Republic of Mauritius

National Inventory Report (NIR) to the United Nations framework Convention on Climate Change

Ministry of Environment, Solid Waste Management and Climate Change

December 2021

Preface

The National Inventory Report (NIR) was compiled by the Department of Climate Change, Ministry of Environment, Solid waste Management and Climate Change (Environment and Climate Change Division) as part as the First Biennial Update Report for the Republic of Mauritius.

The NIR has been prepared in accordance with the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories and the reporting guidelines of national communication for Parties not included in Annex 1 of the United Nations Framework Convention on Climate Change (UNFCCC

For any information, please contact
Department of Climate Change
Ministry of Environment, Solid waste Management and Climate Change
(Environment and Climate Change Division)
Ken Lee Tower, Corner Barracks & St Georges Streets, Port Louis, Mauritius
Tel: + (230) 203 6200-6210
Fax: + (230) 212 9407
E-mail: menv@govmu.org
Web: http://environment.govmu.org

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Acknowledgements

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Authors and Contributors

Ministries/ Departments/ Parastatal Bodies

Prime Minister's Office, Defence, Home Affairs and External Communications, Ministry of Rodrigues, Outer Islands and Territorial Integrity

- Civil Aviation Department
- Mauritius Ports Authority

Ministry of Housing and Lands

- Cartography Section

Ministry of Tourism

- Mauritius Tourism Promotion Authority
- Tourism Authority

Ministry of Land Transport and Light Rail

- National Land Transport Authority

Ministry of Finance and Economic Planning and Development

- Statistics Mauritius

Ministry of Energy and Public Utilities

- Central Electricity Board
- Wastewater Management Authority

Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division)

- Mauritius Standard Bureau

Ministry of Environment, Solid Waste Management and Climate Change (Environment and

- Department of Climate Change
- Solid Waste Management Division
- Department of Environment
  - Pollution Prevention and Control Division
  - Sustainable Development Division
  - Post EIA Monitoring Division
  - National Ozone Unit
  - National Environment Laboratory
- Solid Waste Management Division

Ministry of Agro Industry and Food Security

- Food and Agricultural Research and Extension Institute (Crop and Livestock Section)
- Forestry Service
- Veterinary Services Division
- Land Use Division
- Mauritius Cane Industry Authority

Ministry of Commerce and Consumer Protection

- Commerce Division
- State Trading Corporation

Ministry of National Infrastructure and Community Development

- Mechanical Engineering Division

Ministry of Health and Wellness

Ministry of Blue Economy, Marine Resources, Fisheries and Shipping

Division

- Albion Fisheries Research Centre

- Shipping Division

Rodrigues

Commission for Environment, Forestry, Tourism, Marine Parks and Fisheries
Commission for Agriculture

Private sectors

Air Mauritius Ltd
Alteo Limited
Association of Hoteliers and Restaurants in Mauritius
Business Mauritius
Mauritius Chamber of Agriculture
Mauritius Chamber of Commerce and Industry
Mauritius Chemical and Fertilizer Industry (MCFI) Limited
Mauritius Export Association
Mauritius Meat Association
Mauritius Shipping Corporation Ltd
Omnicane Ltd
Desbro Trading Limited
Islands Fertilizers
Mauritius Co-operative Agricultural Federation Limited
Samlo Ltd
Terragen Ltd
Sotravic Limited

Academia

University of Mauritius
University of Technology, Mauritius

Project Management Team (Environment and Climate Change Division)

Project Steering Committee Chair

Mrs N. Nathoo, Permanent Secretary
Mr N. Soobratty, Permanent Secretary
Mrs N.D. Goorah, Permanent Secretary
Mr D. Deenoo, Deputy Permanent Secretary

Project Director

Mrs S. L. Ng Yun Wing, Director of Environment
Mr S. Mooloo, Director of Environment
Mr J. Seewoobaduth, Officer in Charge, Department of Climate Change

Project Manager

Mrs D. Rajkoomar
Mrs A. Kawol

Project Coordinator

Mrs. V. Kanhye (Feb 2019 – Dec 2021)
Mr R. Moniaruch (Jan 2018 – Jan 2019)

Project Coordination Support

Mrs. A. Golamaully
Ms. M. Gopall

Chairs of Technical Working Groups

Greenhouse Gas Inventory for Energy Industries

Mr S. Sookhraz, Central Electricity Board

Greenhouse Gas Inventory for Transport

Mrs. J. Ramnauth Ramburn, National Land Transport Authority

Greenhouse Gas Inventory for Energy Other Sectors

Mrs D. Hurdowar and Mr. L. Dindoyal, Statistics Mauritius

Greenhouse Gas Inventory for Industrial Processes and Product Use

Mrs. K. Manna, Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division)

Greenhouse Gas Inventory for Agriculture, Forestry and Other Land Use

Mr A. Atawoo, Food and Agricultural Research and Extension Institute
Mr Z. Jhumka, Forestry Service

Greenhouse Gas Inventory for Solid Waste

Mr G. Dookee, Solid Waste Management Division

Greenhouse Gas Inventory for Liquid Waste

Mrs R. Joysury, Wastewater Management Authority

Consultants

***International Consultancy Firm* -** BEA International

The team consisted of the following International Consultants:

– Mr. Juan Jose Rincon Christobal from Spain
– Mr. Jose Manuel Ramirez Garcia from Spain
– Mr. Vinay Singh from India
– Mr. Kamlesh Kumar Pathak from India

Quality Assurance Expert

Mr Jongikhaya Witi from South Africa

Editing team (MoESWMCC)

Mrs A. Kawol
Mr S. Buskalawa
Mrs V. Kanhye
Mr J. Oh Seng
Mr D. Sardoo
Mrs B. A. Golamaully
Mrs R. B. Teemul
Miss M. Gopall
Miss A. Purrahoo

External Editor

Mr. P. Goolaup

List of Acronyms and Abbreviations

AD	Activity Data
AFOLU	Agriculture, Forestry and Other Land Use (2006 IPCC Guidelines)
Annex I	Parties included in Annex I to the United Nations Framework Convention on Climate Change
BAU	Business as Usual
BESS	Battery Energy Storage System
BOD	Biological Oxygen Demand
BUR	Biennial Update Report
CCA	Climate Change Act 2020
CCIC	Climate Change Information Centre
CEB	Central Electricity Board
CH4	Methane
CLRS	Curepipe Livestock Research Station
CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
COP	Conference of Parties
CPEIR	Climate Public Expenditure and Institutional Review
CS	Country Specific Emissions
D	Default Emissions
DCC	Department of Climate Change
DOWA	Deep Ocean Water Application
EE	Energy Efficiency
EEZ	Exclusive Economic Zone
EF	Emission Factor
FAO	Food and Agriculture Organisation of the United Nations
FAREI	Food and Agricultural Research and Extension Institute
FL	Forestland
FOD	First Order Decay
FOLU	Forestry and Other Land Use
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagram
GHG	Greenhouse Gas
GHGI	Greenhouse Gas Inventory
GNI	Gross National Income
GVA	Gross Value Added
GWh	GigaWatt hour
GWP	Global Warming Potential
ha	hectare
HFC	Hydrofluorocarbon
HFO	Heavy Fuel Oil
ICT	Information and Communication Technology
IEF	Implicit Emission Factor
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Producers
IPPU	Industrial Processes and Product Use
KCA	Key Category Analysis

kg	kilogram
km^2	kilometre square
KP	Kyoto Protocol
ktoe	kiloton of oil equivalent
kW	kiloWatt
kWh	kiloWatt hour
l	litre
LFG	Landfill Gas
LNG	Liquified Natural Gas
LPG	Liquid Petroleum Gas
LTO	Landing and Take-Offs
LULUCF	Land Use, Land-Use Change and Forestry
M	Million
m^3	Cubic Metre
MCF	Methane Correction Factor
MCFI	Mauritius Chemical and Fertiliser Industry
MCIA	Mauritius Cane Industry Authority
MIC	Upper-middle-income Country
mm	Millimetre
MoESWMCC	Ministry of Environment, Solid waste Management and Climate Change (Environment and Climate Change Division)
MRC	Mauritius Research Council
MRV	Measurement. Reporting and Verification
MSDG	Medium-Scale Distributed Generation
MSW	Municipal Solid Waste
MUR	Mauritian Rupee
MW	Mega Watt
N	Nitrogen
N_2O	Nitrous oxide
NA	Not available or Not Applicable
NAI	National Accounts and Investment
NAM	National Accounts of Mauritius
NAMA	Nationally Appropriate Mitigation Action
NC	National Communication
NCV	Net Calorific Value
NDC	Nationally Determined Contributions
NE	Not Estimated
NGO	Non-Governmental Organisation
NIR	National Greenhouse Gas Inventory Report
NIS	National Inventory System
NLTA	National Land Transport Authority
NMVOC	Non-methane volatile organic compound
NO	Not Occurring
Non-Annex I	Parties not included in Annex I to the United Nations Framework Convention on Climate Change
NO_x	Oxides of nitrogen
O_2	Oxygen
^oC	Degree Celsius
ODS	Ozone Depleting Substances
OEP	Outline Energy Policy
PV	Photovoltaic

QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RE	Renewable Energy
RoM	Republic of Mauritius
SAR	Second Assessment Report
SIDS	Small Island Developing States
t	tonne
T1	Tier 1
T2	Tier 2
TEU	Twenty-foot Equivalent Unit
TNC	Third National Communication
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
W	Watt
WB	World Bank
WMA	Wastewater Management Authority
WMO	World Meteorological Organisation
WTE	Waste-to-Energy
WWTP	Wastewater Treatment Plant

Global Warming Potential (GWP)

The Global Warming Potential (GWP) was adopted from the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report (SAR – 100 years' time horizon) as in the table below.

Report of IPCC

Common name	Chemical formula	GWP (SAR)
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
HFC-23	CHF_3	11,700
HFC-32	CH_2F_2	650
HFC-125	CHF_2CF_3	2,800
HFC-134a	CH_2FCF_3	1,300
HFC-152a	CH_3CHF_2	140
HFC-143a	CH_3CF_3	3,800
HFC-227ea	CF_3CHFCF_3	2,900
HFC-236fa	$CF_3CH_2CF_3$	6,300

Source: *Second Assessment Report (SAR, 1995)*

Executive Summary

The Republic of Mauritius (RoM) submitted its first inventory of Greenhouse Gas (GHG) as part of its Initial National Communication in April 1999. Then, an improved national GHG inventory was developed by RoM during the preparation of the Second and Third National Communications.

RoM has an obligation to submit its Biennial Update Report (BUR) as well as National Communications (NC) on a regular basis. It is vital that the process be strengthened, and a system is developed and maintained in a robust manner to ensure that it functions on a continuous basis to meet RoM reporting requirement. There is a need to strengthen the existing institutional arrangements or establish new ones to ensure that national capacity is available to yield more technically robust reports and meet the frequency of submissions. An attempt has been made to establish a sustainable team of experts and data flows in the context of the preparation of the BUR.

To meet the United Nations Framework Convention on Climate Change (UNFCCC) reporting requirements, the GHG national inventory is divided into 4 main sectors, namely, Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste (Solid and Liquid); each of which are further subdivided into sub-categories.

The methodology followed for the development of the national inventory is recommended by Intergovernmental Panel on Climate Change (IPCC) in their 2006 Guidelines for National Greenhouse Gas Inventories as well as the Good Practices Guidance.

The National GHG Emission Inventory has been developed for the time period 2000 – 2016. In the following figures, the trend of GHG emissions by gas and sector has been represented.

The trend of the carbon dioxide equivalent (CO_2eq) emissions is clearly rising along the last 16 years, from 2000 to 2016, except for 2004 when a peak in emissions is observed due to the AFOLU sector. This peak was observed due deforestation which occurred mostly on privately owned forest land. Considering the total emissions excluding LULUCF sector, the biggest emitter is the ***Energy sector***, which represents the **80.26%** of the total emissions of the country in 2016 [**4,182.62** Gigagram carbon dioxide equivalent (**Gg CO_2eq**)], followed by the ***Waste sector*** with **10.73% (559.18 Gg CO_2eq)** of the emissions, the ***IPPU sector*** with the **5.97% (311.18 Gg CO_2eq)** of the total emissions and the ***Agriculture Sector*** with the **3.03%** of total emissions in 2016 (**158.08 Gg CO_2eq**).

The ***total amount of GHG*** emissions (excluding the LULUCF sector) increased by **73.7%** from 2000 to 2016 (3,000.34 Gg CO_2eq to **5,211.06 Gg CO_2eq**) and the amount of ***net GHG emissions*** increased in **92.0%** from 2000 to 2016 (2,542.89 Gg CO_2eq to **4,881.36 Gg CO_2eq**).

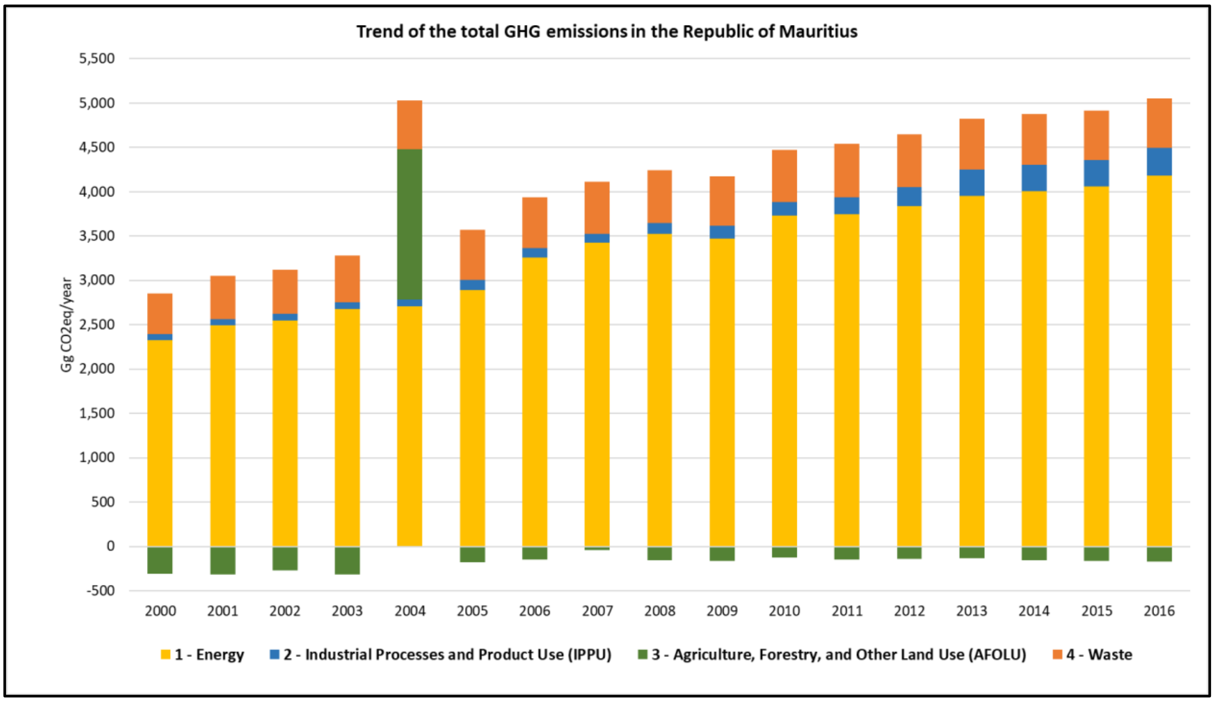


Figure 1. Total GHG Emissions by Sector from 2000 to 2016 (Gg CO2eq)

***Note**: There is a significant change in the pattern in 2004 related with high emissions in the LULUCF sector due to a great area of deforestation, mostly on privately owned forest land.*

Figure 2 shows the trend of the emissions in the RoM for the period 2000 – 2016. In 2016, the biggest emitter of the energy sector corresponds to the ***Energy Industries*** category, representing 57.9% of the total emissions in this sector (**2,422.16 Gg CO_2eq**). The category is followed by the emissions from ***Transport sector*** which represents the **28%** of the total energy emissions in 2016 (**1,169.30 Gg CO_2eq**), the ***Manufacturing Industries and Construction*** represent **8.2%** of the total emissions (**342.18 Gg CO_2eq**) and the ***Energy Other Sectors*** the **5.9%** of the total emissions (**248.10 Gg CO_2eq**) in the energy sector in 2016.

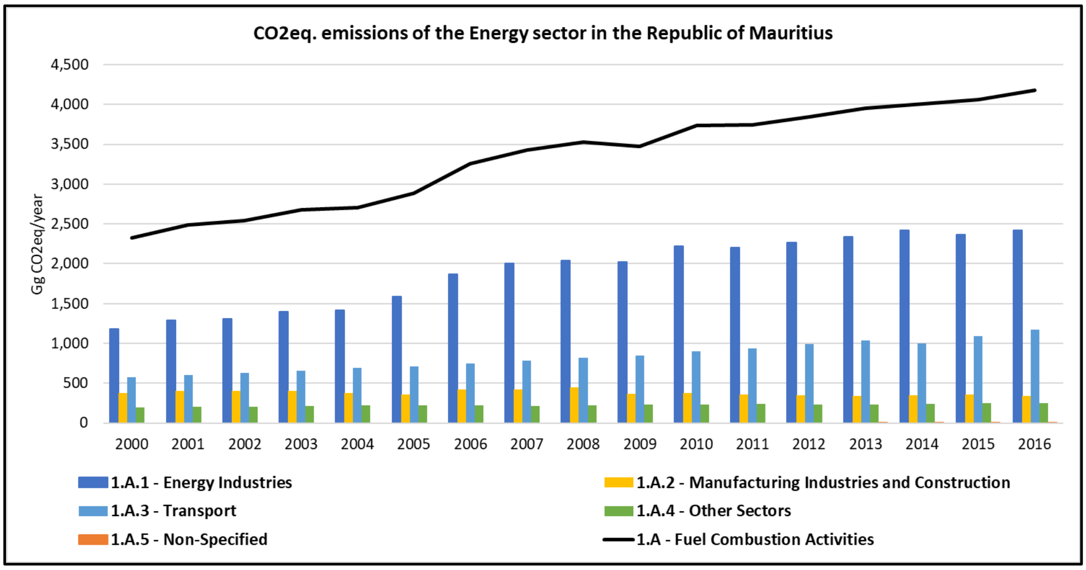


Figure 2. GHG Emissions from Energy Sector 2000 – 2016 (Gg CO_2eq)

GHG emissions from the IPPU Sector have experienced an increase along the time series from 2000 to 2016.

The most significant category, in terms of GHG emissions, that represent the IPPU sector is the Product Use as Substitutes of Ozone Depleting Substances (ODS), represented by stationary refrigerant and air conditioning and mobile air conditioning.

GHG emissions of this sector have increase annually, more moderately between 2000 and 2004 (15.54%, from 70.32 Gg CO_2eq to 81.25 Gg CO_2eq) and more pronounced from 2004 to 2016 (283%, from 81.25 Gg CO_2eq to 311.18 Gg CO_2eq)). The category that most contributed to the increase of the emissions in the last 10 years is the product used as substitutes for ODS.

Product Uses as Substitutes for ODS represent the **90.7%** (**282.10 Gg CO_2eq**) of the total GHG emissions of the IPPU sector in 2016, corresponding to the Refrigeration and Air conditioning category, stationary and mobile.

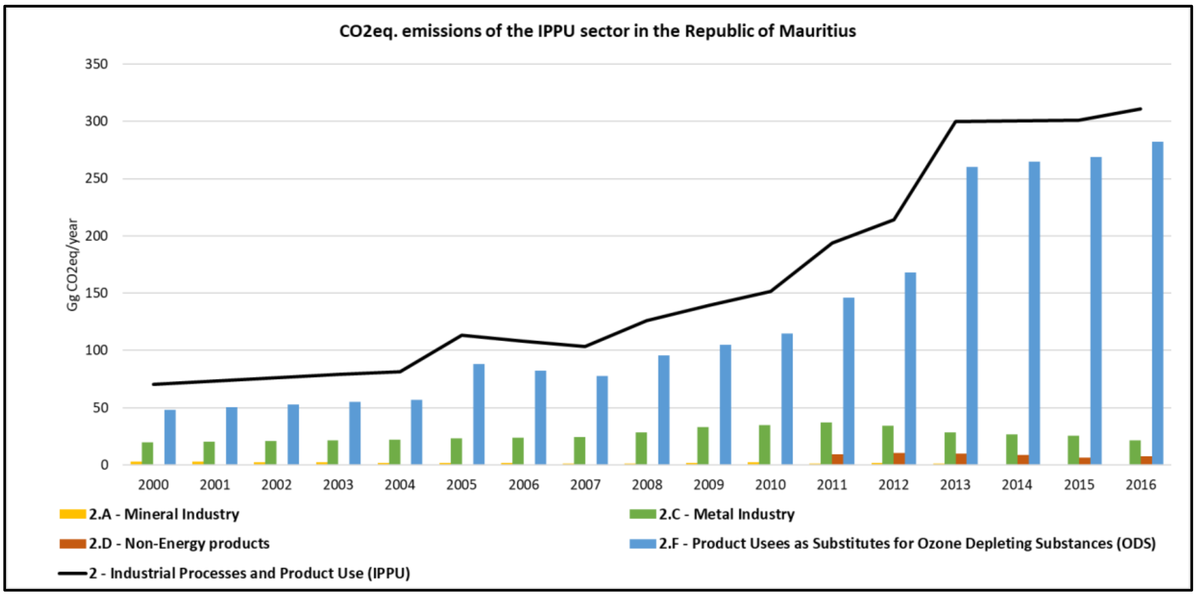


Figure 3. GHG Emissions from IPPU Sector, 2000 – 2016 (Gg CO_2eq)

GHG emissions from the AFOLU sector have been calculated for the period 2000 – 2016, as shown in the figure below, showing negative emissions (removals) from the whole period except for the year 2004 where the sector shows positive emissions. The positive emission is attributed to a great area of deforestation, mostly on privately owned forest land. However, it is to be highlighted that the 2004 data for private forests was obtained after a new survey of private forest land and remote sensing data from the National Remote Sensing Centre. Unlike State Forest Land, private forests are not regularly surveyed. Therefore, it is more likely that this deforestation on private land occurred over several years. For practical reasons, a decision was taken to prevent the cumulated deforestation on private land in 2004.

The period shows an increase in the emissions (decrease in the removals) of **44.9 %** from 2000 to 2016 (from -311.39 Gg CO_2eq to -171.62 Gg CO_2eq).

The most representative categories in this sector are the Land category emission removals. Considering only the emission categories, the most representative is the Aggregate sources and non-CO_2 emissions sources (including direct and indirect emissions from land) which contributes to the 76.26% of the total Agriculture GHG emissions in the sector (excluding removals from LULUCF sector) (120.55 Gg CO_2eq in 2016), while the Livestock category contribute to the remaining 23.74 % in 2016 (37.53 Gg CO_2eq).

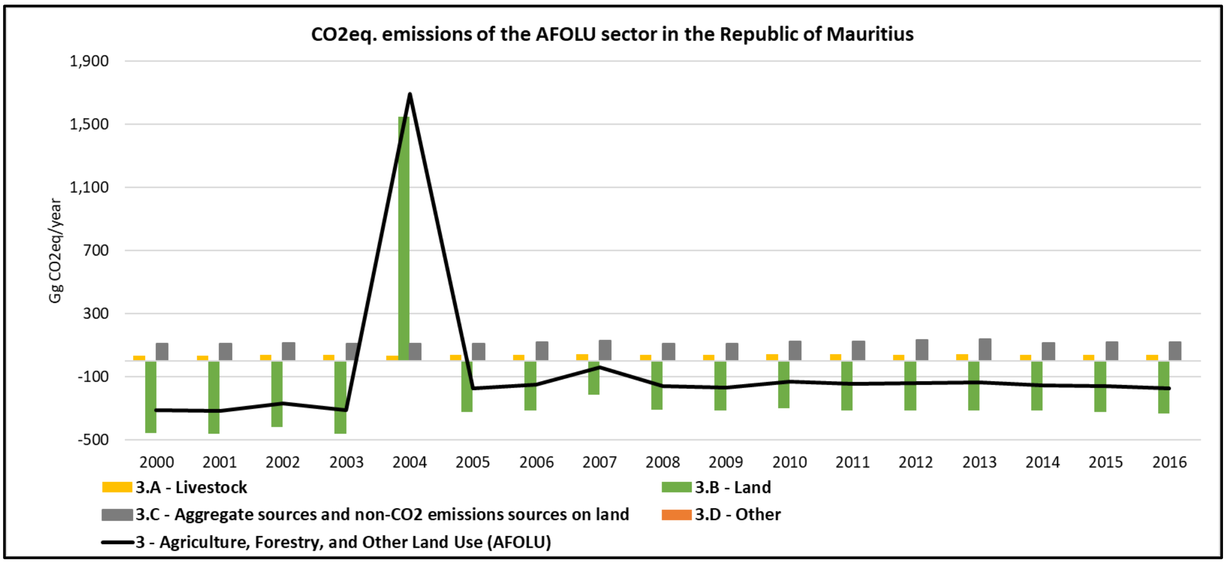


Figure 4. GHG Emissions from AFOLU Sector, 2000 – 2016 (Gg CO_2eq)

***Note**: There was a significant change in the pattern in 2004 related to high emissions in the LULUCF sector due to a great area of deforestation, mostly on privately owned forest land.*

Waste sector's GHG emissions show a slightly ascendant trend along the period 2000 – 2016. The increase of emissions from 2000 to 2016 is estimated at 21.3% (from 460.81 Gg CO_2eq to 559.18 Gg CO_2eq), and the most representative categories within the sector according to their emissions are the Solid Waste Disposal (66.11% of the total Waste sector emissions in 2016, estimated in 369.68 Gg CO_2eq), followed by the Wastewater treatment and discharge (32.67% of the total waste emissions in 2016, estimated in 182.70 Gg CO_2eq), the emissions from biological treatment of solid waste corresponds to the 1.09% of the total emissions of waste sector (6.07 Gg CO_2eq) and the incineration and open burning of waste the 0.13% of the total emissions of the sector in 2016 (0.74 Gg CO_2eq).

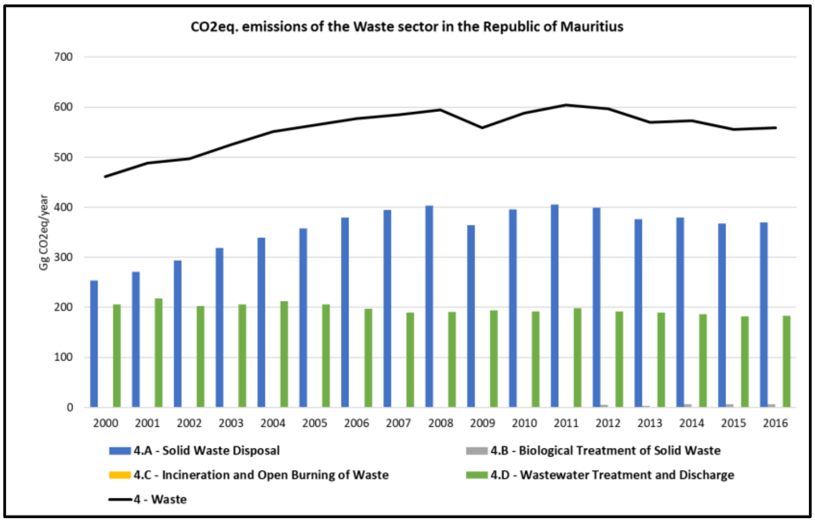


Figure 5. GHG Emissions from Waste Sector, 2000 – 2016 (Gg CO_2eq

1. Introduction

1.1 National Circumstances

The Republic of Mauritius (RoM) consists of the Islands of Mauritius (1,868.4 km^2), Rodrigues (110.1 km^2), Agalega, Tromelin, Cargados Carajos (28.7 km^2) and the Chagos Archipelago, including Diego Garcia and any other island comprised in the State of Mauritius. The Republic of Mauritius has an Exclusive Economic Zone (EEZ) of approximately 2.3 million km^2.

The mainland consists of a central plateau surrounded by mountain ranges and plains. The plateau rises to a maximum elevation of about 600 m (amsl) in the south of the island and has a mean elevation of about 300-400 m (amsl), the highest peak being 828 m (amsl) (Walker and Nicolayson, 1954). The coastline of Mauritius extends over 322 km and the coastal areas, apart from their aesthetic importance, support a number of activities, including tourism, recreation, fishery, trade, and industry. The Island of Mauritius is formed of basaltic rocks and is surrounded by 150 km of fringing reef which encloses an area of about 243 km^2. About 20% of the population resides in the coastal areas.

Rodrigues is approximately 600 km to the north-east of Mauritius, located between latitudes 19°40’ and 19°48’ south and longitudes 63°17’ and 63°31’ east. It is also of volcanic origin and occupies an area of 108 km^2 (excluding the surrounding islets). Rodrigues has a lagoon area of 240 km^2 with the ten Marine Protected Areas (MPAs) namely five fisheries reserved areas, four marine reserves and one multiple-use marine protected area and the total sea area covered by the MPAs is 59 km^2.

Apart from Mauritius and Rodrigues, the other islands/ islets are relatively less populated. Agalega is approximately 1,000 km north of Mauritius, located between latitudes 10°20’ and 10°30’ south and longitudes 56°35’ and 56°43’ east. It consists of two islets - the islands of North and South - connected by a sandy strip during low tide. Its total area is about 9,653 m^2. The island’s strategic location in the Indian Ocean has attracted attention, and it is now witnessing accelerated infrastructural development, with the construction of a state-of-the-art airport and seaport.

1.2 Commitment under UNFCCC for GHG Reporting

RoM submitted its first inventory of GHG as part of its Initial National Communication in April 1999. Then, an improved standalone National GHG Inventory Report was developed by RoM during the preparation of the Second and Third National Communications.

RoM has an obligation to submit its Biennial Update Report (BUR) as well as NC on a regular basis. It is vital that the process be strengthened, and a system is developed and maintained in a robust manner to ensure that it functions on a continuous basis to meet RoM reporting requirements. There is a need to strengthen the existing institutional arrangements or establish new ones to ensure that national capacity is available to yield more technically robust reports and meet the frequency of submissions. An attempt has been made to establish a sustainable team of experts and data flows in the context of the preparation of the BUR.

1.3 Involvement and Participation of Stakeholders

1.3.1 Institutional Arrangements for the BUR Process

In order to integrate the measurement, reporting and verification (MRV) system in the organizational structure of the Mauritian Government, an institutional arrangement must be developed to ensure assigned responsibilities, enough capacity and manpower, as well as a smooth connection and regular exchange of information between the administrations/institutions involved in MRV activities.

In this context, a sustained institutional arrangement for Biennial Update Reports is proposed to create an appropriate working framework. This working framework should cover management and coordination of the parties involved in the MRV system. In addition, sectoral experts should be part of the working framework to provide technical knowledge and data.

The Climate Change Committee under the Climate Change Act 2020 will be coordinating the preparation of greenhouse gas inventories to monitor and control emissions in various key sectors. Therefore, it is proposed that such a Climate Change Committee coordinates the implementation of activities for the MRV system.

National sectoral experts must be involved in this working framework. The institutional arrangement that was set up under the Third National Communication consisting of six Technical Working Groups was adopted for the preparation of the First Biennial Update Report. The sectors for which Technical Working Groups were set up are as follows: Energy Industries, Transport, Energy Other Sector, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use (AFOLU) and Waste (Solid and Liquid). These sectors are as per the categories of the *2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* for reporting emissions and removals.

The Department of Climate Change (DCC) led the process of institutional reorganization and, depending on the sector to which the GHG relates, involved one of the following institutions to provide experts for the review of the monitoring plan:

- Ministry of Environment, Solid Waste Management and Climate Change (MoESWMCC)
- Ministry of Energy and Public Utility (MEPU)
- Ministry of Agro Industry and Food Security
- Ministry of Land Transport and Light Rail
- Ministry of National Infrastructure and Community Development
- Ministry of Blue Economy, Marine Resources, Fisheries and Shipping
- Ministry of Commerce and Consumer Protection
- Ministry of Industrial Development, SMEs and Cooperatives
- Ministry of Housing and Land Use Planning
- Ministry of Health and Wellness

These Ministries were involved in the whole process of institutional arrangement to provide technical resources to shape the sectoral technical working groups.

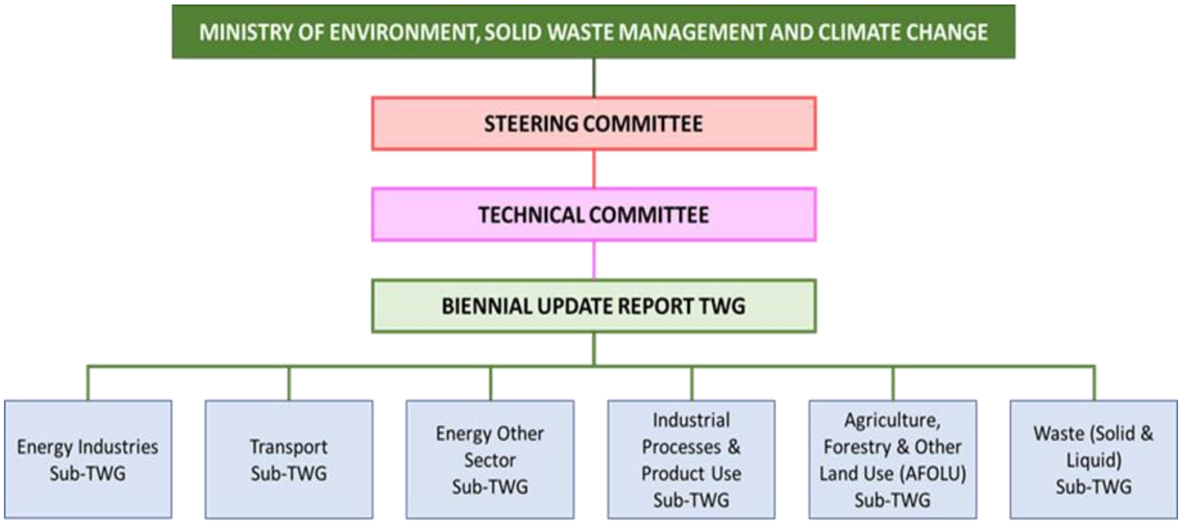


Figure 6. Sustained Institutional Arrangement for Biennial Update Report

To date, RoM has relied upon a system of temporary, ad hoc institutional arrangements to undertake National Communications and their associated inventories, whereby ministries and other institutions have supplied staff members to technical working groups for limited periods of time. This has led to coordination challenges (over 75 such institutions are usually involved), as well as limited institutional memory (as it is rarely the same staff members who work on successive National Communications), a lack of systematic data archiving and a heavy reliance upon short-term consultants. There is a need to develop a sustainable solution for archiving the data collected; currently, data is fragmented across multiple computers, is not readily accessible and is difficult to reconstruct for the purposes of building time-series.

Presently, the Climate Change Division, now transited to the Department of Climate Change (DCC) is responsible for coordinating data collection. Input of data into the 2006 IPCC Inventory Software is either undertaken by consultants or by Local Sectoral Expert under the guidance of a Local Expert. Data processing – i.e., converting data into the form required for the IPCC Software – is a laborious process that varies from sector to sector according to data availability and individual institutional capacities.

The result is an increasingly stressed MRV system that is struggling, and will continue to struggle, in the face of growing demands, notably the increasing frequency of reporting (BURs) and the growing need for GHG data to inform national policies and to track NDC progress.

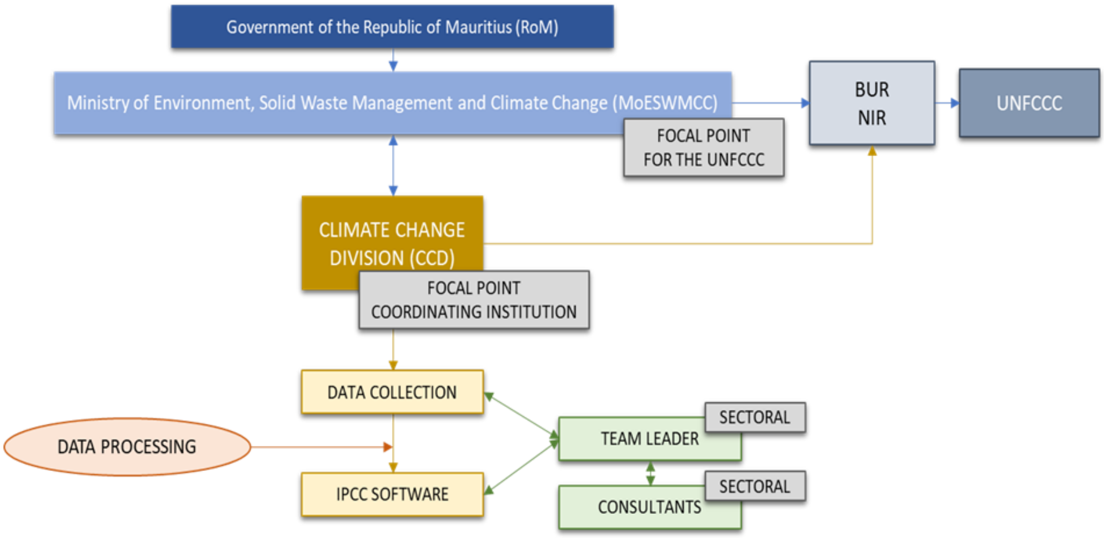


Figure 7. Government Structure relevant to MRV

1.3.2 Institutional Arrangements for GHG Inventory

DCC, under the MoESWMCC, acting like leader for GHG inventory, is responsible for coordinating the activities related to data collection, identification of relevant stakeholders, and the organisation of capacity building exercises. The data collection is led by the Team Leader (TL) of each sectoral working group, under the guidance of consultants.

Institutional arrangements for a sustainable development of GHG inventories

The institutional arrangements used for the elaboration of the GHG emission inventory for the first Biennial Update Report are in line with the institutional arrangements used for the NIR under the Third National Communication (TNC). Six sub-technical working groups formed by assigned experts have been established to oversee the technical implementation of data collection, quality control and GHG Inventory.

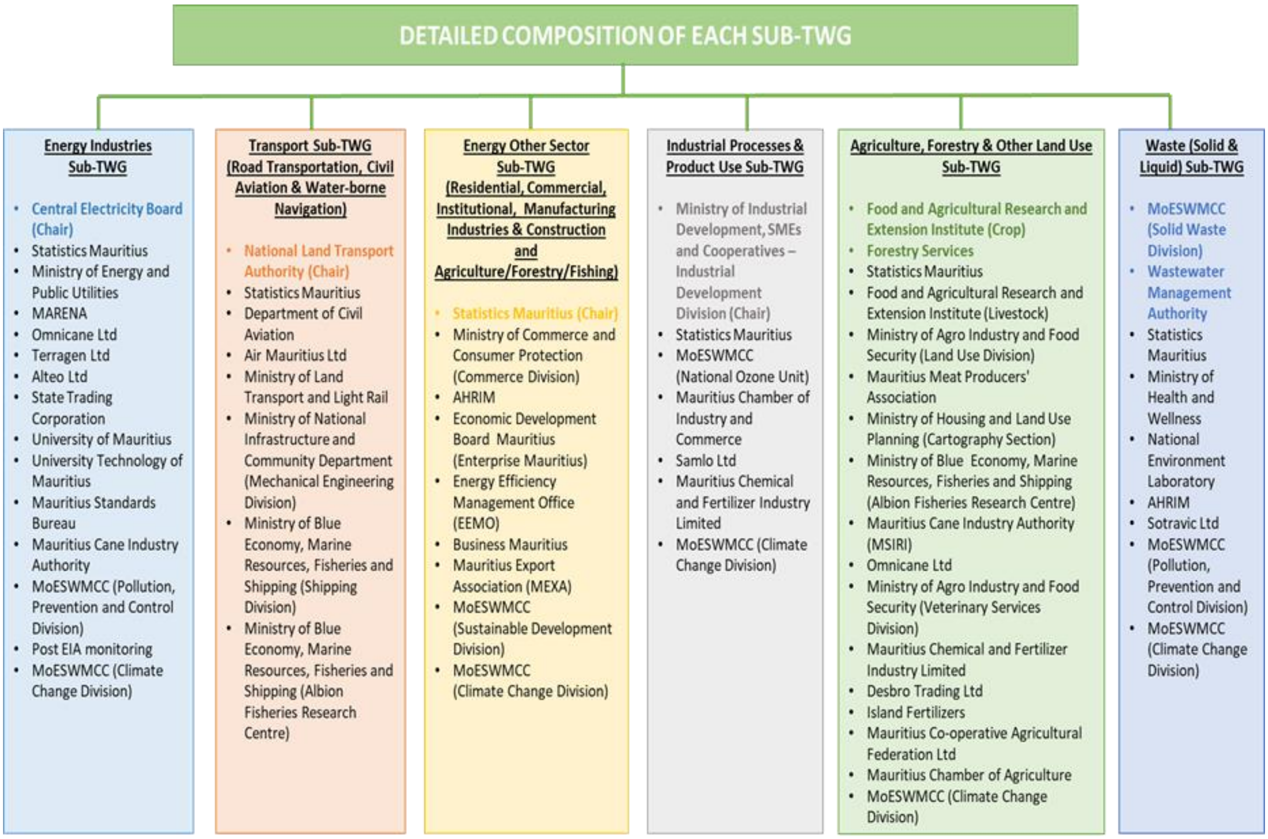


Figure 8. Institutions involved in the preparation of NIR/BUR

The DCC, as focal point of the data collection is responsible for the data gathering from the responsible data providers. For this request of information, it is necessary the development of a correct institutional arrangement. The institutional arrangement should assure the smooth and regular development of the GHG Inventory. In addition, it is recommendable to nominate a responsible officer for each of the data that has to be collected for the development of the national inventory. This responsible officer should have identified the different institutions from which data must be requested.

1.4 Inventory Preparation

1.4.1 Brief Description of Methodology

To meet the reporting requirements of UNFCCC, the GHG national inventory is divided into 4 main sectors (Energy, IPPU, AFOLU and Waste) and each of which are further subdivided into sub-categories.

The methodology followed for the development of the national inventory is recommended by Intergovernmental Panel on Climate Change (IPCC) in their 2006 Guidelines for National Greenhouse Gas Inventories and Good Practices Guidance.

Generally, the methodology adopted for GHG emissions estimation consists of multiplying activity data (AD) by the relevant appropriate emission factor (EF).

$$\text{Emissions (E)} = \text{Activity Data (AD)} \times \text{Emission Factor (EF)}$$

The methodology approach used for each of the sectors are outlined below, but 3 general levels of complexity and detail of methods are defined in IPCC 2006 Guidelines.

- **Tier 1:** the simplest approach and uses IPCC default values. This method is defined to be used where limited activity data is available.
- **Tier 2:** involves the simple methods but include the use of country specific emission factors
- **Tier 3:** the most complex and cover the use of models or plant specific data to generate accurate GHG emission estimates.

The specific methodology used for GHG emission estimation is detailed in each sectorial Chapters 2 to 5 of the 2006 IPCC Guidelines, and in the sections below.

To use a common unit for GHG emissions, the IPCC recommends the use of Global Warming Potentials (GWP) to convert GHG emissions other than CO_2 to the latter equivalent, CO_2 equivalent (CO_2e). The GWP values used in the current inventory are those adopted from the Second Assessment Report (SAR) as collected in the following table for each GHG reported in the National Inventory.

Table 1. GWP values for 100-year time horizon according to the Second Assessment Report of IPCC

Common name	Chemical formula	GWP (SAR)
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
HFC-23	CHF_3	11,700
HFC-32	CH_2F_2	650
HFC-125	CHF_2CF_3	2,800
HFC-134a	CH_2FCF_3	1,300
HFC-152a	CH_3CHF_2	140
HFC-143a	CH_3CF_3	3,800
HFC-227ea	CF_3CHFCF_3	2,900
HFC-236fa	$CF_3CH_2CF_3$	6,300

Source: *Second Assessment Report (SAR,1995)*

1.4.2 Methodology for Key Category Analysis and Trend Assessment

According to the *Good Practice Guidance and Uncertainty Management in National GHG Inventories*, key categories are those which contribute 95% of the cumulative emissions (Level Assessment) or contribute to significantly increasing or decreasing trends (Trend Assessment) (IPCC, 2000). It is considered a good practice to identify key categories, as it helps to prioritize efforts and improve the overall quality of the national inventory.

The category analysis was made using the equation for level 1 approach reported in the 2006 IPCC guidelines (Volume 1, Chapter 4).

Source Category Level Assessment = Source Category Estimate / Total Estimate

$$L_{x.t} = E_{x.t} / E_t$$

The total contribution, which is the sum of the absolute values of emissions and removals in year t, calculated using the aggregation level chosen by the country for key category analysis. Because both emissions and removals are entered with positive signs, the total contribution/level can be larger than a country's total emissions less removal.

The key category analysis was conducted using 2006 IPCC Inventory Software. The results from the software were interpreted as follows:

- The categories totalising the emission contribution thresholds of 95 are compared with the most recent key category analysis with the assessment for three or more previous years
- If a category has been key for all or most previous years according to the either level or trend assessments or both (two assessments should be considered separately), they should be identified as key in the latest year estimate except in cases where a clear explanation can be provided why a category may no longer be key in any future years.

The trend was assessed to identify categories that, although not large enough to be identified by the level assessment, their trend may be significantly increasing or decreasing to require particular attention, checking and possible improvement of methods. The trend assessment was calculated according to equation 4.2 of Volume 1, Chapter 4 of 2006 IPCC Guidelines (IPCC, 2006).

$$T_{x,t} = \frac{|E_{x,0}|}{\sum_y |E_{y,0}|} \bullet \left| \left[\frac{(E_{x,t} - E_{x,0})}{|E_{x,0}|} \right] - \frac{\left(\sum_y E_{y,t} - \sum_y E_{y,0} \right)}{\left| \sum_y E_{y,0} \right|} \right|$$

Where.

$T_{x.t}$ = trend assessment of source or sink category x in year t as compared to the base year

$|E_{x.t}|$ = absolute value of emission or removal estimate of source or sink category x in base year

$E_{x.t}$ and $E_{x.0}$ = real values of estimates of source or sink category x in year t and base year, respectively

$\sum_y \quad E_{y.t}$ and $\sum_y \quad E_{y.0}$ = total inventory estimates in year t and base year, respectively

The results of this analysis are reported in the Appendix 1: Key Category Analysis.

1.4.3 Quality Assurance and Quality Control (QA/QC)

The 2006 IPCC Guidelines recommend that quality control be exercised by comparing emission results using alternative approaches, comparing results and investigating anomalies. They also recommend that controls include review of emission factors, verification of activity data to ascertain source of data, and distinction in use where applicable, and to ensure avoidance of double counting.

All the data used were reviewed during meetings with stakeholders. All calculations made during the exercise used approved standardised procedures for emissions calculations, measurements and documentations as per 2006 IPCC Guidelines.

Regarding the Quality Assurance (QA), by the request of RoM from the UNEP/UNDP Global Support Programme, the services of Mr Jongikaya Witi was retained as Quality Assurance

Expert to review the draft NIR. As an improvement of QA/QC, specific templates were developed for activity data collection based on the 2006 IPCC Guidelines.

1.4.4 Uncertainty Assessment

The 2006 IPCC Guidelines consider the Uncertainty Analysis as an essential part of the GHG emission inventory. This Uncertainty Analysis should be considered to prioritize national efforts aimed to increase the accuracy and precision of future inventories and to guide decisions on the methodology selected.

Chapter 3, Volume 1 of the 2006 IPCC Guidelines defines uncertainty as the lack of knowledge of the true value of a variable by defining the possible range within a confidence level the value could be. Uncertainties are used to highlight where the real emissions/removals have the potential to be significantly different to estimate.

The uncertainty of the national GHG emissions inventory of the Republic of Mauritius has been estimated for emission factors and activity data, and the method used for the calculation has been the Approach 1: Propagation of error. The uncertainty of each category is weighted by the emissions or removals in that category to obtain the contribution to the total combined uncertainty.

The last inventory period estimated by RoM was 2000-2013, where the base year considered was the year 2000. In some cases, the activity data for some of the new year’s included were not available, so these were estimated by using the best adjustment which best fits the trend, and these could lead to a bigger uncertainty of the data used. For that reason, two base years have been established, and two uncertainty analyses have been developed.

The Uncertainty Assessment developed for each category is collected in its corresponding section, and the results of the complete Uncertainty Assessment is available in the Appendix 2: Uncertainty Assessment.

1.4.5 Completeness Assessment

The following table provides the completeness of the inventory.

