0.7	0.2	0.9
1.A.3.a.i - International Aviation (International Bunke	90.8	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	141.5	1.E-02	4.E-03	3.5	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2005

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-15280.7	205.7	4.6	36.5	373.1	21.1	3.8
1 - Energy	2590.5	3.0	0.1	22.4	81.3	10.8	3.8
1.A - Fuel Combustion Activities	2590.5	3.0	0.1	22.4	81.3	10.8	3.8
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	260.3	0	0	0	0	0	0
2.A - Mineral Industry	10.0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	228.4	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	21.8	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-18133.4	198.4	4.4	13.7	286.5	10.0	0
3.A - Livestock		187.3	0.8	0	0	10.0	0
3.B - Land	-18133.6		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.2	11.1	3.6	13.7	286.5	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.9	4.3	0.1	0.3	5.4	0.3	1.E-02
4.A - Solid Waste Disposal		2.2		0	0	0.2	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.9	0.6	9.E-03	0.3	5.4	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.5	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	235.3	1.E-02	6.E-03	3.9	0.7	0.3	0.9
1.A.3.a.i - International Aviation (International Bunkers	91.7	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	143.6	1.E-02	4.E-03	3.5	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2005							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-15280.7	205.7	4.6	36.5	373.1	21.1	3.8
1 - Energy	2590.5	3.0	0.1	22.4	81.3	10.8	3.8
1.A - Fuel Combustion Activities	2590.5	3.0	0.1	22.4	81.3	10.8	3.8
1.A.1 - Energy Industries	53.6	7.E-04	8.E-04	0.1	5.E-03	6.E-04	0.5
1.A.2 - Manufacturing Industries and Construction	154.5	2.E-02	3.E-03	0.6	1.0	0.2	0.8
1.A.3 - Transport	1853.0	0.5	0.1	11.5	43.4	4.5	2.E-02
1.A.4 - Other Sectors	486.2	2.5	4.E-02	9.8	36.7	6.1	2.5
1.A.5 - Non-Specified	43.1	2.E-03	2.E-03	0.5	0.1	3.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	260.3	0	0	0	0	0	0
2.A - Mineral Industry	10.0	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	10.0			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	228.4	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	228.4			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	21.8	0	0	0	0	0	0
2.D.1 - Lubricant Use	3.7			0	0	0	0
2.D.2 - Paraffin Wax Use	18.1			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-18133.4	198.4	4.4	13.7	286.5	10.0	0
3.A - Livestock	0	187.3	0.8	0	0	10.0	0
3.A.1 - Enteric Fermentation		181.3		0	0	0	0
3.A.2 - Manure Management		6.0	0.8	0	0	10.0	0
3.B - Land	-18133.6	0	0	0	0	0	0
3.B.1 - Forest land	-36213.3			0	0	0	0
3.B.2 - Cropland	80.6			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.2	11.1	3.6	13.7	286.5	0	0
3.C.1 - Emissions from biomass burning		11.1	0.8	13.7	286.5	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.2			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.7	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	1.9	4.3	0.1	0.3	5.4	0.3	1.E-02
4.A - Solid Waste Disposal	0	2.2	0	0	0	0.2	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.9	0.6	9.E-03	0.3	5.4	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.5	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	235.3	1.E-02	6.E-03	3.9	0.7	0.3	0.9
1.A.3.a.i - International Aviation (International Bunke	91.7	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	143.6	1.E-02	4.E-03	3.5	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2006							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-13566.6	214.5	4.8	35.2	373.8	21.8	4.2
1 - Energy	2689.3	3.1	0.1	21.1	82.3	10.9	4.2
1.A - Fuel Combustion Activities	2689.3	3.1	0.1	21.1	82.3	10.9	4.2
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	255.1	0	0	0	0	0	0
2.A - Mineral Industry	10.4	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	223.4	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	21.2	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-16513.0	207.0	4.6	13.7	285.8	10.6	0
3.A - Livestock		196.0	0.8	0	0	10.6	0
3.B - Land	-16513.2		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.1	11.0	3.8	13.7	285.8	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.1	4.4	0.1	0.3	5.8	0.3	1.E-02
4.A - Solid Waste Disposal		2.4		0	0	0.2	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.1	0.7	9.E-03	0.3	5.8	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.4	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	238.4	1.E-02	6.E-03	4.0	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers	92.6	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	145.7	1.E-02	4.E-03	3.6	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2006							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-13566.6	214.5	4.8	35.2	373.8	21.8	4.2
1 - Energy	2689.3	3.1	0.1	21.1	82.3	10.9	4.2
1.A - Fuel Combustion Activities	2689.3	3.1	0.1	21.1	82.3	10.9	4.2
1.A.1 - Energy Industries	164.1	2.E-03	3.E-03	0.4	2.E-02	2.E-03	1.4
1.A.2 - Manufacturing Industries and Construction	163.8	2.E-02	3.E-03	0.6	1.0	0.2	0.8
1.A.3 - Transport	1916.9	0.5	0.1	11.9	44.6	4.6	2.E-02
1.A.4 - Other Sectors	401.0	2.5	4.E-02	7.8	36.6	6.1	2.0
1.A.5 - Non-Specified	43.4	2.E-03	0.0	0.5	0.1	3.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	255.1	0	0	0	0	0	0
2.A - Mineral Industry	10.4	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	10.4			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	223.4	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	223.4			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	21.2	0	0	0	0	0	0
2.D.1 - Lubricant Use	4.1			0	0	0	0
2.D.2 - Paraffin Wax Use	17.1			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

