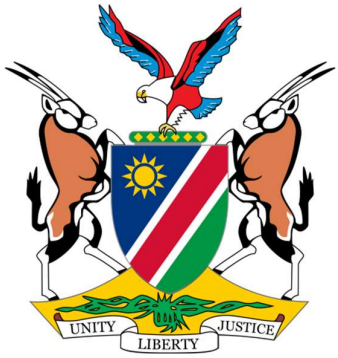


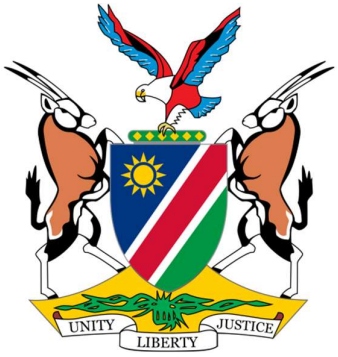
REPUBLIC OF NAMIBIA

NATIONAL GHG INVENTORY REPORT

NIR 2

2000 – 2012

September 2016



REPUBLIC OF NAMIBIA

NATIONAL GHG INVENTORY REPORT

NIR 2

2000 – 2012

September 2016

MET, Private bag 13306, Windhoek, Namibia
Phone: +264612842701

Produced by CLIMAGRIC LTD
rnayamuth@gmail.com

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 second National Greenhouse Gas (GHG) Inventory Report (NIR 2) to the United Nations Framework Convention on Climate Change (UNFCCC). This stand-alone second National Inventory Report accompanies the second Biennial Update Report (BUR 2) to better reflect 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 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, the first Biennial Update Report in 2014 and one stand-alone National Inventory Report. These inventories covered the year 1994 and a consistent time series for the period 2000 to 2012.

This National Inventory Report (NIR 2), compiled in the framework of the BUR 2, updates the NIR 1 (2000 to 2010) with two additional years, namely, 2011 and 2012. This consistent time series, as recommended by the Convention, was compiled using the Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines and the IPCC 2006 software. It was supplemented with the EMEP/EEA Air Pollutant Emission Inventory Guide Book 2013 for gases not covered by the IPCC 2006 software. The NIR 2 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 lost its status of net sink to become an emitter as from the year 2011. Namibia is committed to gain back its status of net sink in the future as planned in the Intended Nationally Determined Contribution (INDC) document through the policies and measures advocated therein. 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 2 was developed through a consultative process with key stakeholders. A multi sectoral GHG inventory working group was set up and further trained on the IPCC guidelines and software. Additional capacity building is earmarked within the framework for preparation of future reports to the Convention. 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 BUR2 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.

Project team and contributors

- Project Supervisor: Mr. Petrus Muteyauli
- Project Coordinator: Mr. Reagan Sibanga Chunga

Main contributors

- Ministry of Environment and Tourism
- Ministry of Mines and Energy
- Ministry of Works and Transport - Civil Aviation Office
- Ministry of Agriculture, Water and Forestry
- Ministry of Industrialization, Trade and SME Development
- Ministry of Fisheries and Marine Resources
- National Planning Commission
- NamPower
- Namibia Statistics Agency
- City councils and municipalities
- NATIS
- TransNamib Holdings Ltd
- Namibia Airports Company
- Petroleum products dealers
- Namport
- AGRA
- Electricity Control Board
- Meatco Namibia

Contact address for technical details

CLIMAGRIC LTD
c/o Mr. Rasack Nayamuth
Le Bocage, Mt. Ory, Moka
Mauritius
Email: rnayamuth@gmail.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AD	Activity Data
AFOLU	Agriculture, Forest and Other Land Use
ALU	Agriculture and Land Use National Greenhouse Gas Inventory Software
BCEF	Biomass Conversion and Expansion Factors
BGB	Below Ground Biomass
bm	Biomass
BUR 1	Biennial Update Report 1 of Namibia
BUR 2	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
dm	Dry Matter
EF	Emission Factor
EMEP/EEA	European Monitoring and Evaluation Program/European Environment Agency
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
IEA	International Energy Agency
INC	Initial National Communication
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
Iv	Annual Growth Rate
LAC	Low Activity Clay
LPG	Liquefied Petroleum Gas
MET	Ministry of Environment and Tourism
MMS	Manure Management System
MODIS	Moderate Resolution Imaging Spectroradiometer
MoU	Memorandum of Understanding
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
t	Tonnes
TACCC	Transparency, Accuracy, Consistency, Completeness, and Comparability
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 its submission of national inventories of greenhouse gases (GHGs). Namibia has submitted four inventories as components of its first, second and third national communications and its first Biennial Update Report. More exhaustive information on the last inventory can be obtained by perusing the full NIR1 of the country that has also been submitted to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). 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 fifth one for the country. This NIR2 supersedes previous inventories and provides for the latest and best emissions estimates of the country in light of available data and information.

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 as from the 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 also and is updating this time series with inventories for the years 2011 and 2012. The emissions and removals of the country are being made available in this present national inventory report in addition.

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, namely, 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 BUR 1. This capacity building exercise continued with the preparation of the other inventories to further improve, implement and consolidate the GHG inventory management system being implemented. 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. Implementation of the different steps of the inventory cycle was staged over less than a year instead of a longer period to fit the availability of funds for the compilation of this inventory. Due to this time constraint, 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 capacities.

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 as in the past was adopted for the present

inventory and all stakeholders agreed to pursue with sharing the responsibilities for the compilation exercise between different departments of the key ministries as for the TNC. The previous exercise of mapping of national institutions and organizations was reviewed again 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 (EFs) to suit national circumstances and enable moving to Tier 2 were consolidated. It was also decided to maintain 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 NIR2 and its summarization into the chapter for the BUR 2. 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, analysing the outputs and reporting to the Convention. All members were once more engaged to ensure consistency of the inventory as the time series is being extended by another 2 years.

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 does 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 facilitate derivation of national EFs and stock factors for improving 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 reduced the uncertainty level accordingly.

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 1 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, data were derived or estimated 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 same rates of land use changes were used for computing emissions for the two additional years 2011 and 2012.

The methods used to generate missing AD are provided in details further in this NIR 2, under the section for the individual sectors or categories as applicable.

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

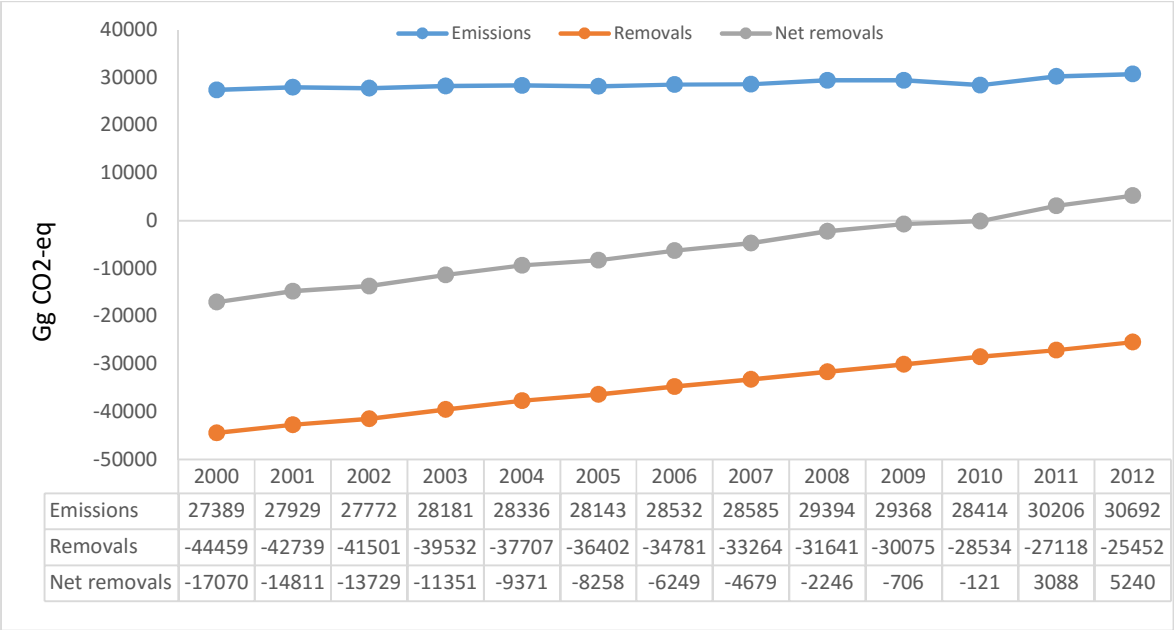
The inventory for the years covered in the previous time series 2000 to 2010 was recalculated to bring them in line with the years 2011 and 2012 being added and to provide for a consistent series in this inventory report. This is essential as there have been changes in the methodologies with the upgrading of the IPCC software to the latest version 2.17 that was released in 2016 for the Waste sector. Following a new set of more detailed data on fertilizers, the full series have been recalculated. The scope of the inventory has also been widened to include cement production that started in 2011 in the IPPU sector.

INVENTORY ESTIMATES

Aggregated emissions

Namibia remained a net GHG sink over the period 2000 to 2010 as a result of the Land sector removals exceeding emissions. However, following the steady decrease of the removals, this situation changed as from 2011 when national emissions exceeded removals. The net removal of CO_2 thus declined from 17 070 Gg to only 121 Gg in 2010. In 2011 and 2012, the country recorded net emissions of 3088 Gg CO_2-eq and 5240 Gg CO_2-eq respectively. The trend for the period 2000 to 2012 indicates that the national

GHG emissions increased from 27 389 Gg CO_2-eq in 2000 to 30 692 Gg CO_2-eq in 2012 while national removals decreased from 44 459 Gg CO_2-eq to 25 452 Gg CO_2-eq during this same period (Figure 1.1).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Emissions	27389	27929	27772	28181	28336	28143	28532	28585	29394	29368	28414	30206	30692
Removals	-44459	-42739	-41501	-39532	-37707	-36402	-34781	-33264	-31641	-30075	-28534	-27118	-25452
Net removals	-17070	-14811	-13729	-11351	-9371	-8258	-6249	-4679	-2246	-706	-121	3088	5240

Figure 1.1 - National emissions, removals and net removals (Gg CO_2-eq) (2000 – 2012)

National and sectoral emissions are presented in Table 1.1 and Figure 1.2. Total national emissions increased by 12.1 % over these 13 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 AFOLU sector increased slightly from 25 274 Gg CO_2-eq in 2000 to 27 028 Gg CO_2-eq in 2012, representing a progression of 6.9 % from the 2000 level. In 2012, the share of GHG emissions from AFOLU amounted to 88.1 % of total national emissions.

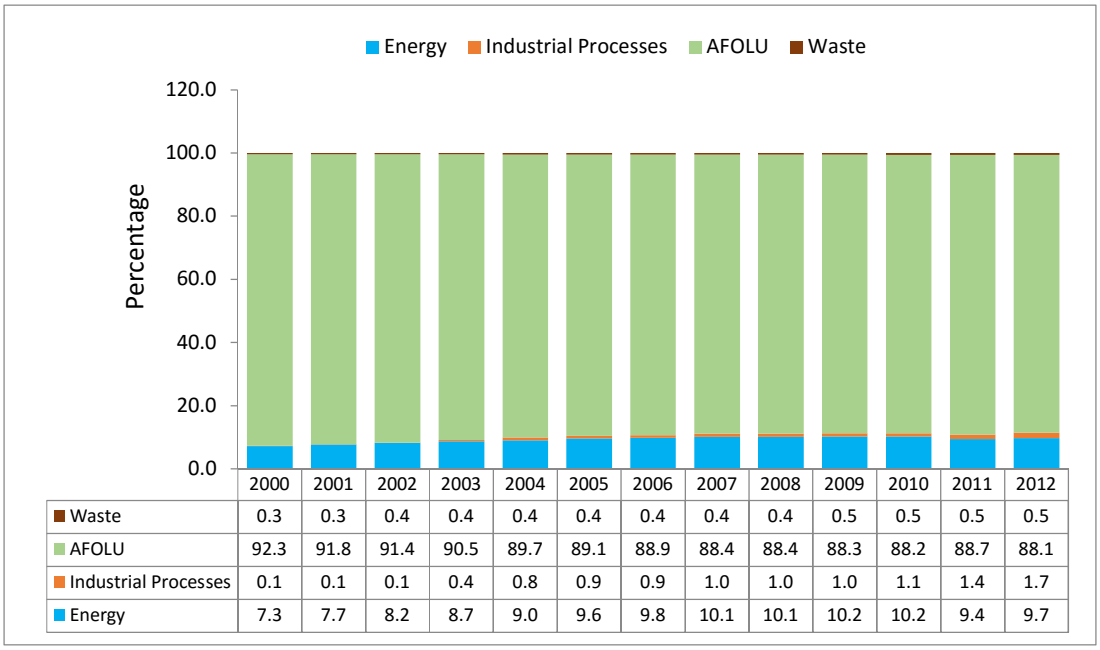
Energy emissions increased from 1995 Gg CO_2-eq (7.3 %) of national emissions in 2000 to 2979 Gg CO_2-eq (9.7 %) in 2012 as depicted in Figure 1.2. During the period 2000 to 2012, the average annual increase of GHG emissions in this sector was 4.1 %.

The contribution of the IPPU sector in total national emissions increased from 25 Gg CO_2-eq in 2000 to 523 Gg CO_2-eq in 2012. On average, the GHG emissions from the industrial processes sector increased by 166 % annually following the industrialization of the country.

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 162 Gg CO_2-eq in 2012, representing a 68.8 % increase.

Table 1.1 - National GHG emissions (Gg, CO_2-eq) by sector (2000 – 2012)

Source Categories	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**27389**	**27772**	**28336**	**28532**	**29394**	**28414**	**30206**	**30692**
Energy	1995	2269	2562	2795	2981	2904	2851	2979
Industrial Processes	25	26	235	255	291	302	421	523
AFOLU	25274	25378	25427	25359	25992	25062	26779	27028
Waste	96	99	113	123	130	145	155	162



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Waste	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5
AFOLU	92.3	91.8	91.4	90.5	89.7	89.1	88.9	88.4	88.4	88.3	88.2	88.7	88.1
Industrial Processes	0.1	0.1	0.1	0.4	0.8	0.9	0.9	1.0	1.0	1.0	1.1	1.4	1.7
Energy	7.3	7.7	8.2	8.7	9.0	9.6	9.8	10.1	10.1	10.2	10.2	9.4	9.7

Figure 1.2. Share (%) of emissions by sector

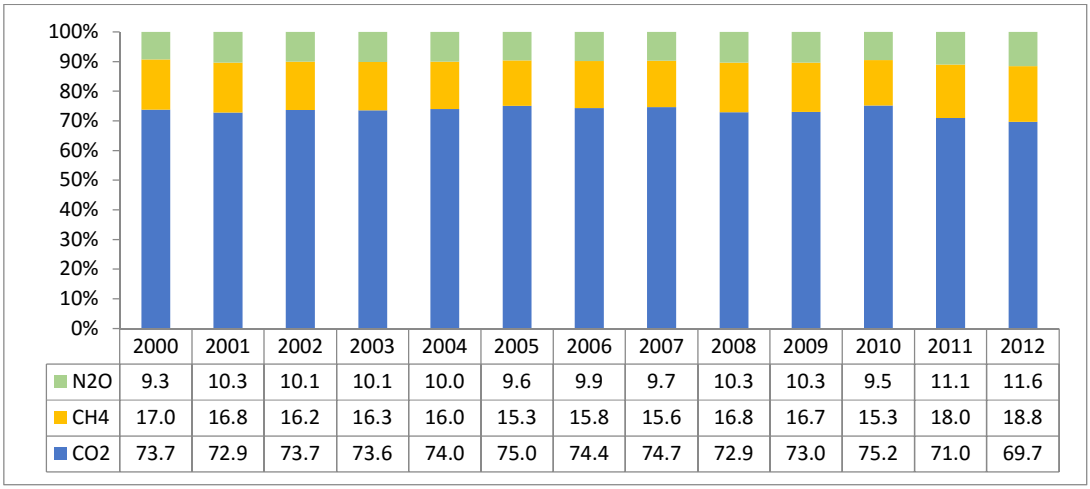
Emissions by gas

The major gas emitted for all years remained CO_2 followed by CH_4 and N_2O (Table 1.2). The amount of CO_2 increased slightly from 20 197 to 21 385 Gg. CH_4 and N_2O increased from 4651 Gg CO_2-eq to 5756 Gg CO_2-eq and from 2541 Gg CO_2-eq to 3551 Gg CO_2-eq respectively for the period 2000 to 2012.

Table 1.2 - National GHG emissions and removals (Gg CO_2-eq) by gas (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
Total GHG emissions (CO_2-eq)	**27389**	**27772**	**28336**	**28532**	**29394**	**28414**	**30206**	**30692**
Removals (CO_2) (CO_2-eq)	**-44459**	**-41501**	**-37707**	**-34781**	**-31641**	**-28534**	**27118**	**25452**
Net removals (CO_2-eq)	**-17070**	**-13729**	**-9371**	**-6249**	**-2246**	**-121**	**3088**	**5240**
CO_2	20197	20470	20965	21214	21432.0	21366	21435	21385
CH_4 (CO_2-eq)	4651	4505	4545	4504	4928	4336	5427	5756
N_2O (CO_2-eq)	2541	2796	2827	2814	3034	2712	3345	3551

The share of emissions by gas is given in Figure 1.3. CO_2 decreased from 74 % of total aggregated national emissions in the year 2000 to 70 % in 2012. The other two gases, CH_4 and N_2O, varied at around 17 % and 10 % respectively over this period of 13 years.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
N2O	9.3	10.3	10.1	10.1	10.0	9.6	9.9	9.7	10.3	10.3	9.5	11.1	11.6
CH4	17.0	16.8	16.2	16.3	16.0	15.3	15.8	15.6	16.8	16.7	15.3	18.0	18.8
CO2	73.7	72.9	73.7	73.6	74.0	75.0	74.4	74.7	72.9	73.0	75.2	71.0	69.7

Figure 1.3 - Share of aggregated emissions (%) by gas (2000 – 2012)

The emissions by gas are presented in Table 1.3. Among the GHG precursors, CO largely exceeded the others in emissions with an increase of 10 Gg from 365 to 369 Gg from 2000 to 2012 after peaking at 376 Gg in 2008. NMVOCs varied between 19.5 and 21.6 Gg while SO_2 dwindled between 2.2 and 4.2 Gg and NO_X increased from 31.5 Gg to 36.3 Gg over this same period.

Table 1.3 - Emissions (Gg) of GHG precursors and SO_2 (2000 – 2012)

Gases	2000	2002	2004	2006	2008	2010	2011	2012
NO_X	31.5	34.7	36.0	35.2	34.6	35.2	36.0	36.3
CO	364.9	366.9	371.6	373.8	375.6	375.3	367.5	369.2
NMVOC	19.5	20.5	21.2	21.8	22.9	22.0	21.5	21.6
SO_2	2.2	2.8	3.6	4.2	4.2	2.8	3.3	2.9

Summary result for the year 2012

The summary results from the software are presented in Annex 13 for the year 2012. The full sets for the whole time series 2000 to 2012 are available in annexes 1 to 13 at the end of this NIR 2 report.

The following findings are based on the 2012 compilations:

(i) most CO_2 were emitted in the AFOLU sector with some 18 000 Gg. Concurrently, this sector acted as a sink of about 25 500 Gg, to be a net sink of about 7500 Gg for the year 2012. The Energy sector came next with 2869 Gg.

(ii) CH_4 emanated mainly from the AFOLU sector followed by the Waste sector. Emissions were 265 Gg and 6 Gg for the year 2012 for these two sectors respectively. The Energy sector was responsible for 3 Gg of CH_4 emissions in 2012.

(iii) N_2O emissions, 11.2 Gg, were associated with the AFOLU sector primarily which contributed more than 98 % of national emissions of this gas.

(iv) Among the indirect GHGs, the AFOLU sector was the highest emitter of CO at 76 % of national emissions with 282 Gg, followed by Energy with 79 Gg and Waste with 8 Gg. Energy emitted 61 % of national NO_X emissions with 22 Gg and AFOLU was responsible for 14 Gg. The Energy and AFOLU sectors contributed 49 % and 46 % of national emissions of NMVOCs which stood at around 22 Gg.

(v) SO_2 emissions of 2.9 Gg emanated from the Energy sector and represented more than 99 % of national emissions.

QA/QC

Namibia has its own national system for quality control (QC) of data which are 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 remained beyond the GHG inventory compiler and the QA/QC process started 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;
- Compare AD with those available on international websites such as FAO and IEA;
- 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.

COMPLETENESS

A source by source category analysis was conducted before the preparation of this inventory and it was updated by adding the latest activity category, namely cement production. A few categories of the IPPU sector on the HFCs and PFCs have not been included due to lack of disaggregated data, the information on them being as blends without the content of the different components.

UNCERTAINTY ANALYSIS

For this Inventory, a Tier 1 uncertainty analysis of the aggregated figures as required by the IPCC 2006 Guidelines, Vol. 1 (IPCC, 2007) was performed. Based on the quality of the data and whether the EFs used were defaults or nationally derived, uncertainty levels were assigned for the two parameters and the combined uncertainty calculated. The uncertainty analysis has been performed using the tool available within the IPCC 2006 Software and an Excel worksheet based on the equations from the IPCC 2006 GL because of serious overestimation which occurred when the Land sector was included in the software. The uncertainty in total emissions obtained using the IPCC tool (excluding emissions and removals from the Land sector) is in the range 5.6 to 6.4 %. When emissions and removals from the Land sector are included, the uncertainty levels shoots up to give results considered unrealistic. This situation is being further investigated.