Table 2. Completeness of the 2000-2016 National GHG Emission Inventory

Category	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
1 - Energy						
1.A – Fuel Combustion Activities						
1.A.1 – Energy Industries	X	X	X			
1.A.2 – Manufacturing Industries and Construction	X	X	X			
1.A.3 – Transport	X	X	X			
1.A.4 – Other sectors	X	X	X			
1.A.5 – Non-specified	X	X	X			
1.B – Fugitive emissions from fuels						
1.B.1 – Solid Fuels	NA	NA	NA			
1.B.2 – Oil and Natural gas	NA	NA	NA			
1.B.3 – Other emissions from Energy production	NA	NA	NA			
1.C – Carbon dioxide Transport and Storage						

1.C.1 – Transport of CO_2	NO					
1.C.2 – Injection and Storage	NO					
1.C.3 – Other	NO					
2 – Industrial Processes and Product Use (IPPU)						
2.A – Mineral Industry						
2.A.1 – Cement production	NO					
2.A.2 – Lime production	X					
2.A.3 – Glass production	NO					
2.A.4 – Other process uses of carbonates	NO					
2.A.5 – Other	NO					
2.B – Chemical Industry						
2.B.1 – Ammonia production	NO	NO	NO			
2.B.2 – Nitric Acid production			NO			
2.B.3 – Adipic Acid production	NO		NO			
2.B.4 – Caprolactam. glyoxal and glyoxylic acid production	NO		NO			
2.B.6 – titanium dioxide production	NO					
2.B.7 – Soda ash production	NO					
2.B.8 – Petrochemical and carbon black production	NO	NO				
2.B.9 – Fluorochemical production				NO	NO	NO
2.B.10 – Other	NO	NO	NO	NO	NO	NO
2.C – Metal Industry						
2.C.1 – Iron and steel production	X	NA				
2.C.2 – Ferroalloys production	NO	NO				
2.C.3 – Aluminium production	NO				NO	
2.C.4 – Magnesium production	NO			NO	NO	NO
2.C.5 – Lead production	NO					
2.C.6 – Zinc production	NO					
2.C.7 – Other	NO	NO	NO	NO	NO	NO
2.D – Non-Energy products from Fuels and Solvent Use						
2.D.1 – Lubricant Use	X	NA	NA			
2.D.2 – Paraffin Wax Use	NO	NO	NO			
2.D.3 – Solvent Use	NO	NO	NO			
2.D.4 – Other	NO	NO	NO			
2.E – Electronics Industry						
2.E.1 – Integrated Circuit or Semiconductor				NO	NO	NO
2.E.2 – TFT Flat Panel Display				NO	NO	NO
2.E.3 – Photovoltaics				NO	NO	NO
2.E.4 – Heat Transfer Fluid				NO	NO	NO
2.E.5 - Other				NO	NO	NO
2.F – Product Uses as Substitutes for Ozone Depleting Substances						

2.F.1 – Refrigeration and Air Conditioning				X	NO	NO
2.F.2 – Foam Blowing Agents				NA	NA	NA
2.F.3 – Fire Protection				NA	NA	NA
2.F.4 – Aerosols				NA	NA	NA
2.F.5 – Solvents				NA	NA	NA
2.F.6 – Other				NO	NO	NO
2.G – Other Product Manufacture and Use						
2.G.1 – Electrical Equipment					NA	NA
2.G.2 – SF6 and PFCs from Other Product Uses					NA	NA
2.G.3 – N_2O from Product uses			NA			
2.G.4 – Other	NA	NA	NA	NA	NA	NA
2.H – Other						
2.H.1 – Pulp and paper Industry	NO	NO	NO	NO	NO	NO
2.H.2 – Food and Beverages Industry	NO	NO	NO	NO	NO	NO
2.H.3 – Other	NO	NO	NO	NO	NO	NO
3 – Agriculture, Forestry and Other Land Use (AFOLU)						
3.A – Livestock						
3.A.1 – Enteric Fermentation		X				
3.A.2 – Manure Management		X	X			
3.B – Land						
3.B.1 – Forest land	X					
3.B.2 – Cropland	X					
3.B.3 – Grassland	NA					
3.B.4 – Wetlands	X					
3.B.5 – Settlements	X					
3.B.6 – Other land	X					
3.C – Aggregate sources and non-CO_2 emissions sources on land						
3.C.1 – Emissions from biomass burning		X	X			
3.C.2 – Liming	NE					
3.C.3 – Urea application	NE					
3.C.4 – Direct N_2O emissions from managed soils			X			
3.C.5 – Indirect N_2O emissions from managed soils			X			
3.C.6 – Indirect N_2O emissions from Manure Management			X			
3.C.7 – Rice Cultivations		NO				
3.C.8 – Other		NO	NO			
3.D – Other						
3.D.1 – Harvested Wood products	X	NA				

3.D.2 – Other	NO	NO	NO			
4 – Waste						
4.A – Solid Waste Disposal	NA	X				
4.B – Biological Treatment of Solid Waste		X	X			
4.C – Incineration and Open Burning of Waste	X	NA	NA			
4.D – Wastewater Treatment and Discharge		X	X			
5 – Other						
5.A – Indirect N_2O emissions from the atmospheric deposition of nitrogen in NO_x and NH_3			NA			
5.B – Other	NA	NA	NA			

X = Estimated; NA = Not Applicable; NO = Not Occurring; NE = Not Estimated

2. Trends of Greenhouse Gas (GHG) Emissions

This chapter summarises the emission trends from 2000 to 2016.The current inventory is based on the methodology contained in the 2006 IPCC Guidelines of National Greenhouse Gas Inventories.

2.1 Emission trend by sector

The trends by sector for the GHG estimate 2000-2016 are tabulated in Table 3 and Figure 9 presents the emission share for each sector.

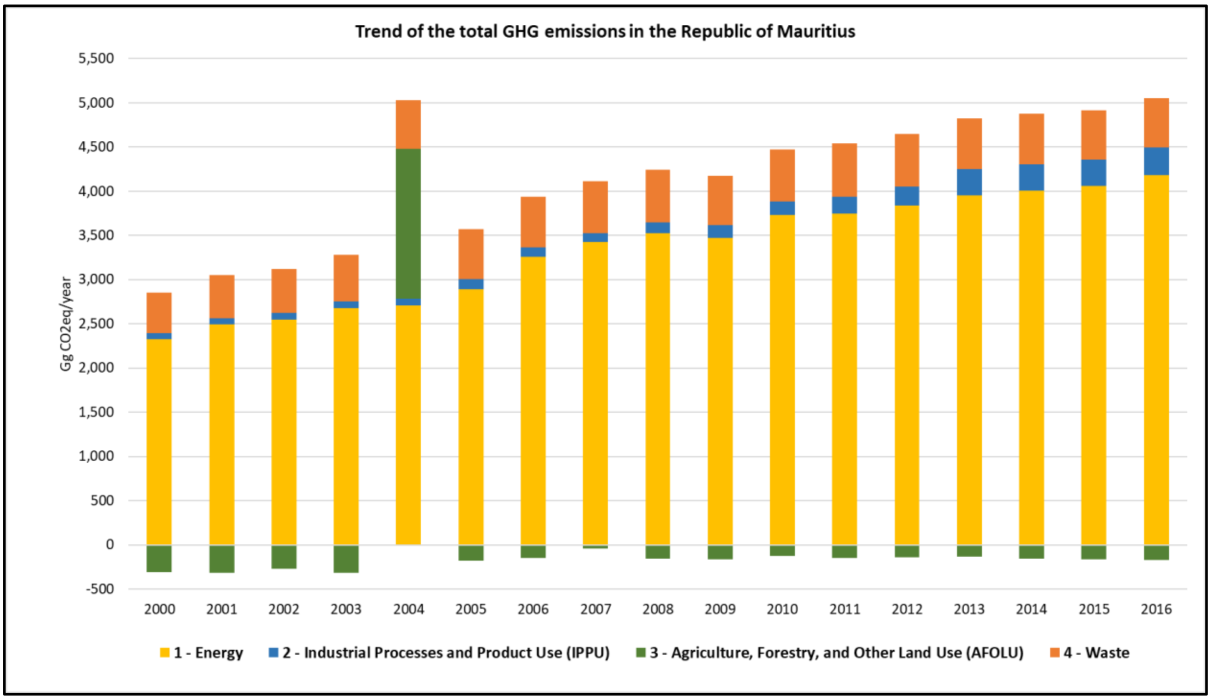


Figure 9. Total GHG Emissions by Sector from 2000 to 2016 (CO_2eq)

***Note**: There was a significant change in the pattern in 2004 related to high emissions in the LULUCF sector due to a great area of deforestation, mostly on privately owned forest land.*

Table 3. Total GHG Emissions by Sector from 2000 to 2016 (Gg CO_2eq)

Year	Energy	IPPU	Agriculture	LULUCF	AFOLU	Waste	Total GHG excluding LULUCF	Total net GHG emissions including LULUCF	Annual Change (%)
2000	2,323.15	70.32	146.06	-457.45	-311.39	460.80	3,000.34	2,542.89	
2001	2,492.10	73.46	145.00	-460.58	-315.58	488.68	3,199.24	2,738.66	7.70%
2002	2,544.85	76.15	151.35	-418.77	-267.42	497.44	3,269.79	2,851.02	4.10%
2003	2,678.11	78.88	147.01	-459.89	-312.88	525.19	3,429.19	2,969.30	4.15%
2004	2,704.03	81.25	145.28	1,549.30	1,694.58	551.36	3,481.92	5,031.22	69.44%
2005	2,889.79	113.16	149.00	-323.91	-174.91	564.01	3,715.95	3,392.04	-32.58%
2006	3,255.86	108.04	161.03	-311.43	-150.40	576.77	4,101.70	3,790.27	11.74%
2007	3,423.66	103.25	171.93	-213.84	-41.91	585.02	4,283.86	4,070.02	7.38%
2008	3,524.63	125.87	149.84	-308.16	-158.32	594.41	4,394.75	4,086.59	0.41%
2009	3,472.88	139.56	148.81	-315.46	-166.65	558.97	4,320.22	4,004.75	-2.00%
2010	3,731.18	151.71	168.17	-296.65	-128.48	588.57	4,639.63	4,342.98	8.45%
2011	3,742.36	193.95	167.07	-312.27	-145.20	604.32	4,707.69	4,395.42	1.21%
2012	3,839.69	214.43	175.80	-313.68	-137.88	596.51	4,826.42	4,512.75	2.67%
2013	3,949.45	300.00	178.83	-313.50	-134.67	569.54	4,997.82	4,684.32	3.80%
2014	4,005.75	300.78	156.37	-310.27	-153.90	572.77	5,035.66	4,725.39	0.88%
2015	4,057.65	300.96	161.02	-321.56	-160.54	555.45	5,075.07	4,753.51	0.59%
2016	4,182.62	311.18	158.08	-329.70	-171.62	559.18	5,211.06	4,881.36	2.69%

2.1.1 Energy Sector

The trend of the CO_2eq emissions is clearly rising along the last 17 years, from 2000 to 2016. The biggest emitter of the sector are the energy industries, which represent the 57.9% (2,422.16 Gg CO_2eq) of the total emissions of the sector in 2016, followed by the transport sector, leaded by the road transport representing the 28.0% (1,169.30 Gg CO_2eq). Manufacturing industries and construction, and "Other sectors", represent the 8.2% (342.18 Gg CO_2eq) and the 5.9% (248.10 Gg CO_2eq) of the total emissions of the sector in 2016 respectively.

The total amount of GHG emissions increased in 80.0% from 2000 to 2016 (from 2,323.15 Gg CO_2eq to 4,182.62 Gg CO_2eq). Energy industries show a constant increase of CO_2eq emissions from 2000 to 2016, especially motivated by the use of coal, the highest emitter of the energy industries category, responsible for the 37.5% of the sector's emissions (2016). In terms of electricity generation by energy industries, the fuel that generates the highest amounts of electricity is the coal (corresponding to the highest amounts of CO_2eq emissions), followed by fuel oil which is responsible for the 15.4% of the emissions of the sector. The third fuel that generates highest amounts of electricity is the bagasse, which is a renewable resource and so CO_2 emission have not been accounted as it is a biogenic emissions source.

The transport category represents the second biggest emitter of the energy sector. This category is divided into civil aviation, road transport, and water-borne navigation. In 2016, transport represents the 28.0% of the total emissions of the energy sector (1,169.30 Gg CO_2eq), and the 93.6% (1,093.96 Gg CO_2eq) of those emissions corresponds to the road transport category, while water-borne navigation represents the 5.6% of the category's emissions (65.55 Gg CO_2eq) and the civil aviation the remaining 0.8% (9.79 Gg CO_2eq). This category showed an exponential growth in terms of emissions all over the time analysed.

The emissions from manufacturing industries and construction experimented lots of variations. From 2000 to 2003, the trend of emissions was ascendant, from 2004 to 2009 the emissions varied a lot and, from 2010 to 2016, the emission decreased. The fluctuations in the period 2004-2009 were especially due to the variable use of coal. In 2016, Manufacturing industries and construction represented 8.2% of the total emission of the energy sector (342.18 Gg CO_2eq).

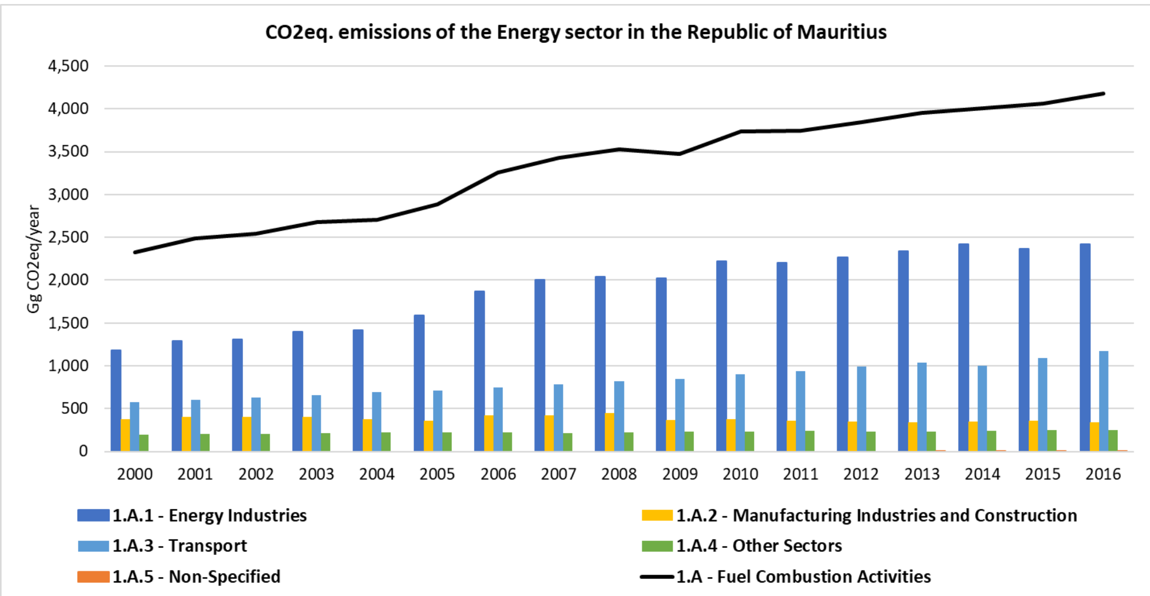


Figure 10. GHG Emissions from Energy Sector 2000 – 2016 (Gg CO_2eq)

Table 4. Total GHG Emissions for Energy Sector from 2000 to 2016 (Gg CO_2eq)

Years	Total emissions for Energy
2000	2,323.15
2001	2,492.10
2002	2,544.85
2003	2,678.11
2004	2,704.03
2005	2,889.79
2006	3,255.86
2007	3,423.66
2008	3,524.63
2009	3,472.88
2010	3,731.18
2011	3,742.36
2012	3,839.69
2013	3,949.45
2014	4,005.75
2015	4,057.65
2016	4,182.62

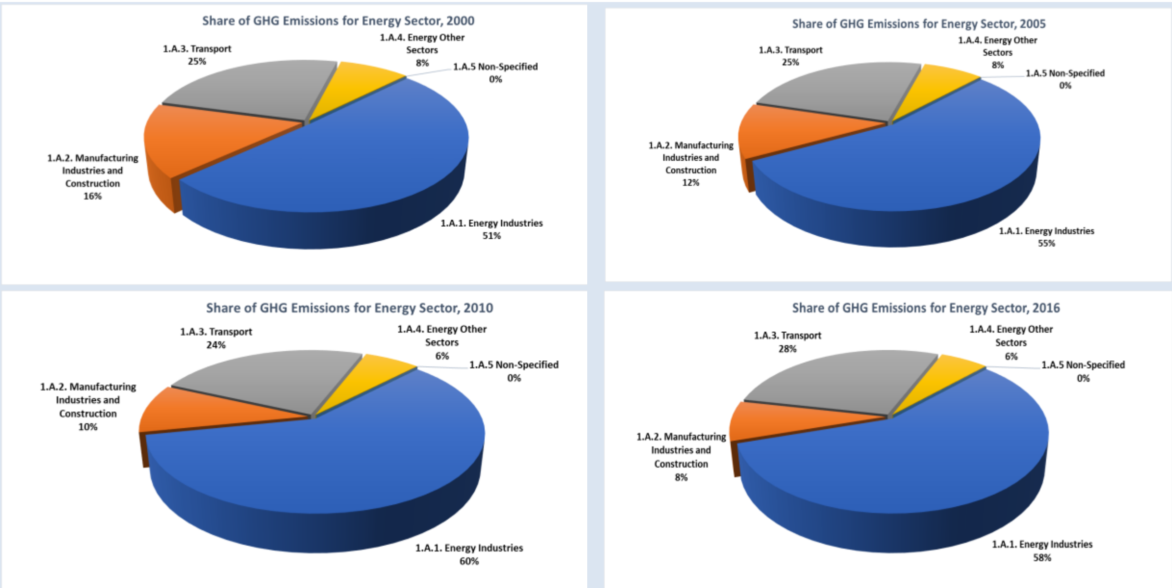


Figure 11. Share of GHG Emissions for Energy Sector 2000, 2005, 2010 and 2016 (%CO_2eq)

2.1.1.1 Energy Industries

The biggest emitter of the energy sector is the energy industries category, responsible of the 57.9% (2,422.16 Gg CO_2eq) of the total Energy GHG Emission in 2016.

As seen in the figure below, the trend of the energy industries emissions is ascendant, with a growth of 105.7% between 2000 and 2016 (from 2,323.15 Gg CO_2eq to 2,422.16 Gg CO_2eq).

This general rising trend can be explained by the change in lifestyle and increased demand for electricity in household and commercial and institutional sectors.

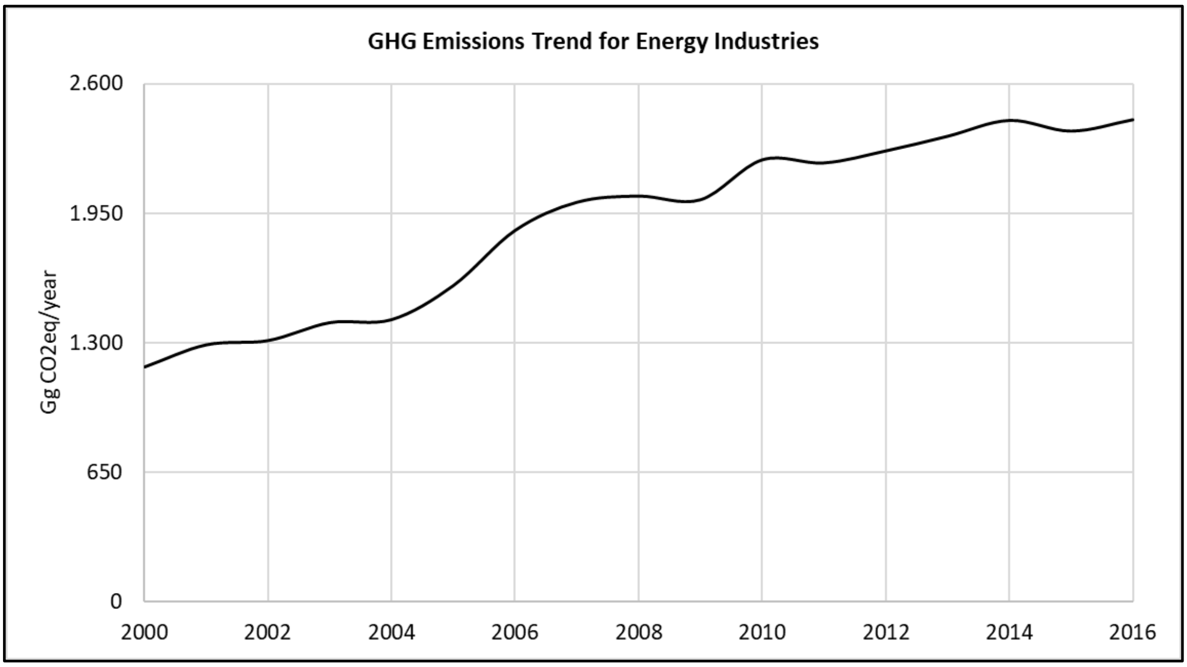


Figure 12. GHG Emission trend for Energy Industry Category, 2000 – 2016 (Gg CO_2eq)

Table 5. Total GHG Emissions for Energy Industries, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	1,159.26	0.25	0.04	1,177.61
2001	1,268.82	0.27	0.05	1,289.30
2002	1,289.42	0.29	0.05	1,310.80
2003	1,381.20	0.26	0.05	1,400.80
2004	1,396.03	0.27	0.05	1,416.17
2005	1,567.12	0.26	0.05	1,587.64
2006	1,843.79	0.26	0.05	1,865.46
2007	1,985.18	0.24	0.05	2,006.65
2008	2,011.06	0.32	0.06	2,037.72
2009	1,994.91	0.28	0.06	2,019.24
2010	2,194.94	0.29	0.06	2,220.34
2011	2,180.34	0.28	0.06	2,204.72
2012	2,240.87	0.27	0.06	2,265.14
2013	2,314.09	0.27	0.06	2,338.84
2014	2,393.79	0.27	0.06	2,418.53
2015	2,339.08	0.29	0.06	2,365.06
2016	2,397.16	0.27	0.06	2,422.16

2.1.1.2 Manufacturing Industries

The Manufacturing Industries and Construction category is responsible for 8.2% of the GHG emissions of the energy sector in 2016, being the third biggest emitter of the energy sector, after energy industries and transport categories.

From 2000 to 2016 the GHG emissions of the manufacturing industries experiment a decrease of 8.2% (from 372.22 Gg CO_2eq to 342.18 Gg CO_2eq).

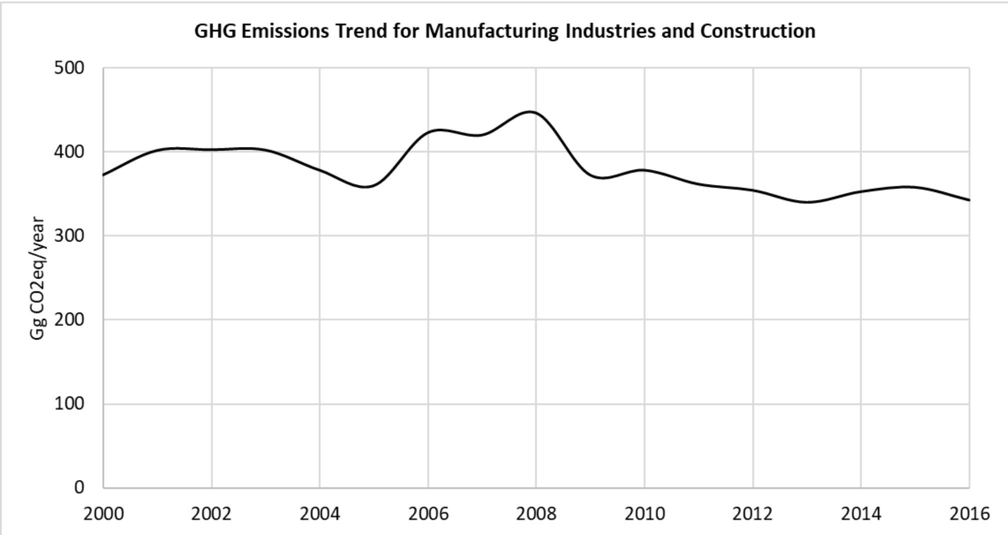


Figure 13. GHG Emission trend from Manufacturing Industry Category, 2000 – 2016 (Gg CO_2eq)

Table 6. Total GHG Emissions from Manufacturing Industries Category, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	363.71	0.13	0.02	372.22
2001	393.06	0.13	0.02	401.62
2002	394.97	0.11	0.02	402.38
2003	393.68	0.13	0.02	402.04
2004	369.68	0.13	0.02	377.99
2005	351.66	0.12	0.02	359.33
2006	415.12	0.12	0.02	422.80
2007	413.57	0.10	0.01	419.98
2008	441.43	0.08	0.01	446.47
2009	367.66	0.07	0.01	372.13
2010	372.84	0.08	0.01	377.90
2011	356.61	0.07	0.01	361.19
2012	349.70	0.06	0.01	353.89
2013	335.31	0.06	0.01	339.42
2014	348.41	0.06	0.01	352.22

2015	353.50	0.06	0.01	357.44
2016	338.80	0.05	0.01	342.18

2.1.1.3 Transport

Road transport is the sector that consumes the biggest amounts of fuels, after the electricity generation industries. Transport represents 28% of the total Energy emissions in 2016 and 93.6% (1,093.96 Gg CO_2eq) corresponds to the road transport category. Fuel consumption from 2000 to 2016 has increased especially due to the increase in the consumption of diesel by buses and consumption of gasoline by cars, together with a decrease of gasoline consumption by dual purpose vehicles and diesel consumption by heavy duty trucks. The emissions of the road transport sector increased from 2000 to 2016 by 103% (from 539.27 Gg CO_2eq to 1,093.96 Gg CO_2eq).

In terms of emissions, the air transport could be differentiated into domestic and international aviation, and only domestic aviation is considered for the national inventory of GHG. In that sense, the emissions from this category also experienced an increase from 2000 to 2016 of 103.5% (from 4.81 Gg CO_2eq to 9.79 Gg CO_2eq).

The fuels used in the water-borne category are mainly fuel oil followed by gasoline and diesel. Sea transport corresponds to a 4.3% of the total energy consumption in the transport sector by 2016 in the country. Regarding the overall time series, the GHG emissions increased along the time series from 30.83 Gg CO_2eq in 2000 to 65.55 Gg CO_2eq in 2016 (112.62%).

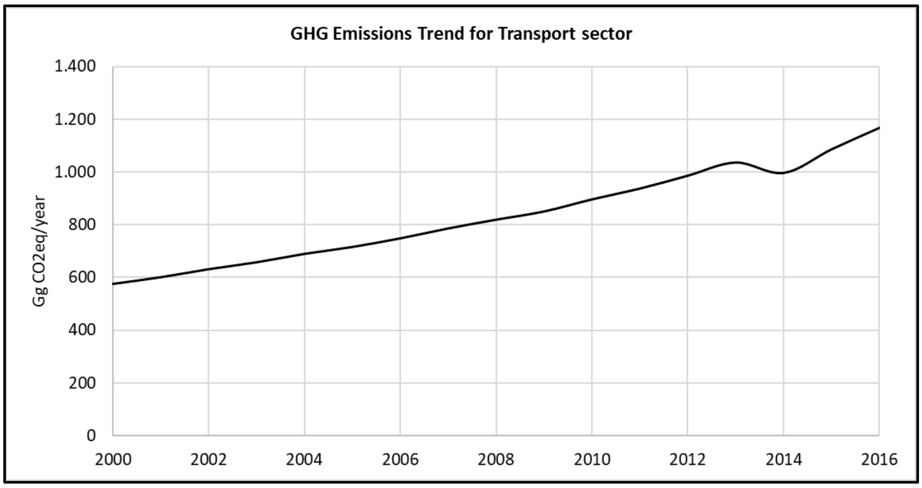


Figure 14. GHG Emission trend from Transport Sector, 2000 – 2016 (Gg CO_2eq)

Table 7. Total GHG Emissions from Transport Sector, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	563.74	0.13	0.03	574.91
2001	588.78	0.13	0.03	600.43
2002	618.63	0.14	0.03	630.83
2003	644.61	0.15	0.03	657.31
2004	675.86	0.15	0.03	689.22

2005	701.73	0.16	0.03	715.66
2006	733.94	0.17	0.04	748.51
2007	770.87	0.17	0.04	786.15
2008	803.47	0.18	0.04	819.46
2009	834.10	0.19	0.04	850.74
2010	879.36	0.20	0.04	896.85
2011	919.71	0.21	0.04	937.99
2012	967.88	0.22	0.05	987.12
2013	1,016.89	0.23	0.05	1,037.11
2014	978.15	0.21	0.05	997.44
2015	1,066.11	0.25	0.05	1,087.43
2016	1,146.34	0.28	0.06	1,169.30

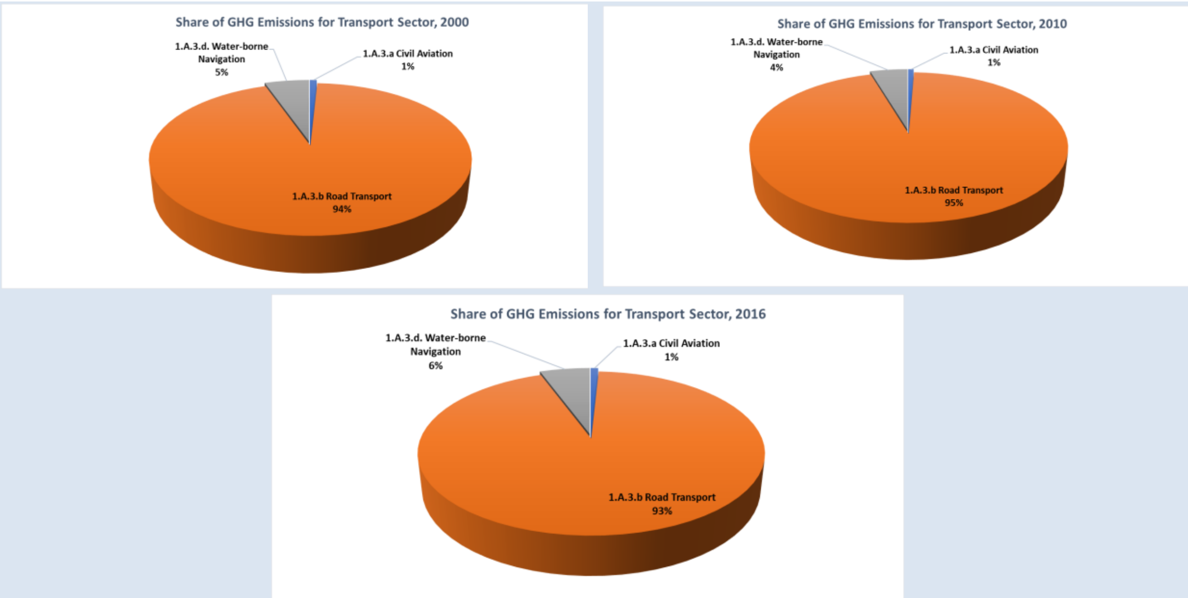


Figure 15. GHG Emission share from Transport Sector 2000, 2010 and 2016 (Gg CO2eq)

2.1.2.4 Energy Other Sectors

Those considered other sectors are commercial/institutional sector, residential, agriculture/forestry/fishing and others and contribute to the 5.9% of the total GHG emissions from the Energy sector in 2016 (248.10 Gg CO_2eq).

Between 2000 and 2016 the GHG emissions of the category increased by 25.04% (from 198.41 Gg CO_2eq to 248.10 Gg CO_2eq).

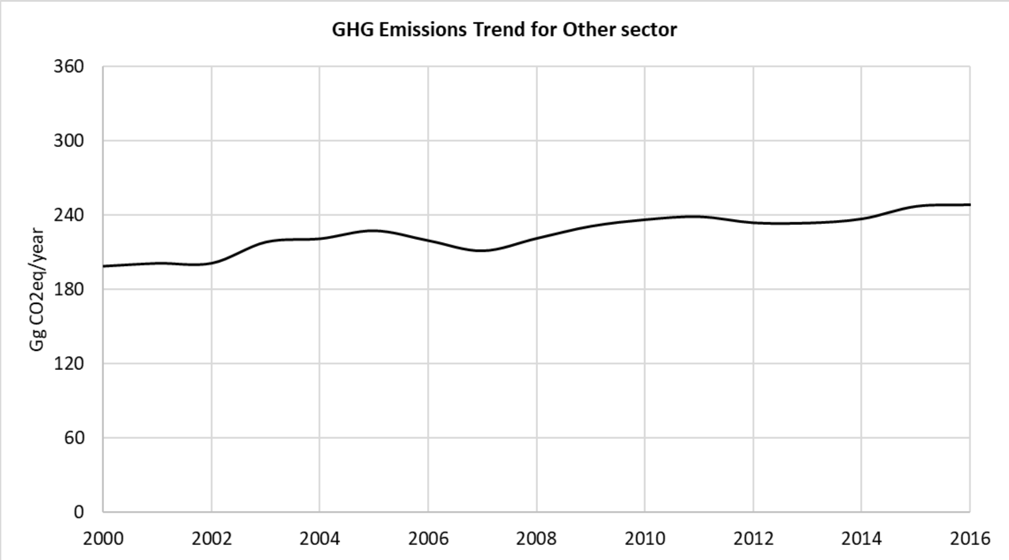


Figure 16. GHG Emission trend from Other Sector, 2000 – 2016 (Gg CO_2eq)

Table 8. Total GHG Emissions from Other Sectors, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	195.82	0.1	0.001	198.41
2001	198.14	0.1	0.001	200.74
2002	198.24	0.1	0.001	200.83
2003	215.31	0.1	0.001	217.96
2004	218.00	0.1	0.001	220.65
2005	224.40	0.1	0.001	227.16
2006	216.30	0.11	0.001	219.09
2007	208.13	0.1	0.001	210.88
2008	218.25	0.1	0.001	220.97
2009	228.02	0.1	0.001	230.77
2010	233.32	0.1	0.001	236.09
2011	235.71	0.1	0.001	238.46
2012	230.88	0.1	0.001	233.54
2013	230.73	0.1	0.001	233.30
2014	234.28	0.09	0.001	236.75
2015	244.49	0.09	0.001	246.87
2016	245.73	0.09	0.001	248.10

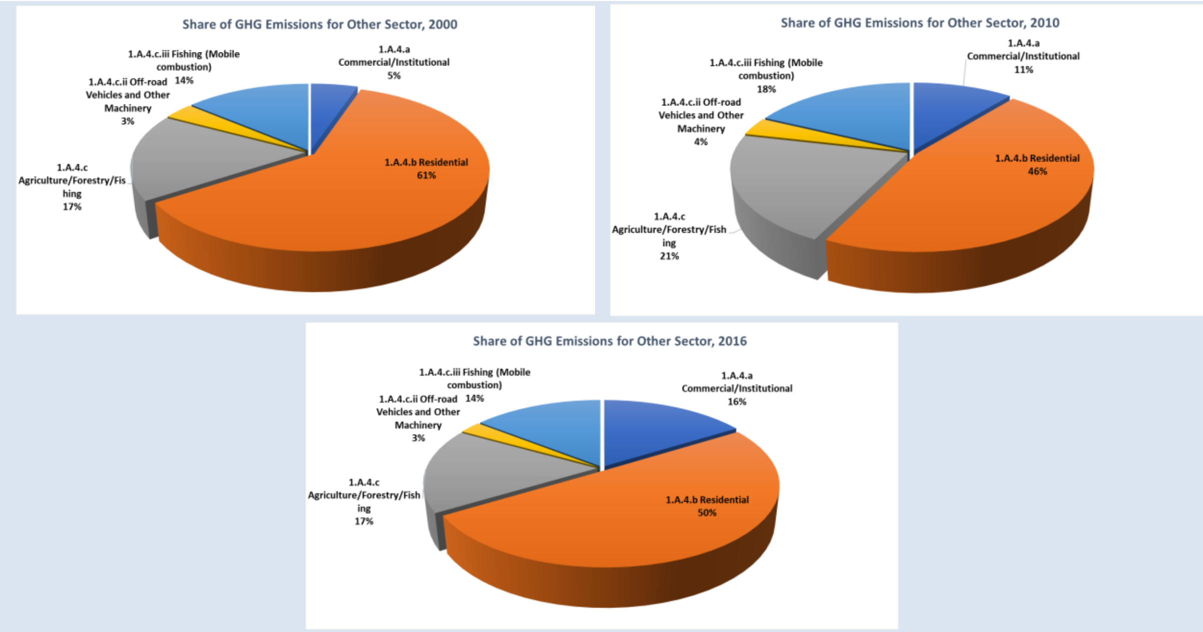


Figure 17. GHG Emission share for Other Sectors 2000, 2010 and 2016 (Gg CO_2eq)

2.1.1.5 Non-Specified Sector

The Non-Specified sector contributed to 0.02% of the total GHG emissions from the Energy sector in 2016 (0.87 Gg CO_2eq).

Consumptions in this category are reported since 2013, which is the first year since this activity happened. Between 2013 and 2016 the GHG emissions of the category increased by 13% (from 0.77 Gg CO_2eq to 0.87 Gg CO_2eq).

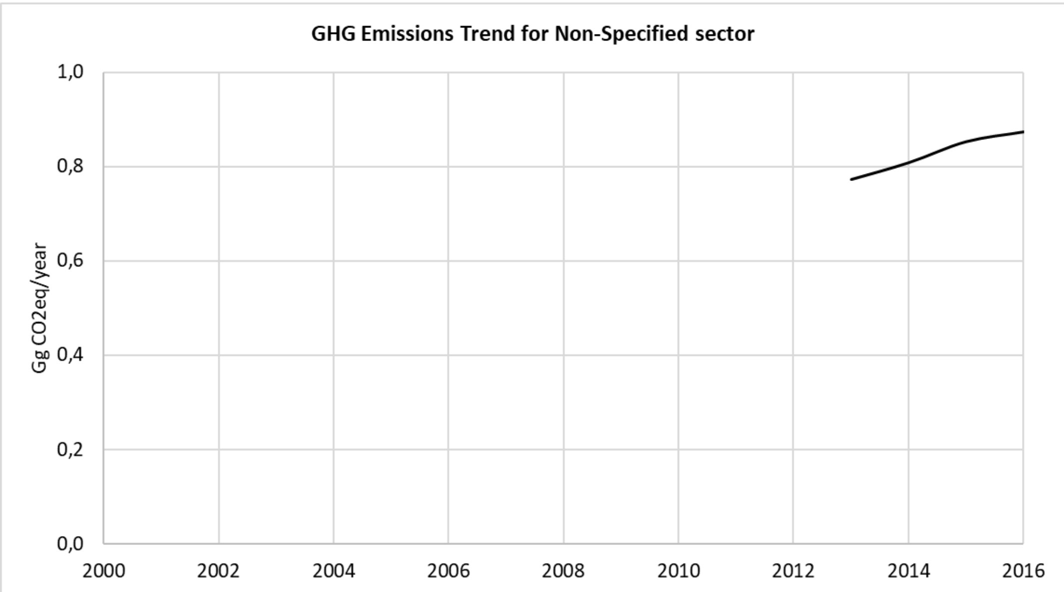


Figure 18. GHG Emission trend from Non-Specified Sector, 2000 – 2016 (Gg CO_2eq)

Table 9. Total GHG Emissions from Non-Specified Sectors, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	NO	NO	NO	NO
2001	NO	NO	NO	NO
2002	NO	NO	NO	NO
2003	NO	NO	NO	NO
2004	NO	NO	NO	NO
2005	NO	NO	NO	NO
2006	NO	NO	NO	NO
2007	NO	NO	NO	NO
2008	NO	NO	NO	NO
2009	NO	NO	NO	NO
2010	NO	NO	NO	NO
2011	NO	NO	NO	NO
2012	NO	NO	NO	NO
2013	0.77	0.00	0.00	0.77
2014	0.81	0.00	0.00	0.81
2015	0.85	0.00	0.00	0.85
2016	0.87	0.00	0.00	0.87

2.1.1.5 Memo Items

Memo Item category is an additional category that includes the international aviation and navigation emissions. Although these emissions are estimated, they are excluded from national totals and are reported separately as memo items, following the 2006 IPCC Guidelines.

The memo items are composed of International Aviation emissions and International Water-borne Navigation emissions. The fuel consumed in international aviation is Jet Kerosene while in international water-borne navigation diesel and fuel oil are used.

An increase of 52.6% of the total GHG emissions considered in this category is observed between 2000 and 2016, from 1,308.99 Gg CO_2eq to 1,997.25 Gg CO_2eq.

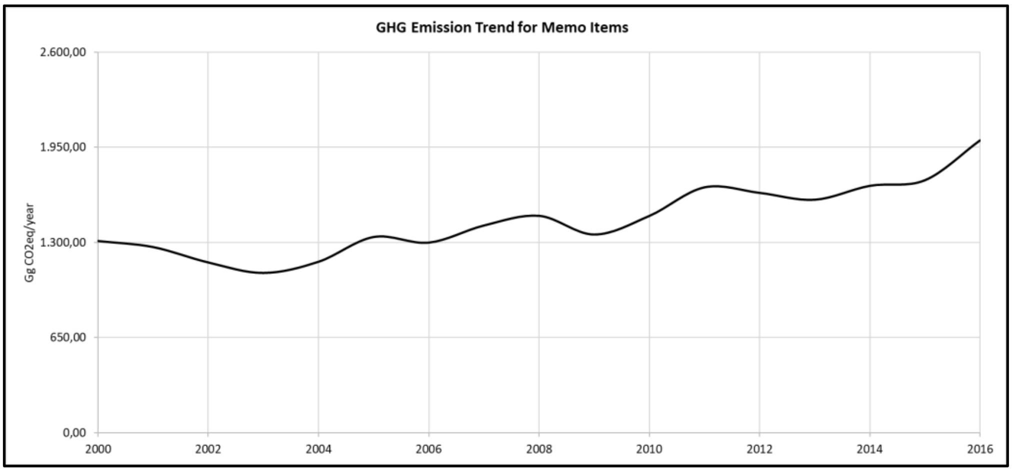


Figure 19. GHG Emission trend from Memo Items, 2000 – 2016 (Gg CO_2eq)

Table 10. Total GHG Emissions from Memo Items, 2000 – 2016 (Gg GHG)

Year	CO_2	CH_4	N_2O	Total GHG Emissions (Gg CO_2eq)
2000	1,296.58	0.07	0.04	1,308.99
2001	1,255.85	0.06	0.03	1,267.84
2002	1,151.65	0.05	0.03	1,162.57
2003	1,080.71	0.04	0.03	1,090.84
2004	1,156.49	0.05	0.03	1,167.33
2005	1,324.20	0.06	0.04	1,336.73
2006	1,286.09	0.06	0.04	1,298.20
2007	1,401.92	0.06	0.04	1,415.12
2008	1,467.58	0.07	0.04	1,481.42
2009	1,340.87	0.07	0.04	1,353.60
2010	1,466.74	0.07	0.04	1,480.64
2011	1,660.18	0.09	0.04	1,675.94
2012	1,623.02	0.08	0.04	1,638.39
2013	1,576.27	0.08	0.04	1,591.26
2014	1,670.57	0.09	0.05	1,686.46
2015	1,708.48	0.09	0.05	1,724.68
2016	1,978.47	0.10	0.05	1,997.25

2.1.2 Industrial Processes and Product Use (IPPU) Sector

As represented in the following figure and table, the GHG emissions from the IPPU Sector have experienced an increase along the time series from 2000 to 2016.

The most significant category, in terms of GHG emissions, in the IPPU sector is the Product Use as Substitutes of Ozone Depleting Substances (ODS), represented by stationary refrigerant and air conditioning and mobile air conditioning.

GHG emissions of this sector have increased annually, more moderately between 2000 and 2004 (15.54%) and more pronounced from 2004 to 2016 (283%). The category that most contributed to the increase of the emissions in the last 10 years is the product used as substitutes for ODS.

Product Uses as Substitutes for ODS represent the 90.7% of the total GHG emissions of the sector in 2016, corresponding to the Refrigeration and Air conditioning category, stationary and mobile. Stationary sources are responsible for 97% of this category, while mobile sources represent the remaining 3% by 2016. This category experienced an exponential increase throughout the studied 2000-2016 period of 90.7%, from 47.99 GgCO_2eq in 2000 to 282.10 GgCO_2eq in 2016.

In stationary air conditioning and refrigeration sub-category, the most used substances are HFC-125, HFC-134a, HFC-143a, HFC-32 and HFC-23 which correspond to the 43.2%, 27.7%, 27.4%, 1.6% and 0.1% of the total amount of ODS substances used in the sub-category by 2016. For the mobile air conditioning sub-category, the only HFC substance used corresponds to HFC-134a.

The Metal Industry, represented by the Iron and Steel Production Industries, contributed to 6.9% of the total GHG emissions of the IPPU sector in 2016. The iron and steel production show some variations along the time series, increasing from 2000 to 2011 by 89.6% and following a decreasing trend until 2016. A decrease of 42.3% is observed in the emissions from 2011 to 2016. From 2000 to 2016, the sector experienced an overall increase of 9.4%.

GHG emissions from the Mineral Industry, more specifically from Lime production, represent 0.3% of the total GHG emissions of the IPPU sector in 2014 when the lime production stopped. The GHG emission trend in this category experienced variations along the time series but with a general decreasing trend of 70.9% between 2000 and 2014.

RoM also has emissions due to the use of lubricants in the industrial sector, as non-energy products, since 2011. The emissions from this category represent the 2.5% of the total emissions of IPPU sector. The emissions present a decrease of a 18% between 2011 and 2016.

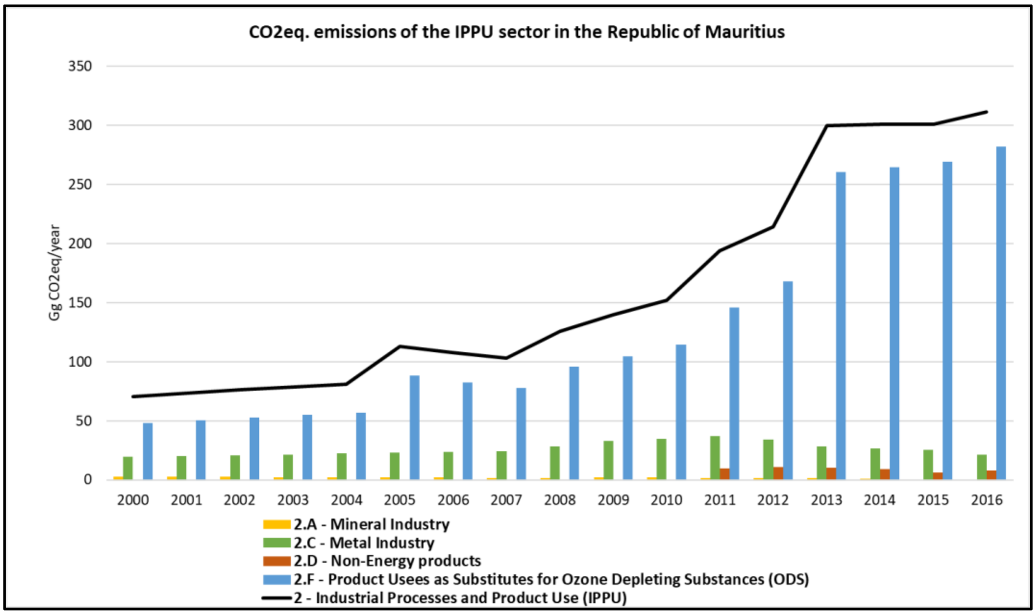


Figure 20. GHG Emissions from IPPU Sector, 2000 – 2016 (Gg CO_2eq)

Table 11. Total GHG Emissions from IPPU Sector, 2000 – 2016 (Gg CO_2eq)

Years	Total emissions for IPPU
2000	70.32
2001	73.46
2002	76.15
2003	78.88
2004	81.25
2005	113.16
2006	108.04
2007	103.25
2008	125.87
2009	139.56
2010	151.71
2011	193.95

2012	214.43
2013	300.00
2014	300.78
2015	300.96
2016	311.18

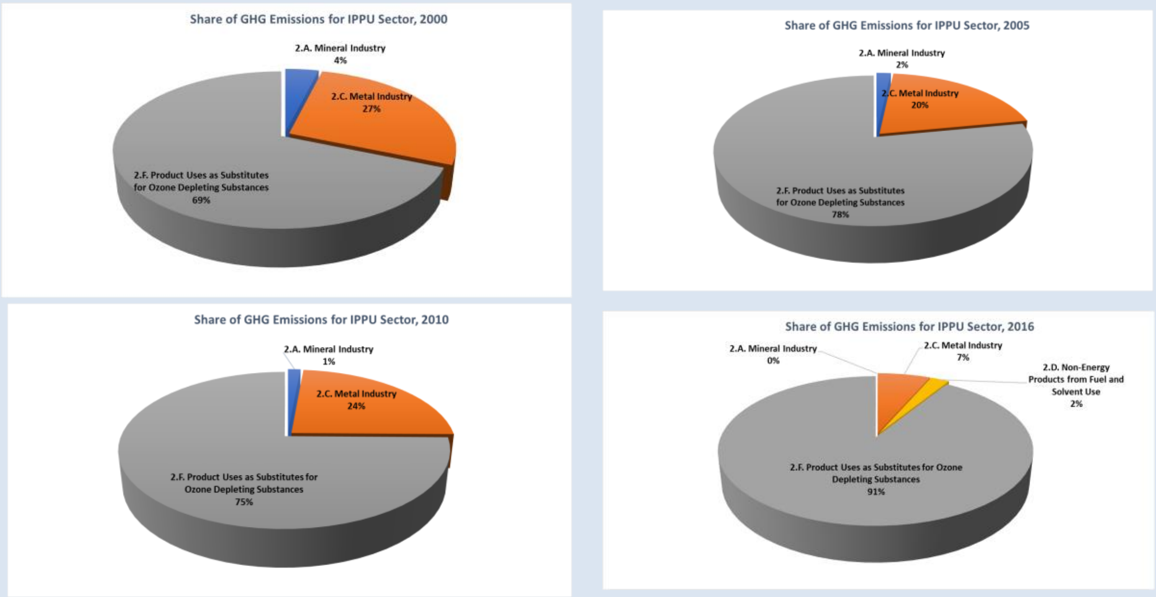


Figure 21. Share of GHG Emissions from IPPU Sector 2000, 2005, 2010 and 2016 (%CO_2eq)

2.1.3 Agriculture. Forestry and Other Land Use (AFOLU) Sector

As presented in the following figures and table, AFOLU sector is a net sink. The net removals (emissions – removals) in Mauritius have decreased from -311.39 Gg CO_2eq to -171.62 Gg CO_2eq (44.88% decrease) mainly due to the decrease in the absorptions in category 3.B and the increase in the emissions of category 3.C. GHG emissions from agriculture (categories 3.A and 3.C[1]) show an increase from 2000 to 2016 of 8.22% (from 146.06 Gg CO_2eq to 158.08 Gg CO_2eq)). On the other hand, GHG removals from LULUCF (categories 3.B and 3.D) decreased from -457.45 Gg CO_2eq to -329.70 Gg CO_2eq from 2000 to 2016.