Annex 7. Summary Tables for the Year 2006 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-16513.0	207.0	4.6	13.7	285.8	10.6	0
3.A - Livestock	0	196.0	0.8	0	0	10.6	0
3.A.1 - Enteric Fermentation		189.7		0	0	0	0
3.A.2 - Manure Management		6.3	0.8	0	0	10.6	0
3.B - Land	-16513.2	0	0	0	0	0	0
3.B.1 - Forest land	-34663.1			0	0	0	0
3.B.2 - Cropland	150.8			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.1	11.0	3.8	13.7	285.8	0	0
3.C.1 - Emissions from biomass burning		11.0	0.8	13.7	285.8	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.1			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.8	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	2.1	4.4	0.1	0.3	5.8	0.3	1.E-02
4.A - Solid Waste Disposal	0	2.4	0	0	0	0.2	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.1	0.7	9.E-03	0.3	5.8	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.4	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	238.4	1.E-02	6.E-03	4.0	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunke	92.6	6.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	145.7	1.E-02	4.E-03	3.6	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2007

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-11911.3	211.7	4.8	34.6	375.5	21.9	4.0
1 - Energy	2788.2	3.1	0.1	20.5	84.6	11.1	4.0
1.A - Fuel Combustion Activities	2788.2	3.1	0.1	20.5	84.6	11.1	4.0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	294.3	0	0	0	0	0	0
2.A - Mineral Industry	11.2	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	259.4	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	23.8	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-14996.0	204.3	4.5	13.7	285.0	10.4	0
3.A - Livestock		193.3	0.8	0	0	10.4	0
3.B - Land	-14996.3		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.3	11.0	3.7	13.7	285.0	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.1	4.3	0.1	0.3	5.9	0.3	1.E-02
4.A - Solid Waste Disposal		2.6		0	0	0.2	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.1	0.7	9.E-03	0.3	5.9	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.0	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen i			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	241.4	1.E-02	7.E-03	4.0	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers)	93.6	7.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	147.9	1.E-02	4.E-03	3.7	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2007							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-11911.3	211.7	4.8	34.6	375.5	21.9	4.0
1 - Energy	2788.2	3.1	0.1	20.5	84.6	11.1	4.0
1.A - Fuel Combustion Activities	2788.2	3.1	0.1	20.5	84.6	11.1	4.0
1.A.1 - Energy Industries	195.0	2.E-03	3.E-03	0.4	2.E-02	2.E-03	1.7
1.A.2 - Manufacturing Industries and Construction	173.1	2.E-02	3.E-03	7.E-01	0.9	0.2	0.7
1.A.3 - Transport	2034.9	0.5	0.1	12.5	47.0	4.9	2.E-02
1.A.4 - Other Sectors	341.7	2.5	4.E-02	6.4	36.6	6.0	1.6
1.A.5 - Non-Specified	43.6	2.E-03	2.E-03	0.5	0.1	3.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	294.3	0	0	0	0	0	0
2.A - Mineral Industry	11.2	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	11.2			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	259.4	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	259.4			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	23.8	0	0	0	0	0	0
2.D.1 - Lubricant Use	6.6			0	0	0	0
2.D.2 - Paraffin Wax Use	17.2			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-14996.0	204.3	4.5	13.7	285.0	10.4	0
3.A - Livestock	0	193.3	0.8	0	0	10.4	0
3.A.1 - Enteric Fermentation		187.2		0	0	0	0
3.A.2 - Manure Management		6.2	0.8	0	0	10.4	0
3.B - Land	-14996.3	0	0	0	0	0	0
3.B.1 - Forest land	-33036.1			0	0	0	0
3.B.2 - Cropland	40.7			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.3	11.0	3.7	13.7	285.0	0	0
3.C.1 - Emissions from biomass burning		11.0	0.8	13.7	285.0	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.3			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.7	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	2.1	4.3	0.1	0.3	5.9	0.3	1.E-02
4.A - Solid Waste Disposal	0	2.6	0	0	0	0.2	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.1	0.7	9.E-03	0.3	5.9	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.0	0.1	0	0	1.E-06	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	241.4	1.E-02	7.E-03	4.0	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunke	93.6	7.E-04	3.E-03	0.4	3.E-02	1.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	147.9	1.E-02	4.E-03	3.7	0.7	0.2	0.9
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2008