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 eight key categories in the level assessment, six of these from the AFOLU sector, of which enteric fermentation from Agriculture, Forest Land remaining Forest Land, Land converted to Grassland, Land converted to Forestland, Direct and Indirect N_2O emissions from FOLU and the remaining two are Road Transportation and Other Sectors-Liquid fuels from the Energy sector. The results change slightly when considering the trend assessment. There are only six key categories that are common in the level assessment also.

ARCHIVING

All raw data, collected for the inventory, have been stored in the IPCC 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 resources - both technical and financial - coupled to insufficient capacity of national experts to take over the compilation of the full inventory remained a major 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.

- Adequate and proper data capture, QC, validation, storage and retrieval mechanism need to be improved to facilitate the compilation of future inventories;
- Capacity building and strengthening of the existing institutional framework to provide improved coordinated action for reliable data collection and accessibility is a priority undertaking in the future;
- Improve the existing QA/QC system in order to reduce uncertainty and improve inventory quality;
- Find the necessary resources to establish a GHG inventory unit within DEA to be responsible for inventory compilation and coordination;
- Conduct new forest inventories to supplement available data on the Land sector;
- Produce new maps for 1990 to 2015 to refine land use change data over 5 years periods as opposed to the decadal one available now which is proving inadequate;
- 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.

1. INTRODUCTION

1.1 NATIONAL CIRCUMSTANCES

The Republic of Namibia is situated in South-Western Africa between latitudes 17° and 29°S and longitudes 11° and 26°E. It extends over 825 418 km^2 of land which support a population of some 2.3 million in 2014. The land surface ascends from the Namib Desert to the mountains of the continental border range, with peaks at 2606 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 very variable and is characterized by 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 3800 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 which accounted for 60 % of Gross Domestic Product (GDP) in 2015 is the most important economic sector of Namibia. Agriculture, fisheries and forestry accounted for 9 % and the manufacturing sector including mining and quarrying another 25 %. 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 12.3 % to the country's GDP in 2015. The manufacturing sector, a priority sector under the NDP4, is estimated to have recorded a constant growth of 1.2 % in 2011 and 2012 and contributed some 12.3 % to national GDP in 2015. Namibia is highly dependent on imports to meet its energy requirements. The domestic economy is estimated to have expanded by 3.5 % in 2015 (NSA, 2016).

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.

Moreover, the submissions should also include the following elements amongst others:

a. A general description of steps taken or envisaged by the Party to implement the Convention; and

b. 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. Namibia also submitted an inventory as a component of its third nation communication in December 2015. Thus, Namibia has to-date submitted four GHG inventories detailing its emissions and sinks as components of these documents. Namibia also produced and submitted a fully detailed national inventory report within the context of the preparation of the third national communication and has now prepared a second fully detailed version. The summary will constitute the chapter on greenhouse gas inventory of the second Biennial Update Report (BUR 2).

2. THE INVENTORY PROCESS

2.1 OVERVIEW OF GHG INVENTORIES

The process of preparation of the present inventory started late 2015. One year was allocated to implement and complete the different steps of the inventory cycle as depicted in Figure 2.1. 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 the detailed second 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 1 level, 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 fourth inventory has been submitted as a chapter of the third national communication and as a stand-alone national inventory report. The IPCC 2006 Guidelines and software was used for preparation of these inventories.

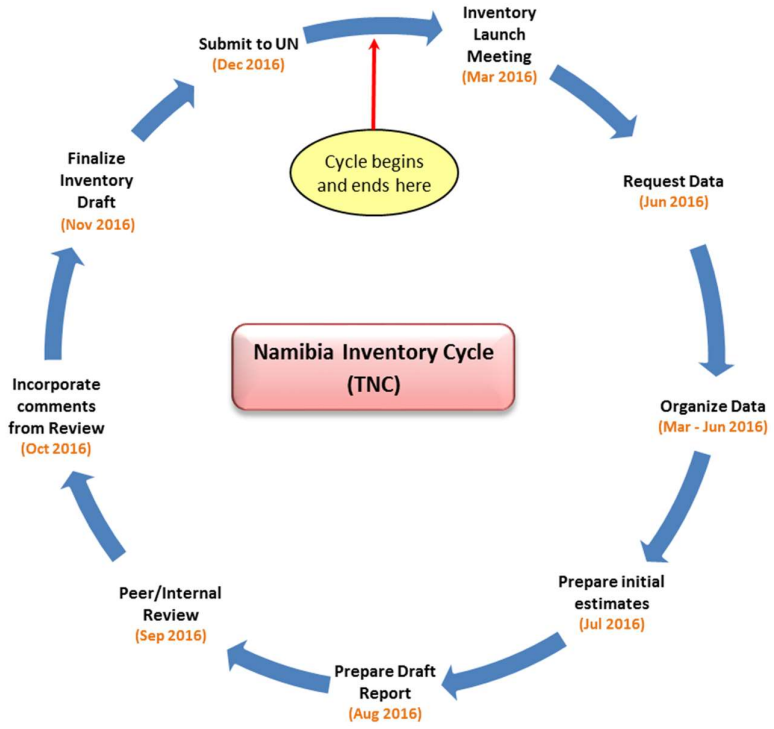


Figure 2.1 - The Inventory cycle of Namibia's BUR 2 GHG inventory

The present GHG inventory report is submitted on a stand-alone basis as an accompanying document to the second Biennial Update Report. It provides data on GHG emissions by sources and removals by sinks for a full time series for the period 2000 to 2012. 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 BUR 1, with the support of an external consultant for capacity building. This exercise continued with the inventory of the TNC and BUR 2 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 is still a very laborious exercise as resources and human capacities continued to be limiting factors. Thus, it is obvious that there still exist shortcomings in this inventory but the country is committed to strive to further raise the quality of future GHG inventories through 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 TNC. 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 collaboration with data providers and potential 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 maintain the 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 analysing the outputs. All members were introduced to the consistency component as a full series over the period 2000 to 2012 was being covered for the first time, including recalculations for the years 2000 to 2010 as necessary.

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 Industrialization, Trade and SME Development for the Industrial 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 capacity building and 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 implementation.

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

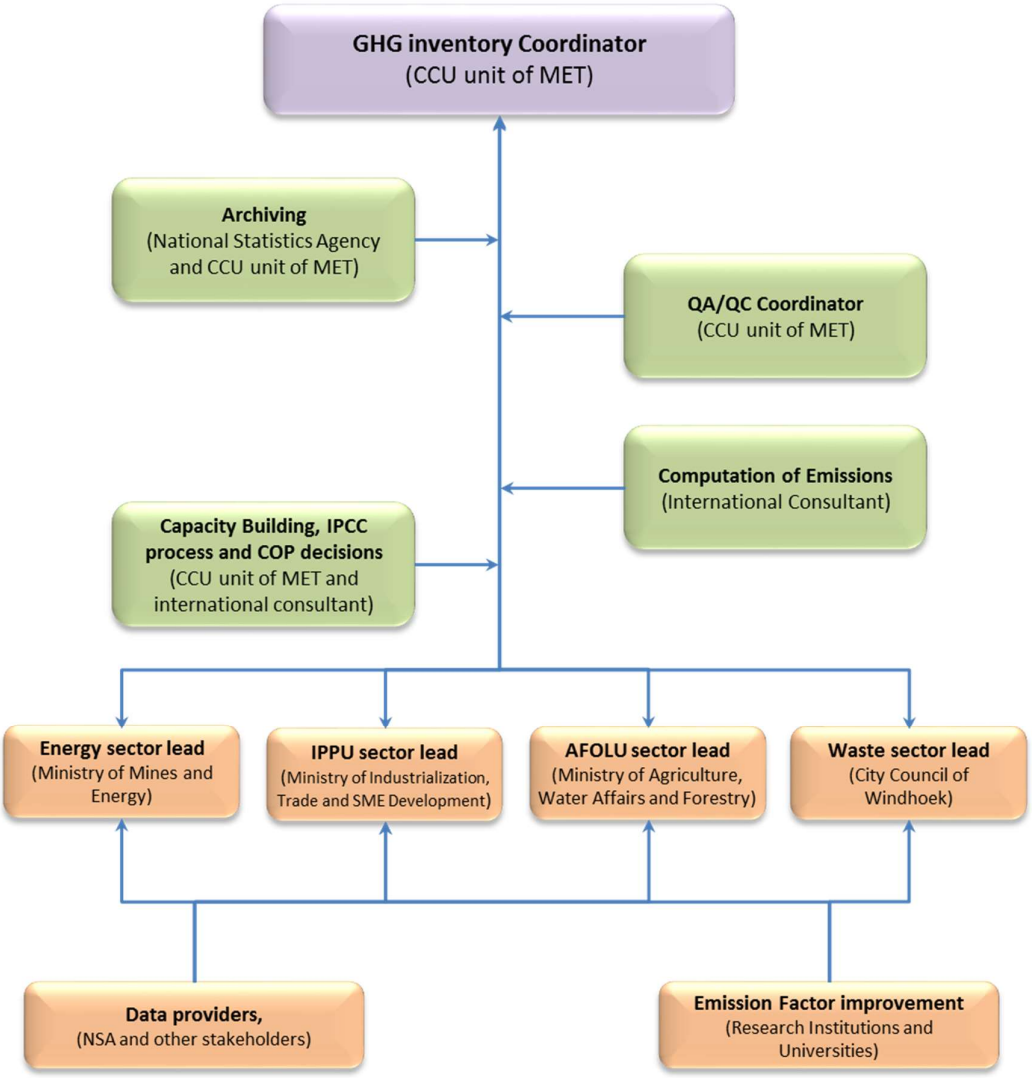


Figure 2.2 - Institutional arrangements for the GHG inventory preparation

The inventory preparation started in January 2016. A work plan with timeframe and responsibilities was drawn for the preparation of the inventory using the mix of Tiers 1 and 2. AD were collected for the years 2011 and 2012 to update the existing series and meet the timing requirement for the BUR 2. The collected AD were processed and sectoral experts of the inventory team computed emissions and performed recalculations as necessary under the supervision of the external consultant. This exercise took place during a three-day workshop with the external consultant providing the support 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 2006 IPCC Guidelines *for National Greenhouse Gas Inventories* (IPCC, 2006) were used with the most appropriate IPCC default EFs. Default EFs were likewise assessed and these were derived or amended in some cases to reflect national circumstances and conditions, the objective being to estimate emissions as accurately as possible. The results were reviewed during another three-day workshop which was attended by the full GHG inventory team. This exercise was very useful to enhance capacity of the national experts

while serving for team building and also strengthening collaboration on cross-cutting issues. The different steps adopted for the preparation of the inventory can be summarized as follows:

- Drawing up of work plan 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 2012 are presented in Table 2.1 and the trend assessment in Table 2.2.

There are eight key categories in the level assessment, six of these from the AFOLU sector, of which enteric fermentation from Agriculture, the other five from FOLU and the remaining two are Road Transportation and Other Sectors-Liquid fuels from the Energy sector.

Table 2.1 - Key Category Analysis for the year 2012 - Approach 1 - Level Assessment

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	GHG	"2012 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	-24307.6	24307.6	0.434	0.434
3.B.3.b	Land Converted to Grassland	CO_2	17721.1	17721.1	0.316	0.750
3.A.1	Enteric Fermentation	CH_4	5169.7	5169.7	0.092	0.842
1.A.3.b	Road Transportation	CO_2	2119.5	2119.5	0.038	0.880
3.C.4	Direct N_2O Emissions from managed soils	N_2O	1991.9	1991.9	0.036	0.916
3.B.1.b	Land Converted to Forest land	CO_2	-1066.0	1066.0	0.019	0.935
3.C.5	Indirect N_2O Emissions from managed soils	N_2O	570.4	570.4	0.010	0.945
1.A.4	Other Sectors - Liquid Fuels	CO_2	348.9	348.9	0.006	0.951

The results changes slightly when considering the trend assessment. There are only six key categories that are common in the level assessment also.

Table 2.2 - Key Category Analysis for the year 2012 - 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)	2012 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	-24307.6	0.453	0.517	0.517
3.B.3.b	Land Converted to Grassland	CO_2	17999.1	17721.1	0.287	0.328	0.845
3.A.1	Enteric Fermentation	CH_4	4163.7	5169.7	0.053	0.061	0.906
3.B.1.b	Land Converted to Forest land	CO_2	-1066.0	-1066.0	0.017	0.019	0.925
3.C.4	Direct N_2O Emissions from managed soils	N_2O	1379.2	1991.9	0.014	0.016	0.941
1.A.3.b	Road Transportation	CO_2	1306.0	2119.5	0.011	0.012	0.953

2.4 METHODOLOGICAL ISSUES

This section gives an overview of the methodologies adopted for all sectors and sub-sectors covered in this inventory report. These procedures are more fully described 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 for the computation of emissions in an inventory 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 facilitate estimates to be made at the Tier 2 level partially for the Livestock and Land sectors by providing a tool to generate emission or stock factors that were eventually fed in the IPCC 2006 software. 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 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), which 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 1 level, were sourced directly from both public and private sector operators by the team members and coordinators. Data gaps were filled through personal contacts with the stakeholders by the national 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 national 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 remained beyond the GHG inventory compiler and the QA/QC process started 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;
- Compare AD with those available on international websites such as FAO and IEA;
- 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, 2007) 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 IPCC 2006 Guidelines, Vol. 1 (IPCC, 2007) 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 EFs or AD 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 and an Excel worksheet to verify the serious overestimations obtained when including the Land sector in the software tool. The results are identical using both methods when the Land sector is excluded but not when it is included. The problem is still under review and will be reported to the Technical Support Unit of the IPCC for consideration and eventual amendment if necessary. Thus, the uncertainty in total emissions based on the IPCC tool (excluding emissions and removals from the Land sector) is presented in Table 2.4. Uncertainty levels in the range 5.6 to 6.5 %.

Table 2.4 - Overall uncertainty (%)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Uncertainty excl. FOLU	6.5	6.4	6.4	6.2	6.1	5.9	5.8	5.6	5.7	5.8	5.7	6.0	5.9

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.

2.8 RECALCULATIONS

The initial inventories submitted for the years 2000 and 2010 in the SNC and BUR 1 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 computation method 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.

Some more recalculations have been performed for the past inventories for the years 2000 to 2010 to maintain consistency with the years 2011 and 2012. The recalculations concerned the Waste sector as there has been a change in the default EF in the latest version (v 2.17) of the software. So the emissions for the period 2000 to 2010 have been computed anew with the new default EF to ensure a consistent time series. Additionally, new precise AD was available for fertilizers and these have been used to replace the previous set.

2.9 TIME SERIES CONSISTENCY

This inventory now covers the period 2000 to 2012 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 2.5 - Completeness of the 2000 to 2012 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.1- Cement Production	X	NA	NA	NA	NA	NA	NA
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

Table 2.5 - Completeness of the 2000 to 2012 inventories

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
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

2.10 GAPS, CONSTRAINTS AND NEEDS

Namibia, as a developing country, has its constraints and gaps that need to be addressed to produce better quality reports to the Convention. This is still a big challenge given that now the reporting standards have been raised and there is also a review of the inventory.

In order to reduce uncertainties and aim at producing an inventory in line with TACCC principles, Namibia invested in improving its national GHG inventory management system and Institutional arrangements.

Additionally, the country aimed at the adopting of higher Tier levels whenever more disaggregated data for the various sectors could be collected and developing country-specific EFs. The review of the previous NIR enabled the identification of areas that could be 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 started when computing the present inventory.

For this inventory, one more category, namely cement production has been covered. Some information was also collected on solvents and Ozone Depleting Substances, but unfortunately, they were not detailed enough to enable computation of emissions.

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 yet been endorsed with the responsibility for collection of specific AD needed for the estimation of emissions according to UNFCCC;
- Almost all of the AD, including those from the NSA are still not yet 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 are not readily available and had to be generated on the basis of scientific and consumption parameters;
- Reliable biomass (bm) 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 was not available and this could have led 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 only partly 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 more accurate estimates;
- Emissions for a few categories have not been estimated due to lack of AD; and
- National experts are not yet ready to take over the full inventory compilation process and another round of training on running the IPCC 2006 software was conducted.

2.11 NATIONAL INVENTORY IMPROVEMENT PLAN (NIIP)

Based on the constraints, gaps and other challenges encountered during the preparation of the present inventory, a list of the most urgent improvements has been identified. These are listed below and will be addressed during the preparation of the NC 4 inventory.

- Adequate and proper data capture, QC, validation, storage and retrieval mechanism need to be improved to facilitate the compilation of future inventories;
- Capacity building and strengthening of the existing institutional framework to provide improved coordinated action for reliable data collection and accessibility is a priority undertaking in the future;

- Emission factors (EFs) more representative of the national context have to be developed;
- Improve the existing QA/QC system in order to reduce uncertainty and improve inventory quality;
- Find the necessary resources to 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;
- Conduct new forest inventories to supplement available data on the Land sector;
- Produce new maps for 1990 to 2015 to refine land use change data over 5 years periods as opposed to the decadal one available now which is proving inadequate;
- 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 2012. 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 2012 included additional sectors and sub-sectors that were not covered in the inventories presented in the INC, SNC and BUR 1 previously.

3.2 THE PERIOD 2000 TO 2012

Namibia remained a net GHG sink over the period 2000 to 2010 as a result of the Land sector removals exceeding emissions. However, following the steady decrease of the removals this situation changed as from 2011 when national emissions exceeded removals. The net removal of CO_2 thus declined from 17 070 Gg to only 121 Gg in 2010. In 2011 and 2012, the country recorded net emissions of 3088 Gg CO_2-eq and 5240 Gg CO_2-eq respectively. The trend for the period 2000 to 2012 indicates that the national GHG emissions increased from 27 389 Gg CO_2-eq in 2000 to 30 692 Gg CO_2-eq in 2012 while national removals decreased from 44 459 Gg CO_2-eq to 25 452 Gg CO_2-eq during this same period (Table 3.1 and Figure 3.1).

Table 3.1 - GHG emissions (Gg CO_2-eq) characteristics (2000 – 2012)

Emissions / Removals	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**27389**	**27772**	**28336**	**28532**	**29394**	**28414**	**30206**	**30692**
AFOLU - removals	-44459	-41501	-37707	-34781	-31641	-28534	-27118	-25452
Net removals	-17070	-13729	-9371	-6249	-2246	-121	3088	5240
Per capita emission (t)	-9.5	-7.4	-4.9	-3.2	-1.1	-0.1	1.5	2.4
GDP emissions index (2000=100)	100.0	75.8	44.2	26.9	8.9	0.5	-11.0	-17.8

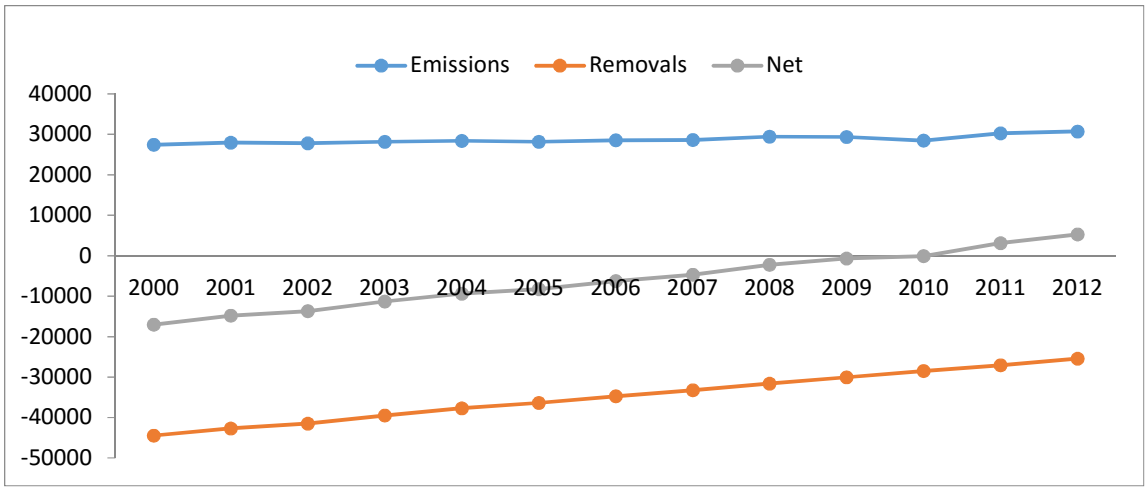


Figure 3.1 - Evolution of national emissions, national removals and the overall (net) situation (Gg CO_2-eq), (2000 – 2012)

Per capita emissions of GHG decreased from a removal of 9.5 t CO_2-eq in 2000 to an emission of 2.4 t CO_2-eq in 2012 (Figure 3.2). The GDP emission index decreased from 100 in the year 2000 to -17.8 in 2012 (Table 3.1) and (Figure 3.3).

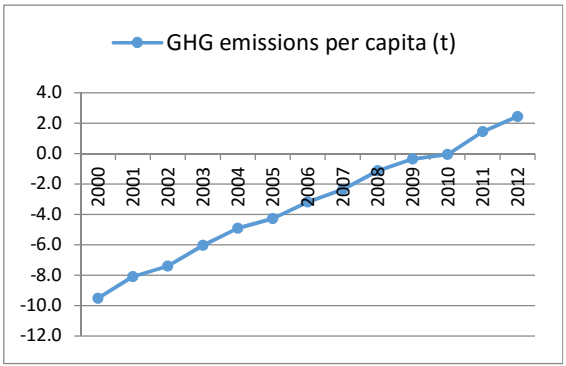


Figure 3.2 - Per capita GHG emissions (2000 – 2012)

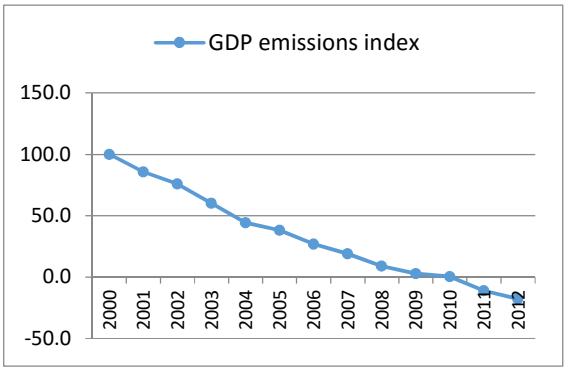


Figure 3.3 - GDP emissions index (2000 – 2012)

3.3 TREND OF EMISSIONS BY SOURCE CATEGORY

Total national emissions increased by 12.1 % over these 13 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 AFOLU sector increased slightly from 25 274 Gg CO_2-eq in 2000 to 27 028 Gg CO_2-eq in 2012, representing a progression of 6.9 % from the 2000 level. In 2012, the share of GHG emissions from AFOLU amounted to 88.1 % of total national emissions.