In 2016, the most significant category of GHG emissions in the AFOLU sector is Direct N_2O Emissions from managed soils (3.C.4) with 78.38 Gg CO_2eq; whilst the most important in terms of removals is Forest Land (3.B.1) with -394.36 Gg CO_2eq.

Livestock (3.A) emissions increased from 36.15 Gg CO_2eq in the year 2000 to 37.53 Gg CO_2eq in 2016, which resulted in an increase of 3.81 %. Enteric fermentation (3.A.1) emissions is the major category in terms of GHG emissions, even though it has decreased from 25.94 Gg CO_2eq in the year 2000 to 23.60 Gg CO_2eq in 2016 (9.01 % reduction).

Land category (3.B) constitutes a net sink for the whole inventory period 2000-2016, except for the year 2004 when it acts as a net source of emissions. The source of emission is attributed to a great area of deforestation, mostly on privately owned forest land. However, it

[1] For the sake of simplicity this mapping is used in this report, even though some emissions from 3.C (e.g. 3.C.1.a biomass burning in forest land) are usually allocated under LULUCF.

is to be highlighted that the 2004 data for private forests was obtained after a new survey of private forest land and remote sensing data from the National Remote Sensing Centre. Unlike State Forest Land, private forests are not regularly surveyed. Therefore, it is more likely that this deforestation on private land occurred over several years. For practical reasons, a decision was taken to prevent the cumulated deforestation on private land in 2004.

The net removals from land show a decreasing trend from -458.89 Gg CO_2eq in 2000 to -331.60 Gg CO_2eq in 2016 (29.28%). The main land use in terms of its contribution is forest land (FL), contributing 100% of total removals from land, being -458.89 Gg CO_2eq and -394.36 Gg CO_2eq in the 2000 and 2016 respectively.

Category 3.C (Total aggregated sources and non-CO_2 emissions sources on land) increased by 9.68% from 109.91 Gg CO_2eq in the year 2000 to 120.55 Gg CO_2eq in 2016. GHG emissions have a peak on 2013 where a maximum of 137.28 Gg CO_2eq was reached. The main two 3.C categories contributing on GHG emissions are 3.C.4 "Direct N_2O Emissions from managed soils" and 3.C.5 "Indirect N_2O Emissions from managed soils". Direct N_2O Emissions from managed soils increased from 75.15 Gg CO_2eq in the year 2000 to 78.38 Gg CO_2eq in 2016, which consist of an increase of 4.30%. Indirect N_2O emissions from managed soils (3.C.5) increased from 23.97 Gg CO_2eq in the year 2000 to 25.54 Gg CO_2eq in 2016 (6.53% increased).

Category 3D (Other) consists of emissions and removals due to the harvested wood products (HWP). The emissions and removals show the typical trend with peaks and valleys due to the different annual inputs. In 2000, HWP emissions were 1.44 Gg CO_2eq, increasing to 1.89 Gg CO_2eq in 2016 (34.23% increase).

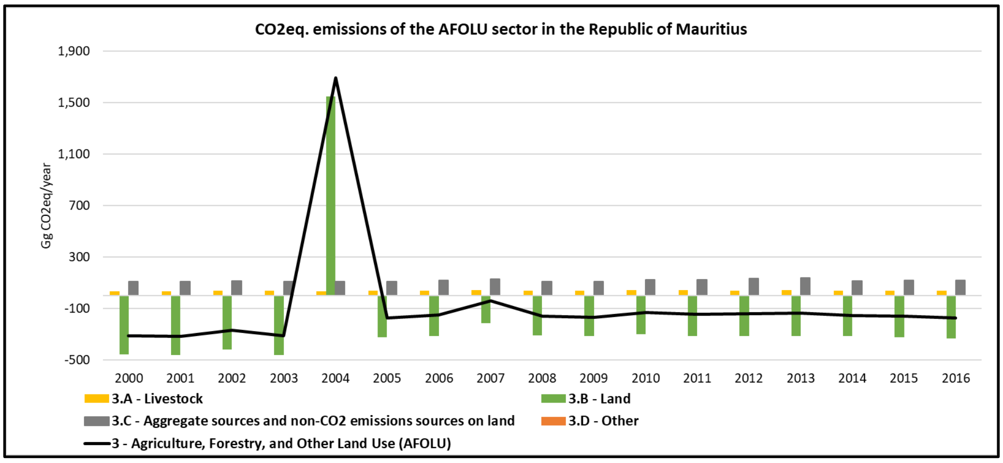


Figure 22. GHG emissions of the AFOLU sector (Gg CO_2eq)

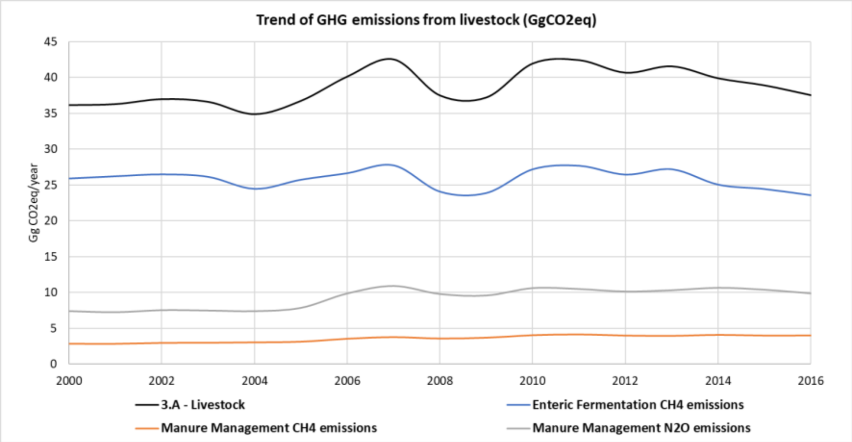


Figure 23. Evolution of total GHG emissions from livestock (3.A.) by source (Gg CO_2eq)

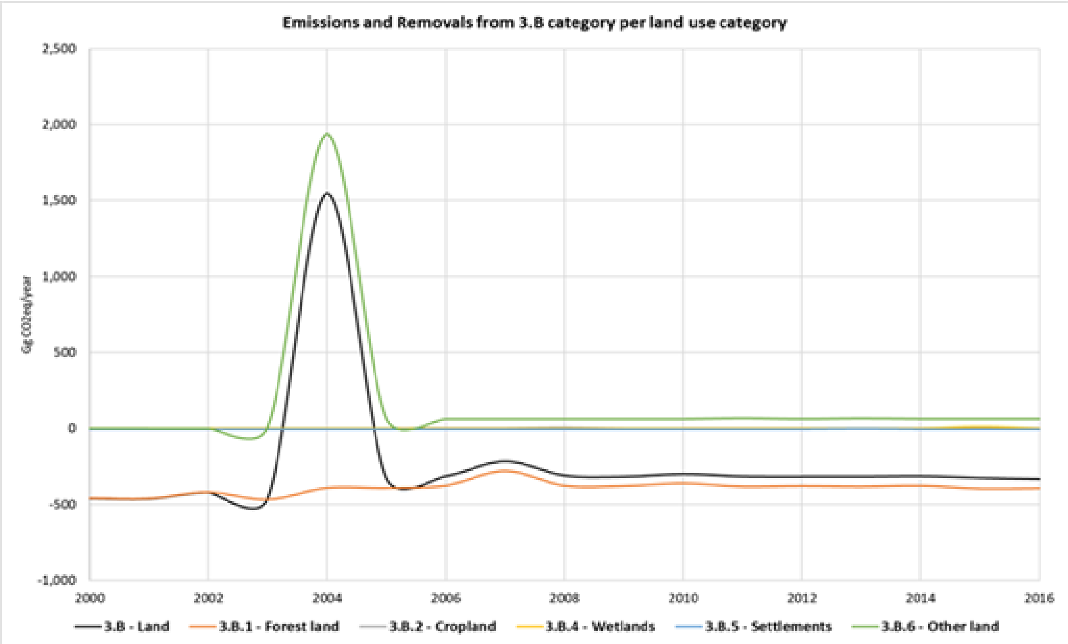


Figure 24. Total net emissions/removals for the different land-use categories and from land (3.B) for the period 2000-2016 (Gg CO_2eq)

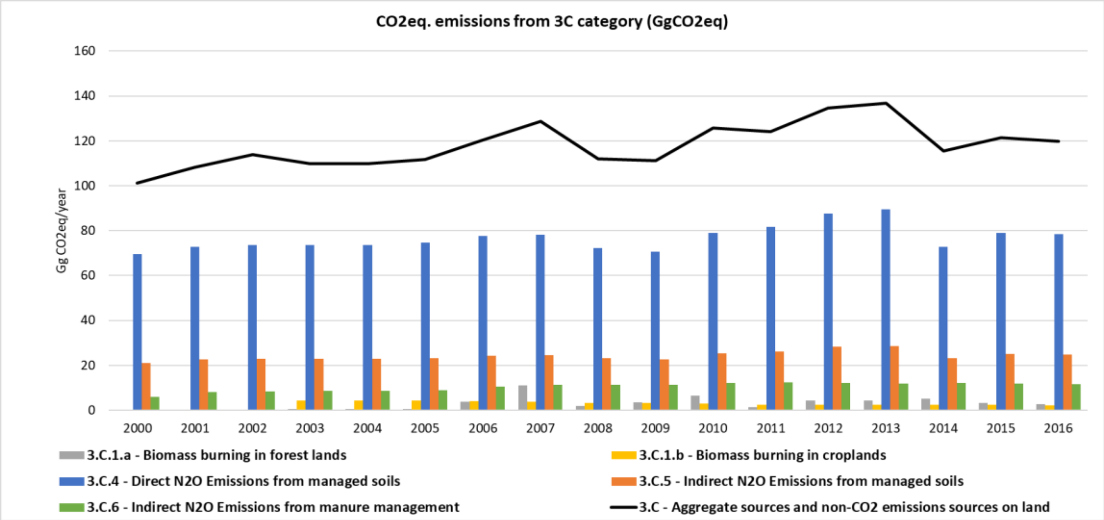


Figure 25. GHG emissions from 3C category (Gg CO_2eq)

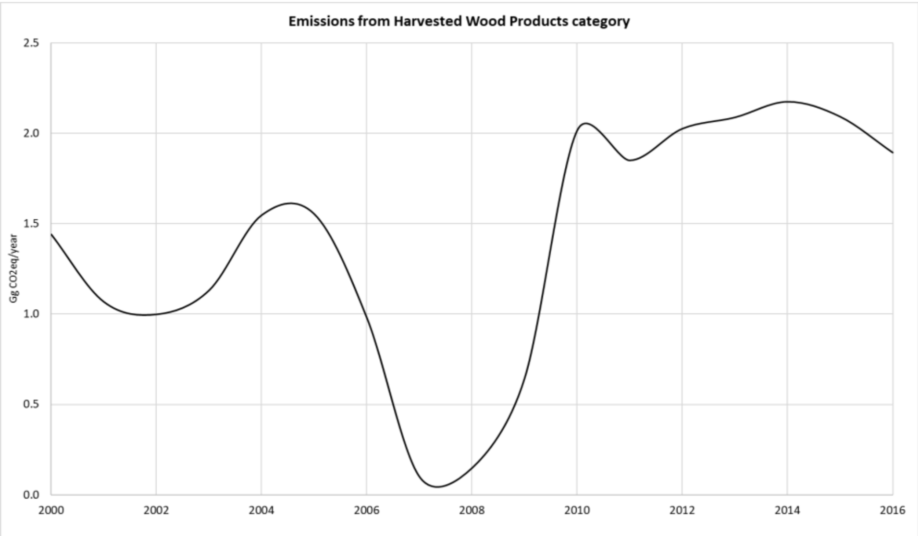


Figure 26. HWP contribution (Gg CO_2eq)

Table 12. GHG Emissions for AFOLU sector (Gg CO_2eq)

Category	2000	2005	2010	2016
3 – Agriculture, Forestry and Other Land Use	**-311.39**	**-174.91**	**-128.48**	**-171.62**
3.A – Livestock	**36.15**	**36.74**	**41.94**	**37.53**
3.A.1 – Enteric Fermentation	25.94	25.77	27.23	23.60
3.A.2 – Manure Management	10.21	10.97	14.72	13.93
3.B – Land	**-458.89**	**-325.46**	**-298.67**	**-331.60**
3.B.1 – Forest land	-458.89	-392.09	-360.45	-394.36
3.B.2 – Cropland	NE	NE	0.11	0.12
3.B.3 – Grassland	NE	NE	NE	NE
3.B.4 – Wetland	NE	NE	NE	NE
3.B.5 – Settlements	NE	NE	NE	0.00
3.B.6 – Other land	NE	66.62	61.67	62.64
3.C – Aggregate sources and non-CO2 emissions sources on land	**109.91**	**112.25**	**126.23**	**120.55**
3.C.1 GHG emissions from biomass burning	4.89	4.85	9.34	4.95
3.C.1.a – Biomass burning in forest lands	0.56	0.52	6.51	2.69
3.C.1.b – Biomass burning in croplands	4.33	4.33	2.83	2.27
3.C.4 - Direct N_2O Emissions from managed soils	75.15	74.70	78.96	78.38
3.C.5 - Indirect N_2O Emissions from managed soils	23.97	23.78	25.91	25.54
3.C.6 - Indirect N_2O Emissions from manure management	5.90	8.92	12.02	11.67
3.D – Other	**1.44**	**1.55**	**2.02**	**1.89**
3.D.2 – Harvested Wood Products	1.44	1.55	2.02	1.89

2.1.4 Waste Sector

As represented in the following figure and table, the GHG emissions from the Waste Sector are relatively constant along the time series from 2000 to 2016, experiencing an increase of 21.3% from 2000 to 2016.

The most significant category, in terms of GHG emissions, for this sector is the solid waste disposal category, which represents the 66.1% of the total GHG emissions of this sector in 2016 and being the category which most contributes to the variations in the total sector's emissions in the analysed period.

The second category that contributes most to the emissions in this sector is the wastewater treatment and discharge, responsible for 32.7% of the total GHG emissions in the sector in the year 2016. These emissions have experienced a small decrease in the period 2000 – 2016 of 11.5%, from the 206.37 Gg CO_2eq estimated in 2000 to the 182.70 Gg CO_2eq estimated in 2016.

Emissions from biological treatment of solid waste represent 1.09% of the total emissions in the waste sector in 2016. The emissions from biological treatment began to be estimated in

2011, with the entry of this type of aerobic waste management system. On the other hand, the incineration and open burning of waste represent 0.13% of the sector emissions in 2016.

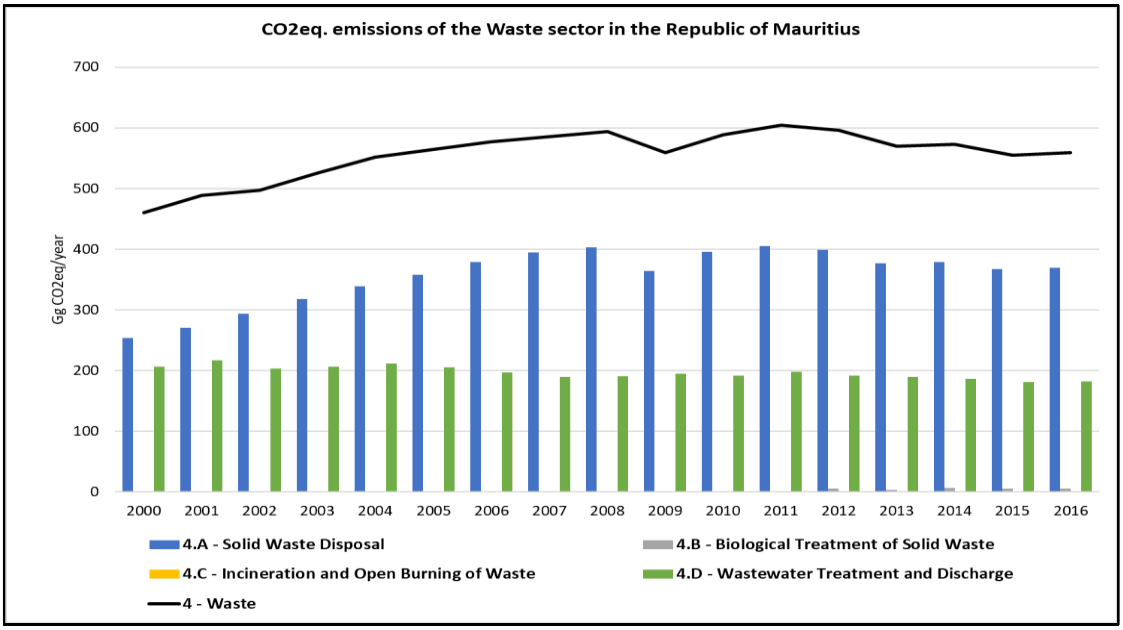


Figure 27. GHG Emissions from Waste Sector, 2000 – 2016 (Gg CO_2eq)

Table 13. Total GHG Emissions from Waste Sector, 2000 – 2016 (Gg CO_2eq)

Years	Total emissions for Waste
2000	460.81
2001	488.68
2002	497.44
2003	525.19
2004	551.36
2005	564.01
2006	576.77
2007	585.02
2008	594.41
2009	558.97
2010	588.57
2011	604.32
2012	596.51
2013	569.54
2014	572.77
2015	555.45
2016	559.18

2.2 Summary of GHG Emission Trends per Gas

2.2.1 Carbon Dioxide

In the figure below, the trend of CO_2 emissions is represented for each of the sectors. As seen in the graph, the sector that contributes most to these emissions is the energy sector, which represents the 99.3% of the total CO_2 emissions in the country (excluding removals from LULUCF). All the sectors present an increase in their CO_2 emissions since the year 2000.

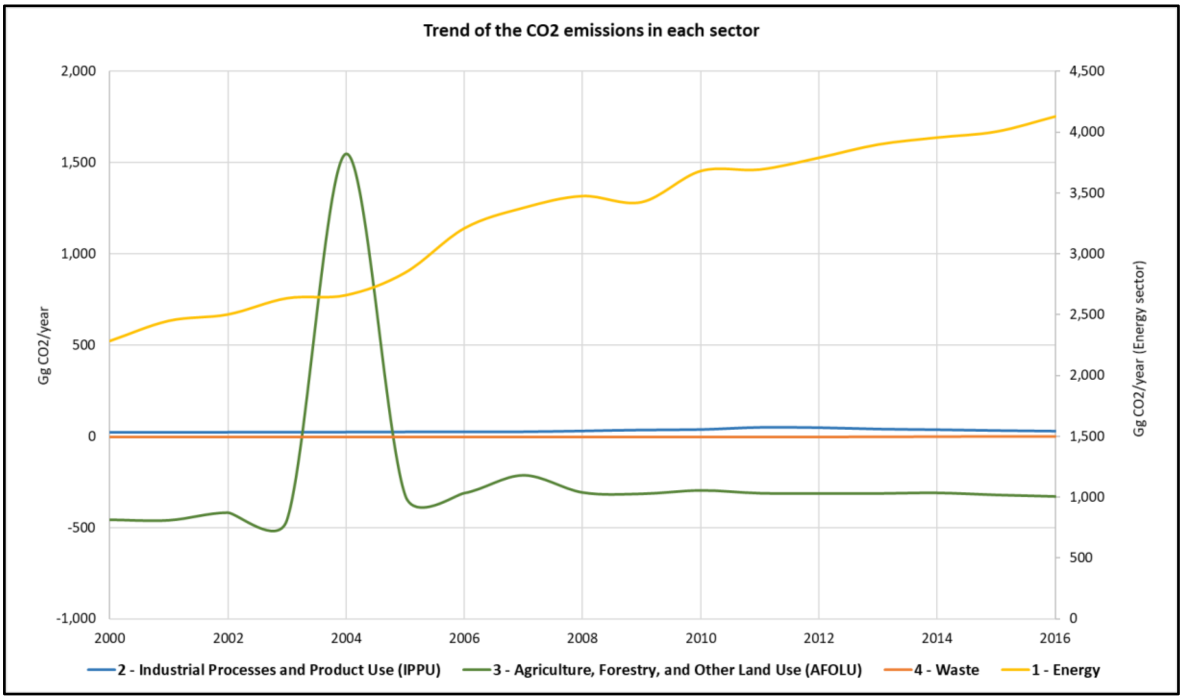


Figure 28. GHG Trend of CO_2 emissions in the RoM (Gg CO_2)

Table 14. Total CO_2 emissions for each sector (Gg CO_2)

Years	Energy	IPPU	AFOLU	Waste	Total net CO_2 emissions	Interannual variation (%)
2000	2,282.52	22.33	-457.45	0.56	1,847.96	
2001	2,448.79	22.92	-460.58	0.55	2,011.68	8.86%
2002	2,501.26	23.37	-418.77	0.56	2,106.42	4.71%
2003	2,634.80	23.92	-459.89	0.52	2,199.35	4.41%
2004	2,659.57	24.17	1,549.30	0.52	4,233.56	92.49%
2005	2,844.92	24.89	-323.91	0.52	2,546.43	-39.85%
2006	3,209.15	25.63	-311.43	0.55	2,923.90	14.82%
2007	3,377.76	25.71	-213.84	0.53	3,190.16	9.11%

2008	3,474.21	29.93	-308.16	0.54	3,196.52	0.20%
2009	3,424.69	34.81	-315.46	0.52	3,144.55	-1.63%
2010	3,680.46	37.14	-296.65	0.53	3,421.47	8.81%
2011	3,692.37	47.90	-312.27	0.57	3,428.57	0.21%
2012	3,789.33	46.54	-313.68	0.57	3,522.76	2.75%
2013	3,897.78	39.62	-313.50	0.59	3,624.49	2.89%
2014	3,955.44	36.15	-310.27	0.66	3,681.98	1.59%
2015	4,004.03	31.93	-321.56	0.74	3,715.13	0.90%
2016	4,128.90	29.08	-329.70	0.74	3,829.01	3.07%

2.2.2 Methane

The emissions of CH_4 are represented in the figure below for each sector. The sector that most contribute to the emissions of these compound is the Waste sector, representing the 92.1% of the total CH_4 emissions in the country. In general, the CH_4 emissions from each of the sectors do not vary much over the inventory period, where the AFOLU sector shows the greatest inter-annual variations.

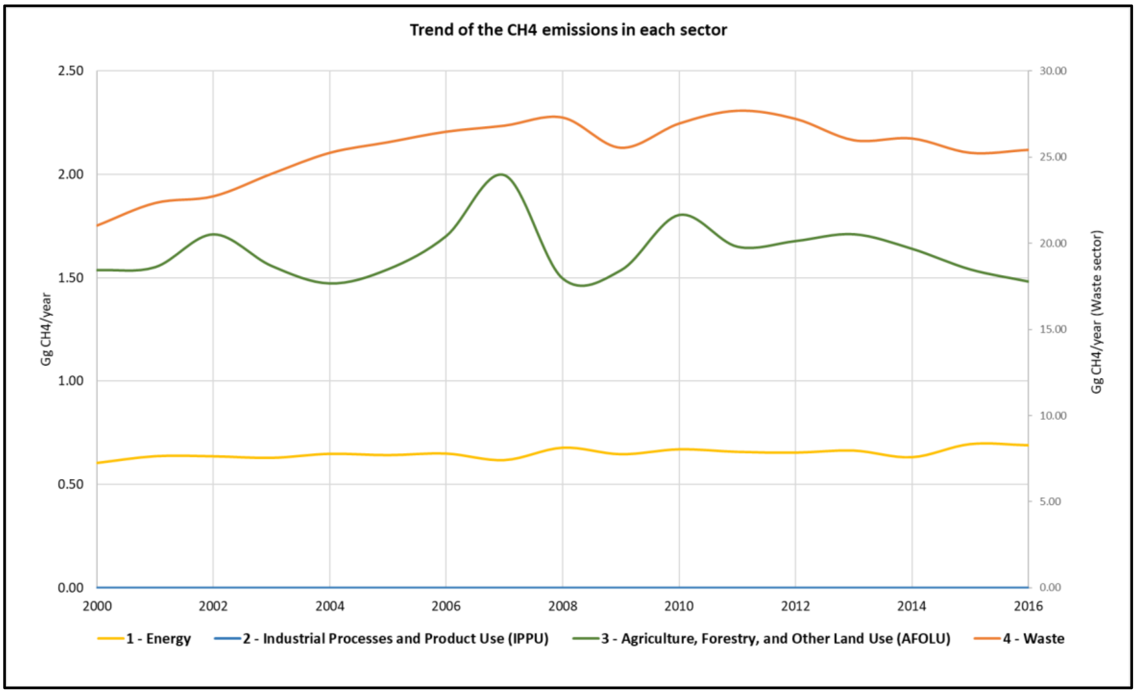


Figure 29. GHG Trend of CH_4 emissions in the RoM (Gg CH_4)

Table 15. Total CH_4 emissions for each sector (Gg CH_4)

Years	Energy	IPPU	AFOLU	Waste	Total CH_4 emissions	Interannual variations (%)
2000	0.60	0.00	1.54	21.05	23.19	
2001	0.64	0.00	1.55	22.35	24.54	5.84%
2002	0.64	0.00	1.71	22.74	25.09	2.22%
2003	0.63	0.00	1.56	24.05	26.23	4.56%
2004	0.65	0.00	1.47	25.26	27.38	4.38%
2005	0.64	0.00	1.54	25.87	28.06	2.46%
2006	0.65	0.00	1.70	26.48	28.84	2.78%
2007	0.62	0.00	2.00	26.83	29.45	2.12%
2008	0.68	0.00	1.50	27.30	29.48	0.10%
2009	0.65	0.00	1.54	25.55	27.73	-5.91%
2010	0.67	0.00	1.80	26.95	29.43	6.10%
2011	0.66	0.00	1.65	27.69	30.00	1.95%
2012	0.65	0.00	1.68	27.23	29.56	-1.48%
2013	0.66	0.00	1.71	25.99	28.36	-4.04%
2014	0.63	0.00	1.64	26.09	28.36	0.00%
2015	0.70	0.00	1.54	25.26	27.50	-3.05%
2016	0.69	0.00	1.48	25.43	27.60	0.38%

2.2.3 Nitrous Oxide

In the figure below, the trend of N_2O emissions is represented for each of the sectors. As seen in the figure, the sector that contributes most to these emissions is the AFOLU sector, which represents the 66.60% of the total N_2O emissions in the country, where the total amount of emissions is due to the Agriculture sector, followed by the energy sector with the 20.59% of the total N_2O emissions and the waste sector representing the 12.81% of the total emissions. The sectors do not present big variations in its N_2O emissions along the inventory period (2000 – 2016), excluding AFOLU sector with several representative variations.

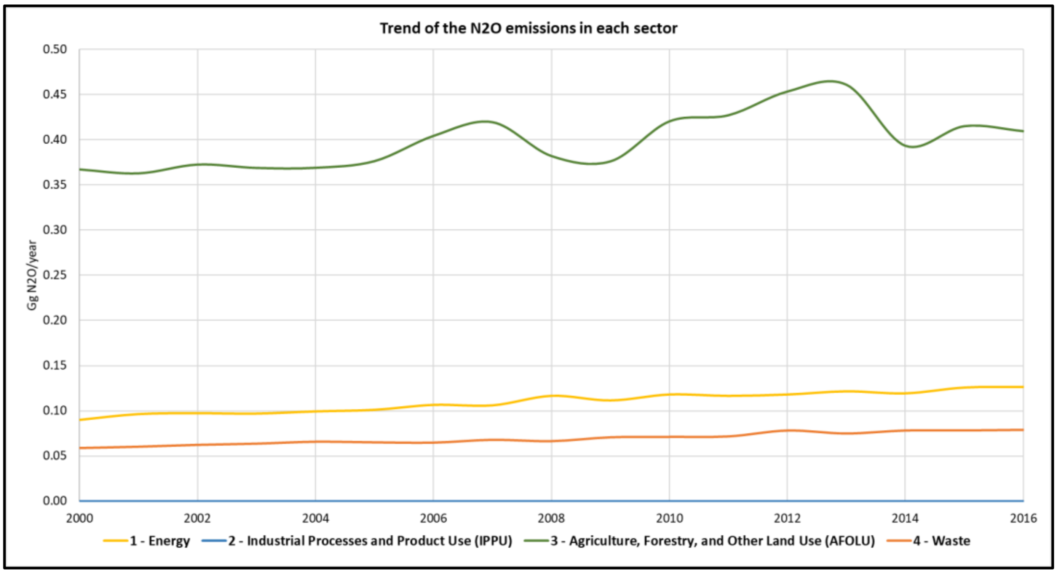


Figure 30. GHG Trend of N_2O emissions in the RoM (Gg N_2O)

Table 16. Total N_2O emissions for each sector (Gg N_2O)

Years	Energy	IPPU	AFOLU	Waste	Total N_2O emissions	Inter-annual variations (%)
2000	0.09	0.00	0.37	0.06	0.52	
2001	0.10	0.00	0.36	0.06	0.52	0.67%
2002	0.10	0.00	0.37	0.06	0.53	2.45%
2003	0.10	0.00	0.37	0.06	0.53	-0.52%
2004	0.10	0.00	0.37	0.07	0.53	0.88%
2005	0.10	0.00	0.38	0.07	0.54	1.58%
2006	0.11	0.00	0.40	0.06	0.58	6.10%
2007	0.11	0.00	0.42	0.07	0.59	3.10%
2008	0.12	0.00	0.38	0.07	0.56	-4.79%
2009	0.11	0.00	0.38	0.07	0.56	-1.20%
2010	0.12	0.00	0.42	0.07	0.61	9.20%
2011	0.12	0.00	0.43	0.07	0.62	0.95%
2012	0.12	0.00	0.45	0.08	0.65	5.56%
2013	0.12	0.00	0.46	0.07	0.66	1.22%
2014	0.12	0.00	0.39	0.08	0.59	-10.14%
2015	0.13	0.00	0.41	0.08	0.62	4.78%
2016	0.13	0.00	0.41	0.08	0.61	-0.68%

2.2.4 Hydrofluorocarbons (HFCs)

The hydrofluorocarbons are emitted mainly from IPPU sector activities such as refrigerants and air conditioning. The emissions from these compounds are represented in the figure below as CO_2eq emissions. The trend of the emissions represents an increase along the inventory time series (2000 – 2016), reaching the maximum in 2016.

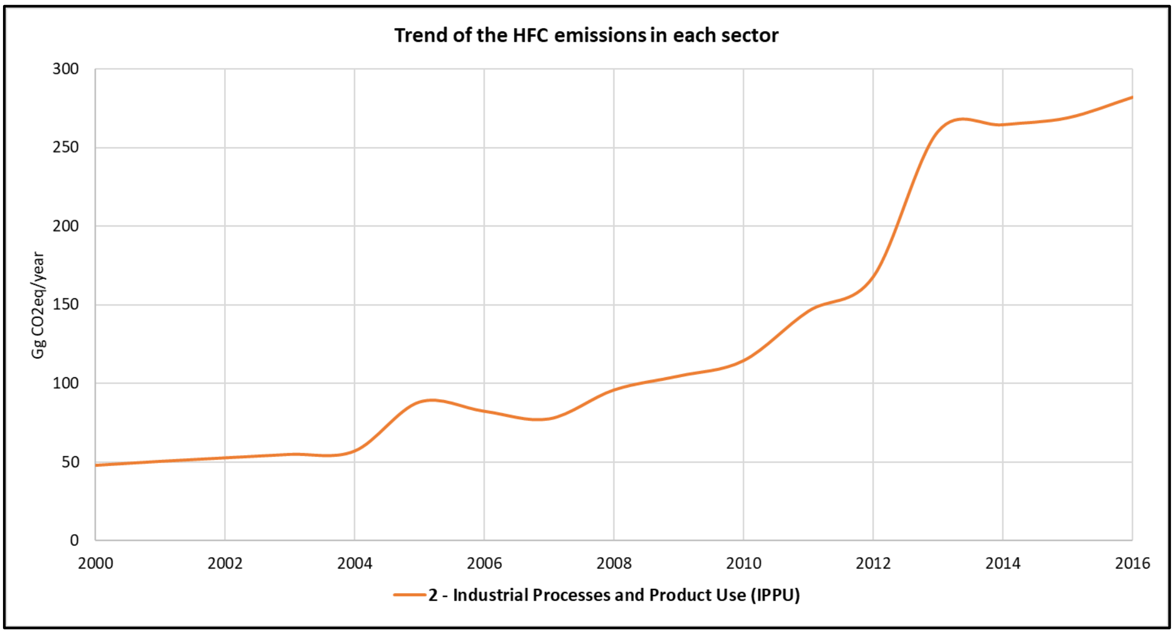


Figure 31. GHG Trend of HFC emissions in the RoM (Gg CO_2eq)

Table 17. Total HFC emissions for each sector (Gg CO_2eq)

Years	Energy	IPPU	AFOLU	Waste	Total emissions	Inter-annual variations (%)
2000	0.00	47.99	0.00	0.00	47.99	
2001	0.00	50.54	0.00	0.00	50.54	5.31%
2002	0.00	52.78	0.00	0.00	52.78	3.96%
2003	0.00	54.96	0.00	0.00	54.96	4.13%
2004	0.00	57.08	0.00	0.00	57.08	3.86%
2005	0.00	88.26	0.00	0.00	88.26	54.62%
2006	0.00	82.40	0.00	0.00	82.40	-6.64%
2007	0.00	77.54	0.00	0.00	77.54	-5.90%
2008	0.00	95.94	0.00	0.00	95.94	23.73%
2009	0.00	104.75	0.00	0.00	104.75	9.18%
2010	0.00	114.58	0.00	0.00	114.58	9.55%
2011	0.00	146.05	0.00	0.00	146.05	27.46%
2012	0.00	167.89	0.00	0.00	167.89	14.95%
2013	0.00	260.38	0.00	0.00	260.38	55.09%
2014	0.00	264.64	0.00	0.00	264.64	1.64%
2015	0.00	269.03	0.00	0.00	269.03	1.66%
2016	0.00	282.10	0.00	0.00	282.10	4.86%

2.3 Key Category Analysis

A Key Category Analysis (KCA) (refer to Table 18 and Table 19) was carried out to determine the categories, fuels and GHGs that are important (cumulatively make up more than 95% of the absolute emissions or have significant upward or downward trends) in the inventory and that needs more focus for accurate calculations.

The level and trend assessment for the period 2000-2016 resulted in the following gases and sectors as key sources/sinks of GHGs. The whole analysis is shown in the Appendix 1: Key Category Analysis:

Table 18. Key Categories analysis from 2006 IPCC Inventory Software – Level Assessment

IPCC Category code	IPCC Category	GHG	2016 $E_{x,t}$ (Gg CO_2eq)	$\lvert E_{x,t} \rvert$ (Gg CO_2eq)	$L_{x,t}$	Cumulative Total of Column $L_{x,t}$
1.A.1	Energy Industries - Solid Fuels	CO_2	1,694.13	1,694.13	0.30	0.30
1.A.3.b	Road Transportation	CO_2	1,071.80	1,071.80	0.19	0.49
1.A.1	Energy Industries - Liquid Fuels	CO_2	703.03	703.03	0.12	0.61
3.B.1.a	Forest land Remaining Forest Land	CO_2	-394.36	394.36	0.07	0.68
4.A	Solid Waste Disposal	CH_4	369.68	369.68	0.07	0.75
2.F.1	Refrigeration and Air Conditioning	HFCs,	282.10	282.10	0.05	0.80

		PFCs				
1.A.2	Manufacturing Industries and Construction – Liquid Fuels	CO_2	261.45	261.45	0.05	0.84
1.A.4	Other Sectors – Liquid Fuels	CO_2	245.73	245.73	0.04	0.89
4.D	Wastewater Treatment and Discharge	CH_4	161.14	161.14	0.03	0.91
3.C.4	Direct N_2O Emissions from managed soils	N_2O	78.38	78.38	0.01	0.93
1.A.2	Manufacturing Industries and Construction – Solid Fuels	CO_2	77.35	77.35	0.01	0.94
1.A.3.d	Water-borne Navigation – Liquid Fuels	CO_2	64.83	64.83	0.01	0.95

Table 19. Key Categories analysis from 2006 IPCC Inventory Software – Trend Assessment

IPCC Category code	**IPCC Category**	GHG	2000 Year Estimate E_{x0} (Gg CO_2eq)	2016 Year Estimate E_{xt} (Gg CO_2eq)	Trend Assessment (T_{xt})	% Contribution to Trend	Cumulative Total
1.A.1	**Energy Industries - Solid Fuels**	CO_2	561.54	1,694.13	0.18	0.22	0.22
1.A.1	**Energy Industries – Liquid Fuels**	CO_2	597.72	703.03	0.13	0.16	0.39
3.B.1.a	**Forest Land Remaining Forest Land**	CO_2	-458.89	-394.36	0.10	0.13	0.52
1.A.2	**Manufacturing Industries and Construction – Liquid Fuels**	CO_2	303.60	261.45	0.09	0.12	0.63
4.D	**Wastewater Treatment and Discharge**	CH_4	188.13	161.14	0.06	0.07	0.71
2.F.1	**Refrigeration and Air Conditioning**	HFCs, PFCs	47.99	282.10	0.05	0.07	0.77
1.A.4	**Other Sectors – Liquid Fuels**	CO_2	195.81	245.73	0.04	0.05	0.82
4.A	**Solid Waste Disposal**	CH_4	253.87	369.68	0.03	0.04	0.86

3.C.4	**Direct N2O Emissions from managed soils**	N_2O	75.15	78.38	0.02	0.02	0.89
3.B.6 .b	**Land Converted to Other land**	CO_2	0.00	62.64	0.02	0.02	0.91
1.A.3 .b	**Road Transportation**	CO_2	528.48	1,071.80	0.02	0.02	0.93
1.A.2	**Manufacturing Industries and Construction – Solid Fuels**	CO_2	60.11	77.35	0.01	0.01	0.95
3.A.1	**Enteric Fermentation**	CH_4	25.94	23.60	0.01	0.01	0.96

3. Energy Sector

3.1 Overview

Energy sector in the RoM corresponds to the highest GHG emissions in the country. The industries for energy production are responsible for the 57.9% of the total amount of GHG emissions generated in the Energy sector in 2016 and is dominated by fuel combustion activities.

In 2018, the primary energy supply in the country is led by fossil fuels which represent the 87.1% of the supply in the country, and the remaining 12.9% corresponding to local renewable sources such as hydro, wind, landfill gas, photovoltaic energy, bagasse and wood. Nevertheless, the country does not have any fossil fuel extraction sources, and for this reason, all the fossil fuels consumed in the country are imported. In the case of coal, this fuel is imported mainly from South Africa; gasoline, diesel, fuel oil and kerosene mainly from India; and Liquified Petroleum Gases (LPG) from different places such us United Arab Emirates, Singapore and/or Bahrain, among others.

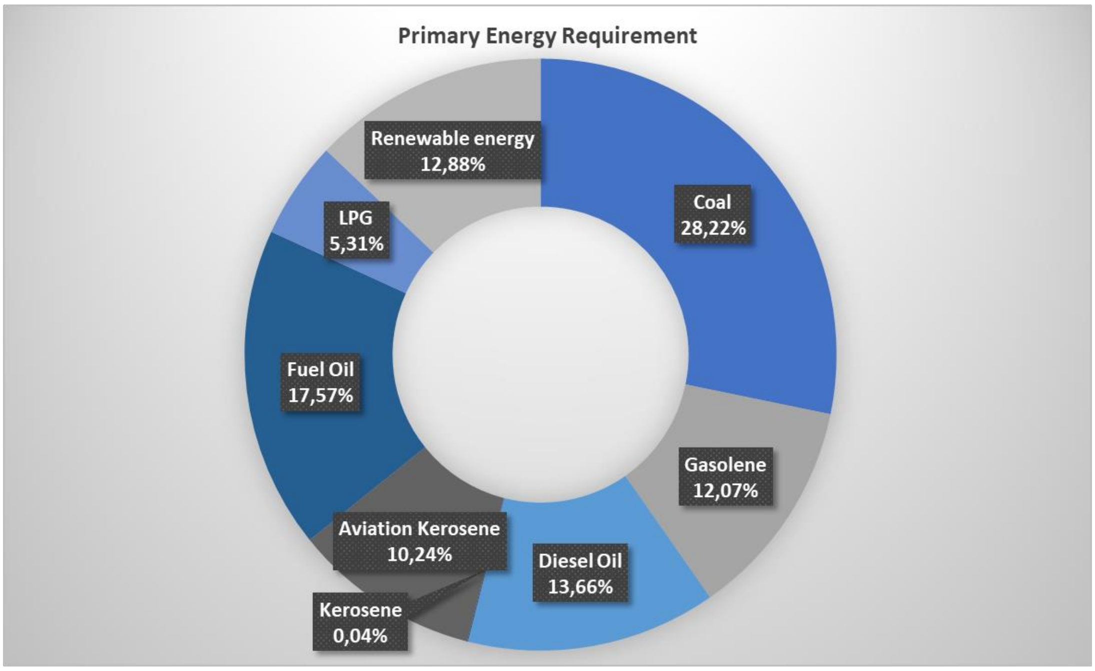


Figure 32. Primary energy requirement in 2018 (% of required energy in terms of TJ) in the RoM

Source*: Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

The primary energy supply in the country has increased 9% from 2013 to 2018, and so does the fossil fuel importation (increase of 11.9% between 2013 and 2018). In case of renewable energy sources, the variation between 2013 and 2018 has experienced fluctuations, considering an increase of 14.5% in 2013-2015 and a decrease of almost 19% in 2015-2018 (Digest of Energy and Water Statistics, 2018).

The high dependence on the supply of fossil fuels has been a major concern for Mauritius due to the uncertainty in the price and supply of fossil fuels in the world market. In this regard, the Government of Mauritius had come up with an Outline Energy Policy (OEP) in 2007 to pave the road map for meeting the future energy demands for the country. The OEP focused on achieving sustainability in the energy sector and focused on the main drivers of the energy sector like electricity generation and transport. Much focus was laid on capturing the potential of renewable energy sources (CEB, 2019).

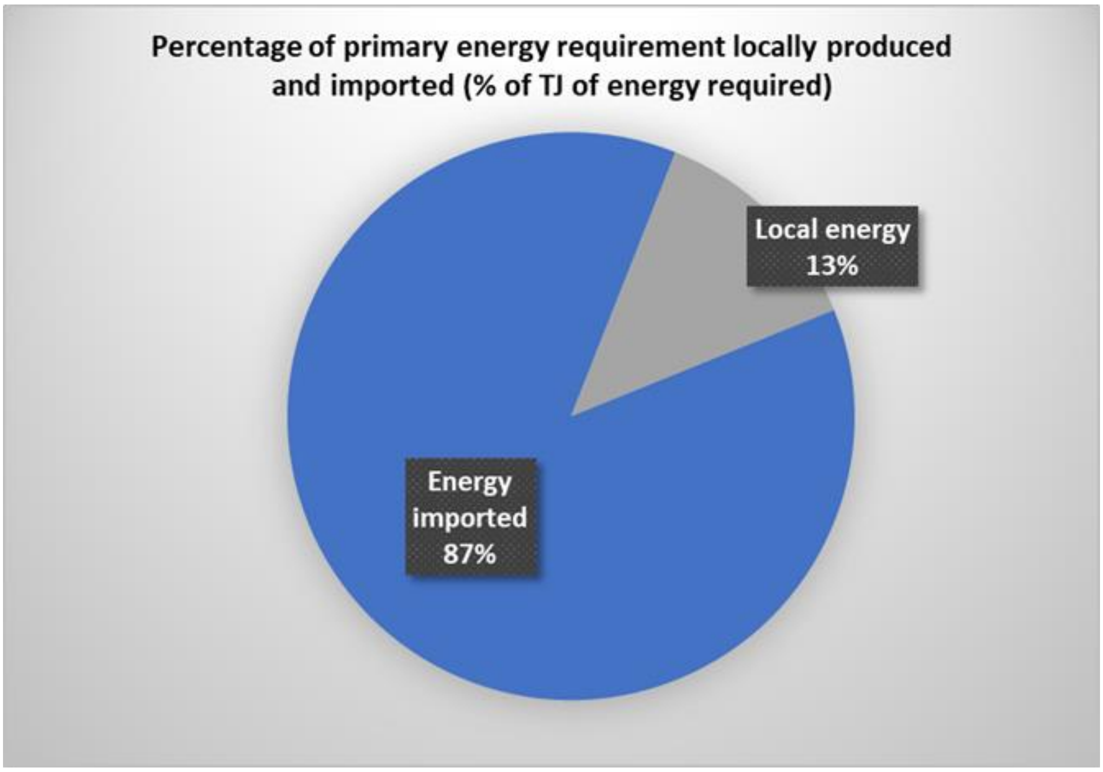


Figure 33. Percentage of primary energy requirement locally produced and imported in 2018 (% of TJ of energy required)

Source*: Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

The total energy consumption in the RoM in 2018 was reported in 560.3 ktoe considering the different types of fuels supplied in the country (gasoline, diesel, LPG, kerosene, fuel oil, coal, and renewables such as wood, bagasse and charcoal). Electricity consumption in 2016 was 2,779.7 GWh. Transport sector is the sector with the highest energy consumption, representing a 54.6% of the total energy consumption in the country, and followed by the manufacturing sector with the 20.6% of the total consumption, households (14% of the total consumption), commercial sector and agriculture, with the 10.2% and 0.4% of total consumption respectively (Energy Statistics, 2018).

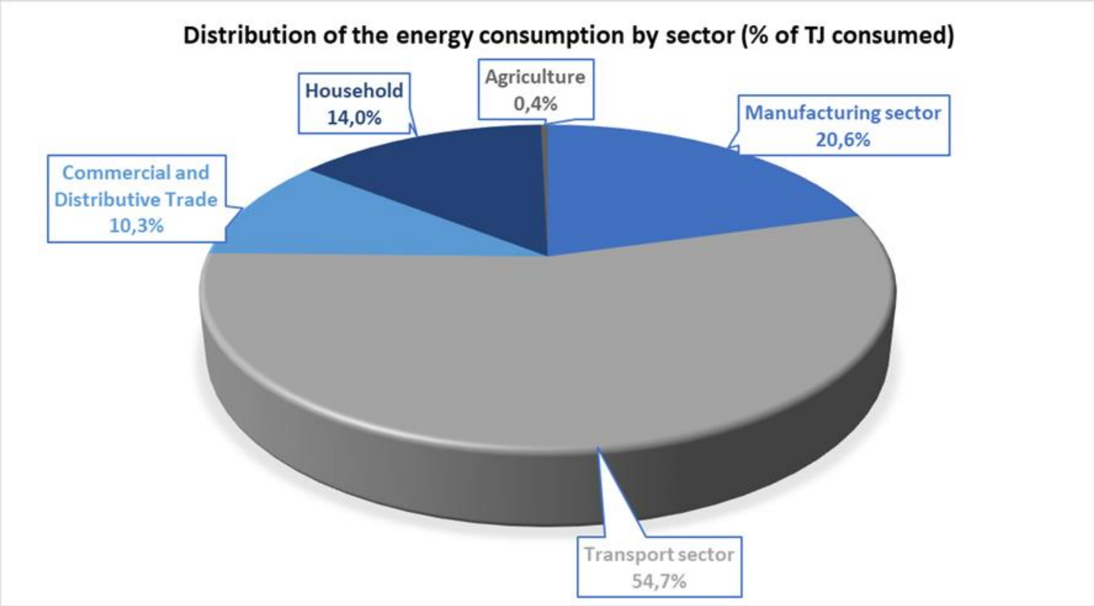


Figure 34. Distribution of Energy consumption by sector in 2018 (% of the total TJ of energy consumed)

Source*: Source: Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

3.1.1 General Methodology

The general methodology used in the energy sector is collected in the following table:

Table 20. Methodology used for the Energy Sector

Category	Activity Data	Emission Factor	Conversion Factor / NCV	Activity Data Source
1.A. Fuel Combustion Activities				
1.A.1. Energy Industries				
1.A.1.a.i. Electricity generation by Energy Industries	T1	D/T1	CS	Energy and Water Statistics Mauritius
1.A.2. Manufacturing Industries and Construction				
1.A.2. Manufacturing Industries and Construction	T1	D/T1	CS	ESDD, Commerce Division and Manufacturing Statistics Mauritius
1.A.3. Transport Sector				
1.A.3.a.i. International Aviation	T1	D/T1	D	International Energy Agency (IEA)
1.A.3.a.ii. Civil Aviation	T1	D/T1	CS	Air Mauritius, Domestic flights
1.A.3.b. Road Transport	T1	D/T2	CS	Transport Toolkit v17.1
1.A.3.d.i. International	T1	D/T1	D	International Energy Agency (IEA)

Water-borne Navigation				
1.A.3.d.ii. Water-borne Navigation	T1	D/T1	CS	Tourism Authority, Water-borne navigation
1.A.4. Other Sector				
1.A.4.a. Commercial / Institutional	T1	D/T1	CS	Ministry of Environment. Data for Energy Other Sectors
1.A.4.b. Residential	T1	D/T1	CS	Ministry of Environment, Data for Energy Other Sectors
1.A.4.c. Agriculture	T1	D/T1	CS	Ministry of Environment, Data for Energy Other Sectors
1.A.4.d. Other	T1	D/T1	CS	Ministry of Environment, Data for Energy Other Sectors
1.B. Fugitive Emissions from Fuels				
1.B. Fugitive Emissions from Fuels	NA	NA	NA	-
1.C. Carbon Dioxide Transport and Storage				
1.C. Carbon Dioxide Transport and Storage	NO	NO	NO	-

T1: Tier 1; T2: Tier 2; D: Default; CS: Country Specific; NO: Not Occurring; NA: Not Applicable; NE: Not Estimated.

3.2 Energy Industries (Category 1A1)

Energy Industries in RoM comprises principally of sub-category 1.A.1.a – Main activity Electricity and Heat Production. Within this category, Electricity Generation (1.A.1.a.i) is solely considered. The other sub-categories are not occurring.

3.2.1 Source Category Description

The energy generation in the country is produced by the Central Electricity Board (CEB), supplying the 43.1% of the total electricity generated, and by the Independent Power Producers (IPPs) the remaining 56.9% of the total electricity generated in the country by 2018, where 3,129.82 GWh of electricity were generated (Energy Statistics, 2018).