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-10207.6	234.6	5.2	34.6	375.6	22.9	4.2
1 - Energy	2871.4	3.1	0.1	20.5	85.0	11.2	4.2
1.A - Fuel Combustion Activities	2871.4	3.1	0.1	20.5	85.0	11.2	4.2
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	291.1	0	0	0	0	0	0
2.A - Mineral Industry	11.9	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	250.1	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	29.2	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-13372.4	226.8	5.0	13.7	284.3	11.4	0
3.A - Livestock		215.9	0.9	0	0	11.4	0
3.B - Land	-13372.5		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.1	11.0	4.0	13.7	284.3	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.3	4.7	0.1	0.4	6.3	0.4	1.E-02
4.A - Solid Waste Disposal		2.8		0	0	0.2	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.3	0.7	1.E-02	0.4	6.3	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.1	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	244.5	1.E-02	7.E-03	4.1	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers	94.5	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	150.0	1.E-02	4.E-03	3.7	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2008							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-10207.6	234.6	5.2	34.6	375.6	22.9	4.2
1 - Energy	2871.4	3.1	0.1	20.5	85.0	11.2	4.2
1.A - Fuel Combustion Activities	2871.4	3.1	0.1	20.5	85.0	11.2	4.2
1.A.1 - Energy Industries	235.7	3.E-03	4.E-03	0.5	2.E-02	3.E-03	2.0
1.A.2 - Manufacturing Industries and Construction	169.2	2.E-02	3.E-03	0.8	0.8	0.2	0.6
1.A.3 - Transport	2086.1	0.5	0.1	12.9	47.4	4.9	2.E-02
1.A.4 - Other Sectors	337.5	2.5	4.E-02	5.9	36.6	6.0	1.5
1.A.5 - Non-Specified	43.0	2.E-03	2.E-03	0.5	0.1	3.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	291.1	0	0	0	0	0	0
2.A - Mineral Industry	11.9	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	11.9			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	250.1	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	250.1			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	29.2	0	0	0	0	0	0
2.D.1 - Lubricant Use	8.8			0	0	0	0
2.D.2 - Paraffin Wax Use	20.4			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-13372.4	226.8	5.0	13.7	284.3	11.4	0
3.A - Livestock	0	215.9	0.9	0	0	11.4	0
3.A.1 - Enteric Fermentation		209.1		0	0	0	0
3.A.2 - Manure Management		6.8	0.9	0	0	11.4	0
3.B - Land	-13372.5	0	0	0	0	0	0
3.B.1 - Forest land	-31519.6			0	0	0	0
3.B.2 - Cropland	147.9			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions source	0.1	11.0	4.0	13.7	284.3	0	0
3.C.1 - Emissions from biomass burning		11.0	0.8	13.7	284.3	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.1			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			1.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.3	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.9	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	2.3	4.7	0.1	0.4	6.3	0.4	1.E-02
4.A - Solid Waste Disposal	0	2.8	0	0	0	0.2	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.3	0.7	1.E-02	0.4	6.3	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.1	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	244.5	1.E-02	7.E-03	4.1	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunke	94.5	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	150.0	1.E-02	4.E-03	3.7	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2009

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-8625.5	233.3	5.3	35.5	375.9	23.0	3.7
1 - Energy	2875.9	3.1	0.1	21.5	85.8	11.3	3.7
1.A - Fuel Combustion Activities	2875.9	3.1	0.1	21.5	85.8	11.3	3.7
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	302.5	0	0	0	0	0	0
2.A - Mineral Industry	13.6	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	258.7	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	30.3	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-11806.3	225.1	5.0	13.7	283.6	11.3	0
3.A - Livestock		214.2	0.9	0	0	11.3	0
3.B - Land	-11806.5		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.2	10.9	4.1	13.7	283.6	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.3	5.1	0.1	0.4	6.5	0.4	1.E-02
4.A - Solid Waste Disposal		3.1		0	0	0.3	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.3	0.8	1.E-02	0.4	6.5	0.1	1.E-02
4.D - Wastewater Treatment and Discharge		1.2	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	247.5	1.E-02	7.E-03	4.2	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers	95.4	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	152.1	1.E-02	4.E-03	3.8	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 10. Summary Tables for the Year 2009 (contd)