Energy emissions increased from 1995 Gg CO_2-eq (7.3 %) of national emissions in 2000 to 2979 Gg CO_2-eq (9.7 %) in 2012 as depicted in Table 3.2. During the period 2000 to 2012, the average annual increase of GHG emissions was 4.1 %.

The contribution of the IPPU sector in total national emissions increased from 25 Gg CO_2-eq in 2000 to 523 Gg CO_2-eq in 2012 (Table 3.2). On average, the GHG emissions from the industrial processes sector increased by 166 % annually following the industrialization of the country.

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 162 Gg CO_2-eq in 2012, representing a 68.8 % increase.

Table 3.2 - National GHG emissions (Gg, CO_2-eq) by sector (2000 – 2012)

Source Categories	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**27389**	**27772**	**28336**	**28532**	**29394**	**28414**	**30206**	**30692**
Energy	1995	2269	2562	2795	2981	2904	2851	2979
Industrial Processes	25	26	235	255	291	302	421	523
AFOLU	25274	25378	25427	25359	25992	25062	26779	27028
Waste	96	99	113	123	130	145	155	162

3.4 TREND IN EMISSIONS OF DIRECT GHGs

The share of emissions by gas has not changed during the period 2000 to 2012. The main contributor to the national GHG emissions remained CO_2 followed by CH_4 and N_2O. In 2012, the share of the GHG emissions was as follows: 69.6 % CO_2, 18.8 % CH_4 and 11.6 % 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 has decreased while those of CH_4 and N_2O have increased respectively over the period 2000 to 2012.

Table 3.3 - Aggregated emissions and removals (Gg) by gas (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
Total GHG emissions (CO_2-eq)	**27389**	**27772**	**28336**	**28532**	**29394**	**28414**	**30206**	**30692**
Removals (CO_2) (CO_2-eq)	**-44459**	**-41501**	**-37707**	**-34781**	**-31641**	**-28534**	**27118**	**25452**
Net removals (CO_2-eq)	**-17070**	**-13729**	**-9371**	**-6249**	**-2246**	**-121**	**3088**	**5240**
CO_2	20197	20470	20965	21214	21432.0	21366	21435	21385
CH_4 (CO_2-eq)	4651	4505	4545	4504	4928	4336	5427	5756
N_2O (CO_2-eq)	2541	2796	2827	2814	3034	2712	3345	3551

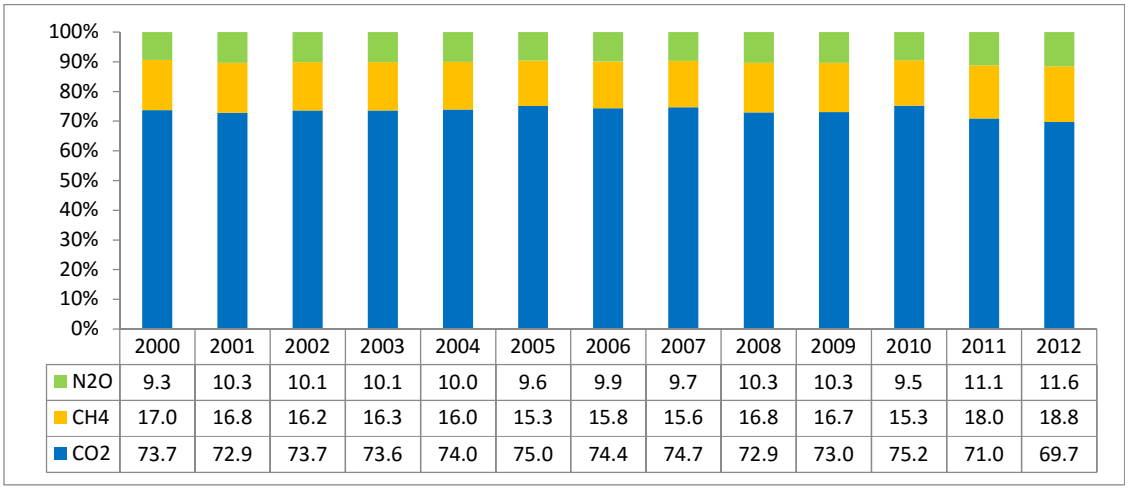


Figure 3.4 - Share of aggregated emissions (Gg CO_2-eq) by gas (2000 – 2012)

3.4.1 Carbon dioxide (CO_2)

The most significant anthropogenic GHG was CO_2. In 2012, it contributed the largest share of national emissions at 21 385 Gg (69.7 %). CO_2 emissions increased by 1188 Gg from the 2000 level of 20 197 Gg (Table 3.3) to 21 385 Gg in 2012. The sector that emitted the highest amount of CO_2 was AFOLU with 17 991 Gg followed by Energy with 2869 Gg (Table 3.4).

Table 3.4 - CO_2 emissions (Gg) by source category (2000 – 2012)

Source Category	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**20197**	**20470**	**20965**	**21214**	**21432**	**21366**	**21435**	**21385**
Total net removals	**-24262**	**-21031**	**-16742**	**-13567**	**-10208**	**-7169**	**-5683**	**-4067**
Energy	1902	2173	2459	2689	2871	2793	2743	2869
Industrial Processes	25	26	235	255	291	302	421	523
AFOLU - emissions	18269	18270	18269	18268	18268	18268	18269	17991
AFOLU - removals	-44459	-41501	-37707	-34781	-31641	-28534	-27118	-25452
Waste	1.2	1.3	1.4	1.6	1.8	1.9	2.0	2.3

3.4.2 Methane (CH_4)

Methane was the next contributor in national emissions after CO_2. It contributed 5756 Gg CO_2-eq of the total emissions of 2012. Methane emissions increased by 1105 Gg CO_2-eq from the 2000 level of 4651 Gg CO_2-eq to 5756 in 2012 (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 – 2012)

Source Category	2000	2002	2004	2006	2008	2010	2011	2012
Total (Gg CO_2-eq)	**4651.5**	**4505.5**	**4544.6**	**4503.8**	**4927.6**	**4335.7**	**5426.9**	**5756.3**
Total	**221.5**	**214.5**	**216.4**	**214.5**	**234.6**	**206.5**	**258.4**	**274.1**
Energy	2.9	3.0	3.0	3.1	3.1	3.1	3.0	3.0
AFOLU - emissions	215.3	208.2	209.4	207.0	226.8	198.0	249.6	265.0
Waste	3.3	3.4	4.0	4.4	4.7	5.4	5.8	6.1

3.4.3 Nitrous Oxide (N_2O)

Nitrous oxide emissions stood at 3551 Gg CO_2-eq in 2012. Emissions increased by 1010 Gg CO_2-eq from 2540 Gg CO_2-eq in the year 2000 to 3551 Gg CO_2-eq (Table 3.) in 2012. The AFOLU sector was the highest emitter of N_2O.

Table 3.6 - N_2O emissions (Gg) by source category (2000 – 2012)

Source Category	2000	2002	2004	2006	2008	2010	2011	2012
Total (Gg CO_2-eq)	**2540.7**	**2796.4**	**2827.2**	**2814.2**	**3034.1**	**2712.0**	**3344.7**	**3551.0**
Total	**8.20**	**9.02**	**9.12**	**9.08**	**9.79**	**8.75**	**10.79**	**11.45**
Energy	0.10	0.11	0.12	0.14	0.14	0.15	0.14	0.15
AFOLU - emissions	8.01	8.82	8.91	8.85	9.55	8.50	10.55	11.20
Waste	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.10

3.5 TRENDS FOR INDIRECT GHGs AND SO_2

Emissions of indirect GHGs (CO, NO_X and NMVOC) and SO_2, 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 2012 are given in Table 3.7 and Figure 3.5.

Table 3.7 - Emissions (Gg) of indirect GHGs and SO_2 (2000 – 2012)

Gases	2000	2002	2004	2006	2008	2010	2011	2012
NO_X	31.5	34.7	36.0	35.2	34.6	35.2	36.0	36.3
CO	364.9	366.9	371.6	373.8	375.6	375.3	367.5	369.2
NMVOC	19.5	20.5	21.2	21.8	22.9	22.0	21.5	21.6
SO_2	2.2	2.8	3.6	4.2	4.2	2.8	3.3	2.9

Emissions of NO_X increased from 31.5 Gg in the year 2000 to 36.3 Gg in 2012. Carbon monoxide emissions increased from 364.9 Gg in 2000 to 375.3 Gg in 2010 and regressed after to 369.2 Gg in 2012. Emissions of NMVOC increased slightly from 19.5 Gg in 2000 to 22.0 Gg in 2010 and fell to 21.6 Gg in 2012 whilst emissions of SO_2 increased from 2.2 Gg in 2000 to peak at 4.2 Gg in 2008 and thereafter decreased to 2.9 Gg in 2012.

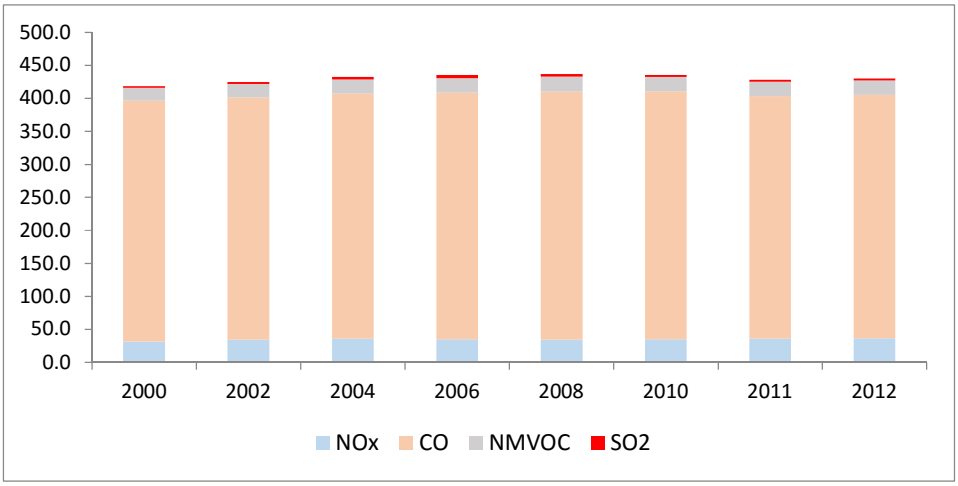


Figure 3.5 - Share of Indirect GHG emissions (Gg CO2-eq) (2000 – 2012)

3.5.1 NO_X

Emissions of NO_X increased over the inventory period from 31.5 Gg in the year 2000 to 36.3 Gg in 2012 (Table 3.8). The two main sources of NO_X emissions were the Energy and AFOLU sectors. The energy and AFOLU sectors contributed 61 % and 38 % of total national emissions in 2012.

Table 3.8 - NO_X emissions (Gg) by source category (2000 – 2012)

Source category	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**31.5**	**34.7**	**36.0**	**35.2**	**34.6**	**35.2**	**36.0**	**36.3**
Energy	17.5	20.7	22.0	21.1	20.5	21.1	21.9	22.2
AFOLU	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
Waste	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5

3.5.2 CO

The two main contributors of CO were the AFOLU and Energy sectors (Table 3.9). National CO emissions increased from 365 Gg in the year 2000 to 369 Gg in 2012. In 2012, 76 % of the total CO emissions originated from the AFOLU sector while the Energy sector contributing 22 %. The Waste sector contributed 2.2 % of total CO emissions in 2012 compared to 1.2 % in 2000. CO emissions in the AFOLU sector decreased from 290 Gg in 2000 to 282 in 2012.

Table 3.9 - CO emissions (Gg) by source category (2000 – 2012)

Source category	2000	2002	2004	2006	2008	2010	2011	2012
Total emissions	**364.9**	**366.9**	**371.6**	**373.8**	**375.6**	**375.3**	**367.5**	**369.2**
Energy	70.4	73.4	79.2	82.3	85.0	85.6	78.3	79.4
Industrial Processes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFOLU	290.2	288.7	287.2	285.8	284.3	282.8	282.0	281.5
Waste	4.3	4.8	5.2	5.8	6.3	6.9	7.2	8.2

3.5.3 NMVOC

In 2012, NMVOC emissions stood at 21.6 Gg compared to 19.5 Gg in the year 2000. The two main emission sources were the Energy and AFOLU sectors (Table 3.10). NMVOC emissions varied throughout the inventory period for these two sectors. Emissions from the Waste sector increased from 0.2 Gg to 0.5 Gg during the inventory period.

Table 3.10 - NMVOC emissions (Gg) by source category (2000 – 2012)

Source	2000	2002	2004	2006	2008	2010	2011	2012
Total emission	**19.5**	**20.5**	**21.2**	**21.8**	**22.9**	**22.0**	**21.5**	**21.6**
Energy	9.4	9.8	10.5	10.9	11.2	11.2	10.7	10.8
Industrial Processes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AFOLU	9.9	10.4	10.5	10.6	11.4	10.3	10.3	10.3
Waste	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5

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 2012. SO_2 emission increased from 2.2 Gg in 2000 to 4.2 Gg in 2006 and 2008 and then declined to 2.9 Gg in 2012. In 2012, the Energy sector contributed 99.4 % of SO_2 emissions and the Waste sector the remaining 0.6 %.

Table 3.11 - SO_2 emissions (Gg) by source category (2000 – 2012)

Source Category	2000	2002	2004	2006	2008	2010	2011	2012
Total emission	**2.2**	**2.8**	**3.6**	**4.2**	**4.2**	**2.8**	**3.3**	**2.9**
Energy	2.2	2.8	3.6	4.2	4.2	2.7	3.3	2.9
Waste	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02

4. ENERGY

4.1 ENERGY CATEGORY AND SUB-CATEGORIES

1.A. - Fuel Combustion Activities

1.A.1 - Energy Industries

The Energy Industries sub-category covers the production of electricity from a mix of liquid and solid fossil fuels. The contribution of fossil fuels is however minimal in the national energy balance since the country generates a high proportion of its electricity from hydro to supplement the imported power which stands at about 65 % of Namibia's demand from the South African Power Pool (SAPP) and Zimbabwe.

Namibia's total installed electricity generation capacity in 2012 was nearly 400 MW for a peak demand of some 500 MW normally. A peak of 534 MW was reached in 2012 (http://africa energy forum.com/webfmsend/2013). Hydro contributed for about 250 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 up to now.

1.A.2 - Manufacturing Industries and Construction

Fossil fuel inputs are primarily used for generating process heat within the mining sector and in the production of cement. The two main mining companies also 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 included domestic aviation, road transportation, railways and domestic water-borne navigation. Emissions for the four sub-categories have been computed in this inventory. Fuel supplied for international bunkering was also covered.

1.A.4 - Other Sectors

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

The fuel mix used within the residential sector by households for cooking was wood/charcoal (54 %), electricity (33 %) and the remainder being LPG. Paraffin and waxes (50 %) and electricity (43 %) were the main sources of energy used for lighting. About 50 % of households consumed wood/charcoal for heating purposes and 30 % had recourse to electricity.

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

Memo items

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

4.2 Methodology

It is Good Practice to estimate emissions using both the Reference and Sectoral approaches. During this exercise, emission estimates were computed using both approaches. The top down Reference approach was carried out using import, export, production and stock change data that constituted the basis for producing the national energy balance. The bottom up Sectoral Approach generally involves the quantification of fuel consumption from end use data by the different sector source categories. Thereafter the IPCC conversion and emission factors were adopted to compile GHG emissions. The Sectoral approach covered all the IPCC source categories where AD were available. AD could not be traced for a few minor sub-categories such as Agriculture, Forestry, Commercial and Institutional but this does not really affect the quality of the inventory as the fossil fuels consumed in these sub-categories have been allocated and burned in other categories.

The basic equations used to estimate GHG emissions are given below:

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

where

Emissions $_{\text{GHG, fuel}}$	= emissions of a given GHG by type of fuel (kg GHG)
Fuel Consumption $_{\text{fuel}}$	= amount of fuel combusted (TJ)
Emission Factor $_{\text{GHG, fuel}}$	= 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. Summary of data sources is given in Table 4.1.

Table 4.1 - Summary of data sources

Category	Fuel type	Data source
Energy industries	Fuel oil	Nampower
	Coal	Nampower
Mining	Gasolene/Diesel	ECB Project "Energy Policy, Regulatory Framework and Energy Future of Namibia (2011-2013)".
	Coal	ECB Project "Energy Policy, Regulatory Framework and Energy Future of Namibia (2011-2013)".
	Waste oil	National statistics.
Other manufacturing	Gasolene/Diesel	Ministry of Industrialization, Trade and SME Development.
Domestic aviation	Aviation Gasoline	Airport profile data and national statistics
	Jet kerosene	Airport profile data and national statistics.

Table 4.1 - Summary of data sources

Category	Fuel type	Data source
Road Transport	Gasolene/Diesel	Gasoline and diesel estimated from vehicles fleet and fuel consumption indicators for respective years
	LPG	Import and export data from NSA
Railways	Diesel/residual	TransNamib
Residential	Kerosene	Import and export data from NSA.
	LPG	Import and export data from NSA.
	Wax candles	Ministry of Industrialization, Trade and SME Development and import and export data from NSA
	Wood fuel	Derived from NSA census data.
	Charcoal	Derived from NSA census data.
Agriculture/ fishing	Gasolene	Import and export data from NSA.
	Diesel	National statistics.
International aviation bunkers	Jet kerosene	Airport profile data and national statistics.
International marine bunkers	Diesel	Ministry of Works and Transport, Maritime Affairs.
	Gasolene	National statistics.
	Residual fuel oil	SNC and National statistics.

AD were not always available and in the format required as well as at the level of disaggregation needed. This is due to the fact that the country is still in the process of putting in place its GHG inventory management system. Gaps were filled using statistical methods such as trend analysis, interpolation and extrapolation as appropriate. In some cases, fuels had to be allocated or determined according to the activity area. One such example is the amount of fuel used in the fishing sector which is directly related to fishing vessel campaigns. Fuel used for sectors like Agriculture, Forestry and Institutional amongst others could neither be traced nor generated. Thus, fuels from these sectors were eventually allocated in different sectors based on amounts distributed and consumed. AD used for the Energy sector is provided in Table 4.2.

Table 4.2 – Activity data (t) for the Energy sector (2000 – 2012)

Categories	Type of fuel	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Energy generation	HFO and LFO	53	119	131	628	130	1239	2610	2569	554	774	1123	2246	8610
	Bitum. coal	2926	3609	18	7942	718	20384	63877	76599	95876	57453	13105	4745	3841
Mining	Motor gasoline	2454	2454	2454	2454	2454	2454	2454	2454	2454	2454	2454	2454	2454
	Gas/diesel	11778	11508	10994	11938	15007	14771	17309	23244	25310	22536	21145	19767	21149
	Bitum. coal	7360	39040	25800	38040	38040	32600	32840	28400	23960	31160	36160	49640	38986
	Waste oil	4655	4784	5041	5425	5842	6233	6448	6855	6965	7046	7128	7610	8092
Other manufacturing	Gasoline	218	212	221	223	239	231	232	239	226	253	257	259	271
	Gas/Diesel	317	326	387	371	396	395	404	398	408	421	440	405	483
Civil aviation	Aviation Gasoline	3012	3043	3074	3105	3136	3167	3210	3210	3210	3210	3596	1559	1808
	Jet kerosene	3074	3105	3136	3168	3200	3232	3264	3297	3330	3363	3456	5913	6859
Road transportation	Motor gasoline	233707	237990	248782	265686	283498	300461	308626	326575	329529	331785	333283	286747	297946
	Diesel oil	184696	194803	207799	225562	249491	269389	281124	300275	314526	330463	348809	343721	377663
	LPG	-	-	-	-	-	-	-	72	276	496	715	500	500

Categories	Type of fuel	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Railways	Diesel oil	12900	13607	14314	15021	15728	16435	16808	17207	16022	15710	6571	5948	6416
	Residuel fuel oil	-	-	-	-	-	-	-	-	-	-	9857	8922	9624
Residential	Kerosene	3316	3283	3251	3219	3187	3155	3124	3093	2700	2357	2057	1796	1568
	LPG	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1200	1200
	Parafin fax	27123	27319	29577	30332	34193	30765	29070	29128	34625	35989	27529	29510	29405
	Wood fuel	510086	517208	517428	517550	517573	517494	517310	517018	516615	516097	515463	514707	507886
	Charcoal	8000	8000	8000	9000	9000	9000	10000	10000	10000	10000	10000	10000	10000
Fishing	Motor gasoline	3300	3470	3640	3810	3980	4150	4320	4490	4660	4830	5000	5170	5340
	Diesel oil	98000	107000	128000	132000	121000	116000	90700	71900	65700	75500	67200	85800	74500
Non-specified	Diesel	10797	11812	12339	12853	13442	13512	13625	13668	13499	13002	12807	13561	16112
	Gasolene	-	-	-	-	-	-	-	-	-	-	-	238	282
Int. aviation	Jet kerosene	27665	27945	28227	28512	28800	29088	29379	29673	29969	30269	31120	39573	45904
Int. water-borne navigation	Diesel oil	25247	24614	23982	23349	22717	22084	21451	20819	20186	19554	18921	18921	18921
	Gasolene	622	622	622	622	622	622	622	622	622	622	622	622	622
	Residual oil	16196	17519	18842	20166	21489	22812	24135	25458	26782	28105	29428	31194	33065

4.2.2 Emission factors

Namibia does not have national emission factors for the Energy sector. Thus, the IPCC default emission factors were adopted to compute greenhouse gas emissions. The EFs are listed in Table 4.3.