Coal is the main fossil fuel used for electricity generation, reaching to produce 40.2% of the total electricity generated in the area. Fossil fuel derived energy represents the 79.3% of the total energy generated, while renewable sources (bagasse, landfill gas, hydro, photovoltaic and wind) accounted for 20.8% of the total electricity generated by 2018. Since 2011, at the Mare Chicose landfill site, the methane generated from the decomposition of the organic matter is being collected and use as renewable energy source (3.14 GWh in 2011), obtaining 22.6 GWh of electricity generation in 2018 (Energy Statistics, 2018). The electricity generation from landfill gas has vary during the years, increasing from 2011 to 2014 (579.3%), decreasing from 2014 to 2017 (20.8%) and increasing again in 2018, when the highest amount of electricity was generated from this source.

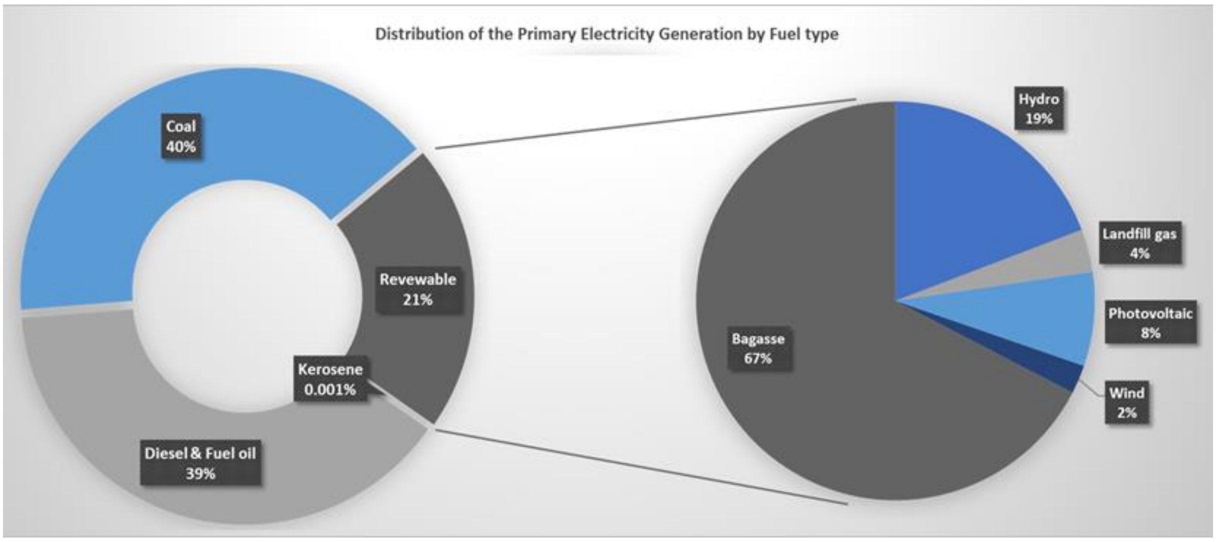


Figure 35. Distribution of the Primary Electricity Generation by Fuel type in 2018

Source*: Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

The electricity produced by CEB comes from their 4 thermal power plants named St Louis, Fort Victoria, Fort George and Nicolay, all located in Port Louis. CEB count on 10 hydroelectric plants and 2 photovoltaic facilities located in the Island of Mauritius, and a wind farm in Rodrigues island. IPPs, on their part, count on 2 photovoltaic facilities located in each island, a wind farm and six thermal plants, as well as an electricity generation plant from landfill gas produced in the Chicose landfill (Energy Statistics, 2018).

With a view to up-scale ocean energy in the energy mix, the Mauritius Research Council (MRC) has signed a Collaboration Agreement with the Carnegie Wave Energy Ltd. Australia in 2015. A project on Wave Resource Assessment and Wave – Integrated Micro grid Design in Mauritius – is currently being implemented[2].

Table 21. Effective Plant Capacity, Peak Demand and Electricity Generation 2000 – 2018

Year	Effective Plant Capacity (MW)	Peak Demand (MW)	Amount of Electricity Generated (GWh)
2000	1,226.6	283.9	1,777.5
2001	1,228.6	297.4	1,910.8
2002	1,220.6	308.6	1,948.9
2003	1,213.1	323.8	2,081.5
2004	1,194.4	332.6	2,165.2
2005	1,256.8	353.1	2,272.2
2006	1,310.1	367.3	2,350.2
2007	1,403.6	367.6	2,464.7
2008	1,333.2	378.1	2,557.2
2009	1,376.3	388.6	2,577.4
2010	1,384.3	404.1	2,688.7

[2] More information about the project can be consulted in the following link http://www.mrc.org.mu/English/Pages/High-Penetration-.aspx

2011	1,385.5	412.5	2,738.6
2012	1,450.2	430.1	2,797.1
2013	1,451.9	441.1	2,885.3
2014	1,465.5	446.2	2,936.9
2015	1,480.3	459.9	2,995.6
2016	1,515.5	467.9	3,042.2
2017	765.5	469.1	3,119.7
2018	814.6	476.3	3,131.6

Source: *Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

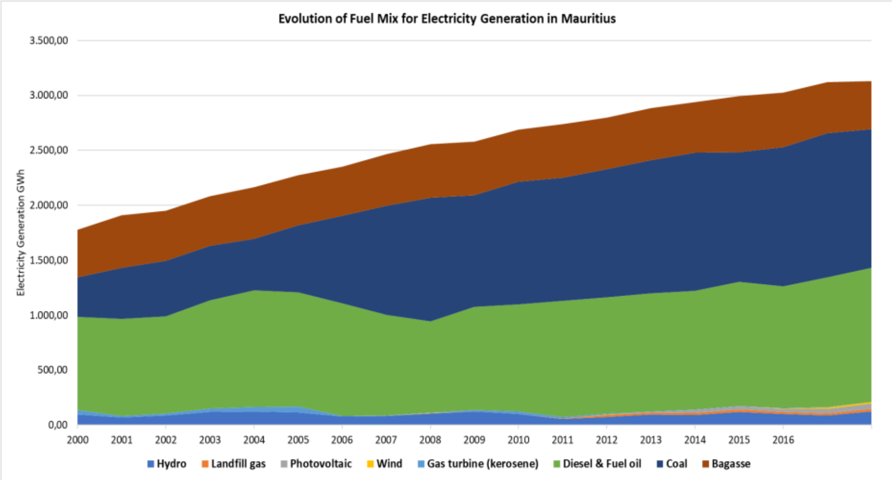


Figure 36. Evolution of the Electricity Mix (2000 – 2018)

Source: *Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

3.2.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for Energy Industries, was a Tier 1 but using Country Specific (CS) Net Calorific Values (NCV). In RoM, different fuels are used for the electricity generation and 79% of them are from fossil origin (coal, diesel, fuel oil and kerosene) where coal is the main fuel. The remaining 21% of the fuels are from renewable origin (bagasse, landfill gas, hydro, photovoltaic and wind) where bagasse is the renewable source with the highest contribution.

As reported in the 2006 IPCC Guidelines, CO_2 emissions from renewable energies do not have to be accounted with the rest of CO_2 emissions from this category, in this case, they should be accounted as CO_2 emissions from biomass and taken as a memo item. The non-CO_2 emissions from renewables has to be accounted in the national totals.

To obtain the results of the GHG emissions from each fuel type used in the electricity generation of the country, each fuel's activity data (AD). NCV and Emission Factor (EF) have been entered in the 2006 IPCC Inventory Software for the computation of GHG emissions. The emission results for each fuel type have been aggregated to obtain the total amount of emissions.

3.2.2.1 Calculation

For the emission calculation, the equation 2.1 from Chapter 2, Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

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

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 2.1 are summed over all fuels.

3.2.2.2 Activity Data

The activity data used for the estimation of GHG emissions for energy industries have been obtained from the amount of fuels consumed for the electricity generation in the country, published in the *Digest of Energy and Water Statistics, 2018* by the Statistics Mauritius under the aegis of the Ministry of Finance, Economic Planning and Development.

The following table compiles the AD values used in the estimation of GHG emissions for the energy industries from 2000 to 2016.

Table 22. Fuel consumed for electricity generation, 2000 – 2016 (Gg Fuel)

Years	Kerosene	Fuel Oil	Diesel	Sub-Bituminous Coal	Bagasse
2000	13.08	175.52	3.36	228.52	1,021.50
2001	3.76	185.34	3.14	273.38	1,142.50
2002	5.44	179.62	3.48	286.89	1,202.10
2003	9.86	204.46	3.90	287.18	1,046.79
2004	16.56	220.07	3.97	265.13	1,092.82
2005	17.73	217.05	2.13	340.68	1,055.74
2006	1.85	226.54	2.53	462.78	1,036.60
2007	1.07	201.82	2.75	552.63	1,040.29
2008	2.10	167.55	1.90	609.75	1,300.94
2009	4.92	190.60	2.76	574.14	1,135.59
2010	6.01	196.88	2.00	643.05	1,140.38
2011	3.66	214.52	1.52	617.30	1,119.04
2012	3.44	213.03	1.86	649.16	1,077.79
2013	0.65	216.19	1.27	683.21	1,056.15
2014	0.68	221.35	1.23	711.24	1,030.56
2015	0.74	229.57	1.08	684.35	1,240.30
2016	0.73	224.21	1.03	701.23	1,129.55

***Source**: Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

The AD was provided in terms of Gg and then, using the NCV for each fuel type, this was converted to TJ. The NCV used in the national inventory are collected in the following table:

Table 23. Country Specific Net Calorific Values (NCV) for fuels consumed in Energy Industries (TJ/Gg)

Fuel type	Country Specific NCV
Kerosene	43.54
Fuel Oil	40.19
Diesel	43.3

Source: *Statistics Mauritius, Digest of Energy and Water Statistics, 2018*

Table 24. Country Specific Net Calorific Values (NCV) for fuels consumed in Energy Industries (TJ/Gg)

Year	Coal	Bagasse
2000	25.57	7.11
2001	25.52	7.10
2002	25.48	7.09
2003	25.43	7.08
2004	25.39	7.07
2005	25.34	7.06
2006	25.30	7.05
2007	25.33	6.48
2008	25.21	7.18
2009	24.97	7.24
2010	25.20	7.25
2011	25.23	6.98
2012	25.03	7.04
2013	24.91	7.24
2014	24.86	7.22
2015	24.62	6.67
2016	25.14	6.71

Source: *Omnicane Management and Consultancy Limited, 2019.*

3.2.2.3 Emission Factors

The Emission Factors used for the estimation of the GHG emissions of the energy industries are adopted from the default values proposed in the 2006 IPCC Guidelines, as shown in the table below:

Table 25. Emissions Factors for the fuel used for the energy industries (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Kerosene	71,900	3	0.6
Fuel Oil	77,400	3	0.6
Diesel	74,100	3	0.6
Sub-Bituminous Coal	96,100	1	1.5
Bagasse	100,000	30	4

Source: *Table 2.2, Chapter 2, Volume 2 of the 2006 IPCC Guidelines.*

3.2.3 Results

Aggregated emissions from the Energy Industries (CEB and IPPs) increased from 1,177.61 Gg CO_2eq in 2000 to 2,422.16 GgCO_2eq in 2016, which represent an increase of 105.68% from 2000 to 2016.

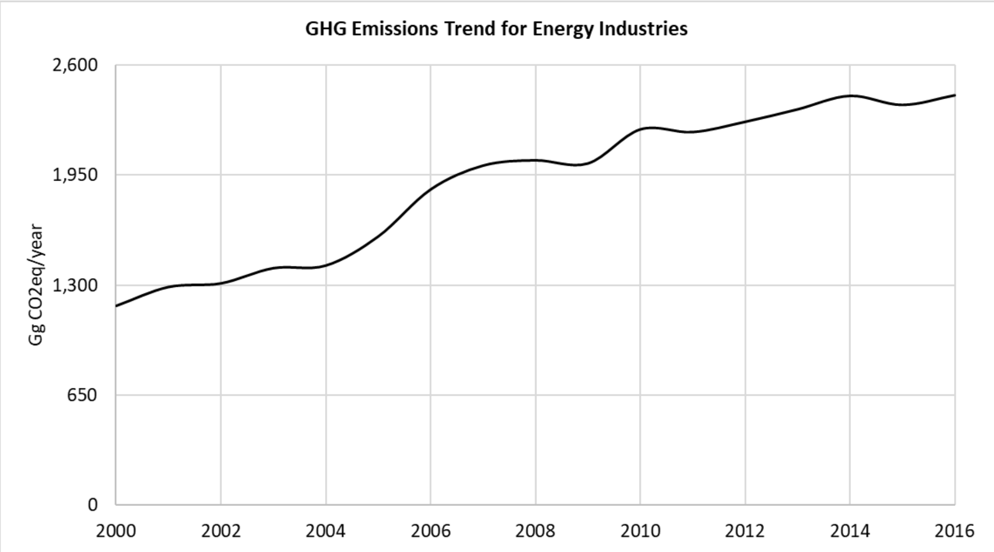


Figure 37. Evolution of the GHG Emissions from Energy Industries from 2000 to 2016 (Gg CO_2eq)

Table 26. GHG Emissions from Energy Industries from 2000 to 2016 (Gg CO_2eq)

Year	Total GHG Emissions for Energy Sector	Total GHG Emissions for Energy Industries	GHG Emission Share for Energy Industries (%)
2000	2,323.15	1,177.61	50.7%
2001	2,492.10	1,289.30	51.7%
2002	2,544.85	1,310.80	51.5%
2003	2,678.11	1,400.80	52.3%
2004	2,704.03	1,416.17	52.4%
2005	2,889.79	1,587.64	54.9%
2006	3,255.86	1,865.46	57.3%
2007	3,423.66	2,006.65	58.6%
2008	3,524.63	2,037.72	57.8%
2009	3,472.88	2,019.24	58.1%
2010	3,731.18	2,220.34	59.5%
2011	3,742.36	2,204.72	58.9%
2012	3,839.69	2,265.14	59.0%
2013	3,949.45	2,338.84	59.2%
2014	4,005.75	2,418.53	60.4%
2015	4,057.65	2,365.06	58.3%
2016	4,182.62	2,422.16	57.9%

3.2.4 Quality Control

Most of the activity data for fuel consumption have been obtained from the respective power plants and sent on a monthly basis to Statistics Mauritius. The Statistics Mauritius presents these data annually in the Digest of Energy and Water Statistics published on its website. The values used in this inventory have been obtained from these annual statistics.

On the other hand, and to ensure the use of right data in the inventory, some of the quality check (QC) implemented during the data collection and emission estimation is listed below:

- Cross verification between data provided via mail by the CEB and IPPs and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for Energy Industries.
- Cross verification between country specific NCV provided by institutional authorities and the NCV range proposed by the IPCC 2006 Guidelines.
- Cross verification between the GHG emissions estimated in the current inventory for energy industries and the results obtained in the last reported national inventory of the RoM.

3.2.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Energy sector categories obtained from the IPCC software are reported in the following tables, for 2000 as base year:

Table 27. Uncertainty Analysis of the Energy Industry category (1.A.1) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.1 - Energy Industries - Liquid Fuels	CO_2	5.00	6.14	7.92
1.A.1 - Energy Industries - Liquid Fuels	CH_4	5.00	228.79	228.84
1.A.1 - Energy Industries - Liquid Fuels	N_2O	5.00	228.79	228.84
1.A.1 - Energy Industries - Solid Fuels	CO_2	5.00	12.41	13.38
1.A.1 - Energy Industries - Solid Fuels	CH_4	5.00	200.00	200.06
1.A.1 - Energy Industries - Solid Fuels	N_2O	5.00	222.22	222.28
1.A.1 - Energy Industries - Biomass	CO_2	5.00	18.69	19.35
1.A.1 - Energy Industries - Biomass	CH_4	5.00	245.45	245.51
1.A.1 - Energy Industries - Biomass	N_2O	5.00	304.55	304.59

It is concluded from the table above, that the greatest source of uncertainty corresponds to the emission factors due to the use of default factors and therefore to the absence of country specific factors.

3.2.6 Recalculations

The recalculations carried out in the Energy Industries category consist of the improvement on the NCV data for coal and bagasse fuels. In the previous inventory developed in 2013, the NCV used for the fuels consumed in the category were country specific values, set as a constant average value for the whole time series and each type of fuel. In this current inventory, the NCV for coal and bagasse was set annually.

The impact in emissions caused by these recalculations compared to the past inventory results in a decrease of a 2% of the emissions estimated from energy industries recorded in 2013, where emissions of 2,386 Gg CO_2eq were estimated in the national inventory in 2013, compared to 2,338.84 Gg CO_2eq emissions estimated in the current national inventory (2000-2016) for the same year.

3.2.7 Planned Improvements

Fossil fuels consumed in the country are all imported from different countries. For this reason, the NCV for the same fossil fuel imported from different countries may vary slightly. This NCV could vary also annually so, for that reason, RoM is considering the recalculation of these NCV for each fossil fuel annually, not solely for coal and bagasse as it has done for this inventory edition.

The activity data used for this category are quite detailed and obtained at plant level, however, this is not the case for EFs. To achieve higher tier levels in the estimation of GHG emissions, it is necessary to obtain plant specific EF, RoM will work on this aspect for the future.

3.3 Manufacturing Industries (Category 1A2)

Manufacturing Industries and Construction category is composed by the following sub-categories in the country:

- 1A2a Iron and Steel
- 1A2c Chemicals
- 1A2d Pulp. Paper and Print
- 1A2e Food processing. Beverages and Tobacco
- 1A2k Construction
- 1A2l Textile and Leather
- 1A2m Other

3.3.1 Source Category Description

The manufacturing and construction activities are part of the secondary sector of the country that contribute to the 20.7% of the total Global Value Added (GVA) of the country. The manufacturing category and its sub-categories, are the largest sector in Mauritian economy, contributing the 13.9% of the GVA of the country in 2016 (National Accounts and Investment, NAI 2016).

The fuel types used in the manufacturing industry are mainly diesel, fuel oil, liquified petroleum gases (LPG), coal, gasoline, and biomass fuels such as fuelwood and bagasse. The GHG emissions provided from this category result from the combustion of these fossil fuels.

3.3.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for Manufacturing Industries, was a Tier 1 but using CS NCV. In this category, as mentioned in the previous section, fossil and non-fossil fuels are used in the combustion activities of the manufacturing category. For that sense, and as reported in the 2006 IPCC Guidelines, CO_2 emissions from non-fossil fuels do not have to be accounted with the rest of CO_2 emissions from this category. In this case, they should be accounted as CO_2 emissions from biomass and taken as a memo item. The non-CO_2 emissions from non-fossil fuels have to be accounted in the national totals.

To obtain the results of the GHG emissions from each fuel type used in the energy combustion activities of the manufacturing industries of the country, each fuel's activity data (AD). NCV and Emission Factor (EF) have been entered in the 2006 IPCC Inventory Software for the computation of GHG emissions. The emission results for each fuel type have been aggregated to obtain the total amount of emissions.

3.3.2.1 Calculation

For the emission calculation, the equation 2.1 from Chapter 2, Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

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

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 2.1 are summed over all fuels.

3.3.2.2 Activity Data

The activity data used for the estimation of GHG emissions for manufacturing industries have been estimated based on the TNC data and methodology and from the Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) and the Statistics Mauritius.

The total fuel consumption estimations are available for the period between 2000 and 2016, as well as the percentage of fuel consumed on each manufacturing industry (estimates based on TNC methodology and Statistics Mauritius). The multiplication between the total fuel consumption and the percentage provided was done to obtain the amount of fuel consumed in each manufacturing industry.

The following table compiles the AD values used in the estimation of GHG emissions for the manufacturing industries from 2000 to 2016.

Table 28. Fuel consumed by Manufacturing Industries and Construction, 2000 – 2016 (Gg Fuel)

Years	Diesel	Fuel Oil	LPG	Coal	Gasoline	Fuelwood	Bagasse
2000	41.60	44.77	4.27	29.72	0.55	1.50	531.80
2001	37.53	56.15	4.18	32.38	0.55	1.50	529.00
2002	37.41	56.90	4.03	32.57	0.55	1.45	442.72
2003	41.27	51.22	3.54	35.02	0.55	1.43	510.25
2004	43.37	45.92	3.36	29.61	0.55	1.42	518.38
2005	41.13	42.63	4.48	28.17	0.55	1.40	476.20
2006	49.77	53.82	4.66	27.99	0.55	1.43	463.56
2007	48.34	55.80	4.74	26.52	0.55	1.43	400.65
2008	46.30	50.36	5.57	47.58	0.55	1.43	239.28
2009	45.88	43.18	5.65	26.64	0.55	1.43	226.76
2010	46.54	41.57	5.77	29.66	0.55	1.43	265.99
2011	43.09	40.42	5.84	28.94	0.55	1.43	244.29
2012	41.31	39.06	6.04	30.20	0.55	1.41	213.12
2013	35.44	39.29	5.85	32.11	0.55	1.39	204.57
2014	36.10	40.58	5.93	36.01	0.55	1.34	177.97
2015	36.59	37.31	6.18	40.81	0.55	1.30	197.65
2016	35.31	36.90	6.10	37.52	0.55	1.26	158.43

***Source**: based on the TNC methodology and data from the Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) and Statistics Mauritius.*

The AD was provided in terms of Gg and then, using the NCV for each fuel type, this was converted to TJ. The NCV used in the national inventory are collected in the following table:

Table 29. Country Specific Net Calorific Values for fuel consumed in Manufacturing Industries and Construction (TJ/Gg)

Fuel type	Country Specific NCV
Diesel	43.3
Fuel Oil	40.19
LPG	47.3
Gasoline	44.8
Fuelwood	15.6

***Source**: Digest of Energy and Water Statistics, 2018*

Table 30. Country Specific Net Calorific Values for fuel consumed (coal and bagasse) in Manufacturing Industries and Construction (TJ/Gg)

Fuel type	Coal	Bagasse
2000	25.57	7.11
2001	25.52	7.10
2002	25.48	7.09
2003	25.43	7.08
2004	25.39	7.07
2005	25.34	7.06
2006	25.30	7.05

2007	25.33	6.48
2008	25.21	7.18
2009	24.97	7.24
2010	25.20	7.25
2011	25.23	6.98
2012	25.03	7.04
2013	24.91	7.24
2014	24.86	7.22
2015	24.62	6.67
2016	25.14	6.71

Source: *Omnicane Management and Consultancy Limited, 2019*

3.3.2.3 Emission Factors

The Emission Factors used for the estimation of the GHG emissions of the manufacturing industries are adopted from the default values proposed in the 2006 IPCC Guidelines, as shown in the table below:

Table 31. Emissions factors for the fuel used for the manufacturing industries (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Diesel	74,100	3	0.6
Fuel Oil	77,400	3	0.6
LPG	63,100	1	0.1
Coal	96,100	10	1.5
Fuelwood	112,000	30	4
Bagasse	100,000	30	4

Source: *Table 2.3, Chapter 2, Volume 2 of the 2006 IPCC Guidelines*

3.3.3 Results

Aggregated emissions from the Manufacturing Industries and Construction increased from 372.17 Gg CO_2eq in 2000 to 429.55 Gg CO_2eq in 2008 where the maximum emission value was reached, and then the GHG emissions decreased from 2008 to 342.18 Gg CO_2eq in 2016. The emissions decreased by 8.1% from 2000 to 2016.

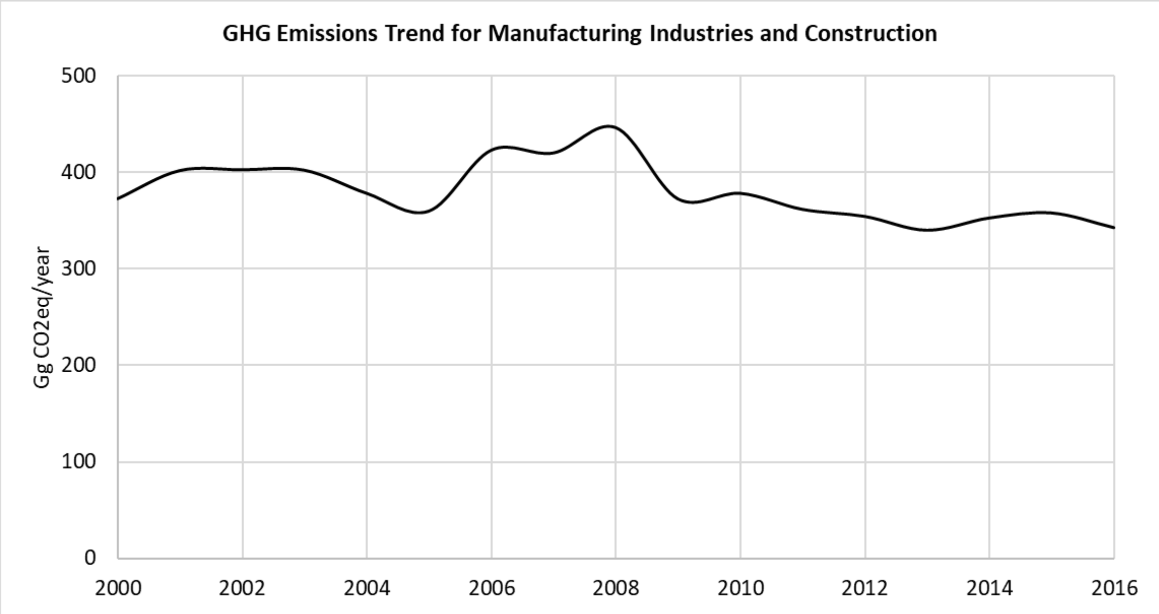


Figure 38. Evolution of the GHG Emissions from Manufacturing Industries and Construction, 2000 – 2016 (Gg CO_2eq)

Table 32. GHG Emissions from Manufacturing Industries, 2000 – 2016 (Gg CO_2eq)

Year	Total GHG Emissions for Energy Sector	Total GHG Emissions for Manufacturing Industries	GHG Emission Share for Manufacturing Industries (%)
2000	2,323.15	372.22	16.0%
2001	2,492.10	401.62	16.1%
2002	2,544.85	402.38	15.8%
2003	2,678.11	402.04	15.0%
2004	2,704.03	377.99	14.0%
2005	2,889.79	359.33	12.4%
2006	3,255.86	422.80	13.0%
2007	3,423.66	419.98	12.3%
2008	3,524.63	446.47	12.7%
2009	3,472.88	372.13	10.7%
2010	3,731.18	377.90	10.1%
2011	3,742.36	361.19	9.7%
2012	3,839.69	353.89	9.2%
2013	3,949.45	339.42	8.6%
2014	4,005.75	352.22	8.8%
2015	4,057.65	357.44	8.8%
2016	4,182.62	342.18	8.2%

3.3.4 Quality Control

The values used in this inventory have been obtained from the estimations elaborated in the TNC and the data from the Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) and the Statistics Mauritius.

On the other hand, and in order to ensure the use of right data in the inventory, some of the QC implemented during the data collection and emission estimation is listed below:

- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for Manufacturing Industries and Construction.
- Cross verification between country specific NCV provided by institutional authorities and the NCV range proposed by the IPCC 2006 Guidelines.
- Cross verification between the GHG emissions estimated in the current inventory for manufacturing industries and construction and the results obtained in the last reported national inventory of the RoM.

3.3.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Manufacturing Industries and Construction sector categories obtained from the 2006 IPCC Inventory software are reported in the following table for 2000 as base year:

Table 33. Uncertainty Analysis from the Manufacturing Industry category (1.A.2) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.2.a - Iron and Steel - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.a - Iron and Steel - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.a - Iron and Steel - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.c - Chemicals - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.c - Chemicals - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.c - Chemicals - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.c - Chemicals - Solid Fuels	CO_2	5,00	12,46	13,43
1.A.2.c - Chemicals - Solid Fuels	CH_4	5,00	200,00	200,06
1.A.2.c - Chemicals - Solid Fuels	N_2O	5,00	222,22	222,28
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid	N_2O	5,00	228,79	228,84

Fuels				
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	5,00	12,46	13,43
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH_4	5,00	200,00	200,06
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	N_2O	5,00	222,22	222,28
1.A.2.k - Construction - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.k - Construction - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.k - Construction - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.l - Textile and Leather - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.l - Textile and Leather - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.l - Textile and Leather - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.l - Textile and Leather - Solid Fuels	CO_2	5,00	12,46	13,43
1.A.2.l - Textile and Leather - Solid Fuels	CH_4	5,00	200,00	200,06
1.A.2.l - Textile and Leather - Solid Fuels	N_2O	5,00	222,22	222,28
1.A.2.m - Non-specified Industry - Liquid Fuels	CO_2	5,00	6,14	7,92
1.A.2.m - Non-specified Industry - Liquid Fuels	CH_4	5,00	228,79	228,84
1.A.2.m - Non-specified Industry - Liquid Fuels	N_2O	5,00	228,79	228,84
1.A.2.m - Non-specified Industry - Solid Fuels	CO_2	5,00	12,46	13,43
1.A.2.m - Non-specified Industry - Solid Fuels	CH_4	5,00	200,00	200,06
1.A.2.m - Non-specified Industry - Solid Fuels	N_2O	5,00	222,22	222,28
1.A.2.m - Non-specified Industry - Biomass	CO_2	5,00	18,69	19,35
1.A.2.m - Non-specified Industry - Biomass	CH_4	5,00	245,45	245,51
1.A.2.m - Non-specified Industry - Biomass	N_2O	5,00	281,82	281,86

It is concluded from the tables above, that the greatest source of uncertainty corresponds to the emission factors due to the use of default factors and therefore to the absence of country specific factors.

3.3.6 Recalculations

The Manufacturing Industries and Construction category collects some recalculations in the activity data used for the estimation of the GHG emissions regarding the last national inventory edition (TNC). In this current inventory, the activity data used for the calculations has been disaggregated considering the fuel consumed in the specific activities in which the category is composed.

The Manufacturing Industry and Construction category presents a recalculation in the EF used for the GHG emission estimation. For last inventory edition (2000 – 2013), the EF reported for the estimation of CH_4 emissions for coal and fuelwood combustion were reported as 1 kgCH_4/TJ and 300 kgCH_4/TJ respectively. Knowing that the EF used for the estimation of the GHG emissions are adopted from the default EF values proposed in the table 2.3 of the 2006 IPCC Guidelines, these values have been identified as errors. The values considered for this current inventory edition are 10 kgCH_4/TJ (coal) and 30 kgCH_4/TJ (fuel wood).

On the other hand, some improvements on the NCV data for coal and bagasse have been made. In the last inventory edition, the NCV used for the fuels consumed in the category where country specific values set as a constant average value for every year and each time of fuel. In this current inventory, the NCV for coal and bagasse was set annually.

As well as in the energy industry category, the recalculations made in the present inventory did not show major differences in terms of GHG emissions. In this sense, between the last inventory and the updated inventory for 2016, a decrease of a 2% has been recorded in the year 2013. In the last inventory 342.3 Gg CO_2eq were estimated in 2013 whilst 333.96 Gg CO_2eq have been estimated for the same year in the present inventory.

3.3.7 Planned Improvements

The data disaggregation available for each of the manufacturing industries and construction categories, is being estimated and not calculated. The country is working to collect more accurate data for each sub-category, especially for iron and steel and construction industries.

As for the energy industries, the fossil fuels consumed in these industries should have different NCV values and EF, for that reason, the country is considering the recalculation of these NCV for each fossil fuel annually, not solely for coal and bagasse as it has done for this inventory edition.

3.4 Transport (Category 1A3)

The transport sector in the Country involves the Civil or Domestic Aviation (1A3a), Road Transportation (1A3b) and Water-borne navigation (1A3d). Rail transport does not apply by the moment since the country does not count on rail-based transport; nonetheless, a rail transport system is being operational in the country currently, which is solely powered by electricity through the national grid.

3.4.1 Source Category Description

Transport sector in the RoM is represented by the aviation, road transport and navigation transports. The transport consumed the 53.2% of the total energy consumption of the country in 2016, corresponding to 505.6 ktoe. The amount of energy consumed in the sector has increased 11.3% from 2014 to 2016 where the maximum amount of energy consumption is registered since 2000 (Digest of Energy and Water Statistics, 2016).

The Republic of Mauritius has a well-developed road network of 2,686 km, 1,192 km of main roads,833 km of secondary roads,100 km of motorways and 561 km of other roads, as registered in 2017. The fleet of vehicles registered in the Republic is 571,122 (556,001 registered in the island of Mauritius and 15,121 in the island of Rodrigues) in 2018,20% higher than in 2014. The highest number of vehicles registered are passenger cars, corresponding to a 42% of the total number of vehicles registered, autocycles and motorcycles corresponding to a 38.7% of total number of vehicles registered. Car registration increased by 13% since 2014 and motorcycles and autocycles by 8% (National Land Transport Authority, NLTA).

Air transport in Mauritius currently has more than 20 scheduled airlines that serve some 30 destinations through our international airport. The passenger terminal handles around 1,640 passengers per hour (both arrivals and departures) and has a capacity of 4 million passengers per year. It is operating at 92% of its capacity. The country is implementing a series of measures to increase passenger handling capacity to 4.5 million by 2020 and to expand air freight traffic to 65,000 tonnes in 2020. In collaboration with private operators, Mauritius is developing a new Cargo, Freeport and Logistics zone in the airport area. In 2017, an increase in air freight traffic by 18% with a freight tonnage of 61,000 was noted.

Water-borne navigation in the Republic of Mauritius is considered as inter-island traffic transport, tugs used in port activities and pleasure crafts in the tourism industry. In 2017, Mauritius reviewed its Port Masterplan and has started work to cement our position as the preferred regional maritime gateway. The country has invested in the extension of the Mauritius Container Terminal berths to 800 m thus strengthening the existing quay. The navigational channel has been deepened to 16.5 m, making Port Louis the deepest port in the region capable of accommodating very large vessels. Additional equipment, including seven cranes for loading and unloading of vessels, was also procured, thus improving port productivity. Backup facilities have also expanded to increase terminal capacity from 550,000 Twenty-foot Equivalent Unit (TEUs) to 750,000 TEUs. These improvements have allowed Port Louis to handle more transhipment traffic. The bunker traffic increased by almost 36% from 404,837 tonnes to 550,241 tonnes in the past three years. The number of cruising ships making calls to Port Louis increased from 24 to 37.

3.4.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for Civil aviation and Water-borne navigation in the Transport sector, was a Tier 1 but using CS NCVs. The methodological approach used for road transport was a Tier 1.

To obtain the results of the GHG emissions from each fuel type used in the transport sector of the country, each fuel's activity data (AD) and Emission Factor (EF) have been entered in the 2006 IPCC Inventory Software for the computation of GHG emissions. The emission results for each fuel type have been aggregated to obtain the total amount of emissions.

3.4.2.1 Calculation

For the emission calculation of **road transport**, the equation 3.2.1 and 3.2.3 from Chapter 3, Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

Emissions $_{GHG.fuel}$ =	emissions of a given GHG by type of fuel (kg GHG)
Fuel Consumption $_{fuel}$ =	amount of fuel consumed (TJ)
Emission Factor $_{GHG.fuel}$ =	default emission factor of a given GHG by type of fuel (kg gas/TJ).

The *Fuel Consumption* $_{fuel}$ parameter has been calculated using the 3.2.6 equation of the 2006 IPCC Guidelines, for each vehicle and fuel type.

$$Fuel\ Consumption_{fuel} = Vehicles_{type.\ fuel} \times Consumption_{vehicle\ type.fuel} \times Distance\ travelled$$

Where:

Fuel Consumption $_{fuel}$ =	amount of fuel consumed (TJ)
Vehicles $_{type.\ fuel}$ =	Number of vehicles by type and fuel used
Consumption $_{vehicle\ type.fuel}$ =	Average fuel consumption by vehicle type and fuel used
Distance travelled	Average distance travelled by each type of vehicle by fuel type (km)

The emissions are calculated for each vehicle and fuel type and to calculate the total emission by gas the emissions calculated in the 3.2.1 and 3.2.3 equations are summed over all fuels.

For the emission calculation of **water-borne navigation**, the equation 3.5.1 from Chapter 3, Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

Emissions $_{GHG.fuel}$ =	emissions of a given GHG by type of fuel (kg GHG)
Fuel Consumption $_{fuel}$ =	amount of fuel consumed (TJ)
Emission Factor $_{GHG.fuel}$ =	default emission factor of a given GHG by type of fuel (kg gas/TJ).

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 3.5.1 are summed over all fuels.

For the emission calculation of **civil aviation**, the equation 3.6.1 from Chapter 3, Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel}\ x\ Emission\ Factor_{GHG.fuel}$$

Where:

Emissions $_{GHG.fuel}$ =	emissions of a given GHG by type of fuel (kg GHG)
Fuel Consumption $_{fuel}$ =	amount of fuel consumed (TJ)
Emission Factor $_{GHG.fuel}$ =	default emission factor of a given GHG by type of fuel (kg gas/TJ).

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 3.6.1 are summed over all fuels.

3.4.2.2 Activity Data

For the **road transport**, the AD used differs depending on the time period. On one hand, the National Land Transport Authority (NLTA) facilitated the number of vehicles by type, technology and fuel consumed for the years 2014, 2015 and 2016, for both Mauritius and Rodrigues. In addition, the NLTA also facilitated the total amount of vehicles for the period 2000 – 2013 in Mauritius, and the total amount of vehicles for the period 2006 – 2013 in the island of Rodrigues. The completion of data with respect to the total amount of vehicles in the island of Rodrigues for the period 2000-2005 has been estimated using the average inter-annual growth rate.

On the other hand, the estimation of vehicle by type of fuel for the period 2000 – 2013 has been carried out according to the average distribution of vehicle type by fuel obtained from 2014-2016 data received from NLTA for both islands.

Table 34. Number of vehicles by type and fuel used matriculated in the Island of Mauritius, 2014 – 2016

Vehicle type	Technology	Fuel	2014	2015	2016	Average
Passenger Cars and Taxis	3 way catalyst	Gasoline	71,092	82,072	97.940	17%
		Diesel	5,682	6,388	7.456	1%
		LPG	178	17	20	0%
		Hybrid	1,829	2,424	3.777	1%
		Electric	9	10	11	0%
	Without 3 way catalyst	Gasoline	101,023	96,804	97.411	20%
		Diesel	10,117	10,004	9.874	2%

		LPG	40	204	203	0%
		Hybrid	0	0	0	0%
		Electric	0	1	2	0%
Motorcycle		Gasoline	195.611	210,055	210,100	42%
Dual Purpose Vehicle (DPV)	**3 way catalyst**	Gasoline	659	692	732	0%
		Diesel	11,666	11,681	13.890	3%
		LPG	5	4	5	0%
	Without 3-way catalyst	Gasoline	5,836	5,656	5.413	1%
		Diesel	19,801	19,610	19.573	4%
		LPG	9	10	9	0%
Light Duty Trucks	**3-way catalyst**	Diesel	3,163	4,120	5.670	1%
	Without 3-way catalyst	Diesel	16,596	16,237	15.960	3%
Heavy Duty Trucks		Diesel	18.492	16,520	15,789	3%
Buses		Diesel	3.244	3,552	3,828	1%
TOTAL			465,052	486,061	507,663	

Source*: National Land Transport Authority (NLTA).*

Table 35. Number of vehicles by type and fuel used matriculated in the Island of Rodrigues, 2014 – 2016

Vehicle type	Technology	Fuel	2014	2015	2016	Average
Passenger Cars and Taxis	**3-way catalyst**	Gasoline	169	129	276	2%
		Diesel	69	26	44	0%
		LPG				0%
		Hybrid	3	3	6	0%
		Electric				0%
	Without 3-	Gasoline	525	677	677	5%

	way catalyst	Diesel	403	401	401	3%
		LPG				0%
		Hybrid	0	0	0	0%
		Electric				0%
Motorcycle		Gasoline	7.436	8.048	8.694	67%
Dual Purpose Vehicle (DPV)	**3-way catalyst**	Gasoline	6	6	12	0%
		Diesel	340	585	685	4%
		LPG	0	2	3	0%
	Without 3-way catalyst	Gasoline	14	14	14	0%
		Diesel	924	916	974	8%
		LPG	5	5	5	0%
Light Duty Trucks	**3-way catalyst**	Diesel	0	0	0	0%
	Without 3-way catalyst	Diesel	0	0	0	0%
Heavy Duty Trucks		Diesel	913	948	999	8%
Buses		Diesel	172	177	185	1%
TOTAL			10,979	11,937	12,975	

Source*: National Land Transport Authority (NLTA).*

Table 36. Total number of vehicles in the RoM, 2000 – 2016

Year	Island of Mauritius	Island of Rodrigues
2000	244,690	4,002
2001	255,149	4,324
2002	265,841	4,672
2003	276,371	5,048
2004	291,605	5,454
2005	305,496	5,894
2006	319,440	6,368
2007	334,145	6,725
2008	351,406	7,099
2009	366,520	7,359
2010	384,115	7,670

2011	400,919	8,083
2012	421,926	8,677
2013	443,495	9,332
2014	465,052	10,979
2015	486,144	11,937
2016	507,676	12,975

***Source**: National Land Transport Authority (NLTA).*

The fuel consumption data for years 2014, 2015 and 2016 has been provided by the NLTA using specific and disaggregated data regarding vehicle type, technology, vehicle year, fuel used, average distance travelled and fuel efficiency for each vehicle in both islands.

The parameters used to estimate the GHG emissions related to the road transport are reported in the following tables.

Table 37. Country Specific Density Values for fuels consumed in road transport (L fuel/ton fuel)

Parameter	Gasoline	Diesel	LPG
Density (L/ton)	1,384	1,174.24	1,769.9

***Source**: National Land Transport Authority (NLTA).*

The NCV used for the road transport in the national inventory are collected in the following table:

Table 38. Country Specific Net Calorific Values for fuels consumed in road transport (TJ/Gg)

Fuel type	Country Specific NCV (TJ/Gg)
Gasoline	44.8
Diesel	43.33
LPG	47.31

***Source**: National Land Transport Authority (NLTA).*

To estimate GHG emissions for 2000 – 2013 period, the main data used was provided by the NLTA: total number of vehicles, densities and NCV values.

On the other hand, to estimate the fuel consumption of road transport in the period 2000 – 2013, and to continue applying the same methodology used for 2014 – 2016, several average data have been used.

Table 39. Average distance travelled in the Road Transport for the period 2000 – 2013

Vehicle type	Fuel	Distance (km/year)
Passenger cars	Gasoline	13,500
	Diesel	13,500
	LPG	13,500
Autocycle and Motorcycle	Gasoline	5,600
Dual Purpose Vehicle	Gasoline	13,500

	Diesel	13,500
	LPG	13,500
Light Duty / Good vehicles	Diesel	13,500
Heavy Duty Trucks	Diesel	13,500
Buses	Diesel	38,000

***Source**: TNC Transport Toolkit, 2017*

Table 40. Average fuel consumption in the Road Transport for the period 2000 – 2013

Vehicle type	Fuel	Fuel consumption (L/100km)
Passenger cars	Gasoline	6.5
	Diesel	9
	LPG	9
Autocycle and Motorcycle	Gasoline	2.75
Dual Purpose Vehicle	Gasoline	11.5
	Diesel	11.5
	LPG	11.5
Light Duty / Good vehicles	Diesel	11.5
Heavy Duty Trucks	Diesel	30.3
Buses	Diesel	30.3

***Source**: TNC Transport Toolkit, 2017*

The methodology used to calculate the fuel consumption in the road transport of the Republic of Mauritius is shown in the following equation (Tier 1 methodology from the 2006 IPCC Guidelines):

Fuel consumption (Gg) = Number of vehicles by type, technology and fuel used (number) x Fuel Consumption by type of vehicle, technology and fuel used (L/km)) x Distance travelled by type of vehicle, technology and fuel used (km/year) x Fuel Density (Gg/L)

The following table reports the fuel consumption by vehicle type and type of fuel consumed.

Table 41. Total fuel consumption in road transport in the RoM, 2000 – 2016 (Gg fuel)

Year	Passenger Cars and Taxis			Motorcycle	Dual Purpose Vehicle (DPV)			Light Duty	Heavy duty and Buses
	Gasoline	Diesel	LPG	Gasoline	Gasoline	Diesel	LPG	Diesel	Diesel
2000	58.24	8.75	0.08	11.80	3.59	22.00	0.01	13.69	48.95
2001	60.74	9.13	0.08	12.31	3.74	22.96	0.01	14.28	51.10
2002	63.29	9.52	0.08	12.84	3.90	23.95	0.01	14.88	53.32
2003	65.81	9.90	0.09	13.36	4.05	24.93	0.01	15.46	55.50
2004	69.44	10.46	0.09	14.11	4.28	26.33	0.01	16.32	58.61

2005	72.75	10.96	0.10	14.79	4.48	27.61	0.01	17.10	61.49
2006	76.09	11.47	0.10	15.48	4.69	28.90	0.01	17.88	64.39
2007	79.59	12.00	0.10	16.20	4.90	30.24	0.01	18.70	67.37
2008	83.70	12.62	0.11	17.04	5.16	31.81	0.01	19.67	70.86
2009	87.30	13.16	0.11	17.77	5.38	33.17	0.01	20.51	73.89
2010	91.49	13.79	0.12	18.62	5.64	34.76	0.01	21.50	77.42
2011	95.50	14.40	0.12	19.44	5.88	36.29	0.01	22.44	80.85
2012	100.51	15.16	0.13	20.47	6.19	38.22	0.01	23.61	85.14
2013	105.65	15.94	0.14	21.54	6.51	40.21	0.02	24.82	89.59
2014	101.75	14.99	0.10	15.13	4.59	33.80	0.01	25.25	96.17
2015	121.32	15.37	0.13	20.34	6.34	33.88	0.02	30.34	89.30
2016	134.03	18.38	0.13	22.53	6.37	36.32	0.02	32.24	89.30

The AD for **civil aviation** and **water-borne navigation** corresponds to the amount of fuel consumed by fuel type. Kerosene for civil aviation, and diesel and gasoline for water-borne navigation.

The following tables compiles the AD values used in the estimation of GHG emissions for the civil aviation and water-borne navigation from 2000 to 2016.

Table 42. Fuel consumed by Civil aviation, 2000 – 2016 (Gg fuel)

Years	Civil Aviation
	Kerosene (Jet Fuel)
2000	1.50
2001	1.59
2002	1.85
2003	1.97
2004	1.89
2005	1.69
2006	1.75
2007	1.96
2008	1.75
2009	1.33
2010	1.82
2011	1.99
2012	2.11
2013	2.17
2014	2.24
2015	2.66
2016	3.04

***Source**: Air Mauritius, Domestic flights between Mauritius Island and Rodrigues Island.*

Table 43. Fuel consumed by Water-borne navigation, 2000 – 2016 (Gg fuel)

Years	Water-borne Navigation	
	Gasoline	Diesel
2000	9.46	0.35
2001	10.03	0.37
2002	11.73	0.43
2003	12.48	0.46
2004	11.93	0.43
2005	10.69	0.39
2006	11.08	0.40
2007	12.40	0.45
2008	11.09	0.40
2009	10.87	0.40
2010	12.63	0.46
2011	13.61	0.50
2012	14.19	0.52
2013	14.66	0.53
2014	14.61	0.53
2015	17.32	0.63
2016	20.12	0.73

***Source**: Tourism Authority, Water-borne navigation.*

The AD was provided in terms of tonnes and then, using the NCV for each fuel type, this was converted to TJ. The NCV used in the national inventory are collected in the following table:

Table 44. Country Specific Net Calorific Values for fuels consumed in aviation and water-borne navigation (TJ/Gg)

Transport	Fuel type	Country Specific NCV
Aviation	Kerosene (Jet Fuel)	44.59
Water-borne navigation	Gasoline	44.8
	Diesel	43.3

***Source**: Digest of Energy and Water Statistics, 2018*

3.4.2.3 Emission Factors

Emission factors for the **road transport, civil aviation and water-borne navigation** are obtained from the proposed default values of the 2006 IPCC Guidelines, as shown in the table below:

Table 45. Emissions factors for the fuel used for the road transport (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Gasoline	69,300	33	3.2
Diesel	74,100	3.9	3.9
LPG	63,100	62	0.2

***Source**: Table 3.2.1 and 3.2.2, Chapter 3, Volume 2 of the 2006 IPCC Guidelines*

Table 46. Emissions factors for the fuel used for civil aviation (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Kerosene (Jet fuel)	71,500	0.5	2

***Source**: Table 3.6.4 and 3.6.5, Chapter 3, Volume 2 of the 2006 IPCC Guidelines*

Table 47. Emissions factors for the fuel used for water-borne navigation (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Gasoline	69,300	7	2
Diesel	74,100	7	2

***Source**: Table 3.5.2 and 3.5.3, Chapter 3, Volume 2 of the 2006 IPCC Guidelines*

3.4.3 Results

Aggregated emissions from the Transport Sector increased from 574.91 Gg CO_2eq in 2000 to 1,16.30 Gg CO_2eq in 2016, representing an increase of 103.4%.