Inventory Year: 2009							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-8625.5	233.3	5.3	35.5	375.9	23.0	3.7
1 - Energy	2875.9	3.1	0.1	21.5	85.8	11.3	3.7
1.A - Fuel Combustion Activities	2875.9	3.1	0.1	21.5	85.8	11.3	3.7
1.A.1 - Energy Industries	142.6	2.E-03	2.E-03	0.3	1.E-02	2.E-03	1.2
1.A.2 - Manufacturing Industries and Constructior	178.3	2.E-02	3.E-03	0.7	1.0	0.2	0.8
1.A.3 - Transport	2143.5	0.5	0.1	13.3	48.0	5.0	2.E-02
1.A.4 - Other Sectors	370.1	2.5	4.E-02	6.6	36.7	6.1	1.7
1.A.5 - Non-Specified	41.4	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	302.5	0	0	0	0	0	0
2.A - Mineral Industry	13.6	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	13.6			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Productio	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	258.7	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	258.7			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent U	30.3	0	0	0	0	0	0
2.D.1 - Lubricant Use	9.1			0	0	0	0
2.D.2 - Paraffin Wax Use	21.2			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

2.F - Product Uses as Substitutes for Ozone Depletin	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-11806.3	225.1	5.0	13.7	283.6	11.3	0
3.A - Livestock	0	214.2	0.9	0	0	11.3	0
3.A.1 - Enteric Fermentation		207.5		0	0	0	0
3.A.2 - Manure Management		6.7	0.9	0	0	11.3	0
3.B - Land	-11806.5	0	0	0	0	0	0
3.B.1 - Forest land	-29960.3			0	0	0	0
3.B.2 - Cropland	154.7			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sou	0.2	10.9	4.1	13.7	283.6	0	0
3.C.1 - Emissions from biomass burning		10.9	0.8	13.7	283.6	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.2			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			1.1	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.3	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.9	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	2.3	5.1	0.1	0.4	6.5	0.4	1.E-02
4.A - Solid Waste Disposal	0	3.1	0	0	0	0.3	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.3	0.8	1.E-02	0.4	6.5	0.1	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.2	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	247.5	1.E-02	7.E-03	4.2	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bun	95.4	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Int	152.1	1.E-02	4.E-03	3.8	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2010