Table 4.3 - 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)

CO_2 emissions were estimated anew under the RA as updated data sets on energy became available. The results differed widely for a few years with quite serious underestimates for the reference approach as for the year 2007 (Table 4.4). The wide differences between the two approaches possibly occurred as import-export data on fuels were quite inconsistent with even net exports sometimes for the country which is not a producer of fossil fuels. It appears that all fuels entering the country are not being systematically recorded. As well, it could be that fuels are purchased outside the borders and then burned on the territory or vice versa. This is computed in the sectoral approach given that, for example, the outputs in the transportation category are based on the number of vehicles and their consumption rather than delivery at the pumps, the latter data not being available. It is worth highlighting that the country is in the process of making annual energy balances that will help refine AD for this sector.

Table 4.4 - Comparison of the Reference and Sectoral Approaches (Gg CO_2) (2000 – 2012)

Approach	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Reference Approach	1835	2062	2000	1799	1895	2112	2133	1624	3341	2936	2498	2233	2758
Sectoral Approach	1902	2062	2173	2355	2459	2590	2689	2788	2871	2876	2793	2743	2869
Difference (%)	-3.5	0.0	-7.9	-23.6	-22.9	-18.5	-20.7	-41.8	16.3	2.1	-10.6	-18.6	-3.8

Sectoral approach

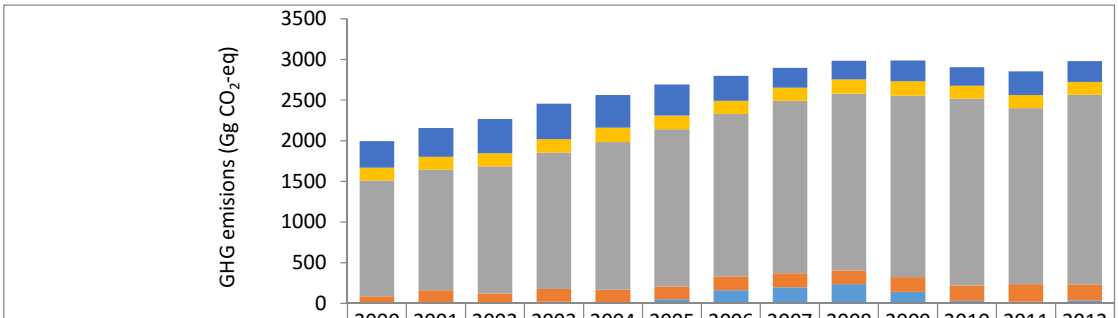
Total aggregated emissions are provided in Table 4.5 while the share of emissions by category is depicted in Figure 4.1 for the five IPCC source categories for the years 2000 to 2012. Total emissions from Fuel Combustion Activities amounted to 1995 Gg CO_2-eq in 2000 and reached 2979 Gg CO_2-eq in 2012. This represented an increase of 984 Gg CO_2-eq since the year 2000 or a 4.1% annual increase in emissions during the 13 years starting 2000.

Table 4.5 - Emissions for Fuel Combustion Activities (Gg CO_2-eq) (2000 – 2012)

Source of emission	2000	2002	2004	2006	2008	2010	2011	2012
Fuel combustion activities	1994.8	2269.1	2561.6	2795.5	2981.0	2904.1	2851.2	2978.6
Energy Industries	7.3	0.5	2.2	164.9	236.9	35.7	18.7	36.4
Manufacturing Industries and Construction	79.1	123.3	168.7	165.1	170.4	187.8	217.9	197.8
Transport	1429.0	1561.2	1814.1	2000.0	2172.3	2296.6	2165.32	2331.5
Other Sectors	479.3	584.4	576.6	465.4	401.4	384.0	449.4	411.9

Other sectors: include Residential and Fishing

Transport contributed the major share of these emissions, between 72 and 78 % for the period 2000 to 2012. Emissions from transport increased by 63 % over these 12 years. Emissions from Other Sectors category fluctuated between 479 Gg CO_2-eq in the year 2000 to 412 Gg CO_2-eq in 2012, while those from Manufacturing Industries and Construction stayed at around 6 % of the Energy sector emissions. Energy Industries emissions varied widely because local electricity generation serves only to supplement import deficits and emissions from that category hit a maximum of 8 % in 2008 and represented only 1 % in 2012.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Agriculture/Fishing	324	353	421	435	400	384	304	244	225	257	231	291	255
Residential	155	157	163	165	177	166	161	162	177	177	153	159	157
Transport	1429	1481	1561	1676	1814	1935	2000	2121	2172	2229	2297	2165	2332
Manufacturing Industries & Construction	79	156	123	157	169	156	165	174	170	180	188	218	198
Energy Industries	7	9	0	21	2	54	165	196	237	143	36	19	36

Figure 4.1 - Share of GHG emissions (Gg CO2-eq) by Energy sub-category (2000 – 2012)

As depicted in Table 4.6, it is clear that out of the nine Energy sub-categories, Road transportation remained the major contributor of 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 and regress slightly to 2163 Gg CO_2-eq in 2012.

Table 4.6 - GHG emissions (Gg CO_2-eq) by Energy sub-category for period 2000 to 2012

Fuel Combustion Activities-Energy sub-categories	Emission expressed in CO_2-eq							
	2000	2002	2004	2006	2008	2010	2011	2012
Energy (Total)	**1994.8**	**2269.1**	**2561.6**	**2795.5**	**2981.0**	**2904.1**	**2851.2**	**2978.6**
Electricity Generation	7.3	0.5	2.2	164.9	236.9	35.7	18.7	36.4
Mining (excluding fuels) and Quarrying	77.4	121.4	166.7	163.1	168.4	185.6	215.8	195.5
Non-specified Industry	1.7	1.9	2.0	2.0	2.0	2.2	2.1	2.4
Civil Aviation	19.1	19.5	19.9	20.3	20.5	22.1	23.6	27.4
Road Transportation	1333.7	1456.0	1700.3	1881.9	2056.7	2181.0	2017.5	2162.8
Railways	41.2	45.8	50.3	53.7	51.2	51.9	47.0	50.7
Residential	155.2	163.1	176.8	161.5	176.5	153.3	158.6	156.7
Fishing (mobile combustion)	324.1	421.3	399.9	303.9	224.8	230.7	290.8	255.1
Mobile (Other)	35.0	40.0	43.6	44.2	43.8	41.5	77.1	91.6

The evolution of emissions of all gases in the Energy sector is presented in Table 4.7. Throughout the period 2000 to 2012, CO_2 contributed the major part of the emissions followed by CH_4 and N_2O. Among the indirect gases, CO was the main gas emitted over the same period of time followed by NO_X and NMVOCs. Over the time series, the emissions increased very slightly for most gases, except for CO_2, due to increased economic activity. It is interesting to note that from 2010 to 2012, a slight decrease is observed for CH_4, N_2O, CO and NMVOCs.

Table 4.7 - Emissions (Gg) by gas for the Energy sector for the period 2000 to 2012

GHG	2000	2002	2004	2006	2008	2010	2011	2012
CO_2	1902.2	2172.6	2459.3	2689.3	2871.4	2793.4	2743.1	2868.5
CH_4	2.9	3.0	3.0	3.1	3.1	3.1	3.0	3.0
N_2O	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
NO_X	17.5	20.7	22.0	21.1	20.5	21.1	21.9	22.2
CO	70.4	73.4	79.2	82.3	85.0	85.6	78.3	79.4
NMVOC	9.4	9.8	10.5	10.9	11.2	11.2	10.7	10.8
SO_2	2.2	2.8	3.6	4.2	4.2	2.7	3.3	2.9

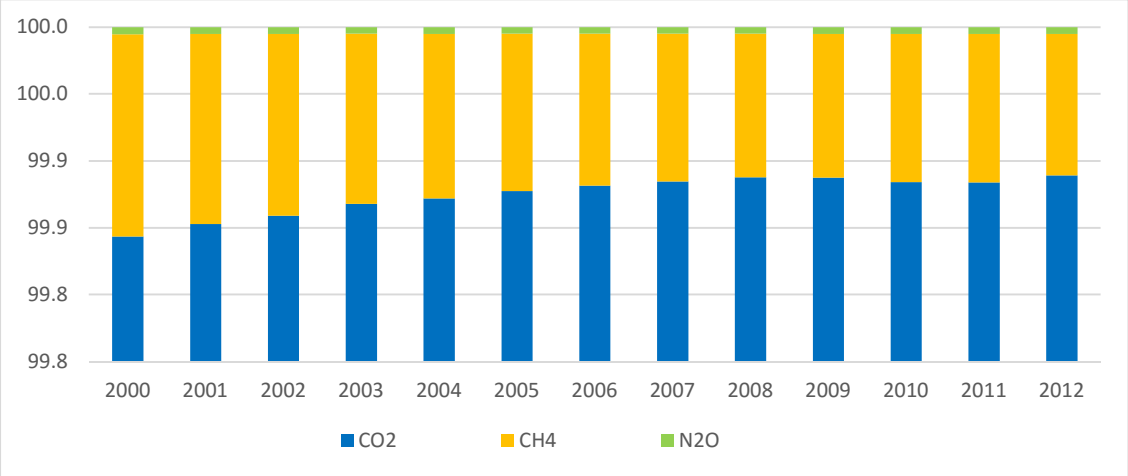


Figure 4.2 - Share emissions by gas (%) for the Energy sector (2000 – 2012)

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

Emissions of CO_2 in the Energy category showed a general increase between the years 2000 to 2012, from 1902 to 2869 Gg. The annual increase which was quite sharp up to 2008 plateaued thereafter until 2012. Average emission was 2552 Gg over the period under review.

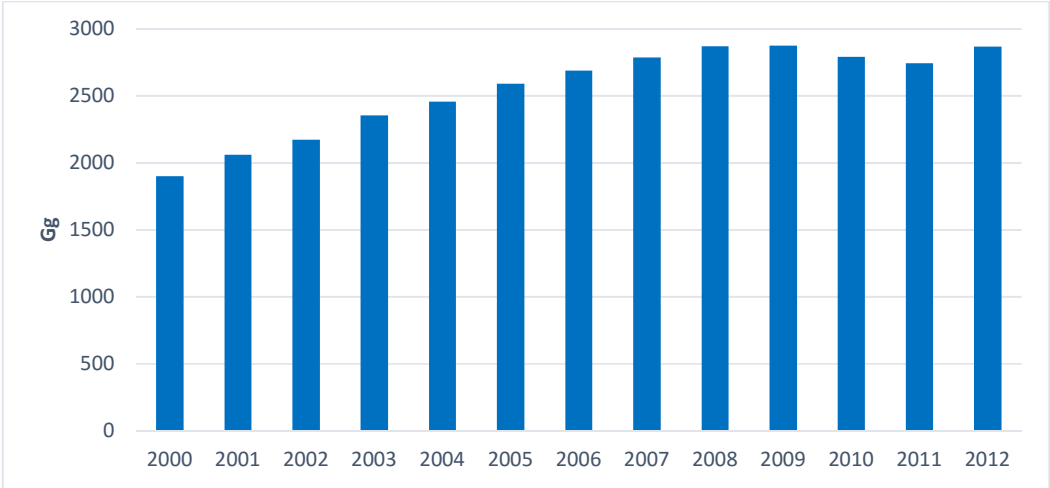


Figure 4.3 - Evolution of CO_2 emissions (Gg) in the Energy Sector (2000 – 2012)

With regard to CH_4, emissions varied between 2.9 Gg and 3.1 Gg during the period 2000 to 2012 (Figure 4.4). After increasing to 3.1 Gg during the period 2006 to 2010, emissions dipped down to 3.0 Gg in 2011 and 2012.

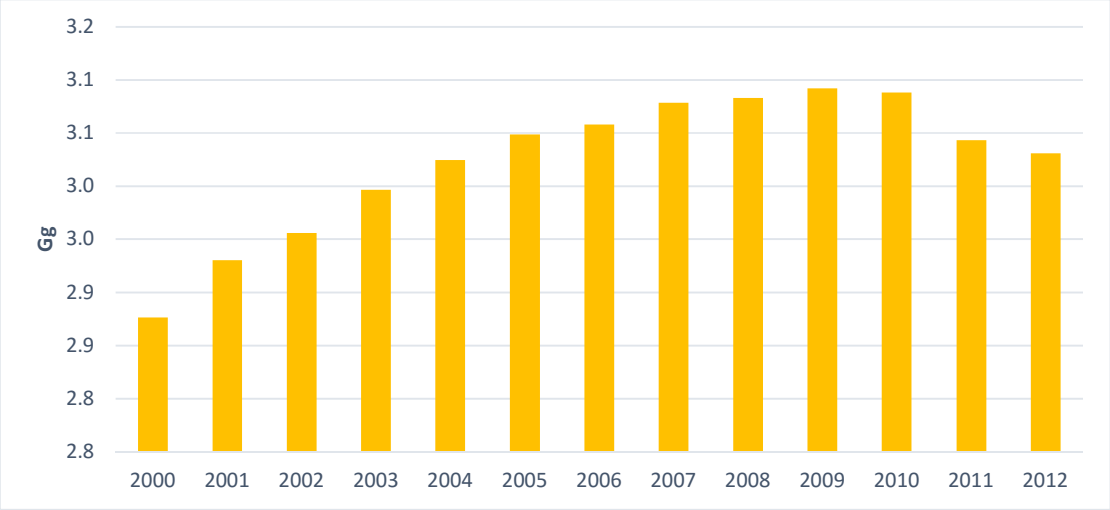


Figure 4.4 - Evolution of CH_4 emissions (Gg) in the Energy Sector (2000 – 2012)

Emissions of N_2O increased from 0.10 to 0.15 Gg (Figure 4.5) over the period 2000 to 2012.

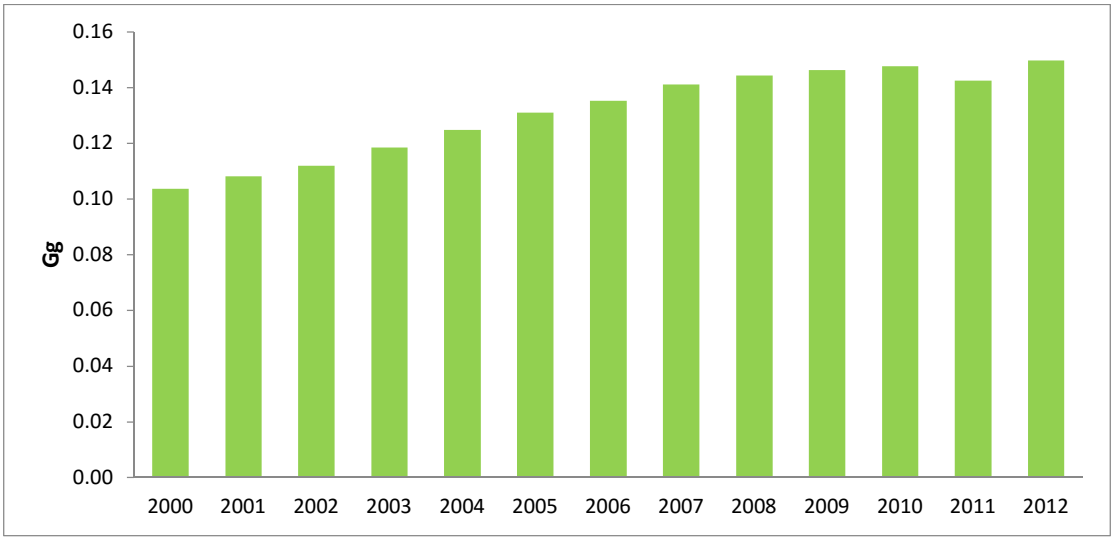


Figure 4.5 - Evolution of N_2O emissions (Gg) in the Energy Sector (2000 – 2012)

Emissions of NO_X varied from 17.5 Gg in 2000 to 22.4 Gg in 2005 (Figure 4.6), and regress to 22.2 Gg in 2012. Average emissions were 20.9 Gg over the period 2000 to 2012.

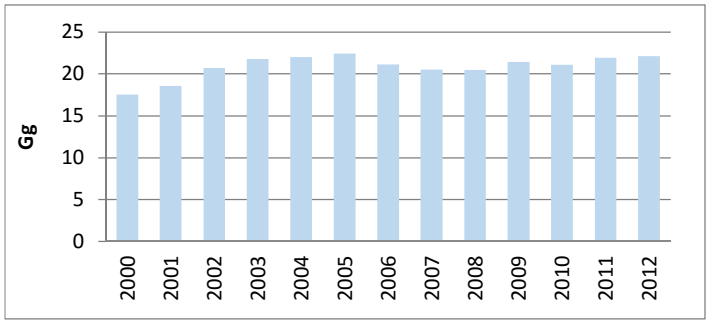


Figure 4.6 - Evolution of NO_X emissions (Gg) in the Energy Sector (2000 – 2012)

Emissions of CO averaged 79.4 Gg over the period, starting at 70.4 Gg in 2000 to reach a peak of 85.8 Gg in 2009, representing a 20 % increase (Figure 4.7). It then decreased to 79.4 Gg in 2012.

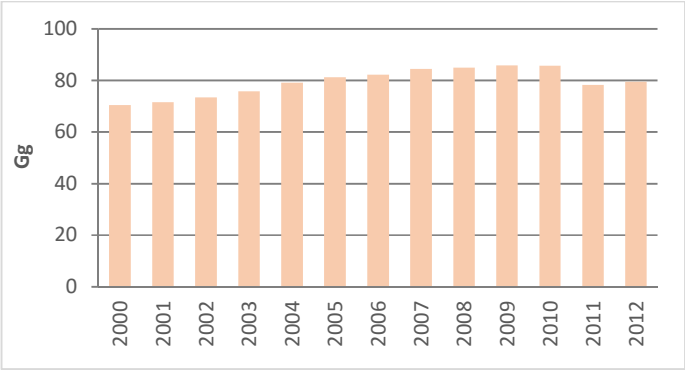


Figure 4.7 - Evolution of CO emissions (Gg) in the Energy Sector (2000 – 2012)

NMVOCs emissions increased by nearly 20 % over the inventory period 2000 to 2010, starting at 9.4 Gg in 2000 to peak at 11.3 Gg in 2009 (Figure 4.8), and regress to 10.8 Gg in 2012.

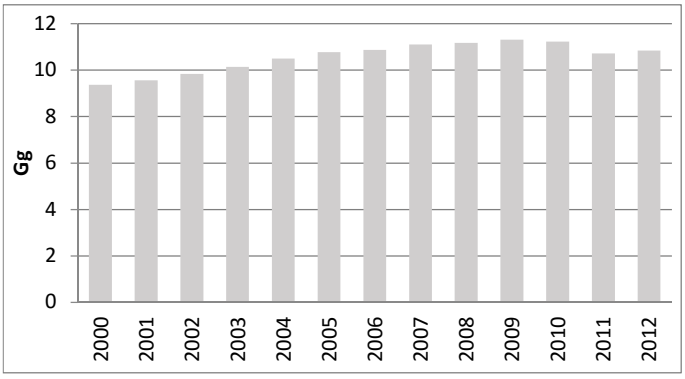


Figure 4.8 - Evolution of NMVOC emissions (Gg) in the Energy Sector (2000 – 2012)

SO_2 emissions increased from 2.2 Gg in 2000 to reach a peak of 4.2 Gg in 2006, a 98 % increase. However, emissions fluctuated thereafter and decreased to 2.9 Gg in 2012 (Figure 4.9).