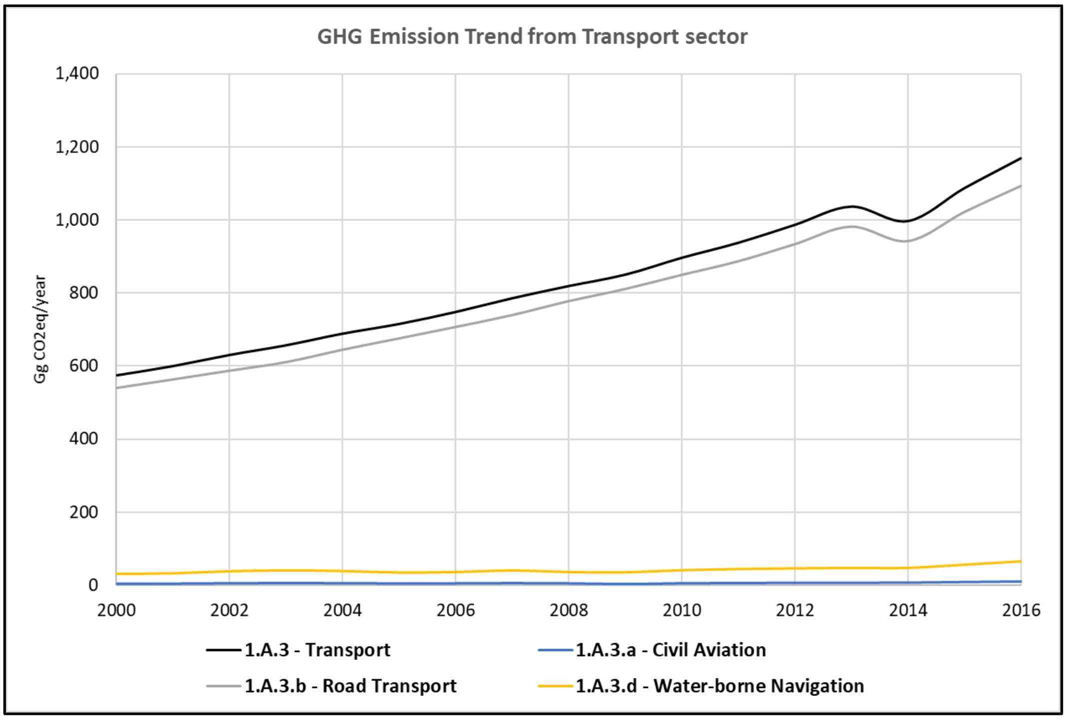


Figure 39. Evolution of the GHG Emissions from Transport Sector, 2000 – 2016 (Gg CO_2eq)

Table 48. GHG Emissions from Transport Sector, 2000 – 2016 (Gg CO_2eq)

Year	Total GHG Emissions for Energy Sector	Total GHG Emissions for Transport Sector	GHG Emissions for Civil Aviation	GHG Emissions for Road Transport	GHG Emissions for Water-borne Navigation	Emission Share for Transport (%)
2000	2,323.15	574.91	4.81	539.27	30.83	24.7%
2001	2,492.10	600.43	5.10	562.67	32.66	24.1%
2002	2,544.85	630.83	5.96	586.66	38.20	24.8%
2003	2,678.11	657.31	6.35	610.31	40.65	24.5%
2004	2,704.03	689.22	6.07	644.29	38.86	25.5%
2005	2,889.79	715.66	5.43	675.42	34.81	24.8%
2006	3,255.86	748.51	5.64	706.77	36.10	23.0%
2007	3,423.66	786.15	6.31	739.45	40.39	23.0%
2008	3,524.63	819.46	5.64	777.70	36.12	23.2%
2009	3,472.88	850.74	4.29	811.05	35.39	24.5%
2010	3,731.18	896.85	5.87	849.86	41.13	24.0%
2011	3,742.36	937.99	6.39	887.27	44.33	25.1%
2012	3,839.69	987.12	6.79	934.12	46.21	25.7%
2013	3,949.45	1,037.11	6.97	982.40	47.74	26.3%
2014	4,005.75	997.44	7.21	942.64	47.59	24.9%
2015	4,057.65	1,087.43	8.56	1,022.44	56.42	26.8%
2016	4,182.62	1,169.30	9.79	1,093.96	65.55	28.0%

3.4.4 Quality Control

To ensure the use of right data in the inventory, some of the QC implemented during the data collection and emission estimation are listed below:

- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for Manufacturing Industries.
- Cross verification between country specific NCV provided by institutional authorities and the NCV range proposed by the IPCC 2006 Guidelines.
- Cross verification between the GHG emissions estimated in the current inventory for transport sector and the results obtained in the last reported national inventory of the RoM.
- Cross verification between the Energy Balance data from NLTA, data provided by the NLTA regarding road transport fuel consumption and the information contained in the transport toolkit.

3.4.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Transport sector categories obtained from the 2006 IPCC software are reported in the following table for 2000 as base year:

Table 49. Uncertainty Analysis of the Transport category (1.A.3) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO_2	5.00	4.17	6.51
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH_4	5.00	100.00	100.12
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N_2O	5.00	150.00	150.08
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO_2	5.00	3.07	5.87
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH_4	5.00	244.69	244.74
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N_2O	5.00	209.94	210.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO_2	5.00	3.07	5.87
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH_4	5.00	244.69	244.74
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N_2O	5.00	209.94	210.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO_2	5.00	5.00	7.07
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH_4	5.00	25.00	25.50
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N_2O	5.00	60.00	60.21
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO_2	5,00	5,00	7,07
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH_4	5,00	5,00	7,07
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	5,00	5,00	7,07
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	5,00	3,07	5,87
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	5,00	244,69	244,74
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	5,00	209,94	210,00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO_2	5.00	4.30	6.60
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH_4	5.00	50.00	50.25
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N_2O	5.00	140.00	140.09

It is concluded from the tables above, that the greatest source of uncertainty corresponds to the emission factors due to the use of default factors and therefore to the absence of country specific factors.

3.4.6 Recalculations

For the road transport category, validated data on fuel consumption by each type of vehicle matriculated in the islands of Mauritius and Rodrigues for the years 2014, 2015 and 2016 was facilitated by the NLTA. For the rest of the time series (2000 – 2013) a recalculation has been made, maintaining a methodological consistency between the two time periods. For the 2000 – 2013 period, data on the number of vehicles by type, technology and fuel used is available from the NLTA. The NLTA data completion has been made using the average parameter values reported in the Excel tool, named Transport Toolkit v17.1, developed under the Third National Communication. The tool was used for the calculation of different proposed mitigation scenarios for the road transport sector. The parameters used from this toolkit were the average fuel consumption by type of vehicle and the average distance travelled by vehicle type. Number of vehicles, NCV values and fuel density values were considered from NLTA data.

In order ensure a complete consistency between the time period with direct data provided by the NLTA and the time period projected and estimated, the data of total number of vehicles matriculated in each island (Mauritius and Rodrigues) available by NLTA, was disaggregated in the same vehicle type by technology and fuel used as reported in the data from NLTA for the period 2014 – 2016.

In order to project the disaggregated values from 2000 to 2013 based on the real values of the period 2014-2016, these steps have been followed:

1. Projection of the total number of matriculated vehicles in each island from 2000 to 2016, using the best statistical adjustment which fit best considering data trend.
2. Calculating the average percentage by type of vehicle, technology and fuel consumption for years 2014, 2015 and 2016.
3. Multiplying each average percentage calculated in the above step by the total value of vehicles matriculated each year that was projected during the first step.
4. Multiplying number of vehicles matriculated by type of vehicle, technology and fuel used by the parameters collected in the tool for the period 2000 – 2013 (average distance travelled, and average consumed combustible by vehicle type) and the values provided by the NLTA such as NCV values for each fuel type and fuel densities, to obtain the total amount of combustible consumed by type of fuel.

The parameters considered for the estimates, disaggregated for each type of vehicle and fuel used (average fuel consumption for each vehicle and average distance travelled by each type of vehicle), have been obtained from the transport toolkit (this information is reported in detail in this section). Emission factors are obtained from the proposed default values of the 2006 IPCC Guidelines.

The activity data used for the estimation of GHG emissions of civil aviation has been re-estimated from the last inventory’s activity data. The activity data for 2008 to 2016 was obtained from Department of Civil Aviation, Air Mauritius Ltd, National Coastguard and the Police Helicopter Squadron. The rest of data values to complete the time series from 2000 to 2016, was estimated using the inter-annual variation data of tourist arrivals and departures available between 2000 and 2016, available by Statistics Mauritius, International Travel and Tourism. This inter annual variation was applied to their respective unknown jet fuel consumption year.

Activity data for water-borne navigation was recalculated too, considering the 2018 data reported by the Tourism Authority for Water-borne navigation. Data was obtained from the Mauritius Ports Authority, National Coast Guard, Mauritius Shipping Corporation Limited and the Tourism Authority. For the collection of the rest of values of the time series (2000-2016) the tourism inter-annual variation has been used (same method used for civil aviation). Furthermore, another recalculation has been made regarding the EF established for CH_4 and N_2O emissions for gasoline and diesel consumed in water-borne navigation. The previous emission inventory sets the same EF values for fuels in road transport and in water-borne navigation, however, according to IPCC 2006 Guidelines, these values should be different. In that sense, the EF values for the water-borne navigation have been updated and default values proposed for this category in IPCC 2006 Guidelines has been used (Gasoline: 7 tons CH_4/ton gasoline and 2 tons N_2O/ton gasoline; Diesel oil: 7 tons CH_4/ton diesel and 2 tons N_2O/ton diesel).

All these recalculations made have had an impact in estimated emissions between the past inventory edition (2000-2013) and the current one (2000-2016). An increase of a 25% has been noticed between the last and current inventory for year 2013.

3.4.7 Planned Improvements

In the transport sector, the country is working to obtain country specific EFs. This improvement could contribute to the achievement of a higher tier level. It will be necessary to recalculate the time series after the implementation of this new methodology to ensure the consistency of the time period.

On the other hand, it is planned to include data for number of vehicles matriculated in the Island of Rodrigues in the toolkit used to calculate and monitor the mitigation actions proposed in the transport sector.

It is planned to improve the accuracy of the activity data used for the transport sector in the country, especially for the road transport.

It is also planned to improve the data collection related to the domestic water-borne navigation sector and domestic aviation sector in the country, due to the lack of information concerning the energy consumption in this activity.

3.5 Other Sectors (Category 1A4)

The Other Sector category involves 1A4a Commercial/Institutional sector, 1A4b Residential and 1A4c Agriculture/Forestry/Fishing, this one is divided into 1A4cii Off-road Vehicles, Other Machinery and 1A4ciii Fishing (mobile combustion).

3.5.1 Source Category Description

Commercial or institutional activities use fossil fuel such as LPG and non-fossil fuels such as Charcoal for the development of their activities.

Residential sector use kerosene and LPG as fossil fuels and wood and charcoal as non-fossil fuels for cooking.

Agriculture/Forestry/Fishing category is divided into stationary and mobile combustion. Stationary combustion in this category is minimal and the mobile combustion uses diesel and gasoline as fossil fuels for field operations and fishing activities.

3.5.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for Other Sector, was a Tier 1 but using CS NCV. In this category, as mentioned in the previous section, fossil and non-fossil fuels are used in the combustion activities of this category. For that sense, and as reported in the 2006 IPCC Guidelines, CO_2 emissions from non-fossil fuels do not have to be accounted with the rest of CO_2 emissions from this category, in this case, they should be accounted as CO_2 emissions from biomass and taken as a memo item. The non-CO_2 emissions from non-fossil fuels must be accounted in the national totals.

To obtain the results of the GHG emissions from each fuel type used in the energy combustion activities of energy other sectors of the country, each fuel's activity data (AD), NCV and Emission Factor (EF) have been entered in the 2006 IPCC Inventory Software for the obtention of GHG emissions. The emission results for each fuel type have been aggregated to obtain the total amount of emissions.

3.5.2.1 Calculation

For the emission calculation, the equation 2.1 from Chapter 2. Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

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

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 2.1 are summed over all fuels.

3.5.2.2 Activity Data

The activity data used for the estimation of GHG emissions for Energy Other Sectors have been obtained from the amount of fuels consumed for the Commercial/Institutional sector, Residential sector and Agriculture/Forestry/Fishing sector, obtained from the Statistics Mauritius.

The amount of fuel consumed in those sectors, except in agriculture, are reported from 2000 to 2016 so no projections of the AD have been necessary for the estimation of the emissions for the inventory. For agriculture sector, the activity data was available from 2000 to 2006 and the projection was made considering the average inter-annual variation of the available activity data.

The following table compiles the AD values used in the estimation of GHG emissions for the Energy Other Sectors from 2000 to 2016.

Table 50. Fuel consumed by Energy Other Sectors, 2000 – 2016 (Gg Fuel)

Years	Commercial / Institutional		Residential			
	LPG	Charcoal	Kerosene	LPG	Wood	Charcoal
2000	4.15	0.30	9.60	37.71	16.00	0.15
2001	4.45	0.33	9.48	37.85	15.90	0.15
2002	4.56	0.34	8.41	39.02	15.85	0.13
2003	5.75	0.35	8.27	40.56	15.78	0.13
2004	6.37	0.36	8.73	42.86	15.94	0.12
2005	6.99	0.38	9.77	43.21	16.54	0.13
2006	11.44	0.39	3.92	41.60	17.47	0.12
2007	10.93	0.41	1.24	42.09	17.50	0.13
2008	10.09	0.42	1.77	42.39	16.73	0.12
2009	10.58	0.44	1.48	43.24	16.62	0.12
2010	10.93	0.45	1.73	44.06	16.60	0.12
2011	11.26	0.47	0.52	44.64	16.34	0.12
2012	11.92	0.47	0.24	45.33	16.00	0.11
2013	13.29	0.48	0.20	46.36	15.47	0.11
2014	14.03	0.50	0.15	47.57	14.53	0.10
2015	15.10	0.45	0.13	49.09	13.63	0.10
2016	16.08	0.42	0.07	49.46	13.56	0.10

Years	Agriculture	Fishing	
	Diesel	Gasoline	Diesel
2000	2.46	8.93	1.63
2001	2.79	9.04	1.62
2002	2.75	9.10	1.49
2003	2.93	11.64	1.78
2004	3.15	8.91	1.87
2005	3.00	9.36	1.67
2006	3.05	10.01	1.52
2007	3.10	9.85	1.71
2008	3.16	12.54	2.17
2009	3.22	14.33	2.48
2010	3.27	14.56	2.52
2011	3.33	15.45	2.68
2012	3.39	13.21	2.29
2013	3.46	11.20	1.94
2014	2.28	11.65	2.02
2015	2.31	12.32	2.13
2016	2.27	11.65	2.02

Source: *Statistics Mauritius*

The AD was provided in terms of Gg and then, using the NCV for each fuel type, this was converted to TJ. The NCV used in the national inventory are collected in the following table:

Table 51. Country Specific Net Calorific Values for fuels consumed in Energy Other Sectors (TJ/Gg)

Fuel type	Country Specific NCV
Diesel	43.3
Gasoline	44.8
LPG	47.3
Charcoal	29.5
Wood	15.6
Kerosene	43.54

***Source**: Digest of Energy and Water Statistics, 2018*

3.5.2.3 Emission Factors

The Emission Factors used for the estimation of the GHG emissions of the energy other sectors are adopted from the default values proposed in the 2006 IPCC Guidelines, as shown in the table below:

Table 52. Emissions factors for the fuel used for the Commercial/Institutional sector from Energy Other Sectors (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
LPG	63,100	5	0.1
Charcoal	112,000	200	1

***Source**: Table 2.4, Chapter 2, Volume 2 of the 2006 IPCC Guidelines*

Table 53. Emissions factors for the fuel used for the Residential (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Kerosene	71,900	10	0.6
LPG	63,100	5	0.1
Charcoal	112,000	200	1
Wood	112,000	300	4

***Source**: Table 2.5, Chapter 2, Volume 2 of the 2006 IPCC Guidelines*

Table 54. Emissions factors for the fuel used for the Agriculture/Forestry/Fishing sector from Energy Other Sectors (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Diesel	74,100	10	0.6
Gasoline	69,300	10	0.6
LPG	63,100	5	0.1

***Source**: Table 2.5, Chapter 2, Volume 2 of the 2006 IPCC Guidelines*

3.5.3 Results

Aggregated emissions from Other Sectors increased from 198.41 Gg CO_2eq in 2000 to 248.10 Gg CO_2eq in 2016, representing an increase of 25.04%.

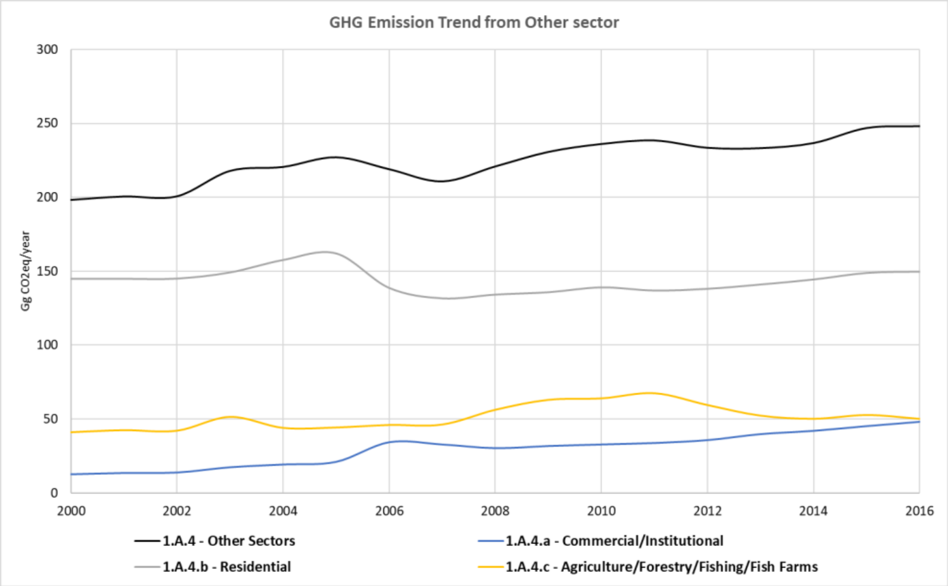


Figure 40. Evolution of the GHG Emissions from Other Sectors, 2000 – 2016 (Gg CO_2eq)

Table 55. GHG Emissions from Energy Other sectors, 2000 – 2016 (Gg CO_2eq)

Year	Total GHG Emissions for Energy Sector	Total GHG Emissions for Other Sectors	GHG Emissions for Commercial	GHG Emissions for Residential	GHG Emissions for Agriculture / Fishing	Emission Share for Other sectors (%)
2000	2,323.15	198.41	12.45	144.91	41.05	8.5%
2001	2,492.10	200.74	13.35	144.94	42.45	8.1%
2002	2,544.85	200.83	13.68	145.07	42.08	7.9%
2003	2,678.11	217.96	17.24	149.20	51.52	8.1%
2004	2,704.03	220.65	19.11	157.54	44.00	8.2%
2005	2,889.79	227.16	20.94	161.93	44.28	7.9%
2006	3,255.86	219.09	34.26	138.85	45.99	6.7%
2007	3,423.66	210.88	32.74	131.86	46.29	6.2%
2008	3,524.63	220.97	30.25	134.36	56.36	6.3%
2009	3,472.88	230.77	31.69	135.94	63.14	6.6%
2010	3,731.18	236.09	32.74	139.20	64.15	6.3%
2011	3,742.36	238.46	33.74	137.08	67.64	6.4%
2012	3,839.69	233.54	35.71	138.24	59.59	6.1%
2013	3,949.45	233.30	39.80	141.14	52.37	5.9%
2014	4,005.75	236.75	42.02	144.49	50.23	5.9%
2015	4,057.65	246.87	45.22	148.87	52.78	6.1%
2016	4,182.62	248.10	48.16	149.75	50.18	5.9%

3.5.4 Quality Control

In order to ensure the use of right data in the inventory. Some of the QC implemented during the data collection and emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for energy other sectors.
- Cross verification between country specific NCV provided by institutional authorities and the NCV range proposed by the IPCC 2006 Guidelines.
- Cross verification between the GHG emissions estimated in the current inventory for energy other sectors and the results obtained in the last reported national inventory of the RoM.

3.5.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Other sector categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 56. Uncertainty Analysis of Other sectors category (1.A.4) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO_2	5.00	6.14	7.92
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH_4	5.00	200.00	200.06
1.A.4.a - Commercial/Institutional - Liquid Fuels	N_2O	5.00	228.79	228.84
1.A.4.a - Commercial/Institutional - Biomass	CO_2	5.00	18.69	19.35
1.A.4.a - Commercial/Institutional - Biomass	CH_4	5.00	227.27	227.33
1.A.4.a - Commercial/Institutional - Biomass	N_2O	5.00	297.73	297.77
1.A.4.b - Residential - Liquid Fuels	CO_2	5.00	6.14	7.92
1.A.4.b - Residential - Liquid Fuels	CH_4	5.00	200.00	200.06
1.A.4.b - Residential - Liquid Fuels	N_2O	5.00	236.36	236.42
1.A.4.b - Residential - Biomass	CO_2	5.00	18.69	19.35
1.A.4.b - Residential - Biomass	CH_4	5.00	227.27	227.33
1.A.4.b - Residential - Biomass	N_2	5.00	297.73	297.77

	O			
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CO_2	5.00	6.14	7.92
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CH_4	5.00	200.00	200.06
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	N_2O	5.00	236.36	236.42
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO_2	5.00	6.14	7.92
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH_4	5.00	200.00	200.06
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N_2O	5.00	236.36	236.42

It is concluded from the tables above, that the greatest source of uncertainty corresponds to the emission factors due to the use of default factors and therefore to the absence of country specific factors.

3.5.6 Recalculations

Unlike the previous inventory, the activity data used in this sector has been disaggregated into different activities (commercial/institutional, residential and agriculture/forestry/fishing). Besides, the activity data used for considering agriculture/forestry/fishing has been recalculated using values from the TNC. In the last developed inventory, the activities considered in this sector were commercial/institutional and residential activities; in this current inventory besides these activities, others such as agriculture and fishing have been considered. For this reason, the GHG emissions have increased compared to the previous inventory edition.

The recalculation made in the Energy Other Sector category corresponds to the modification of the CH_4 EF used for the kerosene in the residential sector, which was considered as 3 kg CH_4/TJ. Knowing that the EF used for the estimation of the GHG emissions were adopted from the default EF values proposed in the IPCC 2006 Guidelines, it was decided to change that value for the correct one of 10 kgCH_4/TJ.

Before these recalculations, no big differences have been observed with the last developed inventory in terms of GHG emissions estimations. In this sense, an increase of a 2% of the emissions estimated in the year 2013 has been noticed.

3.5.7 Planned Improvements

A potential improvement regarding this category could be encouraging the suppliers to keep track of fuel sales for monitoring the GHG emissions.

The fossil fuels consumed in this category could be improved by having different NCV values every year.

3.6 Non-Specified Sector (Category 1A5)

The Other Sector category considers the non-specified fuel consumptions within the Energy sector in the country. These fuel consumptions are consumed in stationary combustion (1A5a).

3.6.1 Source Category Description

The use of LPG fuel as Other quantities consumed since 2013 are reported in the Digest of Energy and Water Statistics, 2018. Nevertheless, not enough information is collected in the in this report with respect to the other category. For that reason, the amount of fuel consumed in this category has been considered as non-specified sector.

The following figure is obtained from the Energy and Water report of the Statistics Mauritius for the year 2016. As it is shown in the figure, a small quantity of fuel is consumed in Other sector, which is not specified.

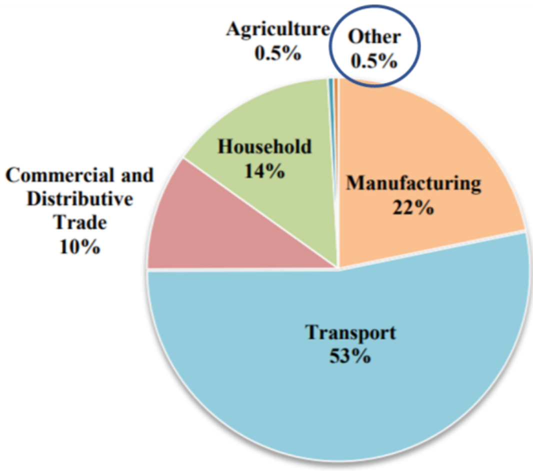


Figure 41. Final Energy consumption by sector in 2016.

Source*: Digest of Energy and Water Statistics, 2018*

3.6.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for Non-Specified Sector, was a Tier 1 but using CS NCV.

3.6.2.1 Calculation

For the emission calculation, the equation 2.1 from Chapter 2. Volume 2 of the 2006 IPCC Guidelines was used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel}\ x\ Emission\ Factor_{GHG.fuel}$$

Where:

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

To calculate the total emission by gas from the source category, the emissions as calculated in Equation 2.1 are summed over all fuels.

3.6.2.2 Activity Data

The activity data used for the estimation of GHG emissions for Non-Specified Sector have been obtained from the amount of fuels consumed for Other categories, obtained from the Ministry of Environment.

The amount of fuel consumed in this sector is reported since 2013, reporting that before 2013 no fuel consumed in this category was identified.

The following table compiles the AD values used in the estimation of GHG emissions for the Non-Specified Sector from 2000 to 2016.

Table 57. Fuel consumed by Non-Specified Sectors, 2000 – 2016 (Gg Fuel)

Years	LPG
2000	NO
2001	NO
2002	NO
2003	NO
2004	NO
2005	NO
2006	NO
2007	NO
2008	NO
2009	NO
2010	NO
2011	NO
2012	NO
2013	0.26
2014	0.27
2015	0.29
2016	0.29

***Source**: Digest of Energy and Water Statistics, 2018*

The AD was provided in terms of Gg and then, using the NCV for LPG, this was converted to TJ. The NCV used in the national inventory are collected in the following table:

Table 58. Country Specific Net Calorific Values for fuels consumed in Non-Specified Sector (TJ/Gg)

Fuel type	Country Specific NCV
LPG	47.3

***Source**: Digest of Energy and Water Statistics, 2018*

3.6.2.3 Emission Factors

The Emission Factors used for the estimation of the GHG emissions of the non-specified sector are adopted from the default values proposed in the 2006 IPCC Guidelines, as shown in the table below:

Table 59. Emissions factors for the fuel used for Non-Specified Sectors (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
LPG	63,100	5	0.1

Source: *Table 2.4, Chapter 2, Volume 2 of the 2006 IPCC Guidelines*

3.6.3 Results

Aggregated emissions from Non-Specified Sectors started occurring in 2013. Emissions increased by 13% from 0.77 Gg CO_2eq in 2013 to 0.87 Gg CO_2eq in 2016.

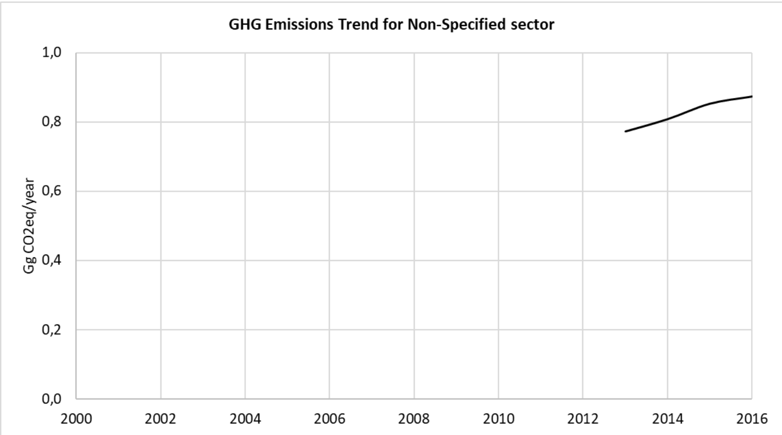


Figure 42. Evolution of the GHG Emissions from Non-Specified Sectors, 2000 – 2016 (Gg CO_2eq)

Table 60. GHG Emissions from Non-Specified Sector, 2000 – 2016 (Gg CO_2eq)

Year	Total GHG Emissions for Energy Sector	GHG Emissions for Non-Specified sector	Emission Share for Other sectors (%)
2000	2,323.15	NO	NO
2001	2,492.10	NO	NO
2002	2,544.85	NO	NO
2003	2,678.11	NO	NO
2004	2,704.03	NO	NO
2005	2,889.79	NO	NO
2006	3,255.86	NO	NO
2007	3,423.66	NO	NO
2008	3,524.63	NO	NO
2009	3,472.88	NO	NO
2010	3,731.18	NO	NO
2011	3,742.36	NO	NO

2012	3,839.69	NO	NO
2013	3,949.45	0.77	0.02%
2014	4,005.75	0.81	0.02%
2015	4,057.65	0.85	0.02%
2016	4,182.62	0.87	0.02%

3.6.4 Quality Control

In order to ensure the use of right data in the inventory. Some of the QC implemented during the data collection and emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for energy other sectors.
- Cross verification between country specific NCV provided by institutional authorities and the NCV range proposed by the IPCC 2006 Guidelines.

3.6.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Other sector categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 61. Uncertainty Analysis of Non-Specified sector category (1.A.5) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.5.a - Stationary - Liquid Fuels	CO_2	5.00	5.00	7.07
1.A.5.a - Stationary - Liquid Fuels	CH_4	5.00	5.00	7.07
1.A.5.a - Stationary - Liquid Fuels	N_2O	5.00	5.00	7.07

It is concluded from the tables above, that not great uncertainty is obtained from the category, probably due to the non-significant amount of fuel consumed.

3.6.6 Recalculations

Unlike the previous inventory, the activity data used in this sector has been considered for the first time. This activity data has been reported in the Energy and Water Statistics since 2013 but it has not been included in the GHG National Inventory since now.

The amount of fuel consumed in this category is insignificant compared to the quantities consumed in the rest of categories of the energy sector. Nevertheless, it is necessary to consider this fuel quantities properly in the GHG inventory in order to ensure the completeness of the Inventory.

3.6.7 Planned Improvements

A potential improvement regarding this category could be the information gathering, in order to determine the type of activities where this fuel has been consumed.

The fossil fuel consumed in this category could be improved by having different NCV values every year.

3.7 Memo Items

The Memo Items category comprises two main categories:

- Category 1.A.3.a.i. International Aviation
- Category 1.A.3.d.i. International Water-borne Navigation

All emissions from fuels used for international aviation (bunkers) and multilateral operations pursuant to the Charter of UN are to be excluded from national totals and reported separately as memo items.

3.7.1 Source Category Description

The information for international travels by air and water-borne navigation has been gathered from the International Energy Agency due to a lack of specific information in the national statistics.

Energy consumption in international aviation consists of on jet kerosene consumption, while in international water-borne navigation comprises diesel and fuel oil consumption.

3.7.2 Methodological Issues

The considered approach for the estimation of GHG Emissions for International aviation and water-borne navigation, was a Tier 1.

3.7.2.1 Calculation

For the emission calculation, the equation 2.1 from Chapter 2. Volume 2 of the 2006 IPCC Guidelines has been used.

$$Emissions_{GHG.fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG.fuel}$$

Where:

$Emissions_{GHG.fuel}$ =	emissions of a given GHG by type of fuel (kg GHG)
$Fuel\ Consumption_{fuel}$ =	amount of fuel consumed (TJ)
$Emission\ Factor_{GHG.fuel}$ =	default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO_2 it includes the carbon oxidation factor, assumed to be 1.

To calculate the total emissions by gas, the emissions calculated with Equation 2.1 are summed over all fuels.

3.7.2.2 Activity Data

The activity data used for the estimation of GHG emissions for Memo Items have been obtained from the International Energy Agency (IEA)[3].

The amount of fuel consumed in this sector is reported for the whole period, from 2000 to 2016.

The following table compiles the AD values used in the estimation of GHG emissions for the Memo Items from 2000 to 2016.

Table 62. Fuel consumed by Memo Items (International Aviation and Water-borne Navigation, 2000 – 2016 (Gg Fuel)

Years	International Aviation	International Water-borne Navigation	
	Jet Kerosene	Diesel	Fuel Oil
2000	192	160	58
2001	196	157	44
2002	198	139	27
2003	209	98	35
2004	221	105	40
2005	229	135	55
2006	236	122	49
2007	250	118	76
2008	252	117	96
2009	208	109	108
2010	229	113	123
2011	242	100	185
2012	249	103	163
2013	230	114	156
2014	242	117	171
2015	259	116	167
2016	291	120	217

Source: *International Energy Agency (IEA).*

The AD was provided in terms of Gg and then, using the NCV default values for jet kerosene, diesel and fuel oil, this was converted to TJ.

The NCV used in the national inventory are collected in the following table:

Table 63. Country Specific Net Calorific Values for fuels consumed in aviation and water-borne navigation (TJ/Gg)

Transport	Fuel type	Country Specific NCV
International Aviation	Kerosene (Jet Fuel)	40.1
International Water-borne navigation	Fuel oil	40.4
	Diesel	43

Source: *Digest of Energy and Water Statistics, 2018*

[3] Information available in the following link: https://www.iea.org/data-and-statistics/data-tables?country=MAURITIUS

3.7.2.3 Emission Factors

Emission factors for the international aviation and international water-borne navigation are obtained from the default values of the 2006IPCC Guidelines, as shown in the table below:

Table 64. Emissions factors for the fuel used for civil aviation (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Kerosene (Jet fuel)	71,500	0.5	2

***Source**: Table 3.6.4 and 3.6.5, Chapter 3, Volume 2 of the 2006 IPCC Guidelines.*

Table 65. Emissions factors for the fuel used for water-borne navigation (kg GHG/TJ)

Fuel type	EF CO_2 (kg CO_2/TJ)	EF CH_4 (kg CH_4/TJ)	EF N_2O (kg N_2O/TJ)
Fuel oil	77,400	7	2
Diesel	74,100	7	2

***Source**: Table 3.5.2 and 3.5.3, Chapter 3, Volume 2 of the 2006 IPCC Guidelines*

3.7.3 Results

Emissions from Memo items increased from 1,308.99 Gg CO_2eq in 2000 to 1,997.25 Gg CO_2eq in 2016, representing an increase of 52.6%.

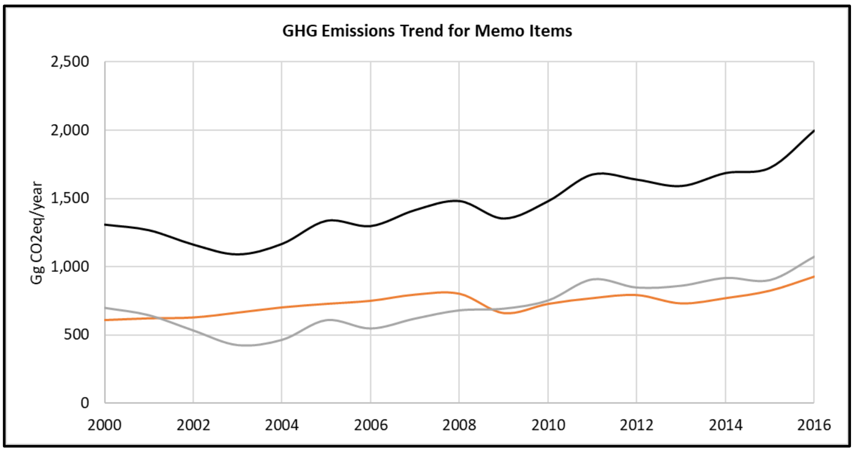


Figure 43. Evolution of the GHG Emissions from Non-Specified Sectors, 2000 – 2016 (Gg CO_2eq)

Table 66. GHG Emissions from Memo Items, 2000 – 2016 (Gg CO_2eq)

Year	Total GHG Emissions for International Aviation	GHG Emissions for International Navigation	Total GHG Emissions for Memo Items
2000	610.74	698.25	1,308.99
2001	623.47	644.38	1,267.84
2002	629.83	532.74	1,162.57
2003	664.82	426.02	1,090.84

2004	702.99	464.34	1,167.33
2005	728.44	608.29	1,336.73
2006	750.71	547.49	1,298.20
2007	795.24	619.88	1,415.12
2008	801.60	679.82	1,481.42
2009	661.64	691.96	1,353.60
2010	728.44	752.21	1,480.64
2011	769.79	906.15	1,675.94
2012	792.06	846.33	1,638.39
2013	731.62	859.64	1,591.26
2014	769.79	916.66	1,686.46
2015	823.87	900.81	1,724.68
2016	925.66	1071.59	1,997.25

3.7.4 Quality Control

The information has been obtained from the IEA and is not available as part of the national statistics (national energy balance), for that reason, no Quality Controls have been possible to be carried out.

3.7.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Memo Item categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 67. Uncertainty Analysis of Memo Item category (1.A.3.a.i and 1.A.3.d.i) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.3.a.i - International Aviation (International Bunkers) – Liquid Fuels	CO_2	5.00	4.17	6.51
1.A.3.a.i - International Aviation (International Bunkers) – Liquid Fuels	CH_4	5.00	100	100.12
1.A.3.a.i - International Aviation (International Bunkers) – Liquid Fuels	N_2O	5.00	150	150.08
1.A.3.d.i – International water-borne navigation (International bunkers) – Liquid Fuels	CO_2	5.00	4.30	6.60
1.A.3.d.i – International water-borne navigation (International bunkers) – Liquid Fuels	CH_4	5.00	50	50.25
1.A.3.d.i – International water-borne navigation (International bunkers) – Liquid Fuels	N_2O	5.00	140	140.09

It is concluded from the table above, that the greatest source of uncertainty corresponds to the emission factors due to the use of default factors.

3.7.6 Recalculations

Only GHG emissions from international aviation sector were considered in the last national inventory developed for the Third National Communication.

For the current national inventory, emissions from memo items have been estimated considering data reported in the International Energy Agency.

3.7.7 Planned Improvements

As it has previously mentioned, data for these activities are not available in national statistics nor through the national energy balance. The improvement for next inventory cycle would be the analysis and study about how to acquire the data from national statistics and include them as part of the national energy balance. This information should be aligned with the information reported by the IEA.

3.8 Reference Approach

3.8.1 Description

The reference approach is a top-down approach carried out using country's energy balance data to calculate the GHG emissions related to the consumption of fossil fuels. This analysis allows the production of a second independent estimate of CO_2 emissions from fuel combustion with limited additional effort and data requirements.

As detailed in the 2006 IPCC Guidelines, it is a good practice to apply both the sectoral and reference approach to estimate a country's CO_2 emissions from fuel combustion and to compare the results of these two independent estimates. Significant differences may indicate possible problems with the energy balance, activity data, net calorific values, carbon content, excluded carbon calculation, etc.

The 2006 IPCC Guidelines consider that for countries with a well-developed statistical system the comparison between sectoral and reference approach could be in range of ±5% for a given fuel. For countries with a less well-developed energy data system, this could be considerably larger, probably about ±10%.

3.8.2 Methodological Issues

For the calculation of reference approach emissions, the equation 6.1 from Chapter 6. Volume 2 of the 2006 IPCC Guidelines was used.

$$CO_2\ Emissions = \sum_{all\ fuels} \begin{bmatrix} ((Apparent\ Consumption_{fuel} \bullet Conv\ Factor_{fuel} \bullet CC_{fuel}) \bullet 10^{-3} \\ - Excluded\ Carbon_{fuel}) \bullet COF_{fuel} \bullet 44/12 \end{bmatrix}$$

Where:

The apparent consumption is calculated following the equation 6.2 from Chapter 6, Volume 2 of the 2006 IPCC Guidelines.

$$Apparent\ Consumption_{fuel} = Production_{fuel} + Imports_{fuel} - Exports_{fuel} - International\ Bunkers_{fuel} - Stock\ Change_{fuel}$$

The conversion factors used in the reference approach are the same factors used in the sectoral approach. For carbon content and fraction of carbon oxidized, default factors proposed by 2006 IPCC Guidelines have been used.

No production of fuels is recorded in the country, and the imports of fuels reported in the energy balance of the country only includes the imports related to the local consumption. Some re-exports and stock change of fuel are reported in the country every year regarding the information available in the energy balance.

3.8.3 Results

The IPCC software has been used to estimate and develop the reference approach. Regarding the results obtained, some possible improvements could be considered.

A summary of the results obtained from the reference approach is reported in the following table.

	2000	2006	2010	2016
Total difference for Energy Consumption	23.04%	-8.26%	10.19%	9.05%
Total difference for CO_2 emissions	21.18%	-7.23%	8.93%	7.97%

The percentage of comparison between sectoral and reference approach for the period between 2007 and 2016 is within the range proposed in the IPCC Guidelines. On the other hand, the previous years present comparison percentages of ±10-25%. Several considerations have been identified that could explain the comparison percentages obtained in the reference approach analysis:

- The data obtained, for the manufacturing and construction industry from the country considered several fuel consumptions that were not identified in the energy balance of the country. It is recommended to check the energy balance with the responsible authority in the information gathering and the responsible authority for the manufacturing and construction industry, in order to report the more accurate data.
- Same happened with several fuel consumptions in the Energy Other Sectors category, due to the inclusion of more updated data from Agriculture, Forestry and Fishing.
- It will be therefore necessary to review and update the information contained in the energy balance.

4. Industrial Processes and Product Use (IPPU)

4.1 Overview

Greenhouse gas emissions are produced from a wide variety of industrial activities. The main emission sources are releases from industrial processes that chemically or physically transform materials. During these processes, many different greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and other fluorinated compounds such as trifluoromethyl sulphur pentafluoride (SF_5CF_3) can be produced and emitted.

In addition, greenhouse gases often are used in products such as refrigerators, foams or aerosol cans. For example, HFCs are used as alternatives to ozone depleting substances (ODS) in various types of product applications. Similarly, sulphur hexafluoride (SF_6) and N_2O are used in a number of products used in industry or by end-consumers.

The main emission sources for the IPPU sector in RoM are the Product Uses as Substitutes for Ozone Depleting Substances (90.7%), followed by the Metal Industry, constituted by iron and steel production industries, construction iron and steel bars (6.9%), Non-Energy products from fuels and solvent use which represent a 2.5% of the emissions of the sector and lime production (0.3% in 2014, 0% in 2016). The main GHG emitted in this sector is carbon dioxide (CO_2). A summary of the trends for this category is included in Chapter 2.

4.1.1 General Methodology

The methodology used to estimate the GHG emissions of the IPPU sector are highlighted in the table below. This table contains information about the tier level used in each IPPU sector category, conversion factor used, and the source of activity data used for the development of the National Inventory.

Table 68. Methodology used for the IPPU Sector

Category	Activity Data	Emission Factor	Activity Data Source
2.A. Mineral Industry			
2.A.2. Lime production	T2	D (CO_2)	Statistics Unit of the ESDD[4] facilitated by the institutional authority via mail
2.B. Chemical Industry			
2.B. Chemical Industry	NO	NO	-
2.C. Metal Industry			
2.C.1. Iron and Steel production	T2	D (CO_2)	Statistics Unit of the ESDD facilitated by the institutional authority via mail
2.D. Non-Energy Products from Fuels and Solvent Use			
2.D. Non-Energy Products from Fuels and Solvent Use	X	D (CO_2)	International Energy Agency (IEA)
2.E. Electronics Industry			
2.E. Electronics Industry	NO	NO	-
2.F. Product Uses as Substitutes for Ozone Depleting Substances (ODS)			

[4] Environmental and Sustainable Development Division

2.F.1. Refrigeration and Air Conditioning			
2.F.1.a. Refrigeration and Stationary Air Conditioning	T1	D (HFCs)	Statistics Unit of the ESDD facilitated by the institutional authority via mail
2.F.1.b. Mobile Air Conditioning	T1	D (HFCs)	Statistics Unit of the ESDD facilitated by the institutional authority via mail
2.G. Other Product Manufacture and Use			
2.G. Other Product Manufacture and Use	NO	NO	-
2.H. Other			
2.H. Other	NO	NO	-

4.2 Mineral Industry – Lime Production (Category 2A2)

In the category of mineral industry, only lime production activities were carried out in RoM. The lime production involving a series of steps, including the quarrying of raw materials, crushing and sizing, calcining the raw materials to produce lime, and (if required) hydrating the lime to calcium hydroxide. Shafts or rotary kilns are used to heat limestone at high temperatures in order to decompose the carbonates. Calcium oxide (CaO) or quick lime is formed. This process releases carbon dioxide (CO_2).

4.2.1 Source Category Description

During the inventory period (2000 – 2016), there was only one manufacturer, which does the quarrying of the raw material and processing it into hydrated lime. This manufacture ceased its operation in 2014, so in 2015 and 2016 the emissions from this category are null. In RoM, lime is mainly used in the sugar factories to remove impurities from the raw cane juice. Any excess lime is then removed through carbonation.

4.2.2 Methodological Issues

4.2.2.1 Calculation

There are 3 general levels of complexity and detail of methods defined in IPCC 2006 Guidelines.

- **Tier 1:** the simplest approach and uses IPCC default values. This method is defined to be used where limited activity data is available.
- **Tier 2:** involves the simple methods but include the use of country specific emission factors
- **Tier 3:** the most complex and cover the use of models or plant specific data to generate accurate GHG emission estimates.

According to the 2006 IPCC Guidelines, the Tier 1 method is based on applying default emission factors to national level lime production data.

The methodology adopted for GHG emissions estimation consist on multiplying activity data (AD) by the relevant appropriate emission factor (EF).

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

To use a common unit for GHG emissions. the IPCC recommends the use of Global Warming Potentials (GWP) to convert GHG emissions other than CO_2 to the latter equivalent, CO_2 equivalent (CO_2e). The GWP values used in the current inventory are those adopted from the Second Assessment Report (SAR) as collected in the following table for each GHG reported in the National Inventory.

4.2.2.2 Activity Data

Activity data for years 2000-2016 were obtained from the Statistics Mauritius.

Table 69. Lime Production in RoM (2000 – 2016)

Years	Lime produced (tons)
2000	4,669
2001	4,573
2002	4,190
2003	3,981
2004	3,249
2005	3,340
2006	3,450
2007	2,441
2008	2,309
2009	3,298
2010	3,654
2011	2,315
2012	3,037
2013	2,188
2014	1,360
2015	NO
2016	NO

Source: *Statistics Mauritius*

4.2.2.3 Emission Factors

Tier 1 method, being an output-based method, applies an emission factor to the total quantity of lime produced. Based on information obtained from the lime manufacturer, the type of lime produced is hydrated lime and the EF adopted from the 2006 IPCC Guidelines is 0.59.

4.2.3 Results

GHG emissions from the Lime Production decreased from 2.75 Gg CO_2-eq in the year 2000 to 0.80 Gg CO_2-eq in 2014, which represented a decrease of 70.91%. This was mainly due to a significant decrease in the production of hydrated lime as most of the sugar manufacturers in RoM import lime from other countries to refine their sugar produced. The share for Lime Production decreased from 3.0% to 0.4% in the IPPU Sector during the same period.

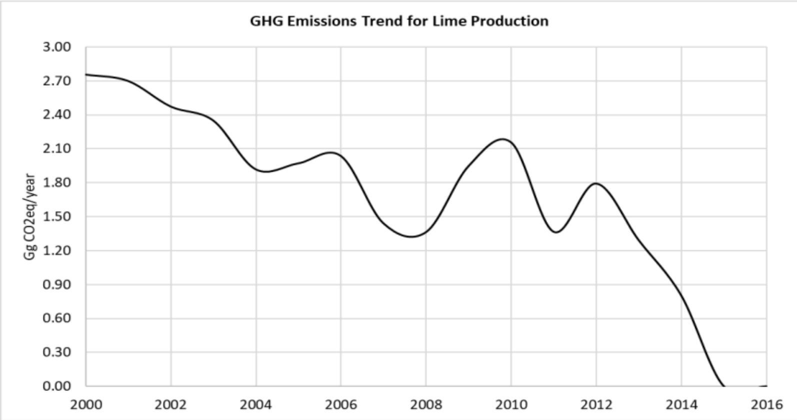


Figure 44. Evolution of the GHG Emissions from Lime Production, 2000 – 2016 (Gg CO_2eq)

Table 70. GHG Emissions (Gg CO_2eq) from Lime Production, 2000 – 2016

Years	Total emissions for IPPU	Lime production emissions	Share for Lime Production (%)
2000	70.32	2.75	3.92%
2001	73.46	2.70	3.67%
2002	76.15	2.47	3.25%
2003	78.88	2.35	2.98%
2004	81.25	1.92	2.36%
2005	113.16	1.97	1.74%
2006	108.04	2.04	1.88%
2007	103.25	1.44	1.39%
2008	125.87	1.36	1.08%
2009	139.56	1.95	1.39%
2010	151.71	2.16	1.42%
2011	193.95	1.37	0.70%
2012	214.43	1.79	0.84%
2013	300.00	1.29	0.43%
2014	300.78	0.80	0.27%
2015	300.96	0.00	0.00%
2016	311.18	0.00	0.00%

4.2.4 Quality Control

Some quality control activities were implemented in order to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for IPPU sector.

- Cross verification between the GHG emissions estimated in the current inventory for the IPPU sector and the results obtained in the last reported national inventory of the RoM.

4.2.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Mineral Industry sector categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 71. Uncertainty Analysis of Lime Production category (2.A.2) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
2.A.2 - Lime production	CO_2	15.00	0.00	15.00

4.2.6 Recalculations

The activity data used in this sector regarding the amount of lime production in the country has been improved using more accurate data from the Statistics Mauritius.

Due to the improvement related to the accuracy of the activity data used for the present inventory, a decrease of a 16% of the emissions estimated in the year 2013 has been reported, compared to the emissions reported in the last inventory (from the 1.5 Gg CO_2eq emissions estimated in the last inventory for the year 2013, to the 1.29 Gg CO_2eq emissions reported in the current inventory for the same year).

4.2.7 Planned Improvements

Considering this activity has not occurred since 2014, there are no planned improvements.

4.3 Metal Industry – Iron and Steel Production (Category 2C1)

In this category, only the iron and steel manufacturing (2C1) was occurring in RoM. According to Volume 3 of the 2006 IPCC Guidelines, the iron and steel industry broadly consist of: primary facilities that produce both iron and steel; secondary steelmaking facilities; iron production facilities; and offsite production of metallurgical coke.

4.3.1 Source Category Description

In RoM, all iron and steel production is manufactured from the recycling of ferrous scrap metals. The scrap metals are firstly segregated by magnets in a shed and then sent to a furnace operating at 1,800ºC to be melted. High quality fluxes, imported by the manufacturer, are used to purify the melt. High strength and superior quality steel ingots are produced. These steel ingots are then used as raw material in the steel rolling mill to finally produce steel construction bars.

According to the information facilitated from the Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division), there are 4 industries under operation for iron production and 2 others that stopped their production between 2015 and 2016.