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-7168.1	206.5	4.8	35.2	375.3	22.0	2.8
1 - Energy	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.A - Fuel Combustion Activities	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0
2 - Industrial Processes and Product Use	302.3	0	0	0	0	0	0
2.A - Mineral Industry	15.2	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	260.9	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	26.2	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-10266.3	198.0	4.6	13.7	282.8	10.3	0
3.A - Livestock		187.1	0.8	0	0	10.3	0
3.B - Land	-10266.4		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.1	10.9	3.8	13.7	282.8	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.5	5.4	0.1	0.4	6.9	0.4	1.E-02
4.A - Solid Waste Disposal		3.4		0	0	0.3	0
4.B - Biological Treatment of Solid Waste		0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.5	0.8	1.E-02	0.4	6.9	0.2	1.E-02
4.D - Wastewater Treatment and Discharge		1.2	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	252.3	1.E-02	7.E-03	4.2	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunkers	98.1	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Interna	154.2	1.E-02	4.E-03	3.8	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Inventory Year: 2010							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-7168.1	206.5	4.8	35.2	375.3	22.0	2.8
1 - Energy	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.A - Fuel Combustion Activities	2793.4	3.1	0.1	21.1	85.6	11.2	2.7
1.A.1 - Energy Industries	35.5	5.E-04	5.E-04	0.1	4.E-03	4.E-04	0.3
1.A.2 - Manufacturing Industries and Construction	186.4	2.E-02	3.E-03	0.7	1.1	0.2	0.9
1.A.3 - Transport	2210.4	0.6	0.1	13.9	48.9	5.1	2.E-02
1.A.4 - Other Sectors	320.4	2.5	4.E-02	6.0	35.5	5.9	1.5
1.A.5 - Non-Specified	40.8	2.E-03	2.E-03	0.4	0.1	2.E-02	2.E-04
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0	0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0	0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0	0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0			0	0	0	0
1.C.2 - Injection and Storage	0			0	0	0	0
1.C.3 - Other	0			0	0	0	0
2 - Industrial Processes and Product Use	302.3	0	0	0	0	0	0
2.A - Mineral Industry	15.2	0	0	0	0	0	0
2.A.1 - Cement production	0			0	0	0	0
2.A.2 - Lime production	15.2			0	0	0	0
2.A.3 - Glass Production	0			0	0	0	0
2.A.4 - Other Process Uses of Carbonates	0			0	0	0	0
2.A.5 - Other (please specify)	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0			0	0	0	0
2.B.2 - Nitric Acid Production			0	0	0	0	0
2.B.3 - Adipic Acid Production			0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0	0	0	0	0
2.B.5 - Carbide Production	0	0		0	0	0	0
2.B.6 - Titanium Dioxide Production	0			0	0	0	0
2.B.7 - Soda Ash Production	0			0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0		0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0
2.C - Metal Industry	260.9	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0		0	0	0	0
2.C.2 - Ferroalloys Production	0	0		0	0	0	0
2.C.3 - Aluminium production	0			0	0	0	0
2.C.4 - Magnesium production	0			0	0	0	0
2.C.5 - Lead Production	0			0	0	0	0
2.C.6 - Zinc Production	260.9			0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	26.2	0	0	0	0	0	0
2.D.1 - Lubricant Use	8.2			0	0	0	0
2.D.2 - Paraffin Wax Use	18.0			0	0	0	0
2.D.3 - Solvent Use				0	0	0	0
2.D.4 - Other (please specify)	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0
2.E.2 - TFT Flat Panel Display				0	0	0	0
2.E.3 - Photovoltaics				0	0	0	0
2.E.4 - Heat Transfer Fluid				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0

Inventory Year: 2010							
	Emissions (Gg)						
Categories	Net CO2	CH4	N2O	NOx	CO	NMVO	SO2
2.F - Product Uses as Substitutes for Ozone Depleting	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0	0	0	0
2.F.2 - Foam Blowing Agents				0	0	0	0
2.F.3 - Fire Protection				0	0	0	0
2.F.4 - Aerosols				0	0	0	0
2.F.5 - Solvents				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment				0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses				0	0	0	0
2.G.3 - N2O from Product Uses			0	0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0		0	0	0	0
2.H.2 - Food and Beverages Industry	0	0		0	0	0	0
2.H.3 - Other (please specify)	0	0	0	0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	-10266.3	198.0	4.6	13.7	282.8	10.3	0
3.A - Livestock	0	187.1	0.8	0	0	10.3	0
3.A.1 - Enteric Fermentation		181.2		0	0	0	0
3.A.2 - Manure Management		5.9	0.8	0	0	10.3	0
3.B - Land	-10266.4	0	0	0	0	0	0
3.B.1 - Forest land	-28428.6			0	0	0	0
3.B.2 - Cropland	163.1			0	0	0	0
3.B.3 - Grassland	17999.1			0	0	0	0
3.B.4 - Wetlands	0		0	0	0	0	0
3.B.5 - Settlements	0			0	0	0	0
3.B.6 - Other Land	0			0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sourc	0.1	10.9	3.8	13.7	282.8	0	0
3.C.1 - Emissions from biomass burning		10.9	0.8	13.7	282.8	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.1			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			1.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.2	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0.7	0	0	0	0
3.C.7 - Rice cultivations		0		0	0	0	0
3.C.8 - Other (please specify)		0	0	0	0	0	0
3.D - Other	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0			0	0	0	0
3.D.2 - Other (please specify)	0	0	0	0	0	0	0
4 - Waste	2.5	5.4	0.1	0.4	6.9	0.4	1.E-02
4.A - Solid Waste Disposal	0	3.4	0	0	0	0.3	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	2.5	0.8	1.E-02	0.4	6.9	0.2	1.E-02
4.D - Wastewater Treatment and Discharge	0	1.2	0.1	0	0	9.E-07	0
4.E - Other (please specify)	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric de	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	252.3	1.E-02	7.E-03	4.2	0.7	0.3	1.0
1.A.3.a.i - International Aviation (International Bunke	98.1	7.E-04	3.E-03	0.4	3.E-02	2.E-02	3.E-02
1.A.3.d.i - International water-borne navigation (Inter	154.2	1.E-02	4.E-03	3.8	0.7	0.2	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0