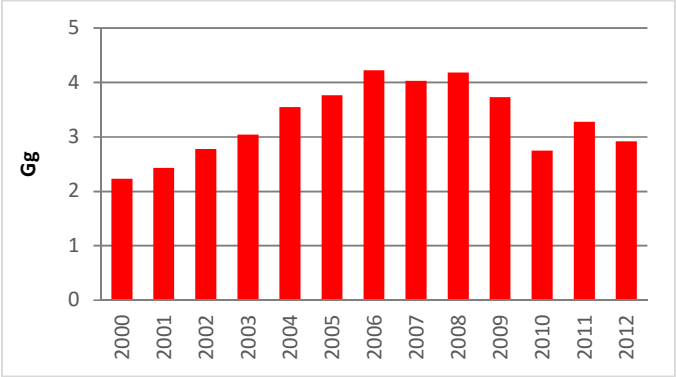


Figure 4.9 - Evolution of SO_2 emissions (Gg) in the Energy Sector (2000 – 2012)

Table 4.8 presents the emissions for the different categories and sub-categories of the Energy sector

Table 4.8 - Energy Sector emissions in 2012

Inventory Year: 2012

Categories	Emissions(Gg)						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
1 - Energy	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
1.A - Fuel Combustion Activities	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
1.A.1 - Energy Industries	36.3	1E-03	4E-04	0.1	6E-03	9E-04	0.3
1.A.1.a - Main Activity Electricity and Heat Produc	36.3	1E-03	4E-04	0.1	6E-03	9E-04	0.3
1.A.1.a.i - Electricity Generation	36.3	1E-03	4E-04	0.1	6E-03	9E-04	0.3
1.A.2 - Manufacturing Industries and Construction	196.3	2E-02	3E-03	0.7	1.2	0.2	1.0
1.A.2.i - Mining (excluding fuels) and Quarrying	193.9	2E-02	3E-03	0.7	1.2	0.2	1.0
1.A.2.m - Non-specified Industry	2.4	1E-04	2E-05	2E-02	2E-03	8E-04	2E-03
1.A.3 - Transport	2197.3	0.5	0.1	14.3	42.8	4.7	2E-02
1.A.3.a - Civil Aviation	27.2	2E-04	8E-04	0.1	2.2	0.0	9E-03
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.a.ii - Domestic Aviation	27.2	2E-04	8E-04	0.1	2.2	4E-02	9E-03
1.A.3.b - Road Transportation	2119.5	0.5	0.1	13.3	40.4	4.6	2E-02
1.A.3.b.i - Cars	443.0	0.2	2E-02	1.4	10.2	1.2	5E-03
1.A.3.b.i.1 - Passenger cars with 3-way catalys	142.8	0.1	7E-03	0.4	3.3	0.4	2E-03
1.A.3.b.i.2 - Passenger cars without 3-way cata	300.2	0.1	1E-02	0.9	6.9	0.8	3E-03
1.A.3.b.ii - Light-duty trucks	923.6	0.3	0.0	4.1	28.1	2.8	0.0
1.A.3.b.ii.1 - Light-duty trucks with 3-way catal	692.7	0.2	3E-02	3.1	21.1	2.1	6E-03
1.A.3.b.ii.2 - Light-duty trucks without 3-way ca	230.9	0.1	1E-02	1.0	7.0	0.7	2E-03
1.A.3.b.iii - Heavy-duty trucks and buses	750.6	4E-02	4E-02	7.9	1.8	0.5	2E-03
1.A.3.c - Railways	50.5	2E-03	4E-04	0.8	0.2	0.1	1E-04
1.A.3.d - Water-borne Navigation				0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.4 - Other Sectors	348.9	2.5	3E-02	6.5	35.3	5.9	1.7
1.A.4.b - Residential	95.2	2.4	0.0	0.6	31.7	4.8	0.1
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	253.8	3E-02	2E-03	5.9	3.6	1.2	1.6
1.A.4.c.iii - Fishing (mobile combustion)	253.8	0.0	0.0	5.9	3.6	1.2	1.6
1.A.5 - Non-Specified	89.7	2E-02	4E-03	0.5	0.2	3E-02	3E-04
1.A.5.b - Mobile	89.7	2E-02	4E-03	0.5	0.2	3E-02	3E-04
1.A.5.b.iii - Mobile (Other)	89.7	2E-02	4E-03	0.5	0.2	3E-02	3E-04
1.B.2 - Oil and Natural Gas				0	0	0	0
1.B.3 - Other emissions from Energy Production				0	0	0	0
1.C - Carbon dioxide Transport and Storage	0			0	0	0	0

Categories	Emissions(Gg)						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
Memo Items (3)							
International Bunkers	310.3	2E-02	8E-03	4.6	0.8	0.3	1.1
1.A.3.a.i - International Aviation (International Bunke	144.7	1E-03	4E-03	0.5	5E-02	2E-02	4E-02
1.A.3.d.i - International water-borne navigation (Inter	165.6	2E-02	4E-03	4.1	0.7	0.3	1.1
1.A.5.c - Multilateral Operations (1)(2)				0	0	0	0
Information Items							
CO2 from Biomass Combustion for Energy Production	920.4						

4.2.5 Emissions by gas by category for the period 2000 to 2012

CO_2 emissions

Emissions (Gg) of CO_2 for the years 2000 to 2012 are summarized in Table 4.9. Total CO_2 emissions emanating from fuel combustion activities increased from 1902 Gg in 2000 to 2876 in 2009 and declined to 2869 Gg in 2012. 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. It fluctuated between 142.6 and 18.6 Gg thereafter until 2012. Emissions from the Other sectors sub-category increased from 416 Gg in 2000 to 535 Gg in 2003 and decreased thereafter to 349 Gg in 2012. The Non-specified sub-category emissions increased from 34 to 90 Gg over the period under review.

Table 4.9 - CO_2 emissions (Gg) (2000 – 2012)

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
2011	2743.1	18.6	216.2	2047.3	385.5	75.5
2012	2868.5	36.3	196.3	2197.3	348.9	89.7

CH_4 emissions

A total of 3.0 Gg of methane (CH_4) was emitted from the Energy category in 2012, with 2.5 Gg from the fishing sub-category within the Other Sectors sub-category (Table 4.10). Transport accounted for 0.50 Gg of emissions of this sector. Total CH_4 emissions from the Energy Industries sub-category contributed 0.001 Gg and manufacturing Industries and Construction 0.023 Gg in 2012.

Table 4.10 - CH_4 emissions (Gg) (2000 – 2012)

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
2011	3.0	3.9E-04	2.5E-02	0.48	2.5	1.8E-02
2012	3.0	1.1E-03	2.3E-02	0.50	2.5	2.1E-02

N_2O emissions

Total emissions from fuel combustion activities varied between 0.10 Gg in 2000 to 0.15 Gg in 2012 (Table 4.11). In general, the highest emission was noted in the Transport sub-category which accounted for 0.11 Gg in 2012 compared to 0.06 Gg in 2000. A total of 0.00036 Gg of N_2O was emitted from the Energy Industries sub-category in 2012, compared to 0.00011 Gg in 2000.

Table 4.11 - N_2O emissions (Gg) (2000 – 2012)

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
2011	0.14	2.4E-04	0.004	0.10	0.036	3.8E-03
2012	0.15	3.6E-04	0.003	0.11	0.035	4.5E-03

NO_X emissions

Emissions of NO_X from the combustion of fuels increased from 17.5 Gg in 2000 to 22.2 Gg in 2012. The main contributor was the Transport and Other Sectors (mainly fishing) sub-categories, followed by the Manufacturing Industries and Construction, and Non-Specified sectors (Table 4.12). Transport emissions increased from 8.4 Gg in 2000 to 14.3 in 2012. Emissions from the Other Sectors sub-category increased from 8.4 Gg in 2000 to 11.1 Gg in 2003 and decreased by nearly 50 % from 2003 to 2012. Energy industries with less than 1 Gg contributed marginally.

Table 4.12 - NO_X emissions (Gg) (2000 – 2012)

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
2011	21.9	0.04	0.76	13.3	7.4	0.46
2012	22.2	0.07	0.74	14.3	6.5	0.54

CO emissions

CO emissions originated mainly from the Other Sectors and Transport sub-categories and accounted for 98.3 % of emissions in 2012 (Table 4.13). CO emissions for the Energy sector evolved from 70 Gg in 2000 to 86 Gg in 2010, and regressed to 79 Gg in 2012. Emissions from the Other Sectors sub-category fluctuated around 36 Gg for the period 2000 to 2012.

Table 4.13 - CO emissions (Gg) (2000 – 2012)

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
2011	78.3	2.4E-03	1.43	41.0	35.7	0.14
2012	79.4	6.1E-03	1.19	42.8	35.3	0.17

NMVOC emissions

NMVOCs originated from the Other Sectors and Transport sub-categories mainly and these accounted for 98.1 % of emissions of the Energy sector (Table 4.14). Emissions increased from 3.5 Gg in 2000 to 4.7 Gg in 2012 for transport and varied around 6 Gg for the same period for the Other sectors sub-category. Total NMVOCs emissions increased from 9.4 Gg in 2000 to 11.3 Gg in 2009 and fell slightly to 10.8 Gg in 2012.

Table 4.14 - NMVOCs emissions (Gg) (2000 – 2012)

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
2011	10.7	3.0E-04	0.23	4.5	6.0	0.03
2012	10.8	9.0E-04	0.21	4.7	5.9	0.03

SO_2 emissions

Emissionsof 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 4.15).Emissions in the former sub-category varied between 1.5 Gg and 2.8 Gg while in the Manufacturing and Construction sub-category, the emissions increased consistently from 0.03 Gg in 2000 to 0.96 Gg in 2012. Total SO_2 emissions in the Energy sector increased from 2.2 Gg in 2000 to peak at 4.2 in 2006 and 2008. Thereafter, emissions decreased to 2.9 Gg in 2012.

Table 4.15 - SO_2 emissions (Gg) (2000 – 2012)

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
2011	3.3	0.15	1.20	0.02	1.9	2.0E-04
2012	2.9	0.25	0.96	0.02	1.7	3.0E-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 highest from the Transport sub-category, which increased from 70 % in 2000 to 78 % in 2010 and then decreased to 75 % in 2012 (Figure 4.10). Emissions from the Manufacturing Industries and Construction sub-category increased from 4.0 % in 2000 to 7.6 % in 2011, 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 in 2012. Other Sectors sub-category witnessed a decrease in emissions, falling from 24 % in 2000 to 13.8 % in 2012.The Non-specified sub-category decreased from 1.8 % to 1.4 % from the year 2000 to 2010 but increased again to reach 3.1 % in 2012.

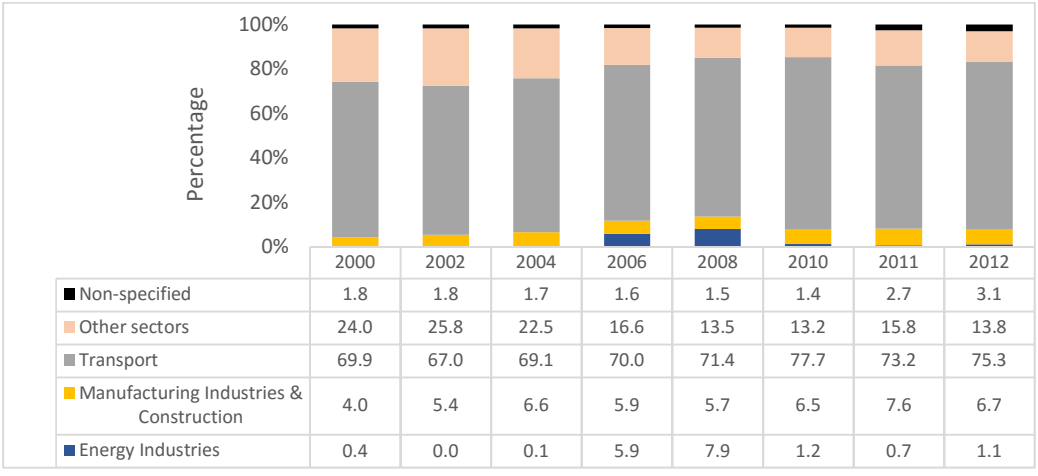


Figure 4.10 - Share of emissions Energy sector sub-categories (CO_2-eq) (2000 – 2012)

4.2.5.1 Emissions (Gg) by gas from Energy Generation

Within the Energy Generation sub-category, GHG emissions, increased from 7 Gg CO_2-eq in 2000 to reach a peak at 237 Gg CO_2-eq in 2008 and then decreased to 36 Gg in 2012 (Table 4.16). The largest share of emissions came from CO_2.

Table 4.16 - 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
2011	18.7	18.6	3.9E-04	2.4E-04	0.04	2.4E-03	3.0E-04	0.15
2012	36.4	36.3	1.1E-03	3.6E-04	0.07	6.1E-03	9.0E-04	0.25

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 216 Gg in 2011 (Table 4.17), and then regressed to 196 Gg in 2012. Nearly all emissions (99.2 %) stemmed from CO_2. Emissions increased by 153 % when compared with the year 2000 with a very sharp increase from 2000 to 2001.

Table 4.17 - 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
2011	215.8	214.1	2.5E-02	3.7E-03	0.74	1.4	0.23	1.20
2012	195.5	193.9	2.3E-02	3.4E-03	0.73	1.2	0.21	0.96

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

GHG emissions in the Non-specified Industry sub-category (Table 4.18) increased from 1.7 Gg CO_2-eq in 2000 to 2.4 Gg CO_2-eq in 2012, representing a 41 % increase, with nearly all emissions (99.7 %) from CO_2.

Table 4.18 - 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
2011	2.1	2.1	8.7E-05	1.7E-05	1.5E-02	1.9E-03	7.0E-04	1.4E-03
2012	2.4	2.4	9.8E-05	2.0E-05	1.7E-02	2.2E-03	8.0E-04	1.5E-03

4.2.5.4 Emissions (Gg) by gas from Civil Aviation

Total emissions increased from 19.1 Gg CO_2-eq in 2000 to 27.4 Gg CO_2-eq in 2012. The two main gases emitted in the Civil Aviation sub-category were CO_2, 19 Gg in 2000 increasing to 27 Gg in 2012 and CO, 3.6 Gg in 2000 which decreased to 2.2 Gg in 2012 after an increase to 4.3 Gg in 2010 (Table 4.19).

Table 4.19 - 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
2011	23.6	23.4	1.6E-04	6.6E-04	6.7E-02	1.9	3.0E-02	7.5E-03
2012	27.4	27.2	1.9E-04	7.7E-04	7.8E-02	2.2	3.5E-02	8.7E-03

4.2.5.5 Emissions (Gg) by gas from Road Transportation

The Road Transportation sub-category emitted 1334 Gg CO_2-eq in 2000 compared to 2163 Gg CO_2-eq in 2012. Emissions of NO_X increased from 8 Gg in 2000 to reach 13 Gg in 2012, representing a 62 % increase. CO and NMVOCs emissions increased over the time period, from 31 Gg to 40 Gg for CO and from 3.4 Gg to 4.6 Gg for NMVOCs for the years 2000 and 2012 respectively (Table 4.20).

Table 4.20 - 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
2011	2017.5	1977.0	0.5	0.10	12.4	39.0	4.4	1.4E-02
2012	2162.8	2119.5	0.5	0.11	13.3	40.4	4.6	1.5E-02

4.2.5.6 Emissions (Gg) by gas from Railways

Within the Railways sub-category, GHG emissions, increased by nearly 23 % over the time period, from 41 Gg CO_2-eq in 2000 to 51 Gg CO_2-eq in 2012 (Table 4.21), with the largest share of emissions (99.7 %) from CO_2.

Table 4.21 - 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
2011	47.0	46.9	1.8E-03	3.7E-04	0.78	0.16	7.0E-02	1.0E-04
2012	50.7	50.5	2.0E-03	4.0E-04	0.84	0.17	7.5E-02	1.0E-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 2000 to reach a peak of 177 in 2009 and then regressing to 157 Gg CO_2-eq in 2012 (Table 4.22). The main direct contributors were CO_2 and CH_4 to the tune of 61 % and 32 % of the total emissions in 2012 respectively. Emissions of NO_X, NMVOC and CO did not change much over the period 2000 to 2010, NO_X stood at around 0.66 Gg, NMVOC around 4.9 Gg and CO around 32.6 Gg.

Table 4.22 - 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
2011	158.6	96.2	2.5	3.3.E-02	0.65	32.1	4.8	8.8E-02
2012	156.7	95.2	2.4	3.3.E-02	0.64	31.7	4.8	8.7E-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 fluctuated to reach 255 Gg CO_2-eq in the year 2012 (Table 4.23). The largest share of emissions, above 99 %, was CO_2. Emissions of all gases, the direct GHGs and precursors as well as SO_2 followed the same trend as CO_2. SO_2 emissions are relatively more important when compared with the other sub-categories. This decrease observed up to 2003 is due to lower fishing activities as a result of the depletion of fish stocks and the fluctuations thereafter attributable to the imposition of fishing quotas.

Table 4.23 - 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
2011	290.8	289.3	0.04	2.4E-03	6.8	3.6	1.18	1.8
2012	255.1	253.8	0.03	2.1E-03	5.9	3.6	1.18	1.6

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

Emissions from this sub-category are mainly from mobile sources. Total emissions increased gradually from 35 Gg CO_2-eq in the year 2000 to 42 Gg CO_2-eq in 2010 and then shot to 77 and 92 Gg CO_2-eq in 2011 and 2012 respectively (Table 4.24). CO_2 represented some 98 % of these total emissions in 2012.

Table 4.24 - 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
2011	77.1	75.5	1.8E-02	3.8E-03	0.46	0.14	2.9E-02	2.0E-04
2012	91.6	89.7	2.1E-02	4.5E-03	0.54	0.17	3.5E-02	3.0E-04

5. INDUSTRIAL PROCESSES AND PRODUCT USE

5.1 Description of IPPU sector

Greenhouse gas emissions occur during the process of production of a wide range of industrial products. Emissions arise during the chemical or physical transformation of materials (for example, in the blast furnace in the iron and steel industry, during the manufacture of ammonia and other chemical products when fossil fuels are used as 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 such as SF_6 and NMVOCs are also emitted in different sub categories.

Activities occurred in three out of the eight categories falling under the IPPU sector and emissions were estimated for these source categories, namely cement production and lime production under mineral industry, and zinc production under metal industry. As well, lubricants and paraffin wax use under non-energy products and falling in the fuel and solvents use category was covered for their emissions.

Quite a number of activity areas have not been included as activity data were still not available to compute the estimates despite special efforts being devoted to collect these AD. ODS have been identified but they are all blends and work is ongoing to trace the exact amounts and the different blends including their composition for estimating emissions. 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 according to the IPCC 2006 Guidelines, at Tier 1 level, due to unavailability of disaggregated information on the technologies used in the production processes for moving to higher Tiers. Only the three main gases CO_2, CH_4 and N_2O were estimated through computations made using 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 and complemented with those requested from the industrialists. Outputs from the production units and the annual report of the Chamber of Mines were used to supplement the import and export data from the NSA for the metal industry. 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. Activity data used for the time series is given in Table 5.1.

Table 5.1 - Activity data for the IPPU sector (2000 – 2012)

Year	Cement production (t)	Lime production (t)	Zinc production t)	Lubricant use (TJ)	Paraffin wax (TJ)
2000	*	9161	*	38.8	1182.5
2001	*	10735	*	18.0	1098.2
2002	*	11200	35	11.8	1189.0
2003	*	12400	47436	81.3	1219.3
2004	*	12600	119205	22.0	1374.5
2005	*	13050	132813	251.8	1236.7
2006	*	13500	129897	280.2	1168.6
2007	*	14500	150800	450.2	1171.0
2008	*	15400	145396	598.4	1391.9
2009	*	17600	150400	619.3	1446.7
2010	*	19800	151688	558.7	1225.5
2011	284 000	17600	144755	612.3	1315.1
2012	504 000	17600	145342	615.0	1315.1

*** No activity**

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 chosen. The EFs used for the different source categories are listed in Table 5.2.

Table 5.2 - References for EFs for the IPPU sector

Category	IPPC 2006 Guideline	Table and page No.
Cement	V3_2_Ch2 Mineral Industry	Chapter 2.2.1.2 Page 2.11
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, also representing estimates by sub-category, is given in Table 5.3 as they did not differ, being only CO_2. Aggregated emissions for the IPPU sector which amounted to 25.0 Gg CO_2-eq in the year 2000, increased sharply in 2003 and 2011 when zinc and cement production started. Emissions reached 302.3 Gg CO_2-eq in 2010 and 421.2 Gg CO_2-eq in 2011. The Metal Industry category became the highest emitter of this sector and contributed 47.8 % in 2012. Cement production came next with 231.4 Gg CO_2-eq representing 44.2 %. Use of paraffin wax ranged between 16.1 to 20.4 Gg CO_2-eq during that period. The remaining two sources are lime production and lubricant use which stood in 2012 at 13.6 and 9.0 Gg CO_2-eq respectively.

Table 5.3 - Aggregated emissions (Gg) by IPPU source category (2000 – 2012)

SOURCE CATEGORY	GHG	2000	2002	2004	2006	2008	2010	2011	2012
TOTAL	**CO_2-eq**	**25.0**	**26.3**	**235.2**	**255.1**	**291.1**	**302.3**	**421.2**	**523.2**
2.A.1 - Cement production	CO_2	NO	NO	NO	NO	NO	NO	130.4	231.4
2.A.2 - Lime production	CO_2	7.1	8.6	9.7	10.4	11.9	15.2	13.6	13.6
2.C.6 - Zinc Production	CO_2	0.0	0.1	205.0	223.4	250.1	260.9	249.0	250.0
2.D - Non-Energy Products from Fuels and Solvent Use	CO_2	17.9	17.6	20.5	21.2	29.2	26.2	28.3	28.3
2.D.1 - Lubricant Use	CO_2	0.6	0.2	0.3	4.1	8.8	8.2	9.0	9.0
2.D.2 - Paraffin Wax Use	CO_2	17.3	17.4	20.2	17.1	20.4	18.0	19.3	19.3

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 all four IPCC categories of this sector.

Country-specific emission and stock factors derived for the country and used in the BUR 1 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

The AFOLU sector remained a net sink over 12 out of the 13 years of the inventory period on account of the land sub-category removals exceeding total AFOLU emissions. However, the net removals decreased constantly over this period from 19 185 Gg CO_2-eq in the year 2000 to 339 in 2011 to change to a net emitter status in 2012 with 1577 Gg CO_2-eq. Emissions from livestock remained more or less constant for the period 2000 to 2010 and increased in 2011 and 2012 on account of a higher population of dairy cows. 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 7462 Gg in 2012 (Table 6.1 and Figure 6.1).