Table 72. Metal Industry Companies

Company name	Description	Status
SAMLO – KOYENCO STEEL LTD	Manufacture of iron bars	Operational as at June 2019
MRC WIRE PRODUCTS LTD	Manufacture of welded mesh	Operational as at June 2019
KOSTO LTD	Cut and bend iron bars for reinforcement concrete	Operational as at June 2019
METAL SHEETS INDUSTRIES LTD	Manufacture of corrugated iron sheets	Operational as at June 2019
SAMLO & SONS CO. LTD	Processing and export of scrap metals	Dormant as from 2015
APPOLLO TUBES	Manufacture of steel tubes, pipes, open door profile and nails	Winding up as from 2016

***Source**: Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division)*

4.3.2 Methodological Issues

4.3.2.1 Calculation

Emissions per unit of steel production varied widely, depending on the method of steel production. According to the 2006 IPCC Guidelines, it is good practice to determine the share of steel produced in different types of steel making processes.

According to the 2006 IPCC Guidelines, the Tier 1 approach for emissions from iron and steel production was adopted.

The methodology adopted for GHG emissions estimation consists of multiplying activity data (AD) by the relevant appropriate emission factor (EF).

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

To use a common unit for GHG emissions, the IPCC recommends the use of Global Warming Potentials (GWP) to convert GHG emissions other than CO_2 to the latter equivalent. CO_2 equivalent (CO_2e). The GWP values used in the current inventory are those adopted from the Second Assessment Report (SAR) as collected in the following table for each GHG reported in the National Inventory.

4.3.2.2 Activity Data

Activity data, as shown in table below, for 2009 – 2016 was obtained from the Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division). To complete the data for the whole time series, the best adjust has been used to estimate data from 2000 to 2008 according to the Gross Output Value (GOV) from the metal industry. This GOV is available for the years 2002, 2007 and 2013, in this way, the rest of the values are obtained interpolating the iron and steel production values for the years 2007 and 2002 (according to the GOV values for those years and the known value for 2013).

Table 73. Iron and Steel Production (2000 – 2016)

Years	Iron and Steel Produced (tons)
2000	18,462.80
2001	19,079.13
2002	19,716.04
2003	20,352.95
2004	20,989.86
2005	21,626.77
2006	22,263.68
2007	22,900.58
2008	26,950.29
2009	31,000.00
2010	33,000.00
2011	35,000.00
2012	32,200.00
2013	26,700.00
2014	25,000.00
2015	24,000.00
2016	20,200.00

4.3.2.3 Emission Factor

Mauritius has several facilities to produce iron and steel, not all having the same type of production technology. It has been identified that some of them have EAE electric ovens, others have a process called Direct Forming Technology (DTF), which is a combination of several technologies. At the time of preparation of the Inventory, the information necessary to apply a Tier 2 is not available, that is, the amount of iron and steel produced by each different and specific type of technology, which would allow assigning each technology the corresponding emission factor. Mauritius continues working to have this disaggregated information for the next Inventory, which is included as part of the improvement plan. For this edition of Inventory, it has been chosen to use a Tier 1 and make use of the emission factor that best represents the technological situation of the country, that is, an average value that considers different types of production technologies.

Mauritius has several facilities to produce iron and steel, not all having the same type of production technology. It has been identified that some of them have EAE electric ovens, others have a process called Direct Forming Technology (DTF), which is a combination of several technologies. At the time of preparation of the Inventory, the information necessary to apply a Tier 2 is not available, that is, the amount of iron and steel produced by each different and specific type of technology, which would allow assigning each technology the corresponding emission factor. Mauritius continues working to have this information for the next Inventory, which is included as part of the improvement plan. For this edition of Inventory, it has been chosen to use a Tier 1 and make use of the emission factor that best represents the technological situation of the country, that is, an average value that considers different types of production technologies.

The emission factor (EF) considered is 1.06 tons of CO_2 per ton of steel produced, according to Table 4.1 from Volume 3, Chapter 4 from 2006 IPCC Guideline. This emission factor represents a global average factor for different types of technologies for the iron and steel production, which considers an average value for EF of these technologies 65% of Basic Oxygen Furnace (BOF), 30% of Electric Arc Furnace (EAF) and 5% of Open-Hearth Furnace (OHF).

4.3.3 Results

GHG emissions from the Iron and Steel Production increased from 19.57 Gg CO_2eq in the year 2000 to 21.41 Gg CO_2eq in 2016, representing an increase of 9.4%.

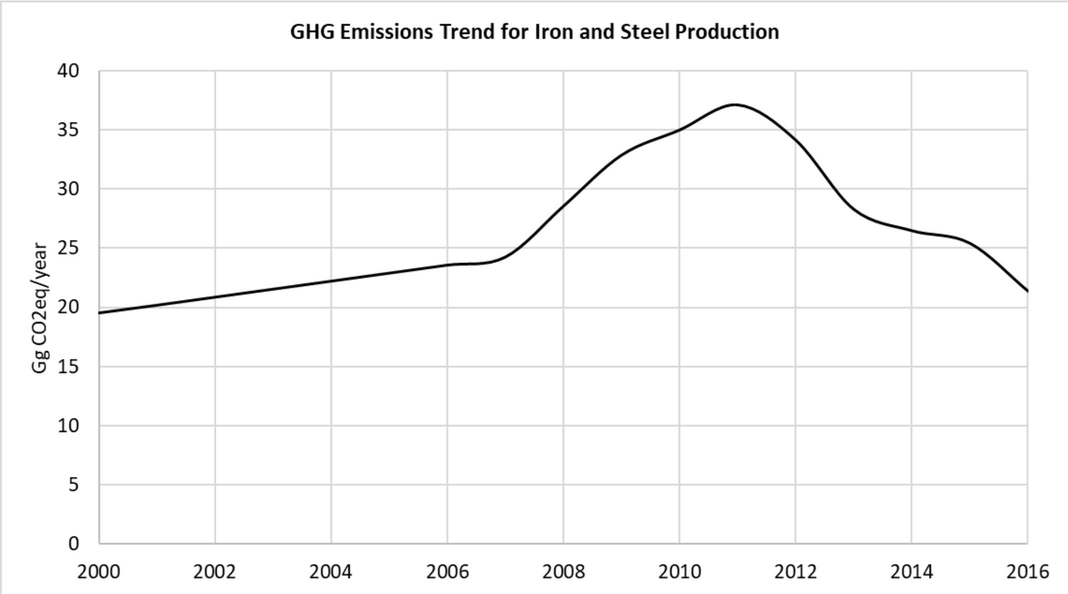


Figure 45. Evolution of the GHG Emissions from Iron and Steel Production (Gg CO_2eq)

Table 74. GHG Emissions (Gg CO_2-eq) from Iron and Steel Production

Years	Total emissions for IPPU	Iron and Steel Production	Share for Iron and Steel Production (%)
2000	70.32	19.57	27.83%
2001	73.46	20.22	27.53%
2002	76.15	20.90	27.44%
2003	78.88	21.57	27.35%
2004	81.25	22.25	27.38%
2005	113.16	22.92	20.26%
2006	108.04	23.60	21.84%
2007	103.25	24.27	23.51%
2008	125.87	28.57	22.70%
2009	139.56	32.86	23.55%
2010	151.71	34.98	23.06%
2011	193.95	37.10	19.13%
2012	214.43	34.13	15.92%
2013	300.00	28.30	9.43%
2014	300.78	26.50	8.81%

2015	300.96	25.44	8.45%
2016	311.18	21.41	6.88%

4.3.4 Quality Control

Some quality control activities were implemented in order to ensure the use of the right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for IPPU sector.
- Cross verification between the GHG emissions estimated in the current inventory for the IPPU sector and the results obtained in the last reported national inventory of the RoM.

4.3.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Metal Industry sector categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 75. Uncertainty Analysis of Iron and Steel Production category (2.C.1) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
2.C.1 - Iron and Steel Production	CO_2	10.00	0.00	10.00

4.3.6 Recalculations

The recalculations implemented in this category consist of the improvement of the activity data used.

On the other hand, the EF previously used in the last inventory has been changed in order to reflect real national circumstances in terms of the technology used. For the last inventory, the EF used was for pig iron production, but this EF didn´t exactly reflect the technology used by this sector. However, the specific production method used by each company is not known so, for that reason, the global average factor used for this inventory edition has been 1.06 tCO_2/ton steel production, based on 2006 IPCC Guidelines.

A bigger difference with the previous inventory is noticed in this category due to the recalculations made for this inventory. After the improvements on the activity data and modifications in the factors used, a decrease of 27% of the emissions estimated in the year 2013 have been calculated between the last inventory and the current one. That is, in the last inventory, 36 Gg CO_2eq of emissions were estimated for the year 2013 and in the current inventory 28.3 Gg CO_2eq of emissions have been estimated for the same year.

4.3.7 Planned Improvements

In order to improve the accuracy of the inventory, the country is working on collecting all the information regarding the technology that every industry in the country is using. In line with this improvement, the activity data should be collected split by each technology. RoM will continue working to determine plant level information for every year.

4.4 Non-Energy Products from Fuels and Solvent Use as Lubricant Use (Category 2D1)

According to 2006 IPCC Guidelines, the products covered here comprise lubricants, paraffin waxes, bitumen/asphalt, and solvents. Information about this consumption is not currently available through national statistics, however, there is relevant information in the International Energy Agency[5], which reports some fuel consumption as non-energy use. Due to the lack of more detailed information, this fuel has been assumed as lubricants, however, this is something to be checked for next inventory cycle to align the information reported by the IEA and the national statistics.

Lubricants are mostly used in industrial and transportation applications. The most common use of these lubricants could be their use as lubricants in engines and their emissions should be considered as non-combustion emissions in the IPPU sector. The use of lubricants is susceptible to emit CO_2.

4.4.1 Methodological Issues

4.4.1.1 Calculation

For the emission estimation of this category, a Tier 1 approach has been used according to the 2006 IPCC Guidelines methodology.

CO_2 emissions = Consumption of lubricant (TJ) x Carbon content of lubricant (t C/TJ) x Oxidised during Use (ODU) Factor x 44/12

As a Tier 1 approach has been used, the carbon content and ODU factor values are obtained from the default values proposed in the 2006 IPCC Guidelines.

4.4.1.2 Activity Data

The activity data values used are obtained from the International Energy Agency (IEA) for the lubricant use in the RoM. It is noticed that consumption of lubricants is only reported from 2011, while from 2000 to 2010, no consumption of lubricants was reported for the country.

Table 76. Consumption (Gg) of Lubricants in RoM (2011 – 2016)

Years	Lubricant consumption
2011	16
2012	18
2013	17
2014	15
2015	11
2016	13

Source: *International Energy Agency*

[5] https://www.iea.org/data-and-statistics/data-tables?country=MAURITIUS&energy=Balances&year=2018

4.4.1.3 Emission Factor

The emission and conversion factors used in this category are the default values proposed by the 2006 IPCC Guidelines.

Table 77. Parameters used for the estimation of CO_2 emissions from lubricant use

	Conversion Factor (TJ/Gg)	Carbon content of lubricant (tC/TJ)	Oxidised During Use (ODU) factor for lubricant
Factor	40.20	20	0.2

Source*: Default values from 2006 IPCC Guidelines, Volume 3, Chapter 5*

4.4.2 Results

GHG emissions from the Non-Energy Products from fuels and solvents use are null until year 2011. From 2011 to 2016 a decrease in the emissions reported in this category are observed (from 9.43 Gg CO_2eq in 2011 to 7.66 Gg CO_2eq in 2016), representing a decrease of a 18.8% between 2011 and 2016.

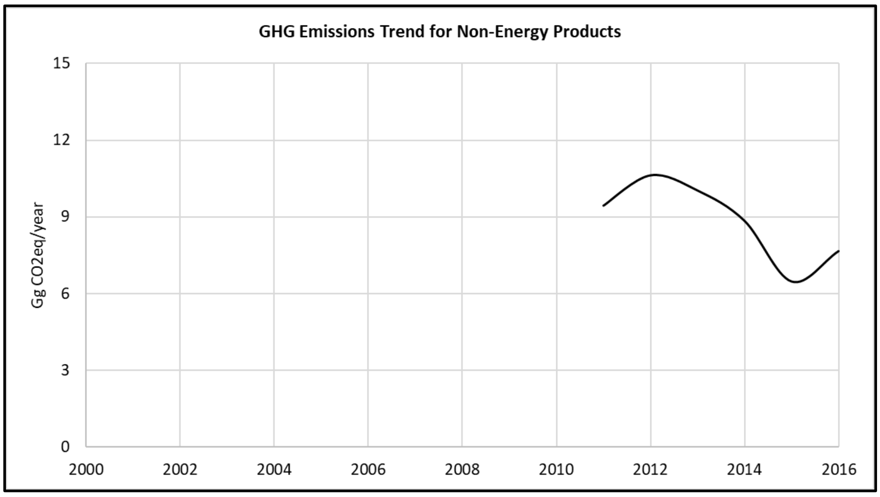


Figure 46. Evolution of the GHG Emissions from Non-Energy Products (Gg CO_2eq)

Table 78. GHG Emissions (Gg CO_2-eq) from Non-Energy Products

Years	Total emissions for IPPU	Non-Energy Products	Share for Non-Energy Products (%)
2000	70.32	NO	
2001	73.46	NO	
2002	76.15	NO	
2003	78.88	NO	
2004	81.25	NO	
2005	113.16	NO	
2006	108.04	NO	
2007	103.25	NO	
2008	125.87	NO	
2009	139.56	NO	

2010	151.71	NO	
2011	193.95	9.43	4.86%
2012	214.43	10.61	4.95%
2013	300.00	10.02	3.34%
2014	300.78	8.84	2.94%
2015	300.96	6.49	2.15%
2016	311.18	7.66	2.46%

4.4.3 Quality Control

It is proposed as an improvement for the next inventory cycle, the cross verification of the activity data be undertaken for the data reported in the International Energy Agency with the one reported by national authorities. Uncertainty Assessment and Time-series Consistency.

The uncertainty analysis results for the Non-Energy Products category obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 79. Uncertainty Analysis of Non-Energy Products category (2.D.1) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
2.D.1 - Lubricant Use	CO_2	10.00	0.00	10.00

4.4.4 Recalculations

The previous inventory developed for the Third National Communication of the RoM did not report the emissions from this category. The oil consumption as lubricant use in this category is not reported at national level but it is reported in the International Energy Agency (IEA). For that reason, the emissions from the category are included in the inventory for the first time.

4.4.5 Planned Improvements

To improve the accuracy of the inventory, the country will work to align its national statistics with the IEA.

4.5 Product Uses as Substitutes for Ozone Depleting Substances (Category 2F)

According to 2006 IPCC Guidelines, HFCs are serving as alternatives to ODS substitute being phased out under the Montreal Protocol. Current application areas of HFCs in RoM include refrigeration and air conditioning systems (stationary and mobile) as well as in fire extinguishers. These appliances and refrigerants are not produced locally and are all imported. This sub-sector will therefore concentrate on emissions of the use of these appliances. These substances are not produced in the country, so they are all imported.

Sulphur hexafluoride (SF_6) is used in electrical equipment such as gas insulated switchgear and substations and in gas circuit breakers.

This sector is divided into 2 sub-categories, 2F1a Refrigeration and Stationary Air Conditioning, and 2F1b Mobile Air Conditioning.

4.5.1 Source Category Description

In RoM, SF_6 are mostly used in breakers, which are categorised as Sealed Pressure Systems or Sealed-for-life Equipment. This type of equipment does not require any refilling with gas during its lifetime and generally contains less than 5 kg of gas per functional unit. Emissions of SF_6 have therefore been assumed to be insignificant as the breakers have been installed since the 1990s and have not exceeded their lifetime during the inventory period.

4.5.2 Methodological Issues

4.5.2.1 Calculation

According to the 2006 IPCC Guidelines, the Tier 1a approach (emission-factor approach) relies on the availability of basic activity data at application level, rather than at the level of equipment or product type. According to these guidelines, for the GHG emission estimations, despite being the time series from 2000 to 2016, the data in this category has to be introduced from 1990 (if applicable).

The calculation formula for Net Consumption with this approach is as follows:

$$\text{Net Consumption} = \text{Production} + \text{Imports} - \text{Exports}$$

Net consumption values for each HFC are then used to calculate annual emissions for applications exhibiting prompt emissions as follows:

$$\textit{Annual Emissions} = \textit{Net Consumption} \times \textit{Composite EF} + \textit{Total Banked Chemical} \times \textit{Composite EF}$$

Where,

Net Consumption = net consumption for the application

Composite EF = composite emission factor for the application

Total Banked Chemical = bank of the chemical for the application

4.5.2.2 Activity Data

Activity data, collected in table below, were obtained from the National Ozone Unit of the Ministry of Environment, Solid Waste Management and Climate Change. and represent the net consumption of the ODS in the country, calculated as importations – exportations, considering that the production of these substances in the country is null.

Table 80. Net Consumption (ton) of ODS Substitute in RoM for Refrigeration and Stationary Air Conditioning (1990 – 2016)

Years	HFC-23	HFC-32	HFC-125	HFC-134a	HFC-143a	HFC-227a
1990	0.00	0.99	5.64	15.19	5.47	0.00
1991	0.00	0.93	5.31	15.23	5.16	0.00
1992	0.00	0.92	5.25	15.24	5.10	0.00
1993	0.00	0.94	5.34	15.23	5.19	0.00
1994	0.00	0.92	5.26	15.24	5.10	0.00
1995	0.00	0.95	5.44	15.21	5.28	0.00
1996	0.00	0.99	5.64	15.19	5.48	0.00
1997	0.00	1.02	5.83	15.16	5.66	0.00
1998	0.00	1.06	6.03	15.14	5.85	0.00
1999	0.00	1.08	6.18	15.12	6.00	0.00
2000	0.00	1.18	6.70	12.82	6.51	0.00
2001	0.00	1.21	6.89	12.80	6.69	0.00
2002	0.00	1.22	6.95	12.70	6.75	0.00
2003	0.00	1.27	7.25	12.56	7.04	0.00
2004	0.00	1.32	7.53	12.48	7.31	0.00
2005	0.00	1.38	7.84	12.36	7.62	0.00
2006	0.00	1.30	7.42	12.37	7.21	0.00
2007	0.21	3.01	14.85	22.51	13.03	0.00
2008	0.00	5.57	14.97	79.65	10.95	0.00
2009	0.00	15.16	27.27	33.99	13.68	0.00
2010	0.00	6.98	22.36	23.74	17.97	0.00
2011	0.00	12.85	45.65	41.25	36.68	0.00
2012	0.05	16.73	45.45	32.20	33.54	0.00
2013	0.26	12.01	52.73	23.74	164.40	0.78
2014	0.26	17.46	65.33	27.82	22.79	0.00
2015	0.00	22.38	51.10	31.43	32.06	0.00
2016	0.09	2.40	64.94	41.72	41.25	0.00

***Source**: National Ozone Unit, Ministry of Environment, Solid Waste Management and Climate Change*

Table 81. Net Consumption (ton) of ODS Substitute in RoM for Mobile Air Conditioning (1990 – 2016)

Years	HFC-134a
1990	0.00
1991	0.00
1992	0.00
1993	0.00
1994	0.00
1995	0.00
1996	0.00
1997	0.00
1998	0.00
1999	0.00
2000	2.23
2001	2.23
2002	2.31
2003	2.41
2004	2.46
2005	2.54
2006	2.59
2007	4.45
2008	17.04
2009	5.94
2010	4.90
2011	9.23
2012	5.74
2013	4.99
2014	5.45
2015	6.67
2016	8.55

***Source**: National Ozone Unit, Ministry of Environment, Solid Waste Management and Climate Change*

4.5.2.3 Emission Factor

A composite emission factor is required to complete a Tier 1 method, as well as some necessary parameters. All these parameters and factors are estimated from the default factors proposed in the 7.5.2.1 section of 2006 IPCC Guidelines.

Table 82. Parameters for GHG Emission estimation for Product Uses as Substitutes for ODS

Parameter	Unit	Value
Lifetime	years	15
Composite Emission Factor (EF)	%	15
Destruction	%	25

2.F.1.a Category	Introduction year
HFC-23	2007
HFC-32	1990
HFC-125	1990
HFC-134a	1990
HFC-143a	1990
HFC-227ea	2013

2.F.1.b Category	Introduction year
HFC-134a	2000

***Source**: National Ozone Unit, Ministry of Environment, Solid Waste Management and Climate Change and Default values from 2006 IPCC Guidelines*

4.5.3 Results

HFCs emissions from Product Uses as Substitutes to ODS increased from 47.99 Gg CO_2eq in 2000 to 282.10 Gg CO_2eq in 2016, which consist in an increase of 487.83%. A complete explanation on the reasons for the large increase in emissions is included in the section 4.5.6 below.

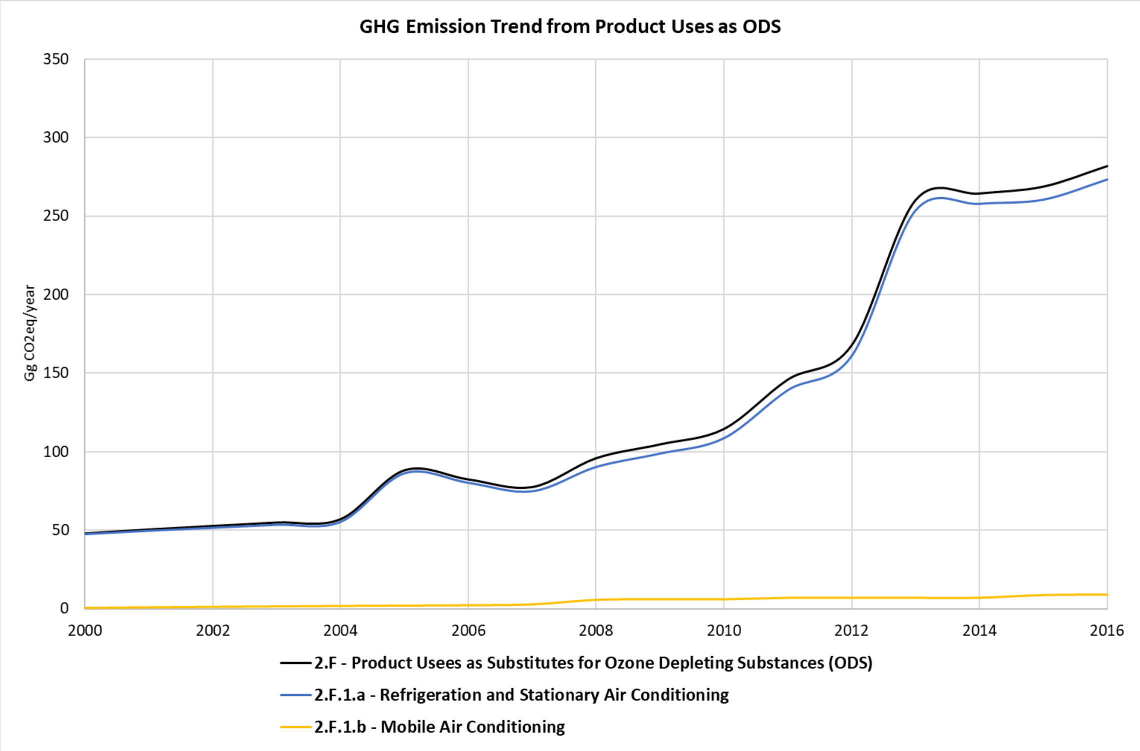


Figure 47. Evolution of the GHG Emissions from Product Uses as ODS (Gg CO_2eq)

Table 83. GHG Emissions (Gg CO_2eq) from Product Uses as Substitutes to ODS

Years	Total emissions for IPPU	Product Uses as Substitutes to ODS	Share for Product Uses as Substitutes to ODS (%)
2000	70.32	47.99	68.25%
2001	73.46	50.54	68.80%
2002	76.15	52.78	69.31%
2003	78.88	54.96	69.67%
2004	81.25	57.08	70.26%
2005	113.16	88.26	78.00%
2006	108.04	82.40	76.27%
2007	103.25	77.54	75.10%
2008	125.87	95.94	76.22%
2009	139.56	104.75	75.06%
2010	151.71	114.58	75.52%
2011	193.95	146.05	75.30%
2012	214.43	167.89	78.30%
2013	300.00	260.38	86.79%
2014	300.78	264.64	87.98%
2015	300.96	269.03	89.39%
2016	311.18	282.10	90.66%

4.5.4 Quality Control

Some quality control activities were implemented in order to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities and data reported in the national Statistics Mauritius.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for IPPU sector.
- Cross verification between the GHG emissions estimated in the current inventory for IPPU sector and the results obtained in the last reported national inventory of the RoM.

4.5.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for the Product Uses as Substitutes for ODS sector categories obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 84. Uncertainty Analysis of Product Uses as Substitutes for ODS category (2.F.1) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF_3	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH_2F_2	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF_2CF_3	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH_2FCF_3	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF_3CH_3	0.00	0.00	0.00
2.F.1.b - Mobile Air Conditioning	CH_2FCF_3	5.00	0.00	5.00

4.5.6 Recalculations

A total recalculation for the "2.F – Product Uses as Substitutes for ODS" category has been carried out to be aligned with the 2006 IPCC Guidelines. To date, for the calculation of the category’s emissions, the emissions related to banks were not considered. GHG emissions that have to be taken into account especially, if a time series estimate is being developed, as in this case, Bank emissions represent the amount of chemical that have been accumulated throughout the lifecycle that as of the end of the most recent year has not been emitted. Considering that the average lifetime exceeds the time series period considered in the national inventory (2000-2016) it is necessary to consider these bank emissions.

Necessary parameters and factors have been taken from default factors proposed by 2006 IPCC Guidelines, and the methodology and calculation method has been taken from the "Calculation Example for 2F1" worksheet, available in the IPCC website[6].

Comparing the emissions estimated in the last inventory and the current one for the year 2013, an increase of the 98% of the emissions have been noticed. In the last inventory the emissions estimated in this category accounted in 6.2 Gg CO_2eq, while emissions estimated in the current inventory are reported at 260.38 Gg CO_2eq for the year 2013.

4.5.7 Planned Improvements

RoM will continue working to obtain the information for the missing years, since the first year of data available is 2006. Furthermore, a mass balance and a determination of country specific EFs will be another aspect in which RoM will focus its future efforts.

In addition, during the QA analysis of the national inventory, it was observed that the data regarding the Product uses as substitutes for ozone depleting substances sector should be checked with the National Ozone Unit to confirm whether HFC compounds are used in firefighting activities in the country, in order to know if this activity is occurring or not. The information obtained should be considered in the next inventory cycle.

[6] Link to the calculation worksheet https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol3.html

5. Agriculture, Forestry and Other Land Use (AFOLU)

5.1 Overview

Agriculture contributes to greenhouse gas emission primarily through the emission and consumption of GHGs such as methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). Enteric fermentation in ruminants is a major source of methane emission. Methane is also produced in soil during microbial decomposition of organic matter under anaerobic conditions. Crop fields, which are submerged under water are the potential source of methane production. Nitrous oxide is produced in soils through the processes of nitrification and denitrification. Nitrification is the aerobic microbial oxidation of ammonium to nitrate, and denitrification is the anaerobic microbial reduction of nitrate to nitrogen gas. Nitrous oxide is a gaseous intermediate in the reaction sequence of denitrification and a by-product of nitrification that leaks from microbial cells into the soil and ultimately into the atmosphere. One of the main controlling factors in this reaction is the availability of inorganic N in soil through additions of synthetic or organic fertilizers, manure, crop residues, sewage sludge or mineralization of N in soil organic matter following drainage/management of organic soils and cultivation/land-use change on mineral soils.

The main source of carbon dioxide in agriculture is the soil management practices. Use of fuel for various agricultural operations and burning of crop residues are the other sources of carbon dioxide emission. An off-site source is the manufacturing of farm implements, fertilizers and pesticides. In general, GHG emissions from the agricultural sector are generally linked to the management of agricultural soils, livestock, crop production and biomass burning.

AFOLU sector plays a vital role in the economy of RoM for ensuring food and nutritional security. The country's economy is closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry. Mauritian agriculture is dependent on many climatic factors such as temperature, rainfall, humidity, and sunshine duration. Climatic variations may impact crops both positively and negatively depending on the nature of crop and the ecosystems they are grown.

In 2015, the land area occupied by agriculture was around 48% of the total land area of Mauritius. The agricultural sector is considered to be of significant importance to the Mauritian economy, employing some 7.3% of total working population and representing 38% of overall exported commodities, but contributing only 3.5% to national GDP in 2017. Nonetheless, the sector still plays a vital, multi-functional role within the economy. It contributes significantly to GDP in absolute terms, and has significant economic, social and environmental impacts. In addition, agriculture provides direct employment to some 45,300 people. Land under agriculture is mainly used for sugarcane, tea, food crops and fruit production (litchi, mango, banana and pineapple) and other crops.

Land on the other hand constitutes a net sink of removals for the whole inventory period 2000-2016, except for the year 2004 when it acts as a net source of emissions (due to a big deforestation and the associated emissions). The main land use category in terms of its contribution is forest land, contributing to approximately 86.3% of total net emissions/removals from land (absolute values). Net removals from land have been estimated to –458.89 Gg CO_2 eq in 2000 and -331.60 Gg CO_2 eq in 2016.

5.1.1 General Methodology

In Table 85 is shown information on methodology, emission factor and activity data used by source category in the AFOLU sector.

Table 85. Methodology used in the AFOLU sector

Category	Methodology	Emission Factor	Activity Data source
3 – Agriculture, Forestry and Other Land Use			
3.A – Livestock			
3.A.1 – Enteric Fermentation			
3.A.1.a – Cattle	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.1.a.i – Dairy Cows	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.1.a.ii – Other Cattle	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.1.b – Buffalo	NA	NA	NA
3.A.1.c – Sheep	T1	D	Digest of Agricultural Statistics Mauritius and MMA Annual Report Importation. (2014-2016)
3.A.1.d – Goats	T1	D	Digest of Agricultural Statistics Mauritius and MMA Annual Report Importation. (2014-2016)
3.A.1.e – Camels	NO	NO	NO
3.A.1.f – Horses	T1	D	Statistics Mauritius
3.A.1.g – Mules and Asses	NO	NO	NO
3.A.1.h – Swine	T1	D	Digest of Agricultural Statistics Mauritius (2014-2016)
3.A.1.i – Poultry	NA	NA	NA
3.A.1.j – Other – Deer	T1	D	FAREI estimation
3.A.2 – Manure Management			
3.A.2.a - Cattle	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.2.a.i – Dairy cows	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.2.a.ii – Other cattle	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.A.2.b - Buffalo	NO	NO	NO
3.A.1.c – Sheep	T1	D	Digest of Agricultural Statistics Mauritius and MMA Annual Report

			Importation. (2014-2016)
3.A.1.d – Goats	T1	D	Digest of Agricultural Statistics Mauritius and MMA Annual Report Importation. (2014-2016)
3.A.1.e – Camels	NO	NO	NO
3.A.1.f – Horses	T1	D	Statistics Mauritius
3.A.1.g – Mules and Asses	NO	NO	NO
3.A.1.h – Swine	T1	D	Digest of Agricultural Statistics Mauritius (2014-2016)
3.A.1.i – Poultry	T1	D	Digest of Agricultural Statistics Mauritius and FAREI estimation
3.A.1.j – Other – Deer	T1	D	FAREI estimation
3.B – Land			
3.B.1 – Forest land			
3.B.1.a – Forest land remaining forest land	T2	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.1.b – Land converted to Forest land	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.1.b.i – Cropland converted to Forest land	T1	D	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.2 – Cropland			
3.B.2.a – Cropland remaining cropland	T1	D	TNC land use areas
3.B.2.b – Land converted to Cropland	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.2.b.i – Forest land converted to Cropland	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.3 – Grassland			
3.B.3.a – Grassland remaining grassland	T1	D	TNC land use areas
3.B.3.b – Land converted to grassland	T1	NO	TNC land use areas
3.B.4 – Wetland			
3.B.4.a – Wetlands remaining wetlands	T1	NO, NA	TNC land use areas
3.B.4.a.i – Peatlands remaining peatlands	T1	NO	NO
3.B.4.a.ii – Flooded land remaining flooded land	T1	NA	TNC land use areas
3.B.4.a – Wetlands remaining wetlands	NO, NA	D, CS	Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.5 – Settlements			

3.B.5.a – Settlements remaining settlements	T1	D	TNC land use areas
3.B.5.b – Land converted to settlements	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.5.b.i – Forest land converted to settlements	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.6 – Other land			
3.B.6.a – Other land remaining other land	T1	NA	TNC land use areas
3.B.6.b – Land converted to other land	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.B.6.b.i – Forest land converted to other land	T1	D, CS	Forestry Service, Ministry of Agro-Industry & Food Security, TNC land use areas
3.C – Aggregate sources and non-CO_2 emissions sources on land			
3.C.1 GHG emissions from biomass burning	T1	D	Forestry Service, Ministry of Agro-Industry & Food Security
3.C.1.a – Biomass burning in forest lands	T1	D	Forestry Service, Ministry of Agro-Industry & Food Security
3.C.1.b – Biomass burning in croplands	T1	D	Digest of Agricultural Statistics, MCIA
3.C.1.c – Biomass burning in grasslands	NE	NE	-
3.C.1.d – Biomass burning in other lands	NE	NE	-
3.C.2 - Liming	NE	NE	-
3.C.3 – Urea application	NE	NE	-
3.C.4 - Direct N_2O Emissions from managed soils	T1	D	Statistics Mauritius, FAREI and livestock estimates in category 3.A
3.C.5 - Indirect N_2O Emissions from managed soils	T1	D	Statistics Mauritius, FAREI and livestock estimates in category 3.A
3.C.6 - Indirect N_2O Emissions from manure management	T1	D	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
3.C.7 – Rice cultivation	NO	NO	NO
3.C.8 – Other	NO	NO	NO
3.D.1 – Harvested wood products	T1	D	FAOSTAT
3.D.2 – Other	NO	NO	

T1 -Tier 1 and Tier 2 Methods; CS – Country Specific Emission; D –Default Emission Factors; NA: Not Applicable

5.2 Livestock (Category 3A)

5.2.1 Source Category Description

Livestock production can result in methane (CH_4) emissions from enteric fermentation (IPCC category 3.A.1) and both CH_4 and nitrous oxide (N_2O) emissions from livestock manure management systems fermentation (IPCC category 3.A.2). Usually, cattle are an important source of CH_4 because of their large population and high CH_4 emission rate due to their ruminant digestive system, as it is the situation in Mauritius. Methane emissions from manure management tend to be smaller than enteric emissions, with the most substantial emissions associated with confined animal management operations where manure is handled in liquid-based systems. Nitrous oxide emissions from manure management vary significantly between the types of management system used and can also result in indirect emissions due to other forms of nitrogen loss from the system. Manure management category, 3.A.2, only covers the volatilization in the farms, so emissions from animals in pasture are not included in category 3.A.2, but in category 3.C.4. The calculation of the nitrogen loss from manure management systems is also an important step in determining the amount of nitrogen that will ultimately be available in manure applied to managed soils, or used for feed, fuel, or construction purposes, emissions that are calculated 3.C.4 Direct N_2O emissions from managed soils.

Based on the available information the following animal species are estimated in the GHGI of Mauritius:

Animal Category	Animal Subcategory
Dairy Cows	
Other Cattle	Bull
	Calf
	Heifer
	Imported Bull
Sheep	
Goat	
Horse	
Swine	Boar
	Fattener
	Piglet
	Sow/Gilt
Poultry	Broiler
	Broiler parent
	Layer/Parent
	Duck
Other	Deer

There is information for all types of animals for Mauritius Island. However, information for Rodrigues Island does not include poultry, horses and deer.

The island of Mauritius has been divided in 3 regions (Flacq District, central region and other regions) for the estimation of the emissions. The following Table 86 shows the regions, areas covered and average annual temperatures.

Table 86. Livestock Regions and Average Annual Temperature

Region	Area included	Average temperature
Flacq	Flacq District	24
Central regions	Plaines Wilhems and Moka District	22
Other regions	Pamplemousses, Grand Port, Savanne, Black River, Riviere du Rempart and Port Louis Districts	25
Rodrigues	Rodrigues island	25
Mauritius island	Total area of Mauritius island	21

Average temperatures were provided for all regions and total Mauritius Island in the previous GHGI. For Rodrigues Island, an average temperature of 25ºC has been selected.

For dairy cows, other cattle, swine and poultry, the number of heads is disaggregated by region. Number of head for all other animals is just provided for the whole Mauritius Island, therefore, the need of a separate category for the whole island.

5.2.2 Methodological Issues

Tier 1 approach of the 2006 IPCC Guidelines has been used to estimate the emissions from enteric fermentation and manure management.

5.2.2.1 Calculations

Enteric Fermentation (CH_4)

2006 IPCC Guidelines Tier 1 approach involve multiplying the number of animals (AD) by the respective EF in the appropriate world region:

$$Emissions = EF_{(T)} \bullet \left(\frac{N_{(T)}}{10^6} \right)$$

Where:

Emissions = methane emissions from Enteric Fermentation, Gg CH_4 yr-1

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH_4 head-1 yr-1

$N_{(T)}$ = the number of head of livestock species / category T in the country

T = species/category of livestock

Manure Management (CH_4)

2006 IPCC Guidelines Tier 1 approach involve multiplying the number of animals (AD) by the respective EF (based on the region and the average temperature). On contrast with N_2O emissions from manure management, the Tier 1 approach for CH_4 emissions does not require information on the manure management system used for the animal manure.

$$CH_{4\,Manure} = \sum_{(T)} \frac{\left(EF_{(T)} \bullet N_{(T)}\right)}{10^6}$$

f

Where:

$CH_{4Manure}$ = CH_4 emissions from manure management, for a defined population, Gg CH_4 yr^{-1}

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH_4 $head^{-1}$ yr^{-1}

$N_{(T)}$ = the number of head of livestock species/category T in the country

T = species/category of livestock

Direct N_2O emissions from manure management (N_2O)

Direct N_2O emissions due to manure management are estimated based on Tier 1 approach of the 2006 IPCC Guidelines. This approach requires information on the number of animals, the nitrogen (N) excreted by head (estimated based on the weight of the animal and default N excretion rates), the percentage of manure in each manure management system (MMS) and the emission factor of that MMS.

$$N_2O_{D(mm)} = \left[\sum_S \left[\sum_T \left(N_{(T)} \bullet Nex_{(T)} \bullet MS_{(T,S)}\right)\right] \bullet EF_{3(S)}\right] \bullet \frac{44}{28}$$

Where:

$N_2O_{D(mm)}$ = direct N_2O emissions from Manure Management in the country, kg N_2O yr^{-1}

$N_{(T)}$ = number of head of livestock species/category T in the country

$N_{ex(T)}$ = annual average N excretion per head of species/category T in the country, kg N $animal^{-1}$ yr^{-1}

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed

in manure management system S in the country, dimensionless

$EF_{3(S)}$ = emission factor for direct N_2O emissions from manure management system S in the country, kg

N_2O-N/kg N in manure management system S

S = manure management system

T = species/category of livestock

44/28 = conversion of (N_2O-N) (mm) emissions to N_2O (mm) emissions

5.2.2.2 Activity Data

The activity data for all these emissions is the number of animals by species and subcategory. Table 87 shows the number of animals disaggregated by subcategory for Mauritius Island, whilst Table 88 shows the information for Rodrigues Island[7].

Table 87. Number of animals by subcategory in Mauritius Island

Animal	2000	2005	2010	2014	2015	2016
Cattle	10,108	7,999	9,162	7,947	7,911	6,232
Dairy cow	3,704	2,931	2,316	2,368	1,997	1,735
Other cattle	6,404	5,068	6,846	5,579	5,914	4,497
Bull	1,861	1,473	665	469	498	379
Calf	2,395	1,895	1,836	1,441	1,528	1,162
Heifer	2,148	1,700	2,523	2,029	2,151	1,635
Imported bull	0	0	1,822	1,640	1,737	1,321
Sheep	463	1,187	2,096	3,513	2,760	2,874
Goat	12,859	21,003	28,267	26,723	26,835	26,990
Horse	567	680	775	873	824	855
Swine	15,718	18,349	22,327	17,510	21,964	24,161
Boar	343	401	528	361	452	498
Fattener	8,544	9,974	1,1917	9,596	12,037	13,241
Piglet	4,633	5,408	6,072	4,327	5,428	5,970
Sow/gilt	2,198	2,566	3,810	3,226	4,047	4,452
Poultry	3,225,665	3,822,940	5,863,089	6,102,657	5,977,990	5,928,050
Broiler	2,465,647	3,095,027	5,133,333	5,277,778	5,155,556	5,088,889
Broiler parent	676,810	644,705	620,060	699,323	699,323	717,383
Layer	3,208	3,208	7,029	20,000	20,000	20,000
Duck	80,000	80,000	102,667	105,556	103,111	101,778
Deer	15,000	16,000	16,000	8,000	8,000	8,000

Source: *Own elaboration based on the national sources.*

Table 88. Number of animals by subcategory in Rodrigues Island

Animal	2000	2005	2010	2014	2015	2016
Cattle	10,133	10,132	7,942	11,000	11,000	11,000
Dairy cow	4,053	4,053	3,177	4,400	4,400	4,400
Other cattle	6,080	6,079	4,765	6,600	6,600	6,600
Bull	1,767	1,767	463	556	556	556
Calf	2,274	2,273	1,278	1,705	1,705	1,705
Heifer	2,039	2,039	1,756	2,400	2,400	2,400
Imported bull	0	0	1,268	1,939	1,939	1,939
Sheep	5,723	5,723	9,188	10,000	10,900	11,850
Goat	10,542	10,542	19,685	19,000	14,600	15,700

[7] In the previous BUR, only the population from Mauritius was included in the estimations.

Swine	17,469	17,470	14,719	16,000	10,430	11,000
Boar	381	382	348	330	215	227
Fattener	9,496	9,496	7,856	8,768	5,716	6,028
Piglet	5,149	5,149	4,003	3,954	2,577	2,718
Sow/gilt	2,443	2,443	2,512	2,948	1,922	2,027

The source for the number of animals in Mauritius island in the period 2000-2013 is the previous GHGI. The information for the period 2014-2016 was compiled as follows:

Species	Source
Cattle	Digest of Agricultural Statistics Mauritius, FAREI and MMA Annual Report Importation (2014-2016)
Sheep	Digest of Agricultural Statistics Mauritius and MMA Annual Report Importation. (2014-2016)
Goat	Digest of Agricultural Statistics Mauritius and MMA Annual Report Importation (2014-2016)
Horse	Central Statistical Office
Swine	Digest of Agricultural Statistics Mauritius (2014-2016)
Poultry	Digest of Agricultural Statistics Mauritius and FAREI estimation
Deer	FAREI estimation

Imported sheep, goats and cattle figures were obtained from MMA slaughter statistics. The data was annualized by dividing by 4 (assuming the animals are reared over a period of 3 months) the values of slaughter. The imported data figure excludes animals slaughtered on religious purposes or home consumption.

The number of broilers was estimated based on the production data (tonnes) of the Food Balance sheet of the Digest of Agricultural Statistics. To estimate the annual number of broilers, the annual production data was divided by 1.5 (kg of carcass weight per animal) and by 6 (representing minimum production cycles per year). The broiler parent stock was estimated by dividing the estimated annual broiler production by 300 (maximum eggs per bird).

The layer population was estimated based on the local egg production statistics included in the Digest of Agricultural Statistics. The layer parent stock was estimated by dividing the layer population by 300 (maximum eggs per bird).

The source of information for Rodrigues is the experts of the livestock sector in the island. It covers the years 2006-2016 and the animal categories cattle, sheep, goats and swine without further disaggregation in animal subcategories. Cattle information for 2014-2016 was not provided. It was decided to maintain the total number of cattle of 2014 for 2015-2016 period and disaggregate the total between dairy cows and other cattle following the weighting in 2013 (last year with disaggregated data).

Information on number of animals in the period 2014-2016 for Mauritius Island and for Rodrigues Island for the whole time series was not disaggregated by animal subcategories (e.g., boar, fattener, piglet…). Mauritius island data for 2014-2016 was disaggregated using the same weighting of 2013. For Rodrigues Island, information is disaggregated using the same weighting as the total Mauritius island in the same year.

Disaggregation of animal numbers by region is only available for the 2000-2013. For 2014-2016, the same weighting of 2013 has been applied.

5.2.2.3 Emission Factors

Enteric fermentation and manure management (CH_4) are estimated using the default Tier 1 values for Africa/developing countries in the 2006 IPCC Guidelines, as shown in the Table 89 below:

Table 89. Enteric Fermentation and Manure Management (CH_4) Emissions Factors

Animal	Animal subcategory	CH_4 Emission factor from enteric fermentation (kgCH4/head/year)	CH_4 Emission factor from manure management (kgCH4/head/year)
Dairy cow		46	1
Other cattle	Bull	31	1
	Calf	31	1
	Heifer	31	1
	Imported bull	31	1
Sheep		5	0.15
Goat		5	0.17
Horse[8]		18	1.64
Swine	Boar	1	1
	Fattener	1	1
	Piglet	1	1
	sow/gilt	1	1
Poultry	Broiler	n.a.	0.02
	Broiler parent	n.a.	0.03
	Layer/Parent	n.a.	0.03
	Duck	n.a.	0.03
Deer		20	0.22

Source: *Table 10.10, table 10.11, table 10.14*[9] *and table 10.15 (2006 IPCC Guidelines, volume 4, chapter 10).*

In order to estimate N_2O emissions from manure management, there is a need to estimate the amount of N in each MMS and region. N excretion per head is estimated based on the animal weight and the N excretion rate per 1000 kg of animal which are shown in Table 90.

Table 90. Animal Weight and N Excretion Rates

Animal	Animal subcategory	Weight (kg)	N excretion rate (kg N/1000 kg/day)
Dairy cow		400	0.73
Other cattle	Bull	200	0.73

[8] IPCC 2006, page 10.28 Table 10.10 (Default for Developing countries)

[9] Emission factors in table 10.14 depends on information on the average annual temperature, which is differs between the considered regions of Mauritius. However, in the particular case of Africa and the range of temperatures of Mauritius, the values are the same.

	Calf	75	0.73
	Heifer	150	0.73
	Imported bull	500	0.73
Sheep		45	1.17
Goat		30	1.37
Horse[10]		377	0.46
Swine	Boar	150	0.55
	Fattener	90	1.57
	Piglet	13	1.57
	sow/gilt	125	0.55
Poultry	Broiler	1,8	1.1
	Broiler parent	2,1	0.82
	Layer/Parent	1,8	0.82
	Duck	2,5	0.83
Deer		60	1.17

Source: *National expert judgement and Table 10.19 (2006 IPCC Guidelines, volume 4, chapter 10).*

The live weight of cattle, sheep, goats, swine and poultry were provided by livestock expert from FAREI based on weighing data collected at FAREI Curepipe Livestock Research Station (CLRS) and on-farms measurements. For horses, the default value of weight in developed countries is used[11] based on expert judgement as they are mainly used for horse racing. Deer weight is based on expert judgement.

Data for manure management system distribution (including pasture) was gathered from a survey carried out by FAREI, resource profile data and expert knowledge. Table 91 shows the results for dairy cow, other cattle and swine and Table 92 for all other animals.

Table 91. Mauritius Manure management system for dairy cow, other cattle and swine (%)

Animal	**Animal subcategory**	**2006-2008**	**2009**	**2010-2013**
Dairy cow		100% solid storage	77% solid storage, 15% pasture range and paddock and 8% aerobic treatment (Central region) 100% solid storage (rest of regions)	85% solid storage, 9% pasture range and paddock and 6% aerobic treatment (Central region) 100% solid storage (rest of regions)
Other cattle	Bull	100% solid storage		85% solid storage, 9% pasture range and

[10] IPCC 2006, page 10.28 Table 10.10 (Default for Development countries)

[11] Table 10A-9 of the 2006 IPCC Guidelines, volume 4, chapter 10.

				paddock and 6% aerobic treatment (Central region) 100% solid storage (rest of regions)
	Calf	100% solid storage		
	Heifer	100% solid storage	63% solid storage, 25% pasture range and paddock and 12% aerobic treatment (Central region) 100% solid storage (rest of regions)	85% solid storage, 9% pasture range and paddock and 6% aerobic treatment (Central region) 100% solid storage (rest of regions)
	Imported bull	100% solid storage (Central regions and Flacq) 100% dry lot (other regions)		
Swine	Boar	100% solid storage (Central regions) 50% solid storage, 25% anaerobic digester and 25% aerobic treatment (other regions)	100% solid storage (Central regions) 50% solid storage, 25% anaerobic digester and 25% aerobic treatment (other regions)	100% solid storage (Central regions) 50% solid storage, 25% anaerobic digester and 25% aerobic treatment Flacq) 50% solid storage and 50% anaerobic digester (rest of regions)
	Fattener			
	Piglet			
	sow/gilt			

Source: *FAREI survey and expert judgement.*

Table 92. Mauritius Manure management system for other animals (%)

Animal	Animal subcategory	MMS
Sheep		99% solid storage and 1% dry lot
Goat		97% solid storage and 3% dry lot
Horse[12]		100% pasture range and paddock
Poultry	Broiler	100% poultry manure with litter
	Broiler parent	100% poultry manure with litter
	Layer/Parent	35% poultry manure with litter and 65% poultry manure without litter
	Duck	15% poultry manure with litter and 85% poultry manure without litter
Deer		100% pasture range and paddock

Source: *FAREI survey and expert judgement.*

[12] IPCC 2006, page 10.28 Table 10.10 (Default for Development countries)

There was no information on manure management system distribution for the periods 2000-2005 and 2014-2016 for Rodrigues. The distribution of MMS of the period 2006-2008 have been used for 2000-2005 and of the period 2010-2013 for 2014-2016.

Table 93. Rodrigues Island Manure Management system (%)

Animal	Animal subcategory	MMS
Dairy Cows		74% pasture and 26% dry lot
Other Cattle		73% pasture and 27% solid storage
Swine		4% pasture and 96% solid storage
Goat		65% pasture and 35% solid storage
Sheep[13]		60% pasture and 40% solid storage
Poultry	Broiler	100% poultry with beddings
	Layer	85% poultry with beddings and 15% poultry without beddings

Source: *Expert judgement of Rodrigues Island husbandry experts.*

Information on MMS distribution for Rodrigues Island was provided by the local husbandry experts for 2016. This distribution value is used for the whole 2000-20016 timeseries. Information on other cattle and swine is not differentiated between animal subcategories (e.g., boar, piglet…), so the same distribution is used for all categories.