Table 6.1 - Aggregated emissions (CO_2-eq) from the AFOLU sector (2000 – 2012)

Source and sink Categories	2000	2002	2004	2006	2008	2010	2011	2012
3 - Agriculture, Forestry, and Other Land Use	-19185.0	-16123.7	-12279.9	-9422.3	-5648.9	-3472.2	-338.5	1576.8
3.A - Livestock	4,513.5	4,390.1	4,419.9	4,367.0	4,819.7	4,181.5	5336.5	5677.4
3.A.1 - Enteric Fermentation	4,163.7	4,005.8	4,031.1	3,983.6	4,391.1	3,805.2	4857.8	5169.7
3.A.2 - Manure Management	349.8	384.3	388.8	383.5	428.5	376.3	478.7	507.7
3.B - Land	-26,190.6	-23,233.2	-19,438.9	-16,513.2	-13,372.5	-10,266.4	-8849.8	-7461.6
3.C - Aggregate sources and non-CO_2 emissions sources on land	2492.2	2719.5	2739.1	2723.8	2903.9	2612.6	3174.7	3360.9

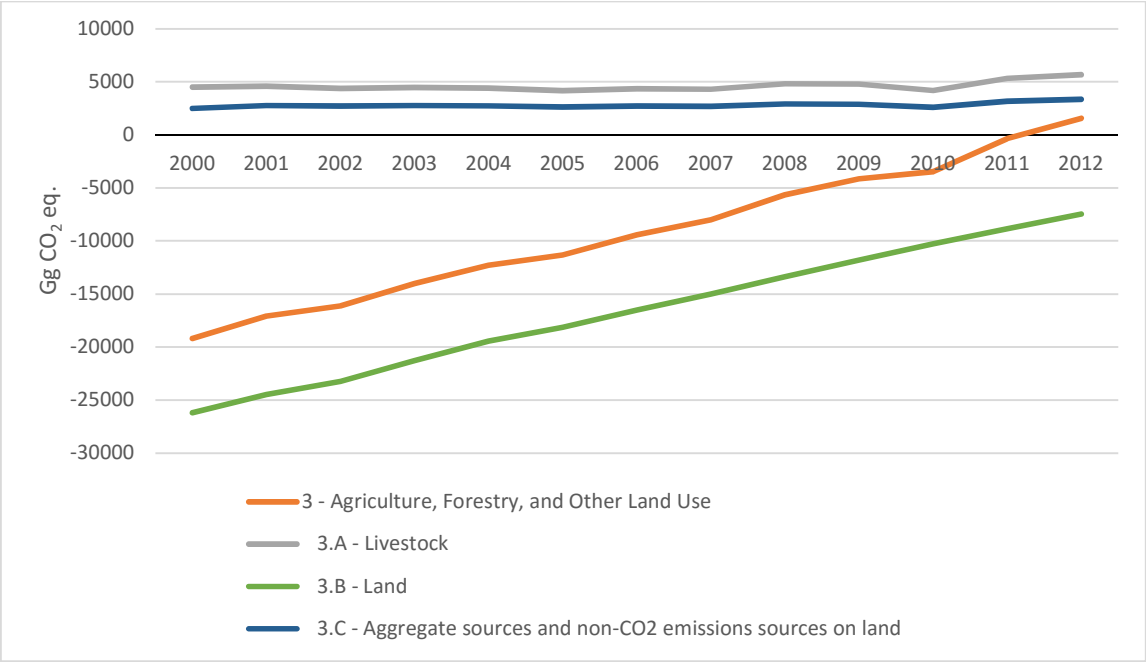


Figure 6.1- Emissions by sub-category (CO_2-eq) in the AFOLU sector (2000 – 2012)

The evolution of the direct and indirect GHGs is given in Table 6.2. CO_2 removals exceeded emissions over the whole period 2000 to 2012 but with a decreasing trend. Net removals declined from 26 190 Gg to 7461 Gg. Emissions of CH_4 increased by 23 % and N_2O by 40 % during the period 2000 to 2012. NO_X and NMVOCs emissions remained stable around 14 and 10 Gg respectively for the time series. Emissions of CO decreased by 3 %.

Table 6.2 - Emissions (Gg) by gas for AFOLU (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
CO_2 - Emissions	18268.6	18270.1	18268.7	18268.2	18268.1	18268.2	18268.5	17990.6
CO_2 - Removals	-44458.7	-41501.3	-37707.0	-34781.2	-31640.6	-28534.4	-27117.8	-25451.7
CO_2 – Net removals	-26190.1	-23231.1	-19438.3	-16513.0	-13372.4	-10266.3	-8849.3	-7461.1
CH_4	215.3	208.2	209.4	207.0	226.8	198.0	249.6	265.0
N_2O	8.0	8.8	8.9	8.9	9.5	8.5	10.5	11.2
NO_X	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
CO	290.2	288.7	287.2	285.8	284.3	282.8	282.0	281.5
NMVOCs	9.9	10.4	10.5	10.6	11.4	10.3	10.3	10.3

The evolution of aggregated emissions, excluding removals, of the three direct GHGs is presented in Figure 6.2. CO_2 was the major gas emitted throughout the period with 72.3 % in year 2000 (18 269 Gg CO_2-eq) decreasing to 66.6 % in 2012 (17 991 CO_2-eq). CH_4 emissions which stood at 4522 Gg CO_2-eq in 2000 (17.9 %) increased to 5565 Gg CO_2-eq, representing 20.6 % in 2012. N_2O emissions progressed from 2483 Gg CO_2-eq (9.8 %) to 3473 Gg CO_2-eq (12.8 %) during the same period.

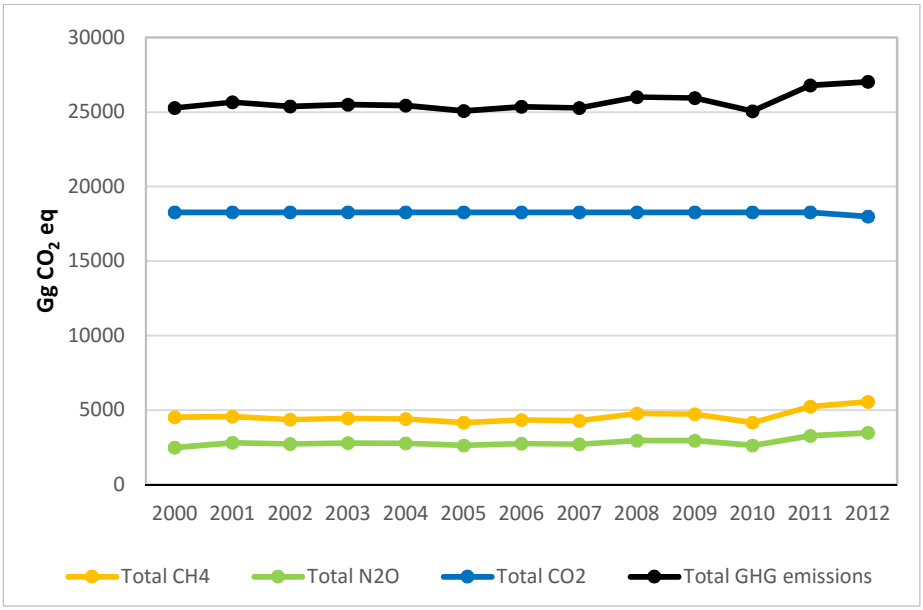


Figure 6.2- Evolution of aggregated emissions (CO_2-eq) in the AFOLU sector (2000 – 2012)

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, equations 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 modelling techniques, interpolation or trend analysis. The livestock population used as AD for making emission estimates is provided in Table 6.3 for the years 2000, 2005, 2010, 2011 and 2012.

The number of dairy cows increased from 1500 over the inventory period 2000 to 2010 to 2500 for the years 2011 and 2012, following new AD collection. 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 specific to this category.

Table 6.3 - Number of animals in 2000, 2005, 2010 – 2012

Category	2000	2005	2010	2011	2012
Total cattle	**2 504 930**	**2 219 330**	**2 389 891**	**2 762 240**	**2 904 451**
Sheep	2 446 146	2 663 795	1 378 861	2 209 593	2 677 913
Goats	1 849 569	2 043 479	1 690 467	1 736 565	1 933 103
Horses	61 885	47,429	49 852	45 529	46 643
Mules and asses	167 548	140 291	141 588	105 062	174 946
Swine	23 148	55 931	63 498	43 865	69 430
Poultry	476 331	998 278	777 480	689 030	946 306
Camels	54	63	43	69	47

Average live weights for the non-dairy cattle sub-categories have been derived from slaughterhouse data of Meatco, Namibia and live 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 at slaughtering or auction time.

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 adopted was 464 kg/head and for communal cattle, a typical mature weight of 451 kg was used.

6.3.2 Emission factors

The management factors for livestock play an important role in emissions. These factors depend on the feeding system, daily work performed, lactation period and frequency of pregnancy, feeding situation and the management of the excreta. These factors influence both enteric fermentation and manure management EFs. Livestock, with cattle being the most important component, results in emissions falling in the key categories. Thus emissions for cattle have been calculated using a Tier 2 approach as specified by IPCC methodologies. For the other animal groups, the default EFs (1996 IPCC GL, Table 4-3 to 4-5, p. 4.10 -4.12, developing countries) have been used to compute enteric and manure CH_4 emissions.

The EFs for enteric and manure CH_4 for cattle have been derived with the use of the ALU software which uses the same formulae as the IPCC 2006 software. Use of the ALU software rendered this exercise easier and less time-consuming as the programming already exists. This avoided repeating the same exercise in new worksheets. The national EF for manure N_2O was obtained by using the live weights along with default nitrogen excretion rates of the IPCC 2006 software. Country-specific values were thus generated for use in making emission estimates.

The datasets described 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 censuses and surveys conducted by the Ministry of Agriculture, Water Affairs and Forestry and NSA while manure management system (MMS) for cattle are based on country expert judgment and on information from 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 reproduction purposes. It is assumed that a percentage 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.

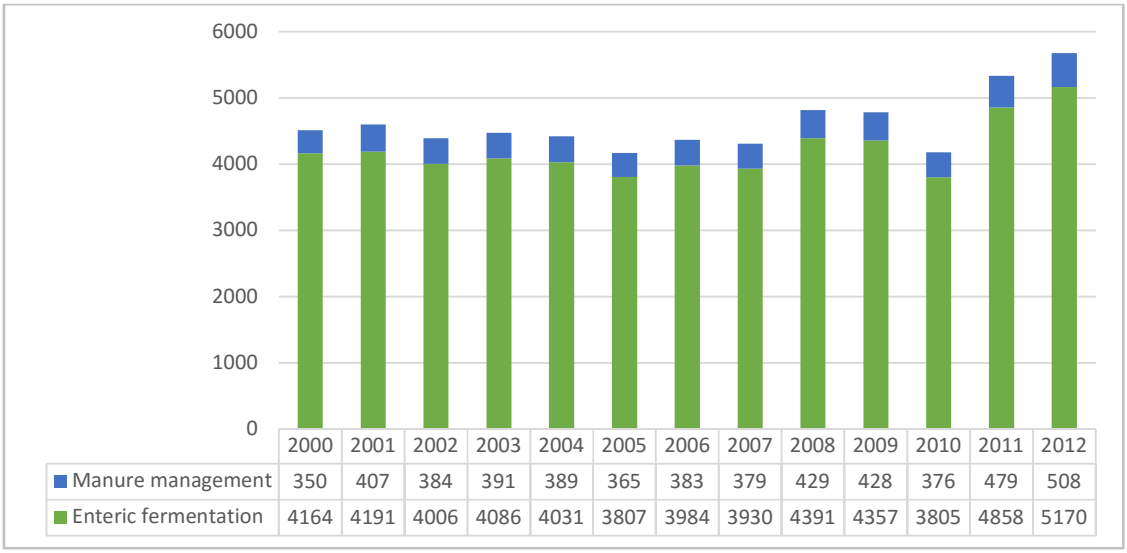
The lactation period of dairy cows is assumed to be over a period of 4 months after birth, based on expert judgment. Therefore, lactation was taken as the number of animals pregnant divided by 3 to bring it in line with the animal population on an annual basis.

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 6.3.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Manure management	350	407	384	391	389	365	383	379	429	428	376	479	508
Enteric fermentation	4164	4191	4006	4086	4031	3807	3984	3930	4391	4357	3805	4858	5170

Figure 6.3 - Emissions (Gg CO_2-eq) from enteric fermentation and manure management of livestock

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 for the period 2000 to 2010. Emissions from enteric fermentation increased substantially as from 2011 as the number of dairy cows jumped from

1500 to 2500 heads. This is being further investigated to smooth the trend through a confirmation of a more precise evolution of the number of dairy cows annually during the period 2000 to 2012.

The evolution of emissions of the three gases methane, nitrous oxide and NMVOCs emitted by the Livestock category is given in Table 6.4. Methane varied in the range 187.1 to 254.2 Gg while nitrous oxide varied between 0.7 and 1.1 Gg. The sharp increase in 2011 and 2012 for these two gases is due to the higher number of heads of dairy cows as mentioned previously. NMVOCS dwindled around 10 Gg annually.

Table 6.4 – Emissions (Gg) by gas for Livestock (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
CH_4	204.1	197.0	198.3	196.0	215.9	187.1	238.7	254.2
N_2O	0.7	0.8	0.8	0.8	0.9	0.8	1.0	1.1
NMVOCs	9.9	10.4	10.5	10.6	11.4	10.3	10.3	10.3

A typical summary report from the software for the emissions for the year 2012 with the contribution from each sub-category and animal group is presented in Table 6.5.

Table 6.5 - Summary of emissions from livestock.

Inventory Year: 2012

Categories	Emissions				
	CH4	N2O	NOx	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	265.0	11.2	13.7	281.5	10.3
3.A - Livestock	254.2	1.1	0	0	10.3
3.A.1 - Enteric Fermentation	246.2	0	0	0	0
3.A.1.a - Cattle	220.5	0	0	0	0
3.A.1.a.i - Dairy Cows	0.2		0	0	0
3.A.1.a.ii - Other Cattle	220.2		0	0	0
3.A.1.b - Buffalo	0		0	0	0
3.A.1.c - Sheep	13.4		0	0	0
3.A.1.d - Goats	9.7		0	0	0
3.A.1.e - Camels	2E-03		0	0	0
3.A.1.f - Horses	0.8		0	0	0
3.A.1.g - Mules and Asses	1.7		0	0	0
3.A.1.h - Swine	0.1		0	0	0
3.A.1.j - Other (please specify)	0		0	0	0
3.A.2 - Manure Management (1)	8.0	1.1	0	0	10.3
3.A.2.a - Cattle	6.6	1.1	0	0	8.6
3.A.2.a.i - Dairy cows	0.2	2E-03	0	0	1E-02
3.A.2.a.ii - Other cattle	6.4	1.1	0	0	8.6
3.A.2.b - Buffalo	0	0	0	0	0
3.A.2.c - Sheep	0.6	0	0	0	0.2
3.A.2.d - Goats	0.4	0	0	0	0.9
3.A.2.e - Camels	1E-04	0	0	0	1E-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	3E-02
3.A.2.i - Poultry	2E-02	8E-04	0	0	0.1
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, described more fully below under land representation and changes.
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 using data from past forest inventories and other available in-country information and 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. Since no new maps have been generated, the same land use change pattern has been adopted for the years 2011 and 2012 which are being added to the existing time series.

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 to meet 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 BUR 1 and NIR. 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 6.6.

Table 6.6 - Total land use adjusted area and annual change used in land matrix

Land Type category	Area (ha)			
	Year 2000	Year 2011	Annual gain	Annual loss
Forestland	8 404 206	6 629 983	321 475	482 768
Cropland	403 178	271 882	23 067	35 003
Grassland	60 731 438	62 636 957	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 2012 inventory.

As reported above and with no new maps produced due to lack of resources, the same land use changes within and between land classes were adopted for the years 2011 and 2012. The trends obtained with this method brought up other inconsistencies in the TRDHAC and TRDSAN land classes. The land class Forestland Woodland < 20 years no longer existed as from end 2011, resulting from the fact that all the woodlands are converted over the period 2000 to 2012 to other uses. Thus the annual gain and loss in Forestland and Grassland had to be amended to accommodate this anomaly. In practice it is known that woodlands still exist in the country. Similarly, if the same mapping exercise and land use changes are adopted, 2815 ha in TRDSAN will also disappear completely in 2013. This situation is totally off and against the real national circumstances. This situation can be depicted from Table 6.7.

Table 6.7. Evolution of the areas under different land use categories in Namibia

Age	Type	2000	2010	2011	2012	Annual loss	Annual gain
Woodland <20	TRDHAC	524 805	76 525	31 697	-13 131	58 148	13 320
	TRDSAN	232 724	30 564	10 348	-9868	25 783	5567
	Minor soil types	3619	3619	3619	3619	-	-
	TOTAL	761 148	110 708	45 664	-19 380	83 931	18 887
Woodland >20	TRDHAC	144 600	31 060	19 706	8352	16 009	4655
	TRDSAN	64 123	13 033	7924	2815	7098	1989
	Minor soil types	998	998	998	998	-	-
	TOTAL	209 721	45 091	28 628	12 165	23 107	6644

Based on all the inconsistencies observed to-date, past problems and future ones being encountered, the big issue is how representative and confident is the use of GIS technology coupled with satellite imagery for determining changes in land use between the different land classes. It is considered imperative that new maps more representative of actual land cover and land use changes over the inventory period be generated.

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 updated 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 (FLFL): tree height of 5 m and a canopy cover of more than 20 %; and
- Forest-Woodlands (FLWD): 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. Growing stock levels and biomass accumulation rates have been calculated on the basis of estimates made in past forest inventories. 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 8000 t from 2000 to 2002, 9000 t from 2003 to 2005, 10 000 tons onwards annually over the inventory period (2000 -to2012. 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 6.4 gives an overview of the final volumes extracted from forestland and woodland for fuelwood and poles.

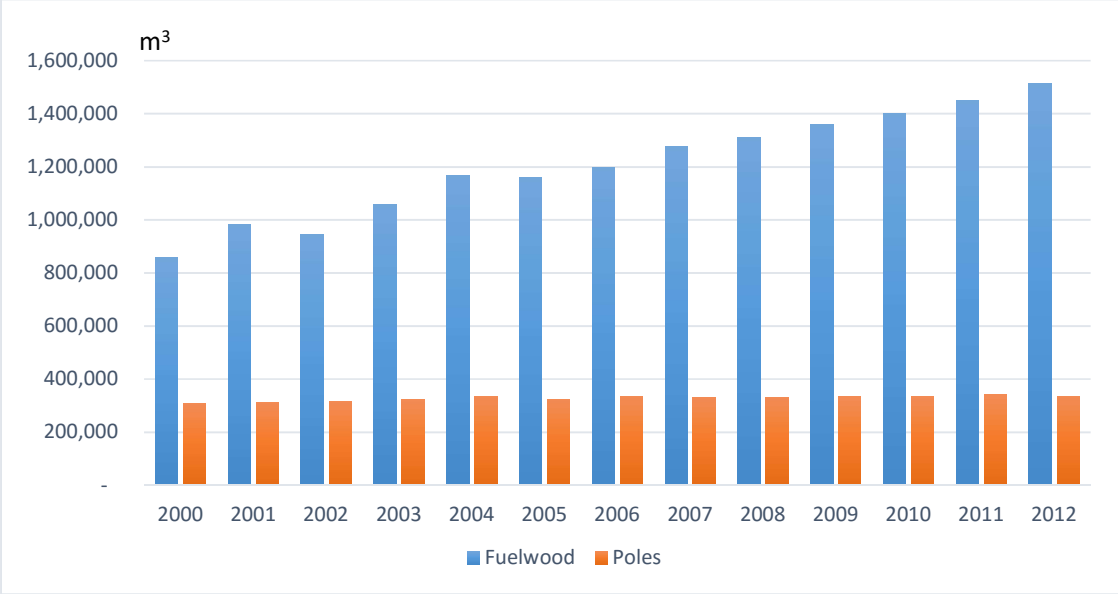


Figure 6.4 - Volume of woody biomass removed from forestland and woodland (2000 – 2012)

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. Following visits made across the country on communal farms mainly to collect information and set up future AD collection to refine the quality on inventories, a very interesting feature of the agricultural system cropped up. In fact, almost all farms had a number of trees growing on it. This is a feature of Namibian communal farms as the trees provide shade for the people and the animals. However, the IPCC 2006 software has not made provision for including this woody stock and the growth emanating from these trees. Again, this is not representative of the national circumstances and will have to be looked into to improve the carbon balance of the country and better reflect emissions and removals. This situation has been reported by Zomer, et al. (2016) and is illustrated in plate 1.

Plate 1. Trees on communal farm in Namibia (photo R Nayamuth)

Area

Cropland area was overestimated from the maps when compared to annual surveys undertaken for food security purposes by the Ministry of Agriculture, Water Affairs and Forestry. Thus, the areas from the surveys were adopted for making the yearly inventory estimates, 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 BUR 1 inventory. The carbon sequestration by this cropland set aside was creating a serious 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 BUR 1 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 in them. 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 analysed, screened, adopted and generated so as to be representative of the national circumstances of Namibia. Where an EF is not country-specific, the most appropriate default value contained in the IPCC 2006 software or Guidelines has been used.

Above ground biomass stock and growth

Forestland

The above ground biomass stock (bm in t dm/ha) and annual growth rate (Iv in 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 Biomass and BGB has been adopted from the IPCC 2006 Guidelines.

Namibia conducted an extensive assessment of its woody biomass resources during the period 2000 to 2006 towards sustainable use of biomass by the country. 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 the 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 (IPCC volume 4 Chapter 4), 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 Biomass for forest with age <20 years was estimated at 21.44 t dm/ha and Biomass 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. However, due to unavailability of data, the rate of invasion of savanna and pure grassland by the invasive bush to shrubland was not accounted for. This is under investigation for refining future inventories. For herbaceous biomass an estimation of 2 t dm/ha has been taken. A summary of biomass and annual growth rate used for forests and woodlands in the inventory is given in Table 6.8.

Table 6.8 - 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 < 20 years	21.44	2.14	3.18
Forest > 20 years	50.03	0.90	1.94
Woodlands < 20 years	12.97	1.80	2.84
Woodlands > 20 years	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. It should be noted here that substantial biomass as tress do occur in the cropland and these woody biomass stocks should be incorporated in future inventories as well as the gains occurring in these croplands to better reflect the national circumstances.

Grassland

Stock factors for grassland are shown in Table 6.9.

Herbaceous biomass is taken as 2.3 t dm/ha, which is the IPCC default value for grasslands. The Biomass 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 6.9 - Above ground biomass for grassland (t dm/ha)

bm woody	bm herbaceous	bm woody after conversion	bm herbaceous after conversion
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. However, with time, there is an overall loss since there is deforestation and the lower area can no longer reflect the amount of standing and growth in woody biomass occurring in the Grassland class. This shortcoming stemming from the IPCC 2006 software will also have to be dealt with in such a manner so as to reflect the national circumstances.

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. Biomass burned for the different land classes are provided in Table 6.10.

Table 6.10 - 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 removals for the Land sector is depicted in Table 6.11. In 2012, the Land sector acted as a net sink, with a total net removal of 7462 Gg of CO_2. Forestland acted as a sink for 25 373 Gg CO_2 while Grassland emitted 17 721 Gg and Cropland 191 Gg. Over the inventory period 2000 to 2012, the sink capacity of forests decreased by some 19 000 Gg CO_2 from 44 204 to 25 373 Gg CO_2. The summary of results from the software output is provided in Table 6.12.

Table 6.11 - Emissions (CO_2) for the FOLU sector (2000 – 2012)

Year	2000	2002	2004	2006	2008	2010	2011	2012
3.B.1 - Forest land	-44,204	-41,112	-37,553	-34,663	-31,520	-28,429	-27031	-25373
3.B.2 - Cropland	14	-120	115	151	148	163	182	191
3.B.3 - Grassland	17,999	17,999	17,999	17,999	17,999	17,999	17999	17721
Total net	-26,191	-23,233	-19,439	-16,513	-13,372	-10,266	-8850	-7462

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. Following a new set with more details on the fertilizer AD, the full series have been recalculated. It should be noted that up to now there is the possibility that some of the urea has been used for preparing animal feeds. The inventory team is still tracking this to improve results of future inventories.

6.6.4 Emission factors

All biomass burning was accounted 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.

Table 6.12 - Emissions and removals from the land category for 2012

Inventory Year: 2012						
Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
		CH4	N2O	NOx	CO	NMVOCs
3.B - Land	-7461.6	0	0	0	0	0
3.B.1 - Forest land	-25373.5	0	0	0	0	0
3.B.1.a - Forest land Remaining Forest land	-24307.6			0	0	0
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			0	0	0
3.B.1.b.ii - Grassland converted to Forest Land	-1058.7			0	0	0
3.B.2 - Cropland	190.8	0	0	0	0	0
3.B.2.a - Cropland Remaining Cropland	-27.9			0	0	0
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			0	0	0
3.B.2.b.ii - Grassland converted to Cropland	121.6			0	0	0
3.B.3 - Grassland	17721.1	0	0	0	0	0
3.B.3.a - Grassland Remaining Grassland	0			0	0	0
3.B.3.b - Land Converted to Grassland	17721.1	0	0	0	0	0
3.B.3.b.i - Forest Land converted to Grassland	17771.3			0	0	0
3.B.3.b.ii - Cropland converted to Grassland	-50.2			0	0	0
3.C - Aggregate sources and non-CO2 emissions sources or	0.5	10.8	10.1	13.7	281.5	0
3.C.1 - Emissions from biomass burning	0	10.8	0.8	13.7	281.5	0
3.C.1.a - Biomass burning in forest lands		4.4	0.2	2.8	100.3	0
3.C.1.b - Biomass burning in croplands		0	0	0	0	0
3.C.1.c - Biomass burning in grasslands		6.4	0.6	10.9	181.3	0
3.C.3 - Urea application	0.5			0	0	0
3.C.4 - Direct N2O Emissions from managed soils (3)			6.4	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.8	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			1.0	0	0	0
3.D - Other	0	0	0	0	0	0

6.6.5 Emissions estimates

Aggregated emissions for aggregate sources and non-CO_2 emissions on land (Table 6.13) varied between 2492 Gg CO_2-eq for the year 2000 and 3361 Gg CO_2-eq for 2012.

Table 6.13 - Aggregated emissions (Gg CO_2-eq) for aggregate sources and non-CO_2 emissions on Land (2000 – 2012)

2000	2002	2004	2006	2008	2010	2011	2012
2492	2719	2739	2724	2904	2613	3175	3361

Emissions by gas are given in Table 6.14. 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 6.14 - Emissions (Gg) by gas for aggregate sources and non-CO_2 emissions on Land (2000 – 2012)

Gas	2000	2002	2004	2006	2008	2010	2011	2012
CO_2	0.5	2.1	0.6	0.1	0.1	0.1	0.4	0.5
CH_4	11.2	11.2	11.1	11.0	11.0	10.9	10.8	10.8
N_2O	7.3	8.0	8.1	8.0	8.6	7.7	9.5	10.1

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 partitioned between urban and rural areas (2001 and 2010)

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.

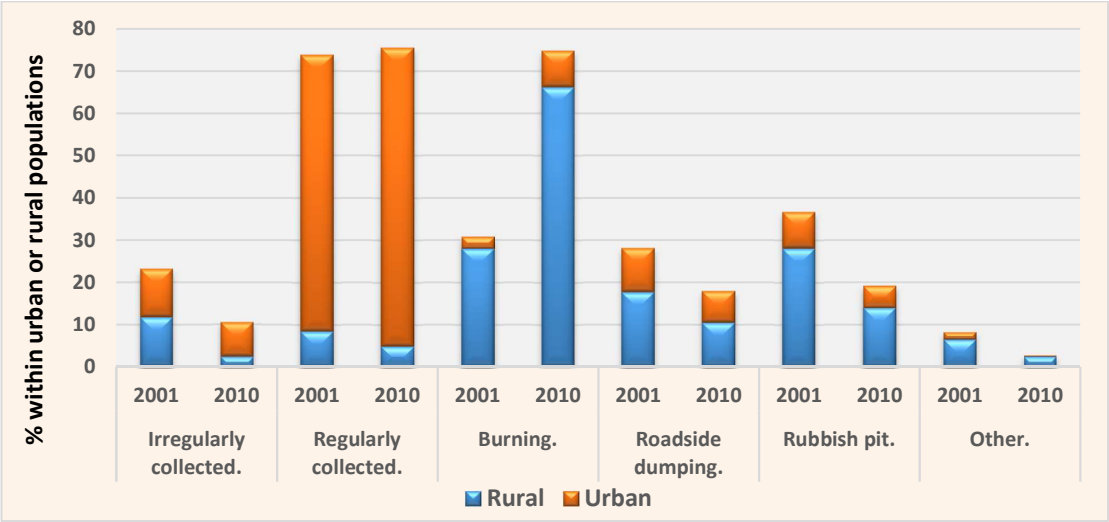


Figure 7.1 - % distribution of households by means of waste/garbage disposal (2001 and 2010)

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

Percent distribution of household by type of main toilet facility is given in Table 7.2. 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

Region	Namibia	Urban	Rural
Private Flush Connected to Sewer	24.8	44.4	5.8
Shared Flush Connected to Sewer	11.7	21.2	2.5
Private Flush Connected to Septic/Cesspool	1.6	1.4	1.9
Shared Flush Connected to Septic/Cesspool	1.4	1.7	1.1
Pit Latrine with Ventilation Pipe	4.3	3.6	4.9
Covered Pit Latrine without Ventilation Pipe	3.2	2.2	4.2
Uncovered Pit Latrine without Ventilation Pipe	1.8	1.4	2.2
Bucket Toilet	1.8	1.3	2.3
No Toilet Facility	48.6	22.4	74.0
Other	0.7	0.4	1.0
Households	464 839	228 955	235 884
Population	2 064 489	872 448	1 192 041

Source: Namibia 2011 Population and Housing Census

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 and fish processing are covered in this inventory. It should be noted that these two activities account for the major part of industrial waste water in the country.

7.2 Methodology

GHG emissions originating from the Waste sector were estimated following a Tier 1 methodological approach as per the IPCC 2006 Guidelines and computed 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 2012. 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 2012 was then estimated for the other urban areas. Activity data for the period 2000 to 2012 is given in Table 7.3.

Table 7.3 - Activity data for MSW in Waste sector (2000 – 2012)

Year	Population			Municipal Solid Waste (MSW) (t)			Sent to MSW (t)	
	Urban high	Urban low	Rural	Urban high	Urban low	Rural	Sludge	Industrial waste
2000		582 736	1 210 299		70 503	97 136	10.0	33.4
2001	287 780	316 229	1 226 321	40 281	39 216	100 883	10.4	34.9
2002	299 643	331 444	1 225 051	44 039	43 158	105 817	10.8	36.5
2003	311 506	347 302	1 223 501	48 071	47 484	110 967	11.3	38.1
2004	323 369	363 817	1 221 664	52 397	52 229	116 341	11.8	39.9
2005	335 232	381 000	1 219 532	57 035	57 430	121 944	12.3	41.7
2006	347 096	398 867	1 217 096	62 007	63 130	127 786	12.8	43.6
2007	358 959	417 429	1 214 350	67 332	69 371	133 873	13.3	45.5
2008	370 822	436 701	1 211 284	73 035	76 202	140 211	13.9	47.6
2009	382 685	456 697	1 207 891	79 140	83 676	146 809	14.4	49.7
2010	394 548	477 431	1 204 161	85 673	91 849	153 674	15.0	52.0
2011	406 411	498 916	1 200 085	92 662	100 781	160 811	15.6	54.3
2012	419 323	520 533	1 196 180	97 455	107 186	184 317	16.1	58.3

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. Activity data for industrial waste water is given in Table 7.4. 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.

Table 7.4 - Activity data for industrial wastewater (2000 – 2012)

Year	Fish processing (t)	Meat and poultry (t)
2000	369 602	44 822
2001	326 008	42 135
2002	263 343	47 869
2003	383 002	46 104
2004	339 010	46 147
2005	352 828	53 176
2006	312 294	46 395
2007	225 182	46 219
2008	205 751	46 855
2009	236 133	48 269
2010	205 902	47 950
2011	241 937	43 329
2012	207 044	42 722

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 2012 for the Waste sector is provided in Table 7.5.

Table 7.5 - Overall GHG emissions (Gg) from the Waste sector (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
CO	4.3	4.8	5.2	5.8	6.3	6.9	7.2	8.2
CH_4	3.3	3.4	4.0	4.4	4.7	5.4	5.8	6.1
CO_2	1.2	1.3	1.4	1.6	1.8	1.9	2.0	2.3
NMVOCs	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5
NO_X	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5
N_2O	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
SO_2	0.01	0.01	0.01	0.01	0.01	0.01	0.0	0.0

Figure 7.2 illustrates the evolution of emissions for the Waste sector from 2000 to 2012.

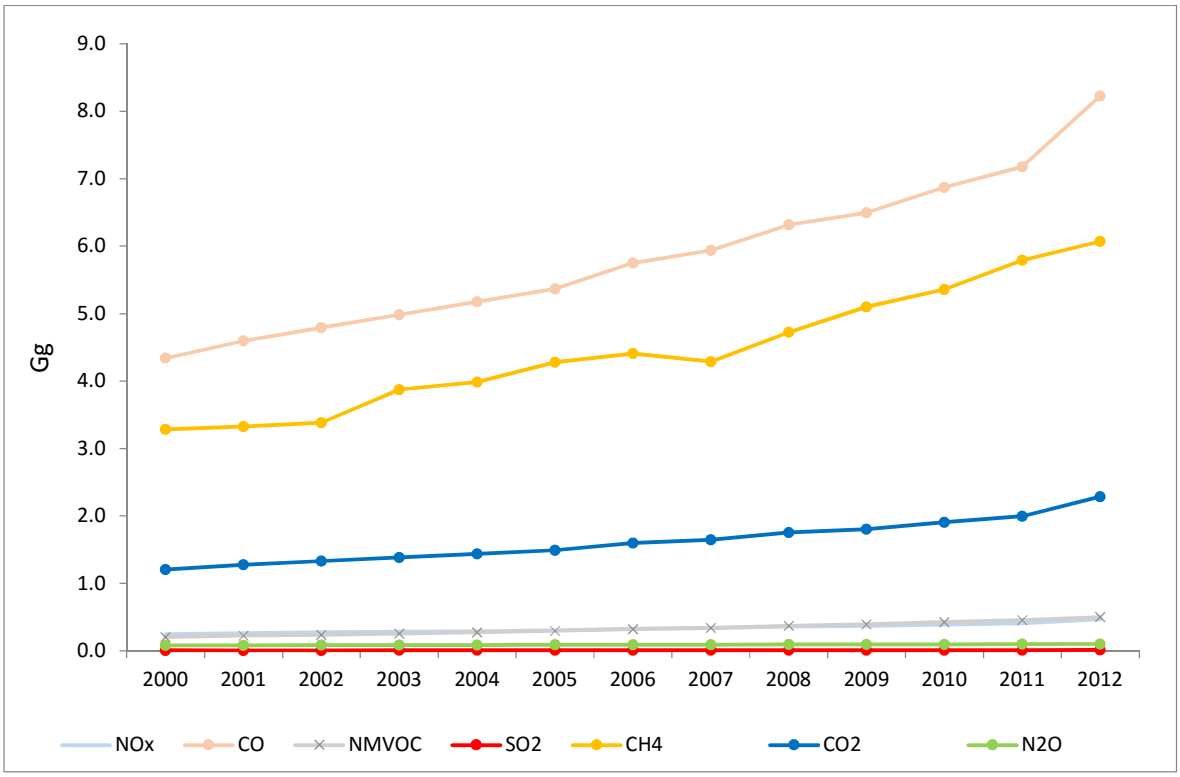


Figure 7.2 - GHG emissions (Gg) from the Waste sector (2000 – 2012)

7.4.1 CO_2, NO_X, CO and SO_2 emissions

CO, CO_2, NO_X and SO_2 emissions that have been inventoried for the Waste sector originated from Open Burning of Waste (Table 7.6). From 2000 to 2012 the percentage increase in emissions for CO_2, NO_X, CO and SO_2 was 89 %.

Table 7.6 - CO, CO_2, NO_X and SO_2 (Gg) emissions from the Waste sector (2000 – 2012)

Waste Category	GHG	2000	2002	2004	2006	2008	2010	2011	2012
4.C.2 - Open Burning of Waste	CO_2	1.206	1.332	1.439	1.599	1.756	1.910	1.996	2.287
4.C.2 - Open Burning of Waste	NO_X	0.247	0.273	0.295	0.328	0.360	0.391	0.409	0.469
4.C.2 - Open Burning of Waste	CO	4.34	4.79	5.18	5.75	6.32	6.87	7.18	8.23
4.C.2 - Open Burning of Waste	SO_2	0.009	0.009	0.010	0.011	0.014	0.014	0.014	0.016

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 for the period 2000 to 2012 is given in Table 7.7 and Figure 7.3.

Table 7.7 - CH_4 emissions (Gg) from the Waste sector (2000 – 2012)

Categories	2000	2002	2004	2006	2008	2010	2011	2012
4 - Waste	**3.285**	**3.382**	**3.985**	**4.408**	**4.725**	**5.360**	**5.790**	**6.071**
4.A - Solid Waste Disposal	1.328	1.632	1.983	2.384	2.846	3.378	3.674	3.890
4.C - Incineration and Open Burning of Waste	0.505	0.558	0.603	0.670	0.736	0.800	0.836	0.958
4.C.2 - Open Burning of Waste	0.505	0.558	0.603	0.670	0.736	0.800	0.836	0.958
4.D - Wastewater Treatment and Discharge	1.451	1.192	1.400	1.354	1.144	1.183	1.281	1.224
4.D.1 - Domestic Wastewater Treatment and Discharge	0.371	0.359	0.389	0.407	0.455	0.489	0.518	0.548
4.D.2 - Industrial Wastewater Treatment and Discharge	1.080	0.833	1.011	0.947	0.689	0.694	0.763	0.676

The activity contributing the most towards emissions was Solid Waste Disposal. CH_4 emissions increased by 84.8 % from 3.3 Gg in 2000 to 6.1 Gg in 2012.

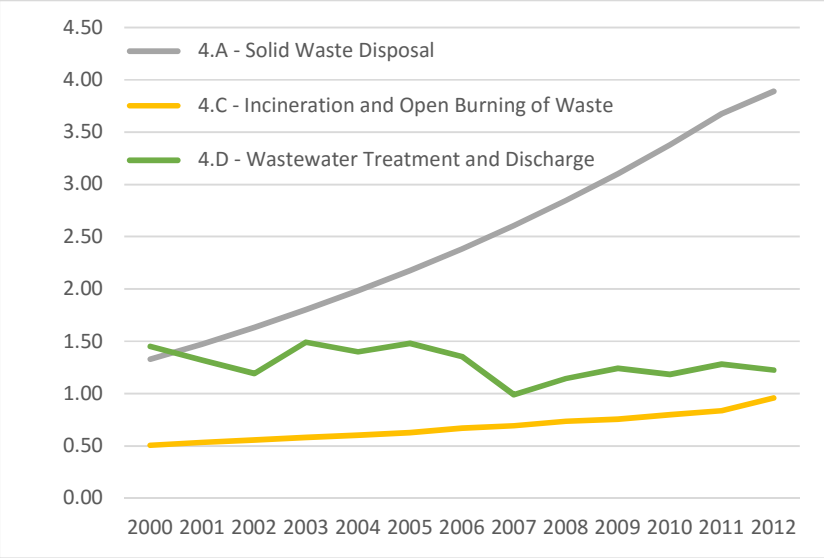


Figure 7.3 - CH_4 emissions (Gg) from different Waste categories (2000 – 2012)

7.4.3 NMVOCs emissions

NMVOCs emissions originated from Managed Waste Disposal Sites, Open Burning of Waste, Domestic Wastewater Treatment and Discharge, and Industrial Wastewater Treatment and Discharge activities for the period 2000 to 2012 is given in Table 7.8.

Table 7.8 - NMVOCs emissions (Gg) from the Waste sector (2000 – 2012)

Waste Categories	2000	2002	2004	2006	2008	2010	2011	2012
4 - Waste	0.21	0.24	0.28	0.32	0.37	0.43	0.46	0.50
4.A - Solid Waste Disposal	0.11	0.14	0.16	0.20	0.23	0.28	0.30	0.32
4.C - Incineration and Open Burning of Waste	0.10	0.11	0.11	0.13	0.14	0.15	0.16	0.18
4.D - Wastewater Treatment and Discharge	1.3E-06	1.3E-06	1.3E-06	1.3E-06	1.2E-06	1.2E-06	1.2E-06	1.2E-06

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 190 % and 90 % respectively from 2000 to 2012 (Figure 7.4). NMVOC emissions from Waste Water Treatment and Discharge was negligible over the full inventory period.

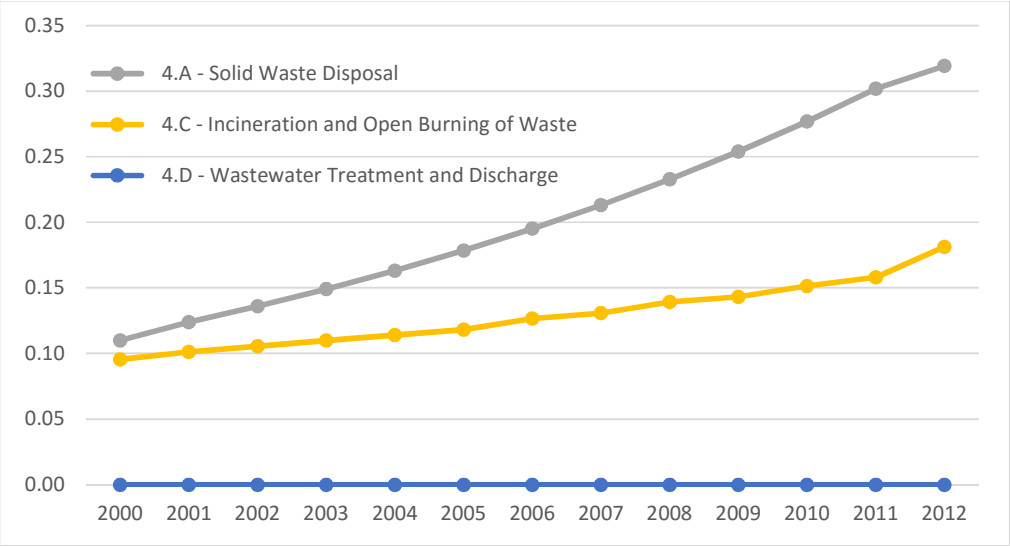


Figure 7.4 - NMVOCs emissions (Gg) from different waste categories (2000 – 2012)

7.4.4 N_2O emissions

NO_2 emissions originated from Open Burning of Waste and Domestic Wastewater Treatment & Discharge categories (Table 7.9). The category contributing most towards NO_2 was Wastewater Treatment and Discharge (Domestic). From 2000 to 2012, NO_2 emissions increased by 24.8 % (Figure 7.5).