Emission factors per MMS are the default IPCC values included in table 10.21 (2006 IPCC Guidelines, volume 4, chapter 10).

Table 94. Emissions Factors for N_2O emissions from manure management

System	EF
Solid storage	0.005
Aerobic treatment	0.01
Dry lot	0.02
Anaerobic digester	0
Poultry manure with litter	0.001

Source: *Table 10.21 (2006 IPCC Guidelines, volume 4, chapter 10)*

5.2.3 Results

Livestock (category 3.A) emissions increased from 36.15 Gg CO_2-eq in the year 2000 to 37.53 Gg CO_2-eq in 2016, an increase of 3.81%. Enteric fermentation (3.A.1) emissions decreased from 25.94 Gg CO_2-eq in the year 2000 to 23.60 Gg CO_2-eq in 2016, a decrease of 9.02%. CH_4 emissions from manure management increased from 2.83 Gg CO_2-eq in the year 2000 to 4.03 Gg CO_2-eq in 2016, an increase of 42.54%. N2O emissions from manure management increased from 7.38 Gg CO_2-eq in the year 2000 to 9.89 Gg CO_2-eq in 2016, an increase of 34.03%.

[13] IPCC 2006, page 10.28 Table 10.10 (Default for Development countries)

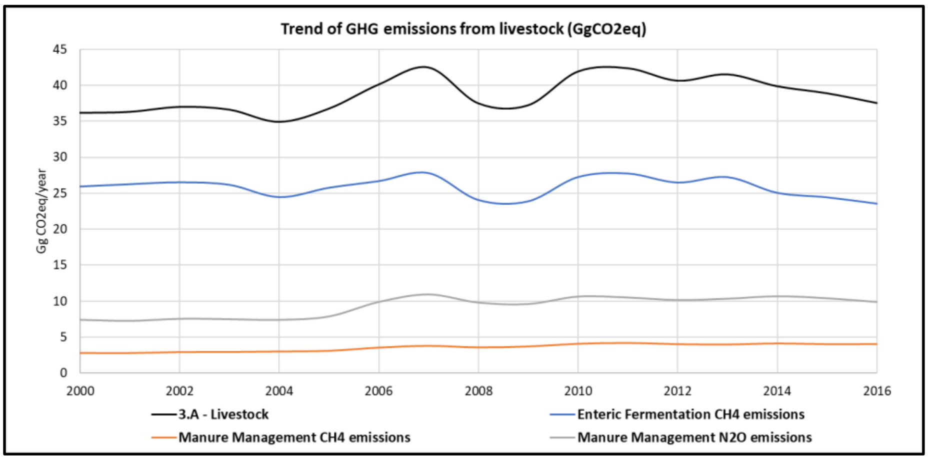


Figure 48. Evolution of total GHG Emissions from Livestock by Source (Gg CO_2eq)

NOTE: All emissions are reported in mass of CO_2eq. Emissions are reported by category and gas in line with the IPCC Guidelines.

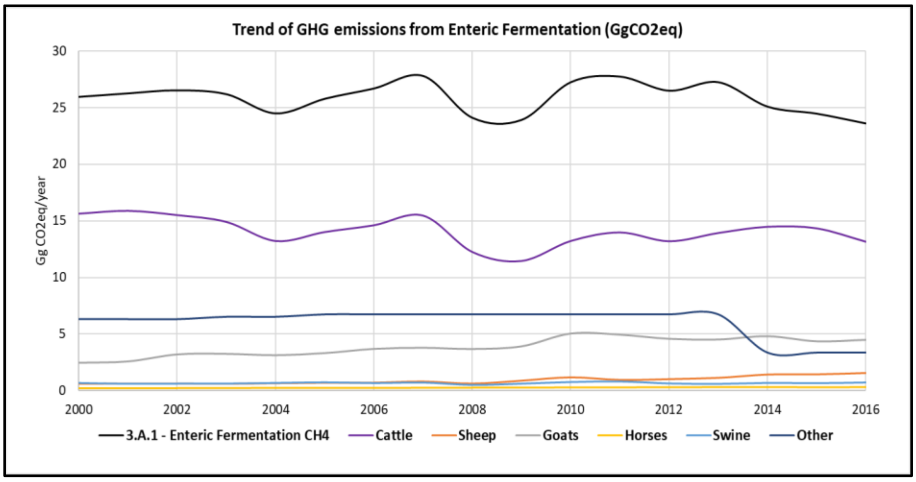


Figure 49. Evolution of the GHG Emissions from Enteric Fermentation (Gg CO_2eq)

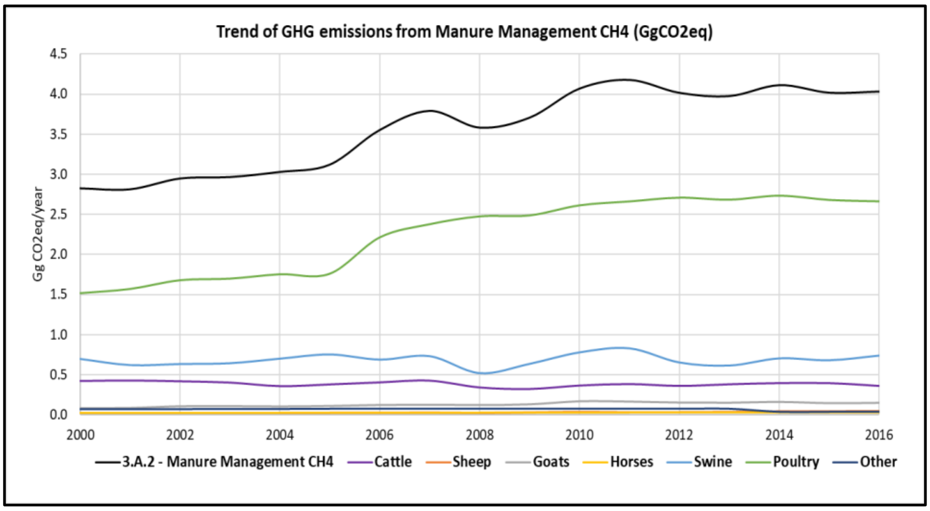


Figure 50. Evolution of the GHG emissions from Manure Management CH_4 (Gg CO_2eq)

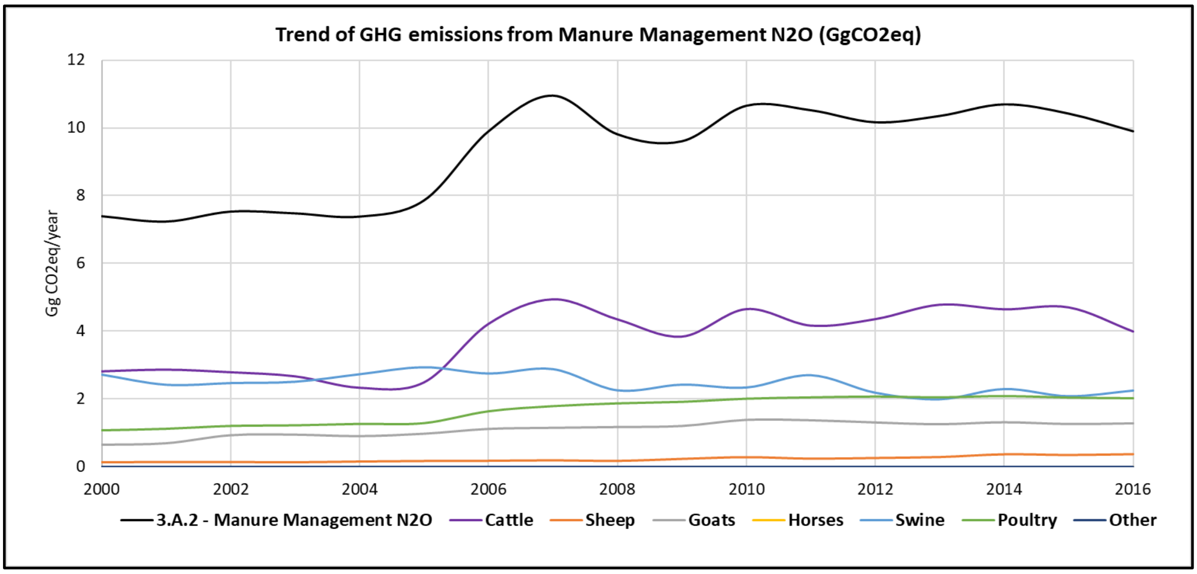


Figure 51. Evolution of the GHG emissions from manure management N_2O (Gg CO_2eq)

In the following Table 95, it is shown the emissions by source category in the livestock subsector.

Table 95. GHG Emissions from 3A livestock (Gg CO_2eq)

Region	Category & gas	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total country	Enteric fermentation CH_4	25.94	26.25	26.51	26.17	24.49	25.77	26.68	27.77	24.10	23.91	27.23	27.72	26.48	27.23	25.08	24.46	23.60
	Manure management CH_4	2.83	2.82	2.95	2.97	3.03	3.12	3.55	3.79	3.58	3.71	4.07	4.18	4.02	3.98	4.11	4.02	4.03
	Manure management N_2O	7.38	7.22	7.52	7.47	7.37	7.85	9.89	10.95	9.81	9.60	10.65	10.52	10.16	10.35	10.69	10.42	9.89
	TOTAL Country	**36.15**	**36.29**	**36.98**	**36.60**	**34.89**	**36.74**	**40.12**	**42.51**	**37.49**	**37.22**	**41.94**	**42.41**	**40.66**	**41.55**	**39.88**	**38.90**	**37.53**
Mauritius Island	Enteric fermentation CH_4	15.99	16.30	16.56	16.22	14.54	15.82	16.73	16.66	17.01	17.12	17.72	17.03	17.37	17.14	13.15	13.02	11.93
	Manure management CH_4	2.19	2.18	2.31	2.33	2.39	2.48	2.91	3.12	3.01	3.18	3.49	3.55	3.44	3.42	3.44	3.48	3.47
	Manure management N_2O	4.48	4.32	4.62	4.57	4.47	4.95	6.87	7.73	7.07	7.27	7.97	7.42	7.41	7.62	7.44	7.67	7.06
	TOTAL	**22.67**	**22.81**	**23.50**	**23.12**	**21.41**	**23.26**	**26.52**	**27.51**	**27.09**	**27.57**	**29.17**	**27.99**	**28.22**	**28.17**	**24.04**	**24.17**	**22.48**
Rodrigues Island	Enteric fermentation CH_4	9.95	9.95	9.95	9.95	9.95	9.95	9.95	11.11	7.09	6.79	9.51	10.69	9.11	10.09	11.93	11.44	11.67
	Manure management CH_4	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.67	0.57	0.53	0.58	0.63	0.58	0.56	0.67	0.54	0.56
	Manure management N_2O	2.90	2.90	2.90	2.90	2.90	2.90	3.02	3.22	2.74	2.33	2.68	3.10	2.75	2.73	3.25	2.75	2.83
	TOTAL	**13.49**	**13.49**	**13.49**	**13.49**	**13.49**	**13.49**	**13.61**	**15.00**	**10.40**	**9.65**	**12.77**	**14.42**	**12.44**	**13.38**	**15.85**	**14.73**	**15.06**

5.2.4 Quality Control

Information was generally obtained from official sources, including Statistics Mauritius and its Digest of Agriculture and Environment Statistics. Statistics Mauritius applies quality controls to the information before publicly realising it. If statistics were not available, expert judgement has been used to fill the gaps.

On the other hand, in order to ensure the use of right data in the inventory, some QC were implemented during the data collection and emission estimation is listed below:

- Cross verification by the Department of Climate Change, FAREI and data reported in the national Statistics Mauritius.
- Cross verification between data provided by FAREI and the default values proposed by the IPCC 2006 Guidelines for AFOLU sector.
- Cross verification between the GHG emissions estimated in the current inventory for AFOLU sector and the results obtained in the last reported national inventory of the RoM.

Activity data check: The livestock data collection methods were reviewed, in particular checking that livestock data for each species/sub species was collected and aggregated correctly with consideration for the duration of production cycles and taking into account imported animals. The data were cross-checked with previous years to ensure the data were reasonable and consistent with the expected trend.

Source specific verification (Quality control): The personnel from FAREI assessed the quality of the data, determined the conformity of the procedures which were followed for the compilation of this inventory and to identify areas of improvement.

Quality and reliability of data: All data collected was done using local expertise, experience in this sector and to the best of knowledge.

5.2.5 Uncertainty Assessment and Time-series Consistency

Uncertainties on the number of animals are: Dairy cattle ±7,5%; Other cattle ±7,5%; Swine ±5%; Goat ±7,5%; Sheep ±7,5%; Horses ±6%; Poultry ±10%; Deer ±2%. Uncertainty values were provided by FAREI Research Department.

Emission Factor uncertainties were obtained from 2006 IPPC Guidelines Volume 4, chapter 10, pages 10.33, 10.48 and 10.66. Given the insularity of Mauritius and its differences from mainland Africa, it was decided to use the upper range of the uncertainty values provided by the 2006 IPCC Guidelines.

The uncertainty analysis results for livestock obtained from the IPCC software are reported in the following table for 2016 as base year:

Table 96. Uncertainty Analysis of Livestock category (3.A)

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
3.A.1.a.i - Dairy Cows	CH_4	7.50	50.00	50.56
3.A.1.a.ii - Other Cattle	CH_4	7.50	50.00	50.56
3.A.1.c - Sheep	CH_4	7.50	50.00	50.56
3.A.1.d - Goats	CH_4	7.50	50.00	50.56
3.A.1.f - Horses	CH_4	6.00	50.00	50.36

3.A.1.h - Swine	CH_4	5.00	50.00	50.25
3.A.1.j - Other (Deer)	CH_4	2.00	50.00	50.04
3.A.2.a.i - Dairy cows	CH_4	50.56	30.00	58.79
3.A.2.a.i - Dairy cows	N_2O	50.56	100.00	112.05
3.A.2.a.ii - Other cattle	CH_4	50.56	30.00	58.79
3.A.2.a.ii - Other cattle	N_2O	50.56	100.00	112.05
3.A.2.c - Sheep	CH_4	50.56	30.00	58.79
3.A.2.c - Sheep	N_2O	50.56	100.00	112.05
3.A.2.d - Goats	CH_4	50.56	30.00	58.79
3.A.2.d - Goats	N_2O	50.56	100.00	112.05
3.A.2.f - Horses	CH_4	50.36	30.00	58.62
3.A.2.f - Horses	N_2O	50.36	100.00	111.96
3.A.2.h - Swine	CH_4	50.25	30.00	58.52
3.A.2.h - Swine	N_2O	50.25	100.00	111.92
3.A.2.i - Poultry	CH_4	50.99	30.00	59.16
3.A.2.i - Poultry	N_2O	50.99	100.00	112.25
3.A.2.j - Other (Deer)	CH_4	50.04	30.00	58.34
3.A.2.j - Other (Deer)	N_2O	50.04	100.00	111.82

Note: The activity data of N_2O emissions from manure management is the N excreted by manure management system. Therefore, its uncertainty is based on the number of animals and the N excretion per animal, being the second ±50% according to 2006 IPCC Guidelines, volume 4, chapter 10, pg. 10.66.

5.2.6 Recalculations

- Estimates for Rodrigues Island were newly included in this GHGI, based on information of number of animals and manure management system distribution.
- Included the number of horses for 2007-2011 that was missing in the previous GHGI, based on interpolation between 2006 and 2012 values.
- Included information for ducks and broiler's parents for 2000-2005, based on 2006 value.
- Manure management system distribution was completed for the whole time-series.

5.2.7 Planned Improvements

- Information on the number of animals is not complete. It includes gaps such as lack of data or data not disaggregated by region in some years. In addition, some time series show unusual trends. In this GHG Inventory, the gaps have been filled using assumptions and gap-filling techniques. However, this should be a temporary solution. It is needed to analyse and verify the existing information, as well as raising the missing information to ensure consistent time-series of number of animals in line with the IPCC requirements.

- Tier 1 methodology and default EF have been used for the livestock subsector. They may not be appropriate for local conditions and carry large uncertainties as RoM is a SIDS country. There is a need to update the estimates to Tier 2 for the most significant categories.

- Information on manure management systems only covers 2006-2013 for Mauritius Island. Information needs to be updated and also complete to also cover Rodrigues Island.

- In general, the collection of activity data and parameters must be standardized, clarifying to the data providers the format, timeline, scope and QC needed for the data.

5.3 Land (Category 3B)

5.3.1 General

GHG emissions/removals from land have to be reported for the six top-level 2006 IPCC land use categories, namely: Forest land, Cropland, Grassland, Wetlands, Settlements and Other land. Each of the 2006 IPCC categories is briefly described below.

Net CO_2 emissions/removals and non-CO_2 emissions resulting from: (i) land remaining in the same land use and (ii) land converted to another land use were estimated for the period 2000 to 2016. Forest land is the category that mainly drives net emissions/removals from the land sector. The land use sector represents a sink of GHGs for the period 2000 to 2016 except the year 2004 where the sector acted as a net source. This source (positive emission) is attributed to a great area of deforestation, mostly on privately owned forest land. However, it is to be highlighted that the 2004 data for private forests was obtained after a new survey of private forest land and remote sensing data from the National Remote Sensing Centre. Unlike State Forest Land, private forests are not regularly surveyed. Therefore, it is more likely that this deforestation on private land occurred over several years. For practical reasons, a decision was taken to prevent the cumulated deforestation on private land in 2004.

Forest land (IPCC Category 3B1)

Greenhouse gas emissions and removals per hectare vary according to site factors, forest or plantation types, stages of stand development and management practices. It is good practice to stratify forest land into various subcategories to reduce the variation in growth rate and other forest parameters and to reduce uncertainty.

In RoM, there is no legal definition for forest land. However, any land area of 0.5 ha or more and having a natural or planted forest tree canopy cover of 30% or more is considered as forest land. Forest land includes plantations and natural forests. This category covers the estimation of CO_2 emissions and removals and includes above-ground biomass, dead organic matter and the soil carbon pools. There has been very little change in the forested areas across the time series. However, the reason that remaining forest land is a net sink is because there is an increase in the standing biomass per hectare.

The total extent of forest cover in RoM is estimated at 51,066 hectares representing about 27.4% of the total land area in 2016. There are only two types of forest ownership: public and private.

Total forest area decreased by 15.8% between 2000 and 2016, from 60,629 hectares in 2000 to 51,066 hectares in 2016. Approximately, 22,066 hectares (47%) of the total forest area in Mauritius in 2016 was state-owned and the remaining 25,000 hectares (53%) was privately-owned.

Out of the 22,066 hectares of state-owned forest area, approximately 12,012 hectares (54.4%) were planted areas while the Black River Gorges National Park and the nature reserves accounted for 6,574 (29.8%) and 799 (3.6%) hectares respectively. "Pas Geometriques" covered about 623 hectares (2.8%), other nature parks, 906 hectares (4.1%) and other forest lands, 1,366 hectares (6.2%).

Rodrigues' island forest land accounts for 4,000 ha. The forest formations are all composed of fast growing "exotic" species: *Acacia nilotica, Casuarina equisetifolia, Eucalyptus tereticornis, Terminalia catappa,Syzygium jambos, Pongamia pinnata*. For this NIR, almost all forest lands have been considered as forest land remaining forest land when compiling the inventory. The detailed assessment of other lands in Rodrigues will be conducted in future inventory.

Both native and planted forests are considered, as they are all managed. They have been classified according to types and ecological zones to be used in the 2006 IPCC Inventory Software. Timber exploitation is carried out mainly in planted forests under Pine and Eucalyptus species. Both these species are moderately resistant to cyclones and suffer substantial damage during their passages. The amount of carbon stored through biomass increment exceeds by far the amount lost through commercial felling, fuel wood gathering and disturbances such as cyclones and fires.

Timber exploitation is limited and there has been a decreasing trend in timber local production.

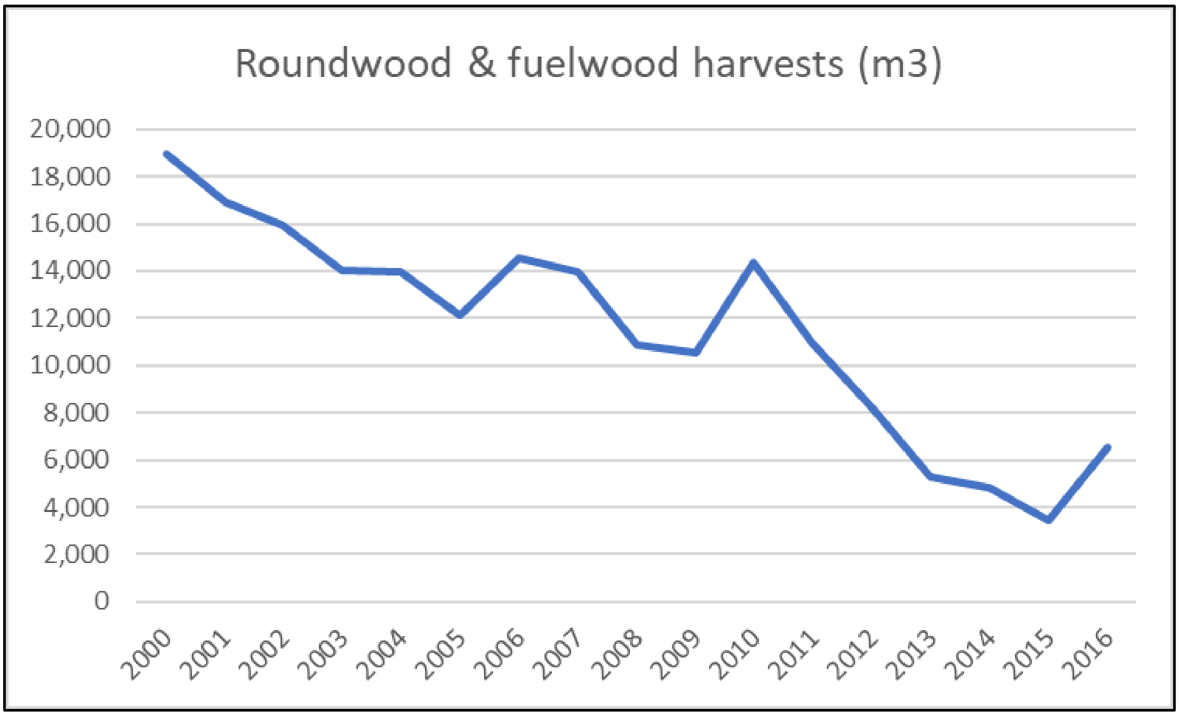


Figure 52. Timber local production for the period 2000-2016 (m3/year)

Forest land in the RoM is stratified as follows:

- Dry land (Araucaria columnaris, Araucaria cunninghamii, Casuarina equisetifolia, Eucalyptus tereticornis, Tabebuia pallida, Scrubland forest);
- Mangrove forest;
- Moist Forest (Araucaria columnaris, Eucalyptus tereticornis, Eucalyptus robusta, Tabebuia pallida, Casuarina equisetifolia, Natural forest);
- Wet upland forest (Eucalyptus robusta, Cryptomeria japonica, Pinus elliottii, Araucaria columnaris, natural forest);

Cropland (IPCC Category 3B2)

Cropland includes arable and tillage land, rice fields, and agroforestry systems where the vegetation structure falls below the thresholds used for the forest land category and is not expected to exceed those thresholds at a later time. Cropland includes all annual and perennial crops as well as temporary fallow land (i.e., land set at rest for one or several years before being cultivated again). Annual crops include cereals, oils seeds, vegetables, root crops and forages. Perennial crops include trees and shrubs, in combination with herbaceous crops (e.g., agroforestry) or as orchards, vineyards and plantations such as cocoa, coffee, tea, oil palm, coconut, rubber trees, and bananas, except where these lands meet the criteria for categorisation as forest land. Arable land, which is normally used for cultivation of annual crops, but which is temporarily used for forage crops or grazing as part of an annual crop-pasture rotation (mixed system) is included under cropland.

In the Republic of Mauritius cropland comprises mostly sugarcane cultivation which covers about 51,476 ha (2016) or 27.6% of the total land area (Statistics Mauritius 2016). Since 2000, cropland area does not present significant changes. In particular, there is a small increase in cropland area from 90,295 ha in 2000 to 90,320 ha in 2016. Cropland in RoM comprise:

- Fruits;
- Mixed Cropping;
- Orchard;
- Sugarcane;
- Tea; and
- Cropland Trees.

Grassland (IPCC Category 3B3)

Grasslands are generally distinguished from “forest” as ecosystems having a tree canopy cover of less than a certain threshold, which varies from region to region. Below-ground carbon dominates in grassland and is mainly contained in roots and soil organic matter. Many shrublands with high proportions of perennial woody biomass may be considered to be a type of grassland and countries may elect to account for some or all of these shrublands in the Grassland category.

According to 2006 IPCC Guidelines, this category includes rangelands and pasture land that are not considered cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the forest land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastoral systems, consistent with national definitions.

In RoM, this category includes land that is left as unoccupied that is invaded by bushes and a few patches of trees, part of hunting areas in private forests and along mountainsides. Since they include some woody biomass, they have been accounted for. Throughout the time series, grassland area remains stable equal to 1,779 ha.

Wetlands (IPCC Category 3B4)

Wetlands include any land that is covered or saturated by water for all or part of the year, and that does not fall into the forest land, cropland, or grassland categories. Managed wetlands will be restricted to wetlands where the water table is artificially changed (e.g., drained or raised) or those created through human activity (e.g., damming a river). Emissions from unmanaged wetlands need not to be estimated.

This category in RoM is considered to be managed as reservoirs and rivers and their surrounding areas. Hence, the trees around them have been considered. However, the 2006 IPCC Guidelines do not provide methods to account for these sinks and therefore the calculations have been included in forests. This also includes mangroves which are classified under forest land. Furthermore, peatlands do not exist in the country. Wetlands area exhibit a small increase (0.9%) from 3,690 ha in 2000 to 3,724 ha in 2016.

Settlements (IPCC Category 3B5)

Settlements are defined as including all developed land, i.e., residential, transportation, commercial, and production (commercial, manufacturing) infrastructure of any size, unless it is already included under other land-use categories. The land-use category settlements includes soils, herbaceous perennial vegetation such as turf grass and garden plants, trees in rural settlements, homestead gardens and urban areas. Examples of settlements include land along streets, in residential (rural and urban) and commercial lawns, in public and private gardens, in golf courses and athletic fields, and in parks, provided such land is functionally or administratively associated with particular cities, villages or other settlement types and is not accounted for in another land-use category.

The trees within the compounds of houses, along roads, parks and others within settlements form an additional sink of carbon in the Republic of Mauritius. Settlements amounted to 2,879 ha in 2000 and 2,880 ha in 2016.

Other Land (IPCC Category 3B6)

Other land includes bare soil, rock and all land areas that do not fall into any of the other five land-use categories. Other land is often unmanaged, and in that case changes in carbon stocks and non-CO2 emissions and removals are not estimated. According to the 2006 IPCC Guidelines, this land-use category is included to allow the total of identified land areas to match the national area. Other land amounted to 27,268 ha in 2000 and 36,771 ha in 2016, showing an increase of 34.9% during the same period.

5.3.2 Information on approaches used for representing land areas and on land-use databases used for the inventory preparation

The area distribution of the different land use categories in 2016 is presented in Figure 54 below:

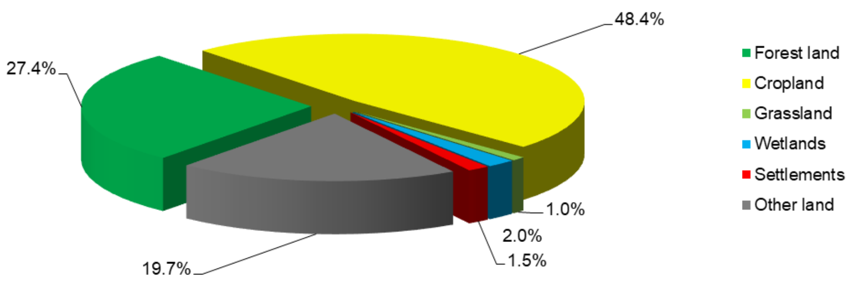


Figure 53. Area distribution of land-use categories for the RoM in 2016

In this GHG inventory various data sources have been used and assumptions have been made for the land representation. It should be noted, that in the current GHG inventory a consistent land representation has been developed, given the available data, for the whole time series of the inventory period.

The different data sources include:

- The Forestry Service, Ministry of Agro-Industry & Food Security;
- Cheong & Umrit (2015);
- IIASA.

As noted in the previous national GHG inventory (Third National Communication), according to the GIS data base used in a study by International Institute for Applied Systems Analysis (IIASA), RoM has a total land surface area of 186,540 ha. This area has been used as the total country area in the current GHG inventory as well. Furthermore, for developing a consistent land representation the various available data have been utilised in order to provide the areas of the different land-use categories and the changes between the land-use categories through time, ensuring at the same time that the total country area remains constant in all years of the whole time series. A combination of approach 1 and approach 2 for land representation has been applied, following guidance from 2006 IPCC Guidelines (volume 4, chapter 3).

Table 97. Land area of each major forest species (ha)

Ecological Zone (Tropical)	Category	Climate Region	Ecosystem Type	Soil Type	Species	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
						Extent (ha)																
	Plantation	Tropical Wet	Tropical rainforest	HAC	*Pinus elliottii*	8,078	8,035	8,062	8,113	8,136	8,143	8,162	8,195	8,165	8,197	8,199	8,176	8,179	8,179	8,137	8,111	8,105
Wet Upland Forest	Plantation	Tropical Wet	Tropical rainforest	HAC	*Eucalyptus*	546	546	546	546	546	546	546	546	550	550	565	565	565	565	565	565	565
R > 2000mm	Plantation	Tropical Wet	Tropical rainforest	HAC	*Cryptomeria japonica*	959	959	966	966	966	967	967	967	967	967	965	965	965	965	965	965	965
	Plantation	Tropical Wet	Tropical rainforest	HAC	Araucaria	59	59	59	59	59	61	62	62	62	62	60	60	60	60	60	60	60
	Natural	Tropical Wet	Tropical rainforest	HAC	Mostly native forests severely invaded by alien plant species	18,685	18,682	18,626	18,541	15,197	15,170	15,146	15,113	15,143	15,111	15,100	15,100	15,100	15,100	15,142	15,134	15,139
	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	Eucalyptus	889	889	889	889	889	889	889	889	889	889	889	889	889	889	889	889	889
Moist Forest	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous	LAC	*Tabebuia pallida*	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139	139
2000 mm> R> 1000 mm	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous	LAC	Araucaria	176	176	176	176	176	176	176	176	176	176	174	174	174	174	174	174	174
	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous	LAC	*Casuarina equisetifolia*	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
	Natural	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	Mostly native forests severely invaded by alien plant species	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,079	5,079	5,079	5,079	5,079	5,079	5079
	Plantation	Tropical Dry	Tropical Dry Forest	Sandy M.	Eucalyptus	2,825	2,841	2,841	2,860	2,389	2,389	2,389	2,410	2,413	2,413	2,433	2,437	2,437	2,402	2,402	2,402	2402
Dry Lowland Forest	Plantation	Tropical Dry	Tropical Dry Forest	LAC	*Tabebuia pallida*	661	683	689	700	708	710	710	710	710	710	710	710	710	710	710	710	710
R <1000mm	Plantation	Tropical Dry	Tropical Dry Forest	LAC	Araucaria	403	405	408	408	408	408	408	384	384	384	382	382	382	382	382	382	382
	Plantation	Tropical Dry	Tropical Dry Forest	Sandy M.	*Casuarina equisetifolia*	114	120	133	116	116	116	116	112	112	112	112	112	112	111	106	106	104
	Scrublands	Tropical Dry	Tropical Dry Forest	Sandy M.	Mainly exotics	17,900	17,900	17,900	17,900	12,276	12,276	12,276	12,278	12,254	12,254	12,242	12,242	12,242	12,243	12,243	12,243	12,243
					Total	56,629	56,629	56,629	56,608	47,200	47,185	47,181	47,176	47,159	47,159	47,159	47,140	47,143	47,108	47,103	47,069	47,066

For the total forest land area, the information provided by the Forest Service has been used as presented in Table 96 above. The table presents the information for the different forest species including their area distribution during the inventory period. In addition to the forest land area presented in Table 96 above, 4,000 ha represent the forest land area in Rodrigues island (stable throughout the inventory period).

For the rest of the land use categories, the information from different sources has been utilised. In particular, an assessment of land use change was made using a national methodology, which is still under development. The methodology uses satellite imagery from online sources as developed by the US Forest Department (USDA 2014) and has been used in a few studies (e.g. Song et al. 2012). Since longer time slots change are not available a 10 to 12 years change is adopted. The estimates are as presented in Table 97 below:

Table 98. Land Cover Change of RoM

	2004 – 2009		2014		
Cover Class	**Extent Ha**	**Share %**	**Extent Ha**	**Share %**	**Change %**
Forest and Other Wooded Lands	52,867	28.3%	52,867	28.34%	0%
Cropland	91,424	49%	90,320	48.42%	-1.208%
Wetland	3,690	2%	3,690	1.98%	0%
Grassland	1,779	1%	1,779	0.95%	0%
Settlements	27,840	14.9%	28,880	15.48%	3.736
Other lands	8,940	4.8%	8,980	4.81%	0.447%
Total	186,540	100%	186,516	100%	-

From the above table, and for the construction of the land-use matrices, the starting year has been defined as the year 2014, since this is the latest year for which area information for all land-use categories is provided. Therefore, the areas of the land use categories (other than forest land) for 2014 are those presented in the table above. The difference in the total country area and the sum of the net areas of all land use categories has been allocated to the other land category.

Furthermore, for the deforestation areas, information provided by the Forestry Service, Ministry of Agro-Industry & Food Security and Cheong & Umrit (2015) has been used as presented in Table 98 below.

Table 99. Deforestation areas in RoM (ha)

Year	Change in land use	Extent (ha)	Ecological Zone	Forest Land Category	Soil Type
2006	Forest Land *(P.elliottii)* to Cropland	4	Wet Upland Forest	Plantation	HAC
2007	Forest Land *(P.elliottii)* to Cropland	5	Wet Upland Forest	Plantation	HAC
2008	Forest Land *(P.elliottii)* to Cropland	17	Wet Upland Forest	Plantation	HAC
2011	Forest Land *(P.elliottii)* to Other Land	17	Wet Upland Forest	Plantation	HAC
2011	Forest Land (Natural) to Cropland	2	Moist Forest	Natural	LAC
2013	Forest Land *(Eucalyptus)* to Other Land	34	Dry Lowland Forest	Plantation	LAC
2013	Forest Land *(Casuarina)* to Settlement	1	Dry Lowland Forest	Plantation	Sandy Mineral
2014	Forest Land *(Casuarina)* to Other Land	5	Dry Lowland Forest	Plantation	Sandy Mineral
2015	Forest Land *(P.elliottii)* to Wetland	34	Wet Upland Forest	Plantation	HAC
2016	Forest Land *(P.elliottii)* to Other Land	1	Wet Upland Forest	Plantation	HAC
2016	Forest Land *(Casuarina)* to Other Land	2	Dry Lowland Forest	Plantation	Sandy Mineral

For the years before 2006, the deforestation areas were obtained from the difference in the net annual forest land areas as presented in Table 97 above. The assumption applied is that for the years before 2006 all deforestation represented forest land conversions to other land.

Back casting and forward casting were made for all years of the inventory period in order to derive the land use matrices based on all information available for all land uses and land use change categories.

It should be highlighted that in the current GHG inventory of the RoM, for the first time, a complete land representation (i.e. considering all available data sources) has been developed, by reporting the annual and 20 years land use matrices in the 2006 IPCC software, for all land use and land-use change categories, ensuring the consistency of the representation throughout the time series.

For the estimation of carbon stock changes and GHG emissions/removals in the different land use categories, the following stratification scheme has been applied, considering the available information and the feasibility of constructing a consistent land representation:

- Forest land: four combinations of climate region/soil zones for land stratification were used based on the land-use change data available, namely Tropical Wet/High Activity Clay (TW HAC); Tropical Moist Short Dry Season/Low Activity Clay (TM LAC); Tropical Dry/Sandy M. (TD SAN); Tropical Dry/LAC (TD LAC).
- Cropland: Two combinations of climate/soil zones for land stratification for which land-use changes from/to croplands are reported, namely TW HAC and TM LAC.

- Grassland: One combination of climate/soil zone for land stratification was used, that of TW HAC, following the one representing the majority of the forest land area.
- Wetlands: One combination of climate/soil zone for land stratification was used for which land-use changes from/to wetlands are reported, namely TW HAC.
- Settlements: One combination of climate/soil zone for land stratification was used for which land-use changes from/to settlements are reported, namely TD SAN.
- Other land: Two combinations of climate/soil zones for land stratification were used for which land-use changes from/to settlements are reported, namely TW HAC and TD SAN.

5.3.3 Forest land

5.3.3.1 Source Category Description

Greenhouse gas emissions and removals per hectare vary according to site factors, forest or plantation types, stages of stand development and management practices. It is good practice to stratify forest land into various subcategories to reduce the variation in growth rate and other forest parameters and to reduce uncertainty.

The carbon stock changes in forest land are due to:

- biomass increments in forests;
- harvesting of round wood and fuel wood gathering;
- disturbances such as fires, cyclones, pests and diseases.

The GHG gas inventory for forest land involves estimation of changes in carbon stocks from five carbon pools (i.e., above-ground biomass, below ground biomass, dead wood, litter, and soil organic matter), as well as emissions of non-CO_2 gases.

The 2006 IPCC Guidelines were used for the estimation of emissions and removals from forest land. CO_2 emissions from living biomass, dead organic matter and soil were calculated using a combination of tier 1 and tier 2 methods, with the use of IPCC default and country-specific parameters.

The forestry sector includes all activities dependent on forests, trees and other woody vegetation, and all industries based on them. It has numerous interactions and linkages with other sectors, such as agriculture, water, environment, tourism and communications.

The native forests which originally covered most of the island have almost completely disappeared except for a few inaccessible areas, which have been spared the onslaught of deforestation. These areas have now been converted to national parks, nature reserves or other protected areas. Large areas of degraded, upland native forests have since been re-afforested with fast growing exotics that form the bulk of the forest plantations.

The total extent of forest cover in RoM is estimated at 51,066 hectares in 2016 representing about 27.4% of the total land area. There are only two types of forest ownership: public and private.

Total forest area decreased by 9,563 hectares between 2000 and 2016. Approximately 22,066 hectares (47%) of the total forest land area in 2016 was state-owned and the remaining 25,000 hectares (53%) was privately-owned.

Out of the 22,066 hectares of state-owned forest area, 12,012 hectares (54.4%) were planted areas while the Black River Gorges National Park and the nature reserves accounted for 6,574 (29.8%) and 799 (3.6%) hectares respectively. “Pas Geometriques” covered about 623 hectares (2.8%), other nature parks, 906 hectares (4.1%) and other forest lands, 1,366 hectares (6.2%).

Approximately 14,605 ha of land, including some 2,593 ha of privately-owned land, are covered with planted forests. The remaining are natural forests, most of which are badly degraded. It is estimated that around 2% of the land area of Mauritius is considered to be covered with good quality native forests.

Native species are not commercially logged in RoM and are now legally protected by the Native Terrestrial Biodiversity and National Parks Act (2015). Only exotic plantation is commercially harvested in RoM. However, in line with the National Forest Policy (2006), timber exploitation is gradually being phased out and exotic species are gradually being replaced by native species.

As a result, the harvested round wood and fuelwood has steadily decreased from 8,806 m^3/year and 10,171 m^3/year respectively in 2000 to 1,333 m^3/year and 5,178 m^3/year respectively in the inventory year 2016.

It should be noted that because the 2006 IPCC software does not facilitate the application of annual areas for land conversions to forest land, the forest land remaining forest land category includes carbon stock changes and associated emissions/removals from land converted to forest land as well.

5.3.3.2 Methodological Issues

Living biomass

All forest data are available at the Forestry Service. A combination of 2006 IPCC default and country-specific parameters has been used for estimating carbon stock changes and associated GHG emissions and removals from forest land. This information is available at forest species level, as presented in Table 100 below.

Table 100. Parameters used in the GHG inventory per forest species*

Ecological Zone	Category	Climate Region	Ecosystem Type	Soil Type	Species	Age class	Growing stock (m3/ha)	Carbon fraction (t C/t dm)	R (t dm/t dm)	BCEFr (t biomass/m3 wood)	Above-ground biomass (t dm/ha)	Above-ground biomass growth (t dm/ha/yr)	SOC (t C/ha)	Litter stock (t C/ha)
(Tropical)														
Wet Upland Forest (R > 2000mm)	Plantation	Tropical Wet	Tropical rainforest	HAC	*Pinus elliottii*	> 20 yr	81-120	0.47	0.37	0.84	**180.00**	**4.60**	44.00	5.20
	Plantation	Tropical Wet	Tropical rainforest	HAC	*Eucalyptus*	> 20 yr	81-120	0.47	0.37	1.67	**277.00**	**6.00**	44.00	2.10
	Plantation	Tropical Wet	Tropical rainforest	HAC	*Cryptomeria japonica*	> 20 yr	61-80	0.47	0.37	0.89	**150.00**	**6.00**	44.00	5.20
	Plantation	Tropical Wet	Tropical rainforest	HAC	Araucaria	> 20 yr	81-120	0.47	0.37	0.84	180.00	**6.00**	44.00	5.20
	Natural	Tropical Wet	Tropical rainforest	HAC	Mostly native forests severely invaded by alien plant species	> 20 yr	61-80	0.47	0.37	1.89	130.00	3.10	44.00	2.10
Moist Forest (2000 mm> R > 1000 mm)	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	Eucalyptus	> 20 yr	61-80	0.47	0.24	1.89	150.00	**5.00**	47.00	2.10
	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	*Tabebuia pallida*	> 20 yr	81-120	0.47	0.24	1.67	150.00	**8.00**	47.00	2.10
	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	Araucaria	> 20 yr	121-200	0.47	0.24	0.77	**180.00**	**6.00**	47.00	5.20
	Plantation	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	*Casuarina equisetifolia*	> 20 yr	81-120	0.47	0.24	1.67	**150.00**	**9.00**	47.00	2.10
	Natural	Trop. Moist,Short Dry Season	Trop. Moist deciduous F.	LAC	Mostly native forests severely invaded by alien plant species	> 20 yr	41-60	0.47	0.20	2.28	82.00	1.30	47.00	2.10
Dry Lowland Forest (R <1000mm)	Plantation	Tropical Dry	Tropical Dry Forest	Sandy M.	Eucalyptus	> 20 yr	41-60	0.47	0.28	**0.69**	70.00	13.00	31.00	2.10
	Plantation	Tropical Dry	Tropical Dry Forest	LAC	*Tabebuia pallida*	> 20 yr	81-120	0.47	0.28	**0.63**	70.00	**8.00**	35.00	2.10
	Plantation	Tropical Dry	Tropical Dry Forest	LAC	Araucaria	> 20 yr	121-200	0.47	0.28	0.61	**166.00**	**8.00**	35.00	5.20
	Plantation	Tropical Dry	Tropical Dry Forest	Sandy M.	*Casuarina equisetifolia*	> 20 yr	61-80	0.47	0.28	0.89	**70.00**	**8.00**	31.00	2.10
	Scrublands	Tropical Dry	Tropical Dry Forest	Sandy M.	Mainly exotics	> 20 yr	21-40	0.47	0.28	2.11	**55.00**	1.80	31.00	2.10

* *The values indicated in bold are country-specific. They were based on expert knowledge of local plantations and sample plot data, and were estimated taking into consideration factors such as local growth rates, stocking density, log volume per ha, etc. Values in normal text are IPCC defaults.*

The growing stock data were obtained from Global Forest Resource Assessment for RoM (2005, 2010 and 2015). As it is depicted in the table above, the growing stock data were available for the following species: *Pinus elliottii*, *Eucalyptus sp*, *Araucaria sp*, *Tabebuia pallida*, *Cryptomeria japonica* and *Casuarina equisetifolia*.

The methodologies and equations used are those proposed by the 2006 IPCC Guidelines. Most of the country specific factors were not available (basic wood density, biomass expansion factors, root-to-shoot ratio, amongst others).

Carbon stock changes in living biomass were estimated using equation 2.7 from volume 4, chapter 2, 2006 IPCC Guidelines (Gain-loss method).

$$\Delta C_B = \Delta C_G - \Delta C_L$$

Where,

- ΔC_B = annual change in carbon stocks in biomass (above-ground and below-ground), tonnes C yr^{-1}
- ΔC_G = annual increase in carbon stocks due to biomass growth, tonnes C yr^{-1}
- ΔC_L = annual decrease in carbon stocks due to biomass loss, tonnes C yr^{-1}

The annual increase in biomass carbon stock is estimated using Equation 2.9 from volume 4, chapter 2, 2006 IPCC Guidelines in combination with Equation 2.10, where area under each forest land stratum is multiplied by the mean annual growth.

$$\Delta \mathbf{C_G} = \sum_{i,j} \left(\mathbf{A}_{i,j} \times \mathbf{G}_{TOTAL_{i,j}} \times \mathbf{CF}_{i,j} \right)$$

Where,

- ΔC_G = annual increase in biomass carbon stocks due to biomass growth in land remaining in the same land-use category by vegetation type and climatic zone, tonnes C yr^{-1}
- A = area of land remaining in the same land-use category, ha
- G_{TOTAL}= mean annual biomass growth, tonnes dm ha^{-1} yr^{-1}
- *i* = ecological zone (*i* = 1 to *n*)
- *j* = climate domain (*j* = 1 to *m)*
- CF = carbon fraction of dry matter, tonne C (tonne dm)$^{-1}$

$$G_{TOTAL} = \sum \{ G_W \bullet (1 + R) \}$$

Where,

- G_{TOTAL} = average annual biomass growth above and below-ground, tonnes dm ha^{-1} yr^{-1}
- G_W = average annual above-ground biomass growth for a specific woody vegetation type, tonnes dm ha^{-1} yr^{-1}
- R = ratio of below-ground biomass to above-ground biomass for a specific vegetation type, in tonne dm below-ground biomass (tonne dm above-ground biomass)$^{-1}$.

Biomass carbon stocks losses were estimated using Equation 2.11 from volume 4, chapter 2, 2006 IPCC Guidelines, in combination with Equations 2.12, 2.13 and 2.14 for $L_{wood\text{-}removals}$, $L_{fuelwood}$ and $L_{disturbance}$, respectively)

$$\Delta C_L = L_{wood-removal} + L_{fuelwood} + L_{disturbance}$$

Where,

- ΔC_L = annual decrease in carbon stocks due to biomass loss in land remaining in the same land-use category, tonnes C yr^{-1}
- $L_{wood\text{-}removals}$ = annual carbon loss due to wood removals, tonnes C yr^{-1}
- $L_{fuelwood}$ = annual biomass carbon loss due to fuelwood removals, tonnes C yr^{-1}
- $L_{disturbance}$ = annual biomass carbon losses due to disturbances, tonnes C yr^{-1}

Since there was not available information for all changes between and from/to the different forest species categories for the whole inventory period and because by applying this disaggregated level (at forests species level) the development of the annual land use matrices would be very complicated, for the purposes of this GHG inventory, parameters of specific forest species were assigned to each of the forest land strata presented above, taking into account the information available for deforestation events, harvestings and disturbances occurring in the different forest species (i.e. in which forest species harvestings, wood removals and disturbances occur).

In practice, the parameters applied for each of the forest land strata applied in the GHG inventory are presented in the table below.