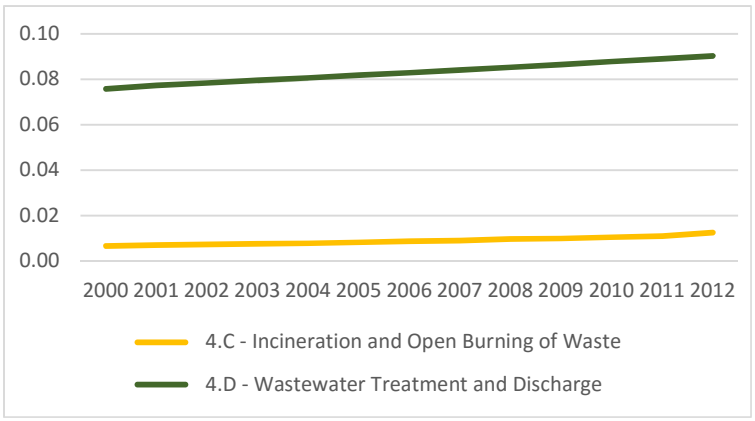


Figure 7.5 - N_2O emission (Gg) from incineration and open burning of waste and wastewater treatment and discharge (2000 – 2012)

Table 7.9 - N_2O emissions (Gg) from the Waste sector (2000 – 2012)

Categories	2000	2002	2004	2006	2008	2010	2011	2012
4 - Waste	0.083	0.086	0.089	0.092	0.095	0.099	0.100	0.103
4.C - Incineration and Open Burning of Waste	0.007	0.008	0.008	0.009	0.010	0.011	0.011	0.013
4.D - Wastewater Treatment and Discharge	0.076	0.078	0.081	0.083	0.085	0.088	0.089	0.090

7.4.5 Emissions in terms of CO_2 equivalent

In terms of CO_2 equivalent, the total contributions to emissions increased from 95.7 Gg CO_2-eq in 2000 to 161.7 Gg CO_2-eq in 2012 (Table 7.10), that is a 69.0 % increase. The gas contributing most to emissions from the Waste sector was CH_4.

Table 7.10 - Aggregated emissions (Gg CO_2-eq) by gas from Waste sector (2000 – 2012)

GHG	2000	2002	2004	2006	2008	2010	2011	2012
Total	**95.7**	**98.9**	**112.6**	**122.6**	**130.4**	**144.9**	**154.6**	**161.7**
CO_2	1.2	1.3	1.4	1.6	1.8	1.9	2.0	2.3
CH_4	69.0	71.0	83.7	92.6	99.2	112.6	121.6	127.5
N_2O	25.6	26.6	27.5	28.5	29.5	30.5	31.0	31.9

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 56.4 % of emission) (Table 7.11). However, in 2012 the major contributor was the Solid Waste Disposal category with 82 Gg (50.5 % of emissions).

Table 7.11 - Aggregated emissions (Gg CO_2-eq) by Category for the Waste sector (2000 – 2012)

Waste Categories	2000	2002	2004	2006	2008	2010	2011	2012
4 - Waste	95.7	98.9	112.6	122.6	130.4	144.9	154.6	161.7
4.A - Solid Waste Disposal	27.9	34.3	41.6	50.1	59.8	70.9	77.1	81.7
4.C - Incineration and Open Burning of Waste	13.9	15.3	16.6	18.4	20.2	22.0	23.0	26.3
4.C.2 - Open Burning of Waste	13.9	15.3	16.6	18.4	20.2	22.0	23.0	26.3
4.D - Wastewater Treatment and Discharge	54.0	49.4	54.4	54.2	50.5	52.0	54.5	53.7
4.D.1 - Domestic Wastewater Treatment and Discharge	31.3	31.9	33.2	34.3	36.0	37.5	38.5	39.5
4.D.2 - Industrial Wastewater Treatment and Discharge	22.7	17.5	21.2	19.9	14.5	14.6	16.0	14.2

8. REFERENCES

ALU Ver. 4.0 (2014). Agriculture and Land Use National Greenhouse Gas Inventory Software http://www.nrel.colostate.edu/projects/ALUsoftware/.

FRA (2010). Global Forest Resources Assessment. http://www.fao.org/docrep/013/al577e/al577e.pdf forms part of the Global Forest Resources Assessment 2010. Country Report, Namibia.

http://opendataforafrica.org/esewdqb/main-indicators-Namibia. World Bank (2015). Accessed on 19 August 2015.

http://www.agra-alliance.org/files/934_file_AGRA_Early_Accomplishments_lo_res.pdf Agric. Stats (2009), AGRA. AGRA (2009). AGRA: Early Accomplishments, Foundations for Growth. Alliance for a Green Revolution in Africa, 2009.

http://www.mfmr.gov.na/documents/53305/832050/annual_report_2005/09d2538c-86b6-440f-885c-2117599c4f76. Annual Report (2005). Annual Report of the Ministry of Fisheries and Marine Resources. Republic of Namibia. Accessed on 1 August 2015.

Humavindu, M. N. and J. Stage (2013). Key Sectors of the Namibian Economy. http://www.journalofeconomicstructures.com/content/2/1/1

ICRAF Species Switchboard (2013). Agroforestry Species Switchboard 1.0 Developed by: Kindt R, Ordonez J, Smith E, Orwa C, Harja D, Kehlenbeck K, Luedeling E, Munjuga M, Mwanzia L, Sinclair F and Jamnadass R. 2013. ICRAF Species Switchboard. Version 1.0. World Agroforestry Centre, Nairobi.

IPCC (1996). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (Volume 3).

IPCC (1996). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: The Reporting Instructions.

IPCC (1997). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Houghton J.T., Meira Filho L.G., Lim B., Treaton K., Mamaty I., Bonduky Y., Giggs D.J., Callander B.A. (Eds.) Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA, Paris, France.

IPCC (2000). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Penman J., Kruger D., Galbally I., Hiraishi T., Nyenzy B., Emmanuel S., Buendis L., Hoppaus, R., Maritsen T., Meijer J., Miwa K., Tanabe K. (Eds.) IPCC. Intergovernmental Panel on Climate Change (IPCC), IPCC/OECD/IEA/IGES, Hayama, Japan

IPCC (2003). Good Practice Guidance for Land Use, Land Use Change and Forestry. Penman J., Gytarsky M., Hiraishi T., Krug T., Kruger D., Pipatti R., Buendia L., Miwa K., Ngara T., Tanabe K., Wagner F. (Eds.) IPCC. Intergovernmental panel on Climate Change (IPCC), IPCC/IGES, Hayama, Japan

IPCC (2007). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan

Mendelsohn, J and S. El Obeid (2007). Forests and Woodlands of Namibia, Windhoek.

Namibia Statistics Agency NPHC (2011). Namibia Population and Housing Census 2011.

NHIES (2009-2010). The Namibia Household Income and Expenditure Survey (NHIES). http://www.microdata.nsa.org.na/index.php/catalog/6, Accessed on 30 July 2015.

NNFU (2006). Annual Report Namibia National Farmers Union. http://www.nnfu.org.na/downloads.php%3Fop%3Dshow%26cat_id%3D3.

Preliminary census (2011). To confirm reference (section 7.3, Activity data, Wastewater)

Republic of Namibia (2002). Initial National Communication to the United Nations Framework Convention on Climate Change.

Republic of Namibia (2011) Population and Housing Census Main Report. (2012). Republic of Namibia, Windhoek, 2012.

Republic of Namibia (2011). Second National Communication to the United Nations Framework Convention on Climate Change.

Republic of Namibia's Fourth National Development Plan (NDP4). (2012). Republic of Namibia, Windhoek, May 2012.

Schlettwein, CHG (2014). Republic of Namibia. Statement by Carl-Hermann Gustav, MP Minister of Trade and industry at Namibia's Agricultural Outlook Conference 2014 Safari Hotel & Conference Centre 8 October 2014.

Zanne, A.E., Lopez-Gonzalez, G., Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B., Swenson, N.G., Wiemann, M.C., and Chave, J. (2009). Global wood density database. Dryad. Identifier: http://hdl.handle.net/10255/dryad.235.

Robert J. Zomer, Henry Neufeldt, Jianchu Xu, Antje Ahrends, Deborah Bossio, Antonio Trabucco, Meine van Noordwijk and Mingcheng Wang. (2016). Global Tree Cover and Biomass Carbon on Agricultural Land: The contribution of agroforestry to global and national carbon budgetswww.nature.com/scientific reports.

9. ANNEXES

Annex 1. Summary Tables for the Year 2000

Inventory Year: 2000							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-24261.7	221.5	8.2	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	8.0	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 source	0.5	11.2	7.3	13.7	290.2	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.2	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	1.2	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

Annex 1. Summary Tables for the Year 2000 (Contd)

Inventory Year: 2000

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-24261.7	221.5	8.2	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

Annex 1. Summary Tables for the Year 2000 (Contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substar	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	8.0	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 sources on la	0.5	11.2	7.3	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			4.4	0	0	0	0
3.C.5 - Ind. N2O Emissions from managed soils			1.3	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	1.2	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	1.2	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 depositio	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 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 (Internationa	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	-22380.8	223.5	9.3	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	9.1	13.7	289.5	10.8	0.0
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 source	3.0	11.2	8.2	13.7	289.5	0	0
3.D - Other	0	0	0	0	0.0	0.0	0.0
4 - Waste	1.3	3.3	0.1	0.3	4.6	0.2	0.0
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	1.3	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 (Intern	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)

Inventory Year: 2001

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-22380.8	223.5	9.3	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 and Construction	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 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	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 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	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

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

2.F - Product Uses as Substitutes for Ozone Depleting Subs	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	-24468.3	217.3	9.1	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 emissions sources or	3.0	11.2	8.2	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			5.1	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.3	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 Waste	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	1.3	0.5	7.E-03	0.3	4.6	0.1	9.E-03
4.D - Wastewater Treatment and Discharge	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 the atmospheric depos	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 (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 (Internati	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

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-21031.0	214.5	9.0	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	8.8	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 source	2.1	11.2	8.0	13.7	288.7	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.3	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	0
4.C - Incineration and Open Burning of Waste	1.3	0.6	7.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

Annex 3. Summary Tables for the Year 2002 (contd)

Inventory Year: 2002

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-21031.0	214.5	9.0	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

Annex 3. Summary Tables for the Year 2002 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	8.8	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 sources on land	2.1	11.2	8.0	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			5.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.3	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	0
4.C - Incineration and Open Burning of Waste	1.3	0.6	7.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 deposition	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	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

Annex 4. Summary Tables for the Year 2003

Inventory Year: 2003

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-18796.3	219.0	9.2	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	9.0	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 source	0.9	11.1	8.1	13.7	288.0	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.4	3.9	0.1079	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	1.4	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

Annex 4. Summary Tables for the Year 2003 (contd)

Inventory Year: 2003

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-18796.3	219.0	9.2	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 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	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

Annex 4. Summary Tables for the Year 2003 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	9.0	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 sources on land	0.9	11.1	8.1	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			5.1	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.4	3.9	0.1	0.3	5.0	0.3	0.0
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	1.4	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 deposition	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 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 (International	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

Annex 5. Summary Tables for the Year 2004

Inventory Year: 2004							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-16742.3	216.4	9.1	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	8.9	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 source	0.6	11.1	8.1	13.7	287.2	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.4	4.0	0.1082	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	1.4	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

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-16742.3	216.4	9.1	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

Annex 5. Summary Tables for the Year 2004 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	8.9	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 sources on land	0.6	11.1	8.1	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			5.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.4	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	1.4	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 deposition	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 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 (International	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

Annex 6. Summary Tables for the Year 2005

Inventory Year: 2005							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-15281.2	205.7	8.7	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	8.5	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 source	0.2	11.1	7.7	13.7	286.5	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.5	4.3	0.1085	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	1.5	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 ir			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

Annex 6. Summary Tables for the Year 2005 (contd)

Inventory Year: 2005

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-15281.2	205.7	8.7	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 Substance	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	8.5	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 sources on land	0.2	11.1	7.7	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			4.8	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.4	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	1.5	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	1.5	0.6	8.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 deposition o	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 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 (International b	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

Annex 7. Summary Tables for the Year 2006

Inventory Year: 2006							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-13567.1	214.5	9.1	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	8.9	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 source	0.1	11.0	8.0	13.7	285.8	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.6	4.4	0.1088	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	1.6	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 (Intern	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

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

Inventory Year: 2006

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-13567.1	214.5	9.1	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

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	8.9	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 sources on land	0.1	11.0	8.0	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			5.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.6	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	1.6	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 deposition	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 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 (International	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

Annex 8. Summary Tables for the Year 2007

Inventory Year: 2007							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-11911.8	211.7	9.0	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	8.8	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	8.0	13.7	285.0	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.7	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	1.7	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

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-11911.8	211.7	9.0	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 Substance	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	8.8	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 sources on land	0.3	11.0	8.0	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			4.9	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.4	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	1.7	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	1.7	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 deposition	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 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 (International	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

Annex 9. Summary Tables for the Year 2008

Inventory Year: 2008							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-10208.1	234.6	9.8	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	9.5	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 source	0.1	11.0	8.6	13.7	284.3	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.8	4.7	0.11	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	1.8	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

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-10208.1	234.6	9.8	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 Substance	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	9.5	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 sources on land	0.1	11.0	8.6	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			5.4	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.8	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	1.8	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 deposition	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 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 (International	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

Annex 10. Summary Tables for the Year 2009

Inventory Year: 2009

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-8626.1	233.3	9.7	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	9.5	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 source	0.2	10.9	8.6	13.7	283.6	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.8	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	1.8	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

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-8626.1	233.3	9.7	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 Construction	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 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	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 Use	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

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

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	9.5	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 sources on land	0.2	10.9	8.6	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			5.4	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.5	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	1.8	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	1.8	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 deposition	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 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 (International	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 11. Summary Tables for the Year 2010

Inventory Year: 2010							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-7168.6	206.5	8.7	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	8.5	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 source	0.1	10.9	7.7	13.7	282.8	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	1.9	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	1.9	0.8	1.E-02	0.4	6.9	0.2	1.E-02
4.D - Wastewater Treatment and Discharge		1.2	0.0878	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

Annex 11. Summary Tables for the Year 2010 (contd)

Inventory Year: 2010

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-7168.6	206.5	8.7	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

Annex 11. Summary Tables for the Year 2010 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	8.5	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 sources on land	0.1	10.9	7.7	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			4.8	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.4	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	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	1.9	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 deposition	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 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 (International	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

Annex 12. Summary Tables for the Year 2011

Inventory Year: 2011							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-5683.1	258.4	10.8	36.0	367.5	21.5	3.3
1 - Energy	2743.1	3.0	0.1	21.9	78.3	10.7	3.3
1.A - Fuel Combustion Activities	2743.1	3.0	0.1	21.9	78.3	10.7	3.3
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	421.2	0.0	0.0	0.0	0.0	0.0	0.0
2.A - Mineral Industry	143.9	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	249.0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	28.3	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	-8849.3	249.6	10.5	13.7	282.0	10.3	0
3.A - Livestock	0	238.7	1.0	0	0	10.3	0
3.B - Land	-8849.8	0	0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.4	10.8	9.5	13.7	282.0	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.0	5.8	0.1	0.4	7.2	0.5	1.E-02
4.A - Solid Waste Disposal		3.7		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	2.0	0.8	1.E-02	0.4	7.2	0.2	1.E-02
4.D - Wastewater Treatment and Discharge		1.3	0.089	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 i			0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	284.5	2.E-02	8.E-03	4.5	0.8	0.3	1.1
1.A.3.a.i - International Aviation (International Bunkers)	124.8	9.E-04	3.E-03	0.5	5.E-02	2.E-02	4.E-02
1.A.3.d.i - International water-borne navigation (Interna	159.7	1.E-02	4.E-03	4.0	0.7	0.3	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 12. Summary Tables for the Year 2011 (contd)

Inventory Year: 2011

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-5683.1	258.4	10.8	36.0	367.5	21.5	3.3
1 - Energy	2743.1	3.0	0.1	21.9	78.3	10.7	3.3
1.A - Fuel Combustion Activities	2743.1	3.0	0.1	21.9	78.3	10.7	3.3
1.A.1 - Energy Industries	18.6	4.E-04	2.E-04	0.0	2.E-03	3.E-04	0.1
1.A.2 - Manufacturing Industries and Construction	216.2	2.E-02	4.E-03	0.8	1.4	0.2	1.2
1.A.3 - Transport	2047.3	0.5	0.1	13.3	41.0	4.5	2.E-02
1.A.4 - Other Sectors	385.5	2.5	4.E-02	7.4	35.7	6.0	1.9
1.A.5 - Non-Specified	75.5	2.E-02	4.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	421.2	0	0	0	0	0	0
2.A - Mineral Industry	143.9	0.0	0.0	0.0	0.0	0.0	0.0
2.A.1 - Cement production	130.4			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 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	249.0	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	249.0			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	28.3	0	0	0	0	0	0
2.D.1 - Lubricant Use	9.0			0	0	0	0
2.D.2 - Paraffin Wax Use	19.3			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

Annex 12. Summary Tables for the Year 2011 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	-8849.3	249.6	10.5	13.7	282.0	10.3	0
3.A - Livestock	0	238.7	1.0	0	0	10.3	0
3.A.1 - Enteric Fermentation		231.3		0	0	0	0
3.A.2 - Manure Management		7.4	1.0	0	0	10.3	0
3.B - Land	-8849.76	0	0	0	0	0	0
3.B.1 - Forest land	-27031.4			0	0	0	0
3.B.2 - Cropland	182.5			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 sources on land	0.4	10.8	9.5	13.7	282.0	0	0
3.C.1 - Emissions from biomass burning		10.8	0.8	13.7	282.0	0	0
3.C.2 - Liming	0			0	0	0	0
3.C.3 - Urea application	0.4			0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			6.0	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.7	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			1.0	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	2.0	5.8	0.1	0.4	7.2	0.5	1.E-02
4.A - Solid Waste Disposal	0	3.7	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	2.0	0.8	1.E-02	0.4	7.2	0.2	1.E-02
4.D - Wastewater Treatment and Discharge	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 the atmospheric deposition	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	284.5	2.E-02	8.E-03	4.5	0.8	0.3	1.1
1.A.3.a.i - International Aviation (International Bunkers)	124.8	9.E-04	3.E-03	0.5	5.E-02	2.E-02	4.E-02
1.A.3.d.i - International water-borne navigation (International	159.7	1.E-02	4.E-03	4.0	0.7	0.3	1.0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 13. Summary Tables for the Year 2012

Inventory Year: 2012							
	Emissions (Gg)						
Categories	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-4067.1	274.1	11.5	36.3	369.2	21.6	2.9
1 - Energy	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
1.A - Fuel Combustion Activities	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
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	523.2	0.0	0.0	0.0	0.0	0.0	0.0
2.A - Mineral Industry	244.9	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0
2.C - Metal Industry	250.0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	28.3	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	-7461.1	265.0	11.2	13.7	281.5	10.3	0
3.A - Livestock		254.2	1.1	0	0	10.3	0
3.B - Land	-7461.6		0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources	0.5	10.8	10.1	13.7	281.5	0	0
3.D - Other	0	0	0	0	0	0	0
4 - Waste	2.3	6.1	0.1	0.5	8.2	0.5	2.E-02
4.A - Solid Waste Disposal		3.9		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	1.0	1.E-02	0.5	8.2	0.2	2.E-02
4.D - Wastewater Treatment and Discharge		1.2	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	310.3	2.E-02	8.E-03	4.6	0.8	0.3	1.1
1.A.3.a.i - International Aviation (International Bunkers)	144.7	1.E-03	4.E-03	0.5	5.E-02	2.E-02	4.E-02
1.A.3.d.i - International water-borne navigation (Internat	165.6	2.E-02	4.E-03	4.1	0.7	0.3	1.1
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0

Annex 13. Summary Tables for the Year 2012 (contd)

Inventory Year: 2012

Categories	Emissions (Gg)						
	Net CO2 (1)(2)	CH4	N2O	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	-4067.1	274.1	11.5	36.3	369.2	21.6	2.9
1 - Energy	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
1.A - Fuel Combustion Activities	2868.5	3.0	0.1	22.2	79.4	10.8	2.9
1.A.1 - Energy Industries	36.3	1.E-03	4.E-04	0.1	6.E-03	9.E-04	0.3
1.A.2 - Manufacturing Industries and Construction	196.3	2.E-02	3.E-03	0.7	1.2	0.2	1.0
1.A.3 - Transport	2197.3	0.5	0.1	14.3	42.8	4.7	2.E-02
1.A.4 - Other Sectors	348.9	2.5	3.E-02	6.5	35.3	5.9	1.7
1.A.5 - Non-Specified	89.7	2.E-02	4.E-03	0.5	0.2	3.E-02	3.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	523.2	0	0	0	0	0	0
2.A - Mineral Industry	244.9	0.0	0.0	0.0	0.0	0.0	0.0
2.A.1 - Cement production	231.4			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 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	250.0	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	250.0			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	28.3	0	0	0	0	0	0
2.D.1 - Lubricant Use	9.0			0	0	0	0
2.D.2 - Paraffin Wax Use	19.3			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

Annex 13. Summary Tables for the Year 2012 (contd)

2.F - Product Uses as Substitutes for Ozone Depleting Substance	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	-7461.1	265.0	11.2	13.7	281.5	10.3	0
3.A - Livestock	0	254.2	1.1	0	0	10.3	0
3.A.1 - Enteric Fermentation		246.2		0	0	0	0
3.A.2 - Manure Management		8.0	1.1	0	0	10.3	0
3.B - Land	-7461.6	0	0	0	0	0	0
3.B.1 - Forest land	-25373.5			0	0	0	0
3.B.2 - Cropland	190.8			0	0	0	0
3.B.3 - Grassland	17721.1			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 sources on land	0.5	10.8	10.1	13.7	281.5	0	0
3.C.1 - Emissions from biomass burning		10.8	0.8	13.7	281.5	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			6.4	0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			1.8	0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			1.0	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	6.1	0.1	0.5	8.2	0.5	2.E-02
4.A - Solid Waste Disposal	0	3.9	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	1.0	1.E-02	0.5	8.2	0.2	2.E-02
4.D - Wastewater Treatment and Discharge	0	1.2	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	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0
Memo Items (5)							
International Bunkers	310.3	2.E-02	8.E-03	4.6	0.8	0.3	1.1
1.A.3.a.i - International Aviation (International Bunkers)	144.7	1.E-03	4.E-03	0.5	5.E-02	2.E-02	4.E-02
1.A.3.d.i - International water-borne navigation (International	165.6	2.E-02	4.E-03	4.1	0.7	0.3	1.1
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0