	Stratum	Note
Climate/soil zone	TW HAC	This climate/soil zone is assigned to Pinus elliottii, because all deforestation from this climate/soil zone is from Pinus elliottii and all harvest, disturbances from Pinus elliottii are assigned to this zone
Species	Pinus elliottii	
Growing stock level (m3/ha)	81-120	
Carbon fraction (t C/t dm)	0.47	IPCC default
R (t dm/t dm)	0.37	Weighted average by the area of forest species of IPCC default values (the same R value is used for all species in this zone)
BCEFr (t biomass/m3 wood)	0.84	IPCC default for Pinus because all removals from P. elliottii are assigned to this climate/soil zone
Above ground biomass (t dm/ha)	180	Country specific value for Pinus elliottii because all disturbances from Pinus elliottii are assigned to this climate/soil zone and all deforestation from P. elliottii is in this climate/soil zone
Above ground biomass growth (t dm/ha/yr)	3.75	Weighted average of the climate/soil zone by the average area of the forest species for the period 2000-2016
Reference SOC (t C/ha)	44	IPCC default
Litter carbon stocks (t C/ha)	5.2	IPCC default for Tropical needleleaf evergreen, because all deforestation is from P. elliottii in this climate/soil zone

	Forest land	
	Stratum	Note
Climate/soil zone	TM LAC	This climate/soil zone is assigned to natural forest, because all deforestation from this climate/soil zone is from natural. Also, disturbances from scrubland is assigned to this zone
Species	Natural forest	
Growing stock level (m3/ha)	41-60	
Carbon fraction (t C/t dm)	0.47	IPCC default
R (t dm/t dm)	0.21	Weighted average by the area of forest species of IPCC default values
BCEFr (t biomass/m3 wood)	2.28	IPCC default for natural forest
Above ground biomass (t dm/ha)	82	Country specific value for Tropical moist deciduous natural forest
Above ground biomass growth (t dm/ha/yr)	2.22	Weighted average of the climate/soil zone by the average area of the forest species for the period 2000-2016
Reference SOC (t C/ha)	47	IPCC default
Litter carbon stocks (t C/ha)	2.1	IPCC default for Tropical Broadleaf deciduous, because all deforestation is from natural forest in this climate/soil zone

	Forest land	
	Stratum	Note
Climate/soil zone	TD SAN	This climate/soil zone is assigned to Eucalyptus, because most of deforestation from this climate/soil zone is from Eucalyptus. Also, harvest and disturbances from Eucalyptus is assigned to this zone
Species	Eucalyptus	
Growing stock level (m3/ha)	41-60	
Carbon fraction (t C/t dm)	0.47	IPCC default
R (t dm/t dm)	0.28	Weighted average by the area of forest species of IPCC default values (the same R value is used for all species in this zone)
BCEFr (t biomass/m3 wood)	0.69	Country specific value for Eucalyptus for tropical dry hardwood
Above ground biomass (t dm/ha)	70	IPCC default for tropical dry broadleaf plantation for Eucalyptus because most of deforestation from this climate/soil zone is from this forest species
Above ground biomass growth (t dm/ha/yr)	3.58	Weighted average of the climate/soil zone by the average area of the forest species for the period 2000-2016
Reference SOC (t C/ha)	31	IPCC default
Litter carbon stocks (t C/ha)	2.1	IPCC default for Tropical Broadleaf deciduous, because all deforestation is from natural forest in this climate/soil zone

	Forest land	
	Stratum	Note
Climate/soil zone	TD LAC	This climate/soil zone is assigned to Casuarina, and disturbances from Casuarina are assigned to this climate/soil zone
Species	Casuarina	
Growing stock level (m3/ha)	61-80	
Carbon fraction (t C/t dm)	0.47	IPCC default
R (t dm/t dm)	0.28	Weighted average by the area of forest species of IPCC default values (the same R value is used for all species in this zone)
BCEFr (t biomass/m3 wood)	0.89	IPCC default for tropical dry conifers
Above ground biomass (t dm/ha)	70	Country specific value for Causarina because disturbances from this climate/soil zone is assigned to this forest species
Above ground biomass growth (t dm/ha/yr)	8	Weighted average of the climate/soil zone, based on the average area of the forest species for the period 2000-2016
Reference SOC (t C/ha)	35	IPCC default
Litter carbon stocks (t C/ha)	2.1	IPCC default for Tropical Broadleaf deciduous, because all deforestation is from natural forest in this climate/soil zone

	Forest land	
	Stratum	Note
Climate/soil zone	Rodriguez TD SAN	Rodriguez forest land is assigned to this climate/soil zone based on the majority of activity data for wood removals from this region. For the same reason the parameters of Eucalyptus like in the Mauritius TD SAN zone were applied
Species	Eucalyptus	
Growing stock level (m3/ha)	41-60	
Carbon fraction (t C/t dm)	0.47	IPCC default
R (t dm/t dm)	0.28	Similar to Mauritius TD SAN zone
BCEFr (t biomass/m3 wood)	0.69	Similar to Mauritius TD SAN zone
Above ground biomass (t dm/ha)	70	Similar to Mauritius TD SAN zone
Above ground biomass growth (t dm/ha/yr)	3.58	Similar to Mauritius TD SAN zone
Reference SOC (t C/ha)	31	IPCC default
Litter carbon stocks (t C/ha)	2.1	IPCC default for Tropical Broadleaf deciduous similar to Mauritius TD SAN zone

Figure 54. Parameters used in the forest land strata for estimating carbon stock changes

For the estimation of carbon losses due to wood and fuelwood removals data on annual harvestings were used.

Table 101. Annual harvest amounts of roundwood and fuelwood (m^3/year)

Year	Harvest of roundwood (m^3/year)	*Of which "Hardwood (Eucalyptus spp)"*	*of which "Softwood (Pinus elliottii)"*	Fuelwood gathering (m^3/year)	*Of which "Hardwood (Eucalyptus spp)"*	*of which "Softwood (Pinus elliottii)"*
2000	**8,806**	*3,306*	*5,500*	**10,171**	*4,159*	*6,012*
2001	**7,611**	*2,845*	*4,766*	**9,334**	*3,472*	*5,862*
2002	**6,988**	*2,706*	*4,282*	**8,922**	*4,060*	*4,862*
2003	**7,541**	*3,373*	*4,168*	**6,466**	*2,982*	*3,484*
2004	**8,168**	*3,305*	*4,863*	**5,805**	*2,435*	*3,370*
2005	**7,005**	*1,973*	*5,032*	**5,093**	*1,984*	*3,109*
2006	**8,474**	*2,055*	*6,419*	**6,058**	*3,280*	*2,778*
2007	**6,885**	*1,752*	*5,133*	**7,067**	*3,857*	*3,210*
2008	**5,614**	*1,000*	*4,614*	**5,271**	*2,253*	*3,018*
2009	**5,049**	*718*	*4,331*	**5,482**	*2,335*	*3,147*
2010	**4,916**	*1,700*	*3,216*	**9,412**	*3,593*	*5,819*
2011	**4,488**	*912*	*3,576*	**6,472**	*2,612*	*3,860*
2012	**3,155**	*936*	*2,219*	**5,077**	*2,821*	*2,256*
2013	**1,432**	*656*	*776*	**3,885**	*2,064*	*1,821*
2014	**1,236**	*528*	*708*	**3,611**	*1,911*	*1,700*
2015	**766**	*285*	*481*	**2,685**	*1,164*	*1,521*
2016	**1,333**	*421*	*912*	**5,178**	*2,098*	*3,080*

In the case of carbon losses from fuelwood gathering, the values represent the volume of whole trees removed. The basic density values of 0.51 t dm/m^3 and 0.46 t dm/m^3 for Eucalyptus and Pinus, respectively, were used.

Similarly, for carbon losses due to disturbances (fires, pests/diseases, cyclones) annual area statistics were utilised as presented in table below. The fraction of biomass lost in the disturbances was taken as 1.

Table 102. Areas affected by disturbances for the period 2000-2016 (ha)

Year	Total disturbances (ha/yr)				
	Total	*Pinus*	*Eucalyptus*	*Casuarina*	*Scrubland*
2000	**13.65**	0.00	3.15	1.00	9.50
2001	**18.80**	0.60	5.40	5.00	7.80
2002	**173.80**	75.50	62.50	27.50	8.30
2003	**14.80**	0,30	3.60	0.00	10.90
2004	**13.30**	0.00	3.90	3.00	6.40
2005	**18.50**	3.00	3.60	7.00	4.90
2006	**94.80**	0.80	35.00	0.00	59.00
2007	**368.00**	214.00	154.00	0.00	0.00
2008	**136.00**	0.00	136.00	0.00	0.00
2009	**123.00**	0.00	80.00	0.00	43.00
2010	**188.00**	0.00	90.00	0.00	98.00

2011	**96.00**	0.00	96.00	0.00	0.00
2012	**154.00**	0.00	98.00	0.00	56.00
2013	**157.00**	0.00	102.00	0.00	55.00
2014	**207.00**	0.00	151.00	0.00	56.00
2015	**78.00**	0.00	25.00	0.00	53.00
2016	**60.00**	0.00	13.00	0.00	47.00

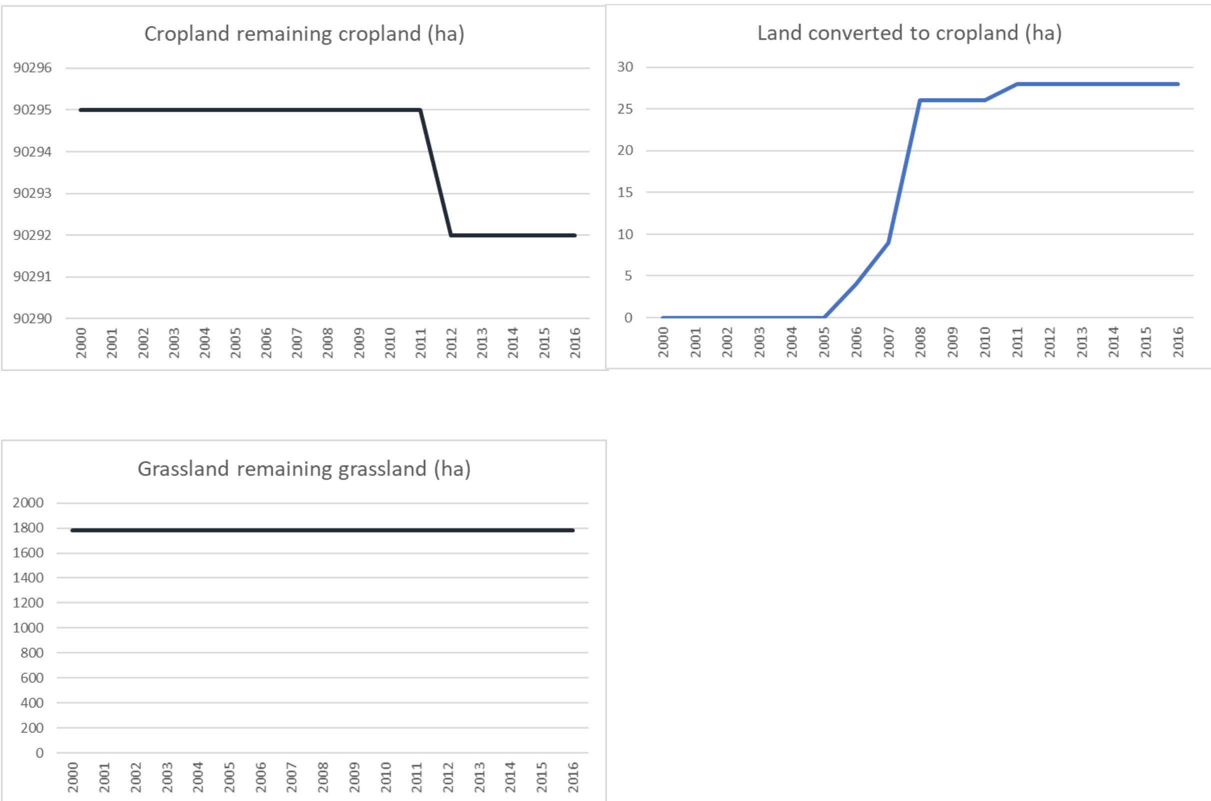
Dead organic matter, Soil organic matter (SOM)

For the dead organic matter and soil organic matter pools, the tier 1 assumption from 2006 IPCC guidelines was followed, according to which the carbon pools are in equilibrium. Thus, carbon stock changes are assumed to be zero for the whole inventory period.

5.3.4 Cropland, Grassland, Wetlands, Settlements, Other land

5.3.4.1 Source Category Description

Area information has been reported for the whole inventory time series for all land-use categories for both lands remaining in the same land use and land conversion categories. The relevant information is presented in Figure 54.



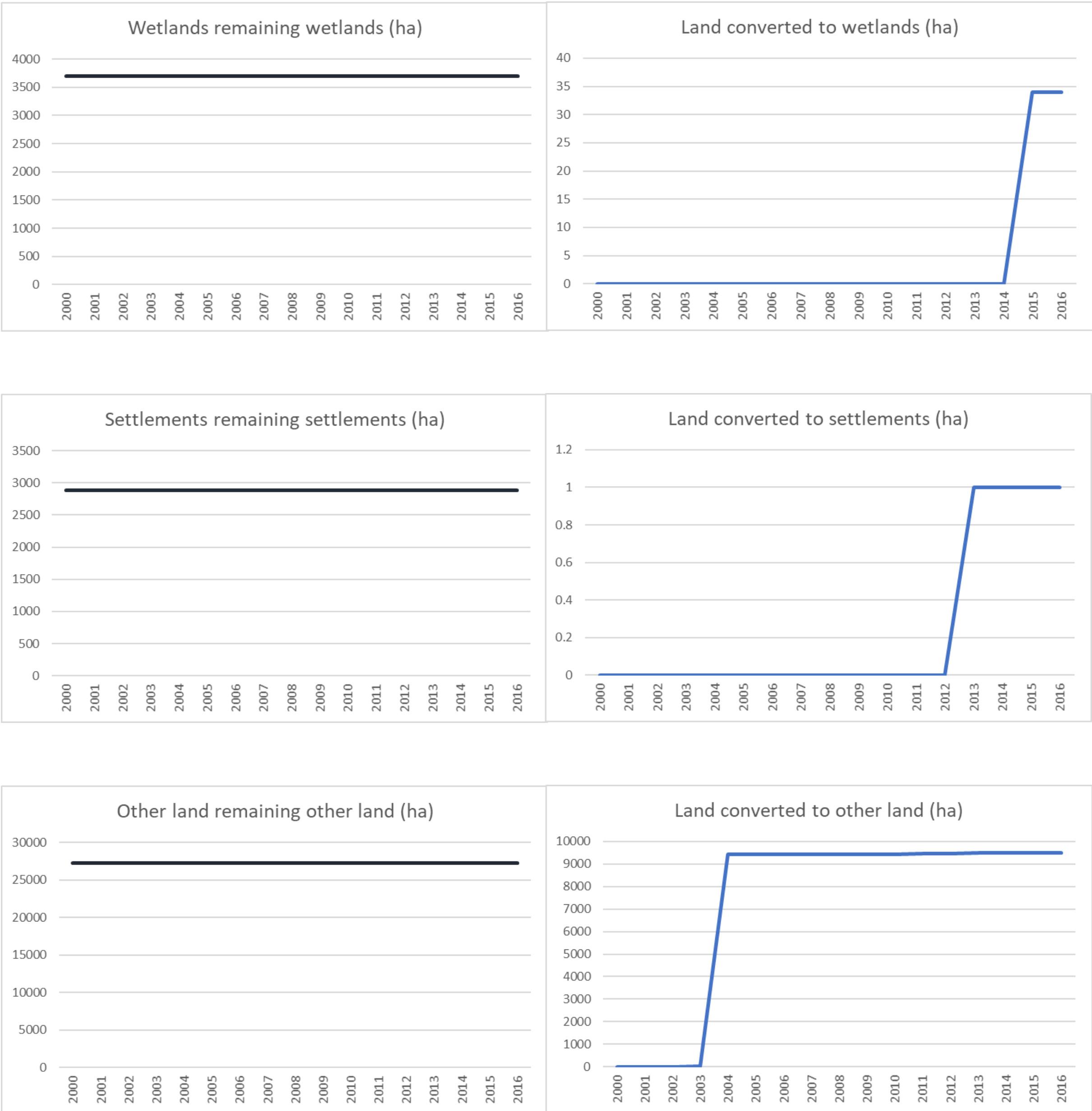


Figure 54. Areas for each main land-use category separately for land remaining in the same land use and land converted to another land use (ha)

Cropland area has increased by 0.03% during the period 2000-2016, while grassland area has remained constant within the same period. Wetlands have increased by 0.9%, settlements have increased by 0.03% and other land area has increased by 34.9% between 2000 and 2016.

5.3.4.2 Methodological Issues

Carbon stock changes and associated GHG emissions/removals have been estimated for land converted to cropland (forest land conversion to cropland), land converted to wetlands (forest land conversion to flooded land), land converted to settlements (forest land conversion to settlements) and land converted to other land (forest land conversion to other land).

Living biomass

For estimating carbon stock changes in living biomass, Equation 2.15 from volume 4, chapter 2, 2006 IPCC Guidelines has been used.

$$\Delta C_B = \Delta C_G + \Delta C_{CONVERSION} - \Delta C_L$$

Where,

- ΔC_B = annual change in carbon stocks in biomass on land converted to other land-use category, in tonnes C yr^{-1}
- ΔC_G = annual increase in carbon stocks in biomass due to growth on land converted to another land-use category, in tonnes C yr^{-1}
- $\Delta C_{CONVERSION}$ = initial change in carbon stocks in biomass on land converted to other land-use category, in tonnes C yr^{-1}
- ΔC_L = annual decrease in biomass carbon stocks due to losses from harvesting, fuel wood gathering and disturbances on land converted to other land-use category, in tonnes C yr^{-1}

More specifically, only carbon stock changes due to the initial change in biomass carbon stocks as a result of land use conversions have been estimated using Equation 2.16 from volume 4, chapter 2, 2006 IPCC Guidelines.

$$\Delta C_{Conversion} = \sum_i \{(B_{AFTER_i} - B_{BEFORE_i}) \times A_{TO\_OTHERS_i}\} \times CF$$

Where,

- $\Delta C_{CONVERSION}$ = initial change in biomass carbon stocks on land converted to another land category, tonnes C yr^{-1}
- B_{AFTERi}= biomass stocks on land type immediately after conversion, t dm ha^{-1}
- $B_{BEFOREi}$= biomass stocks on land type before conversion, t dm ha^{-1}
- $\Delta A_{TO\_OTHERSi}$= area of land use converted to another land-use category in a certain year, ha yr^{-1}
- CF = carbon fraction of dry matter, tonne C $(t\ dm)^{-1}$
- i= type of land use converted to another land-use category

In all land use conversions, the biomass stocks immediately after conversion was taken equal to zero.

Dead organic matter

In this GHG inventory carbon stock changes in dead organic matter pool are reported for forest land conversions to cropland and settlements (i.e. carbon losses). Emissions/removals have been estimated using Equation 2.23 from volume 4, chapter 2, 2006 IPCC Guidelines.

$$\Delta C_{DOM} = \frac{(C_n - C_o) \bullet A_{on}}{T_{on}}$$

Where,

- ΔC_{DOM} = annual change in carbon stocks in dead wood or litter, tonnes C yr^{-1}
- A_{on} = area undergoing conversion from old to new land-use category, ha
- C_o = DOM stock, under the old land-use category, tonnes C ha^{-1}
- C_n = DOM stock, under the new land-use category, tonnes C ha^{-1}
- T_{on} = time period of the transition from old to new land-use category, yr (1 year has been applied).

Since 2006 IPCC Guidelines do not provide dead wood carbon stock values, only carbon stock changes from the litter pool have been reported in the current inventory using the IPCC default values presented in Figure 55. Litter stocks under the new land-use category for all land-use conversions has been taken equal to zero.

Soil organic matter pool - Mineral soils

Carbon stock changes have been estimated and reported for mineral soils for the land-use conversion categories occurring in the country and for which 2006 IPCC Guidelines provide methodologies, namely forest land conversions to cropland, settlements, and other land. Equation 2.25 from volume 4, chapter 2, 2006 IPCC Guidelines has been used together with IPCC default parameters which are presented in the Figure 57 below in detail for each land-use category.

Cropland				
	Stratum	Note, assumption	Stratum	Note, assumption
Climate/soil zone	TW HAC	Based on deforestation information to cropland	TM LAC	Based on deforestation information to cropland
Cropland management	Assumed conversion to annual croplands			
Stock change factor for land use (Flu)	0.48	IPCC default	0.48	IPCC default
Stock change factor for tillage (Fmg)	1	IPCC default (full tillage)	1	IPCC default (full tillage)
Stock change factor for input (Fi)	1	IPCC default (medium input)	1	IPCC default (medium input)
Reference SOC (t C/ha)	44	IPCC default	47	IPCC default

Settlements		
	Stratum	Note, assumption
Climate/soil zone	TD SAN	Assumed one combination of climate/soil zone for which land-use changes from/to settlements are reported
Stock change factors Flu, Fmg, Fi	0.8	IPCC default (8 times of the previous land use carbon stock)
Reference SOC (t C/ha)	31	IPCC default

Other land				
	Stratum	Note, assumption	Stratum	Note, assumption
Climate/soil zone	TD SAN	Assumed two combinations of climate/soil zone for which land-use changes from/to other land are reported	TW HAC	Assumed two combinations of climate/soil zone for which land-use changes from/to other land are reported
Stock change factors Flu, Fmg, Fi	0	IPCC default	0	IPCC default
Reference SOC (t C/ha)	31	IPCC default	44	IPCC default

Figure 56. Parameters used for estimating carbon stock changes in the mineral soil carbon pool for land-use conversion categories

For forest land, the stock change factors (Flu, Fmg, Fi) were taken equal to 1.

5.3.5 Results

Land (category 3.B) net removals decreased from -458.89 Gg CO_2eq in the year 2000 to -331.60 Gg CO_2eq in 2016, a decrease of -27.74%. Forest land (3.B.1) net removals decreased from -458.89 Gg CO_2eq in the year 2000 to -394.36 Gg CO_2eq in 2016, a decrease of -14.06%. Cropland (3.B.2) net emissions increased from zero in the year 2000 to 0.12 Gg CO_2eq in 2016. Grassland (3.B.3) net emissions/removals have been reported equal to zero for the whole inventory period. Wetlands (3.B.4) net emissions have been reported equal to zero in both the years 2000 and 2016, but in 2015 net emissions have been estimated equal to 11.22 Gg CO_2eq. Settlements (3.B.5) net emissions have been reported equal to zero in both the years 2000 and 2016, but in 2013 net emissions have been estimated equal to 0.14 Gg CO_2eq. Other land (3.B.6) net emissions increased from zero in the year 2000 to 62.64 Gg CO_2eq in 2016.

In Table 103 below, net emissions and removals from land and the different land-use categories are presented for the inventory time series.

Table 103. Net emissions/removals from Land (3.B) and the six main land-use categories (Gg CO_2eq)

IPCC Categories	2000	2005	2010	2011	2012	2013	2014	2015	2016
3.B - Land	-458.89	-325.46	-298.67	-314.12	-315.70	-315.59	-312.45	-323.65	-331.60
3.B.1 - Forest land	-458.89	-392.09	-360.45	-381.97	-377.63	-382.21	-375.24	-397.03	-394.36
3.B.2 - Cropland	0.00	0.00	0.11	0.43	0.12	0.12	0.12	0.12	0.12
3.B.3 - Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4 - Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.22	0.00
3.B.5 - Settlements	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
3.B.6 - Other land	0.00	66.62	61.67	67.42	61.81	66.37	62.67	62.03	62.64

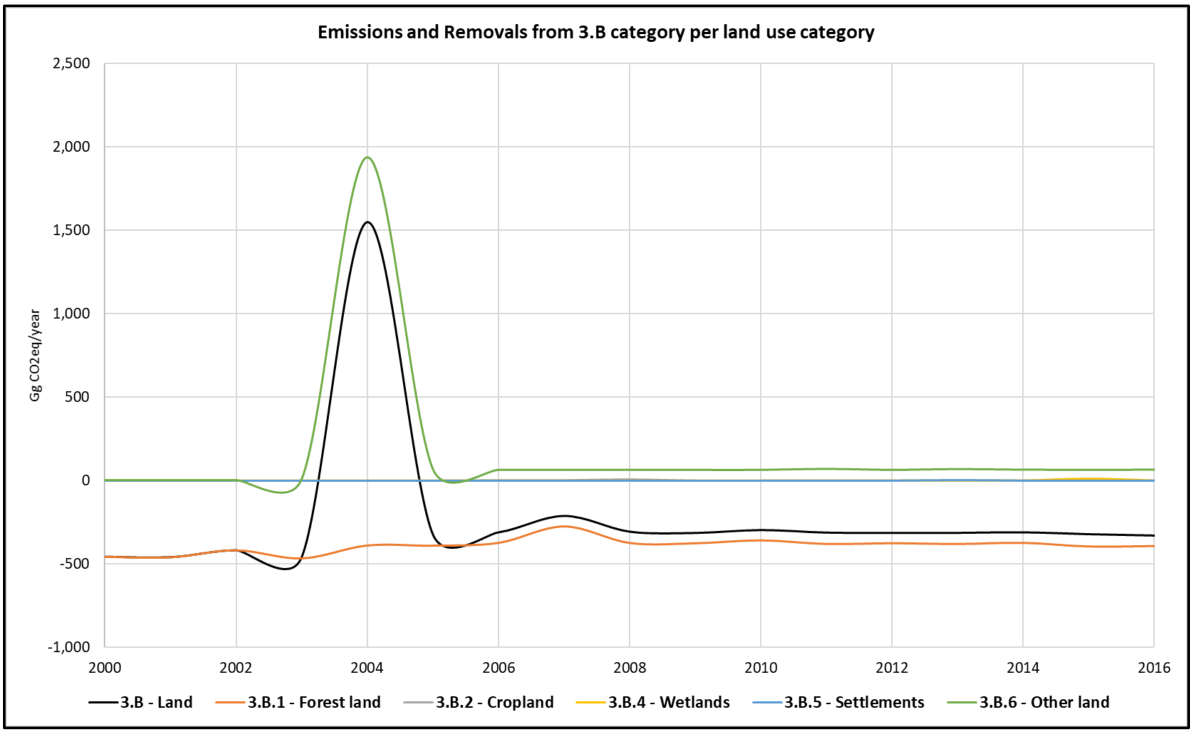


Figure 57. Evolution of total GHG emissions from 3.B Land by source (Gg CO_2eq)

5.3.6 Quality Control

All the field data collected (e.g. Plantation sites, area, silvicultural practices, dbh, tree height, volume of forest produce harvested, among others) are verified at every stages by the Forestry Service of Mauritius and the same is reported regularly to the Statistics of Mauritius which then reports the total amount of emission reduction, harvesting of wood, plantation details in Digest of Environment which is published annually by the Statistics of Mauritius. The values used in this inventory have been obtained from these annual statistics.

On the other hand, to ensure the use of right data in the inventory, some of the QC implemented during the data collection and emission estimation is listed below:

- Cross verification between data provided via mail by Forest Service and data reported in the national statistics of Mauritius.
- Cross verification between the GHG emissions and removals estimated in the current inventory for AFOLU sectors and the results obtained in the last reported national inventory of the RoM.

Finally, it should be noted that an appropriate archiving system is in place in order to store all information used in the development of the GHG inventory, including the time series of activity data, emission/stock change factors and parameters used, along with their data sources.

5.3.7 Uncertainty Assessment

The uncertainty analysis does not include the Land sector. In relation to the uncertainty of the input data, since most of the parameters used in the GHG inventory are 2006 IPCC defaults, the uncertainty associated with those parameters is the respective provided by the 2006 IPCC Guidelines.

The uncertainty associated with activity data, in particular with the area data for land representation has not been assessed and is planned as a future improvement for the next GHG inventory.

5.3.8 Recalculations

The recalculations implemented in the current GHG inventory are mainly the result of the complete refinement of the land representation and the updated approach for developing consistent land-use matrices.

5.3.9 Planned Improvements

During the development process of the GHG inventory, the major data gaps identified were in relation to the area data availability for land uses and land use changes. This information covers the changes within the same land-use category (e.g. changes between different forest species, changes between annual and perennial croplands, etc.) but also changes between different land-use categories (e.g. possible changes in addition to forest land conversions to other land uses) in order to develop a finer and more disaggregated land-use matrix. Furthermore, in accordance with 2006 IPCC Guidelines it is a good practice to obtain area data information for 20 years back from the first year of the inventory period in order to properly estimate carbon stock changes and associated emissions/removals.

To address some of these gaps the adoption of GIS and remote sensing, and the use of either wall-to-wall mapping or sampling techniques with complementary ground truthing exercise is essential. These activities are under consideration as part of the improvement plan. Land cover/use maps that will be produced will have to be overlaid with climatic and soil maps.

In addition, in order to move to higher tier methods, a significance analysis is planned to be undertaken for the next GHG inventory, which together with the key category analysis and uncertainty analysis will help in prioritizing the source/sinks categories which should be estimated using higher tier methods.

Another improvement is the development of a complete uncertainty analysis for the land sector.

Finally, the improvement plan includes the following:

- Collection of necessary data and estimation of carbon stock changes in living biomass in cropland remaining cropland (perennial crops).
- Collection of necessary data and estimation of carbon stock changes in soil organic matter (SOM) pool in cropland remaining cropland and grassland remaining grassland categories.
- Estimation of direct and indirect N_2O emissions from N mineralization associated with the loss of soil organic matter resulting from change of land use or management of mineral soils.

5.4 Aggregate sources and non-CO2 emissions sources on land (Category 3C)

5.4.1 Source Category Description

Aggregate Sources and non-CO_2 Emissions Sources on Land (3.C) include the following sources of emissions:

- 3C1 GHG emissions from biomass burning
- 3C2 Liming
- 3C3 Urea application
- 3C4 Direct N_2O emissions from managed soils
- 3C5 Indirect N_2O emissions from managed soils
- 3C6 Indirect N_2O emissions from manure management
- 3C7 Rice cultivation
- 3C8 Other

In the GHGI of Mauritius, the following sources have been estimated:

- 3C1 GHG emissions from biomass burning (only forest land and cropland)
- 3C4 Direct N_2O emissions from managed soils
- 3C5 Indirect N_2O emissions from managed soils
- 3C6 Indirect N_2O emissions from manure management

It is considered that the the use of limestone and dolomite (liming) is not occurring. There is no information available on the use of or urea application in the crops. Rice cultivation emissions are associated to flooding of rice fields. However, no flooded rice practices occur in Mauritius.

5.4.2 Methodological Issues

Tier 1 approach of the 2006 IPCC Guidelines has been used to estimate the emissions from biomass burning, direct and indirect N_2O emissions from managed soils and indirect emissions from manure management.

5.4.2.1 Calculations

GHG emissions from biomass burning

The emissions are estimated using the default 2006 IPCC Guidelines methodology (volume 4, chapter 2, equation 2.27):

$$L_{fire} = A \bullet M_B \bullet C_f \bullet G_{ef} \bullet 10^{-3}$$

Where:

L_{fire} = amount of greenhouse gas emissions from fire, tonnes of each GHG

A = area burnt, ha

MB = mass of fuel available for combustion, tonnes ha^{-1}. This includes biomass, ground litter and dead wood.

Cf = combustion factor, dimensionless

Gef = emission factor, g kg^{-1} dry matter burnt

Forest land

Biomass burning emissions from forest land are the result of fires in forest land. Emissions from this source category have been estimated and reported separately for each of the forest land strata applied in the GHG inventory.

Cropland

Emissions due to the burning of agricultural residues in Mauritius are linked to the sugarcane production as it is the only crop with available information on the parameters needed for the estimation.

Direct N_2O emissions from managed soils

Emissions from managed soils were calculated using a Tier 1 method of the 2006 IPCC Guidelines. The equation 11.1 (2006 IPCC Guidelines volume 4, chapter 11) was adapted to local conditions, as far as certain activities were not occurring in the RoM.

The equation for direct N_2O emission is as follows:

$$N_2O_{Direct}\text{-}N = N_2O\text{–}N_{N\ inputs} + N_2O\text{–}N_{PRP} =$$

$$= [(F_{SN} + F_{ON} + F_{CR}) \times EF_1] += [F_{PRP,CPP} \times EF_{3PRP,CPP}) + (F_{PRP,SO} \times EF_{PRP,SO})]$$

Where:

N_2O_{Direct}– N = Annual direct N_2O–N emissions produced from managed soils (kg N_2O–N yr^{-1});

N_2O–$N_{N\ inputs}$ = Annual direct N_2O–N emissions from N inputs to managed soils (kg N_2O–N yr^{-1})

N_2O–N_{PRP}= annual direct N_2O–N emissions from urine and dung inputs to grazed soils (kg N_2O-N yr-1)

F_{SN} = annual amount of synthetic fertiliser N applied to soils (kg N yr^{-1})

F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soil (kg N yr^{-1})

F_{CR} = annual amount of N in crop residues, including N- fixing crops, and forage/pasture renewal, returned to soils (kg N yr^{-1})

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock (kg N yr^{-1})

EF_1 = emission factor for N_2O emissions from N inputs (kg N_2O – N (kg N input)$^{-1}$)

EF_{3PRP} = emission factor for N2O emissions from urine and dung N deposited on pasture, range and paddock by grazing animals (kg N_2O – N (kg N input)$^{-1}$), CPP = Cattle, Poultry and Pigs, SO = Sheep and Other.

Indirect N_2O emissions from managed soils

In addition to the direct emissions of N_2O from managed soils that occur through a direct pathway, emissions of N_2O also take place through two indirect pathways (atmospheric deposition and leaching and run-off.

The first of these pathways is the volatilization of N as NH_3 and oxides of N (NOx), and the deposition of these gases and their products NH^{4+} and NO^{3-} onto soils and the surface of lakes and other waters.

Emissions from atmospheric deposition are calculated using a Tier 1 method of the 2006 IPCC Guidelines (equation 11.9, volume 4, chapter 11, 2006 IPCC Guidelines).

$$N_2O_{(ATD)}\text{–}N = \left[\left(F_{SN} \bullet Frac_{GASF}\right) + \left(\left(F_{ON} + F_{PRP}\right) \bullet Frac_{GASM}\right)\right] \bullet EF_4$$

Where:

$N_2O_{(ATD)}$–N = annual amount of N_2O–N produced from atmospheric deposition of N volatilised from managed soils, kg N_2O–N yr^{-1}

F_{SN} = annual amount of synthetic fertiliser N applied to soils, kg N yr^{-1}

$Frac_{GASF}$ = fraction of synthetic fertiliser N that volatilises as NH_3 and NOx, kg N volatilised (kg of N applied)$^{-1}$

F_{ON} = annual amount of managed animal manure, compost, sewage sludge and other organic N additions applied to soils, kg N yr^{-1}

F_{PRP} = annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock, kg N yr^{-1}

$Frac_{GASM}$ = fraction of applied organic N fertiliser materials (F_{ON}) and of urine and dung N deposited by grazing animals (F_{PRP}) that volatilises as NH_3 and NOx, kg N volatilised (kg of N applied or deposited)$^{-1}$

EF_4 = emission factor for N_2O emissions from atmospheric deposition of N on soils and water surfaces, [kg N–N_2O (kg NH_3–N + NOx–N volatilised)$^{-1}$]

The second pathway is the leaching and runoff from land of N from synthetic and organic fertiliser additions, crop residues, mineralisation of N associated with loss of soil C in mineral and drained/managed organic soils through land-use change or management practices, and urine and dung deposition from grazing animals.

Emissions from leaching and runoff are calculated using a Tier 1 method of the 2006 IPCC Guidelines (equation 11.10, volume 4, chapter 11, 2006 IPCC Guidelines).

$$N_2O_{(L)}\text{–}N = \left(F_{SN} + F_{ON} + F_{PRP} + F_{CR} + F_{SOM}\right) \bullet Frac_{LEACH-(H)} \bullet EF_5$$

Where:

$N_2O_{(L)}$–N = annual amount of N_2O–N produced from leaching and runoff of N additions to managed soils in regions where leaching/runoff occurs, kg N_2O–N yr^{-1}

F_{SN} = annual amount of synthetic fertiliser N applied to soils in regions where leaching/runoff occurs, kg N yr^{-1}

F_{ON} = annual amount of managed animal manure, compost, sewage sludge and other organic N additions applied to soils in regions where leaching/runoff occurs, kg N yr^{-1}

F_{PRP} = annual amount of urine and dung N deposited by grazing animals in regions where leaching/runoff occurs, kg N yr^{-1}

F_{CR} = amount of N in crop residues (above- and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils annually in regions where leaching/runoff occurs, kg N yr-1

F_{SOM} = annual amount of N mineralised in mineral soils associated with loss of soil C from soil organic matter as a result of changes to land use or management in regions where leaching/runoff occurs, kg N yr^{-1}

$Frac_{LEACH-(H)}$ = fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff, kg N (kg of N additions)$^{-1}$

EF_5 = emission factor for N_2O emissions from N leaching and runoff, kg N_2O–N (kg N leached and runoff)$^{-1}$

Indirect N_2O emissions from manure management

Indirect N2O emissions due to manure management are estimated based on Tier 1 approach of the 2006 IPCC Guidelines. The Tier 1 calculation of N volatilisation in forms of NH3 and NOx from manure management systems is based on multiplication of the amount of nitrogen excreted (from all livestock categories) and managed in each manure management system by a fraction of volatilised nitrogen. N losses are then summed over all manure management systems. The Tier 1 method is applied using default nitrogen excretion data, default manure management system data and default fractions of N losses from manure management systems due to volatilisation.

N LOSSES DUE TO VOLATILISATION FROM MANURE MANAGEMENT

$$N_{volatilization-MMS} = \sum_S \left[\sum_T \left[\left(N_{(T)} \bullet Nex_{(T)} \bullet MS_{(T,S)} \right) \bullet \left(\frac{Frac_{GasMS}}{100} \right)_{(T,S)} \right] \right]$$

Where:

$N_{\text{volatilization-MMS}}$ = amount of manure nitrogen that is lost due to volatilisation of NH3 and NOx, kg N yr^{-1}

$N_{(T)}$ = number of head of livestock species/category T in the country

$N_{ex(T)}$ = annual average N excretion per head of species/category T in the country, kg N animal-1 yr-1º

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed

in manure management system S in the country, dimensionless

$Frac_{GasMS}$ = percent of managed manure nitrogen for livestock category T that volatilises as NH_3 and NO_x in the manure management system S, %

The indirect N2O emissions from volatilisation of N in forms of NH3 and NOx (N2OG(mm)) are estimated using the following equation:

INDIRECT N_2O EMISSIONS DUE TO VOLATILISATION OF N FROM MANURE MANAGEMENT

$$N_2O_{G(mm)} = \left(N_{volatilization-MMS} \bullet EF_4 \right) \bullet \frac{44}{28}$$

Where:

$N_2O_{G(mm)}$ = indirect N_2O emissions due to volatilization of N from Manure Management in the country, kg N_2O yr^{-1}

EF_4 = emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N_2O-N (kg NH_3-N + NO_x-N volatilised)$^{-1}$; default value is 0.01 kg N_2O-N (kg NH_3-N +NO_x-N volatilised)$^{-1}$

5.4.2.2 Activity Data

GHG emissions from biomass burning

Forest land

The activity data used for estimating GHG from biomass burning in forest land are presented in Table 101.

Cropland

The activity data is the area of burnt sugarcane that is estimated based on the area under cultivation obtained from the Digest of Agricultural Statistics and the percentage burnt based on the Third National Communication: “Sugar cane burning was practised in 1995 on approximately 35% of land managed by corporate miller-planters on both mechanically and manually harvested fields. However, as per TNC, “this figure decreased to 15% in 2005 and has gradually been reduced to around 10 % of cultivated sugar cane areas in recent years” (NIR, page 108). For the years in between a linear interpolation has been done. As no further information is available, the 10% has been maintained from 2011 to 2016. The results are shown in Table 104.

Table 104. Sugarcane areas burned (ha)[14]

	2000	2001	2002	2003	2004	2005	2006	2007
Total Area(ha)	70.800	70.800	70.800	70.800	70.800	70.800	70.800	68.520
% burned	25%	23%	21%	19%	17%	15%	14%	13%
Burned area(ha)	17.700	16.284	14.868	13.452	12.036	10.620	10.030	9.136

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total Area (ha)	65.440	65.850	64.130	61.730	57.160	56.464	57.081	56.872	55.560
% burned	13%	12%	11%	10%	10%	10%	10%	10%	10%
Burned area (ha)	8.180	7.682,5	6.947,4	6.173	5.716	5.646,4	5.708,1	5.687,2	5.556

[14] Addendum: After the completion of the GHGI, some updated information was received for sugar cane burning that changed the area cultivated and the percentage of burning. Emissions from GHGI estimates and new addendum estimates are: 4.33and 7.84 Gg CO2e in 2000; and 2.26 and 0.23 Gg CO2e in 2016.
Addended data is:

	2000	2001	2002	2003	2004	2005	2006	2007
Total Area(ha)	76,962	76,478	75,501	74,117	72,955	71,583	70,801	68,523
% burned	25%	23%	21%	19%	17%	15%	14%	13%
Burned area(ha)	19,241	17,590	15,855	14,082	12,402	10,737	9,912	8,908

	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total Area (ha)	65,710	64,120	62,100	59,724	57,160	56,391	57,081	56,872	55,560
% burned	13%	12%	11%	8%	6%	4%	2%	1%	1%
Burned area (ha)	8,542	7,694	6,831	4,777	3,428	2,256	1,142	568	556

Direct N_2O emissions from managed soils

Direct N_2O emissions from managed soils are the result of different inputs to the soil:

- Synthetic fertilizers;
- Animal manure, compost and sewage sludge;
- Crop residues; and
- Pasture, range and paddock.

Synthetic fertilizers

For 2006-2014, the fertilizer has been estimated by considering both local production and imports in estimating the amount of fertiliser applied to land (i.e., data from Statistics Mauritius and FAREI). No data is available for 2014-2016, so it has been estimated based on the cropping areas and the average N application (source: Digest of Agricultural Statistic 2017 and expert judgement for N application). For 2000-2005, as no information is available, the value of 2006 has been used.

Animal manure, compost and sewage sludge

Animal manure applied to soils is estimated based on the N excreted in the farms (see section 6.2 Livestock) and the losses which are estimated based on the default values included in table 10.23 (volume 4, chapter 10, 2006 IPCC Guidelines).

No information was available on the content of compost and sewage sludges applied to soils.

Crop residues

Data on crop residues inputs to soils is taken from the previous GHGI which was based on past unpublished results of research projects available at the FAREI. The dry matter fraction of crop residues was obtained from a combination of unpublished data and expert knowledge from different crop specialists". 2013 value was used for the period 2014-2016 in the lack of available data for those years.

Pasture, range and paddock

Animal manure in pasture, range and paddock is estimated based on the N excreted and the percentage of animals in pasture system (see section 6.2 Livestock). No losses are considered in line with the 2006 IPCC Guidelines.

In Table 105, the N inputs to managed soils are shown.

Table 105. N inputs to soils (t N)

N input	2000	2005	2010	2014	2015	2016
Synthetic fertilizers	7,526	7,526	7,468	7,559	7,751	7,602
Animal manure, compost and sewage sludge	2,964	2,839	3,935	2,513	3,862	3,850
Crop residues	3,316	3,316	3,012	2,665	2,665	2,665
Pasture, range and paddock	1,104	1,136	1,274	1,281	1,237	1,260
Total	14,910	14,817	15,689	14,018	15,515	15,377

Indirect N_2O emissions from managed soils

Indirect N_2O emissions from managed soils activity data is the inputs of N to the managed soils (see previous point).

Indirect N_2O emissions from manure management

Indirect N_2O emissions from manure management activity data is the N excreted in the farms (see section 6.2 Livestock).

5.4.2.3 Emission factors

The parameters and emission factors used for the estimations are the default values included in the 2006 IPCC Guidelines.

The emission factors used for biomass burning in forest land are 6.8 g kg^{-1} dm burnt for CH_4 emissions and 0.2 g kg^{-1} dm burnt for N_2O emissions.

Parameters and emission factors for burning of agricultural residues are listed in Table 106

Table 106. Emission factors and parameters for burning of agricultural residues

Crop	Mass of fuel (t/ha)	Combustion factor	EF CH_4 (g /kg d.m. burnt)	EF N_2O (g /kg d.m. burnt)	EF NOx (g /kg d.m. burnt)	EF CO (g /kg d.m. burnt)
Sugarcane	6.5	1	2.7	0.07	2.5	92

Source: *Table 2.4, 2.5 and 2.6 (volume 4, chapter 11, 2006 IPCC Guidelines).*

Parameters and emission factors used for direct and indirect N_2O emissions from managed soils are listed in Table 107 below.

Table 107. Emission factors and parameters for direct and indirect N_2O emissions from managed soils

Source of Emission	Parameter	Unit	Value
Direct N_2O emission from managed soil	EF_1 for N additions from mineral fertilisers, organic amendments and crop residues, and N mineralised from mineral soil as a result of loss of soil carbon	Kg N_2O-N/kg N	0.01
	$EF_{3PRP, CPP}$ for cattle (dairy, non-dairy and buffalo), poultry and pigs	Kg N_2O-N/kg N	0.02
	$EF_{3PRP, SO}$ for sheep and 'other animals'	Kg N_2O-N/kg N	0.03
Indirect N_2O emission from managed soil	EF_4 N volatilisation and re-deposition	kg N_2O–N / kg NH_3–N + NO_X–N	0.01
	EF_5 N_2O from N leaching/ run-off	Kg N_2O -N/kg N	0.0075
	$Frac_{GASF}$ - Volatilisation from synthetic fertilizer	Kg NH_3-N +	0.1

	NOx-N	
Frac$_{GASM}$ - Fraction of applied organic N fertilizer, urine and dung N deposited by grazing animal that volatilizes	Kg NH_3-N + NOx-N	0.2
Frac$_{LEACH}$ - Fraction of all N addition that is loss through leaching and run-off	Kg N/kg N additions	0.3

Source: *Table 11.1 and table 11.3 (volume 4, chapter 11, 2006 IPCC Guidelines).*

For indirect N_2O emissions from manure management, the parameter Frac$_{GasMS}$ (percent of managed manure nitrogen for livestock category T that volatilises as NH_3 and NO_x in the manure management system S, %) has been obtained from table 10.22 (volume 4, chapter 10, 2006 IPCC Guidelines).

5.4.3 Results

Category 3.C emissions increased from 109.91 Gg CO_2eq in the year 2000 to 120.55 Gg CO_2eq in 2016, which resulted in an increase of 9.68%.

GHG emissions from category 3.C.1 biomass burning (both forest and cropland) increased from 4.89 Gg CO_2eq in the year 2000 to 4.95 Gg CO_2eq in 2016, an increase of 1.25%.

Direct N_2O emissions from managed soils increased from 75.15 Gg CO_2eq in the year 2000 to 78.38 Gg CO_2eq in 2016, an increase of 4.30%. Indirect N_2O emissions from managed soils increased from 23.97 Gg CO_2eq in the year 2000 to 25.54 Gg CO_2eq in 2016, an increase of 6.53%. Indirect N_2O emissions from manure management increased from 5.90 Gg CO_2eq in the year 2000 to 11.67 Gg CO_2eq in 2016, an increase of 97.93%.

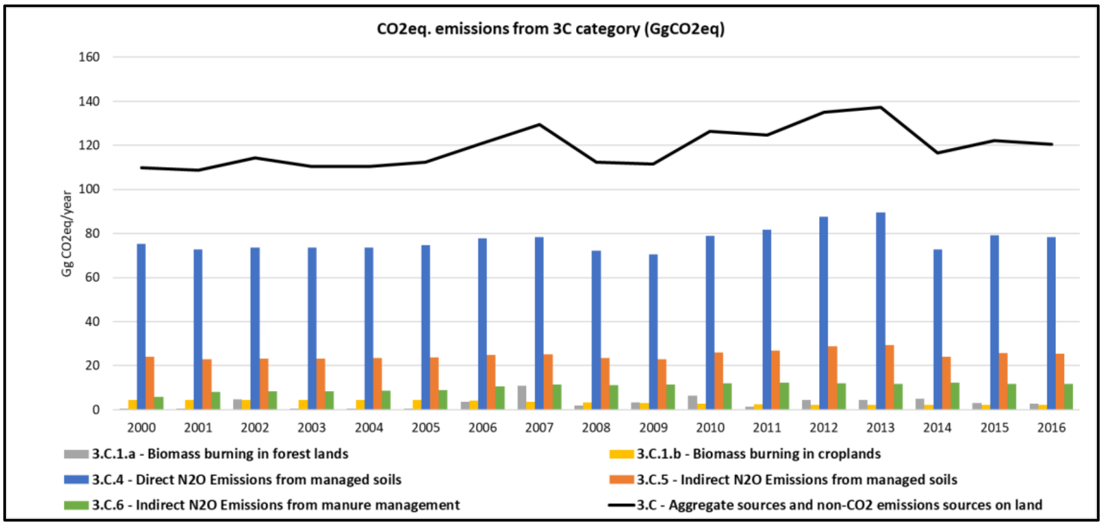


Figure 58. Evolution of total GHG emissions from 3C aggregated sources (Gg CO_2eq)

In the following Table 108, the emissions from aggregate sources are shown.

Table 108. GHG Emissions from 3C aggregate sources (Gg CO_2eq)

Years	3C1a GHG emissions from biomass burning – forest land	3C1b GHG emissions from biomass burning – cropland	3C4 Direct N_2O emissions from managed soils	3C5 Indirect N_2O emissions from managed soils	3C6 Indirect N_2O emissions from manure management	TOTAL
2000	0.56	4.33	75.15	23.97	5.90	109.91
2001	0.58	4.33	72.76	22.96	8.09	108.71
2002	4.77	4.33	73.52	23.28	8.47	114.37
2003	0.64	4.33	73.62	23.32	8.48	110.40
2004	0.43	4.33	73.70	23.36	8.56	110.39
2005	0.52	4.33	74.70	23.78	8.92	112.25
2006	3.68	4.09	77.67	24.84	10.63	120.91
2007	10.97	3.72	78.25	25.09	11.37	129.41
2008	1.95	3.33	72.31	23.51	11.25	112.35
2009	3.44	3.13	70.64	23.04	11.34	111.59
2010	6.51	2.83	78.96	25.91	12.02	126.23
2011	1.38	2.52	81.62	26.76	12.38	124.66
2012	4.39	2.33	87.57	28.76	12.09	135.14
2013	4.39	2.30	89.42	29.29	11.87	137.28
2014	5.15	2.33	72.74	24.05	12.22	116.49
2015	3.18	2.32	79.06	25.75	11.81	122.12
2016	2.69	2.27	78.38	25.54	11.67	120.55

5.4.4 Quality Control

Information was generally obtained from official sources, including Statistics Mauritius and its Digest of Agriculture and Environment Statistics. Statistics Mauritius applies quality controls to the information before publicly realising it. If statistics were not available, expert judgement has been used to fill the gaps.

Quality and reliability of data: All data collected was done using local expertise, experience in this sector and to the best of knowledge.

5.4.5 Uncertainty Assessment and Time-series Consistency

Category 3C uncertainties have not been considered in this National GHG Emission Inventory due to the lack of information on the uncertainty of the activity data used.

5.4.6 Recalculations

- Update in the parameters to estimate CH_4 emissions from biomass burning of sugar cane.
- Direct N_2O emissions from managed soils have been recalculated based on the new information on livestock (see section 6.2).
- Indirect N_2O emissions from managed soils have been updated, as the previous estimation did not include all the inputs.

- Indirect N_2O emissions from manure management have been estimated for the first time in this GHGI.

5.4.7 Planned Improvements

- Several categories were not estimated due to the lack of activity data. There is a need to raise information for enhancing the completeness of this category.
- Activity data time-series are not complete (e.g. synthetic fertilizers). A system for collecting updated data needs to be put in place.

5.5 Other (Category 3D)

5.5.1 Source Category Description

Carbon stock changes from the Harvested Wood Product (HWP) pool have been estimated and reported in this source/sink category.

The contribution of the HWP pool has been estimated for the whole inventory period 2000-2016 using activity data from 1961 and default parameters from the 2006 IPCC Guidelines.

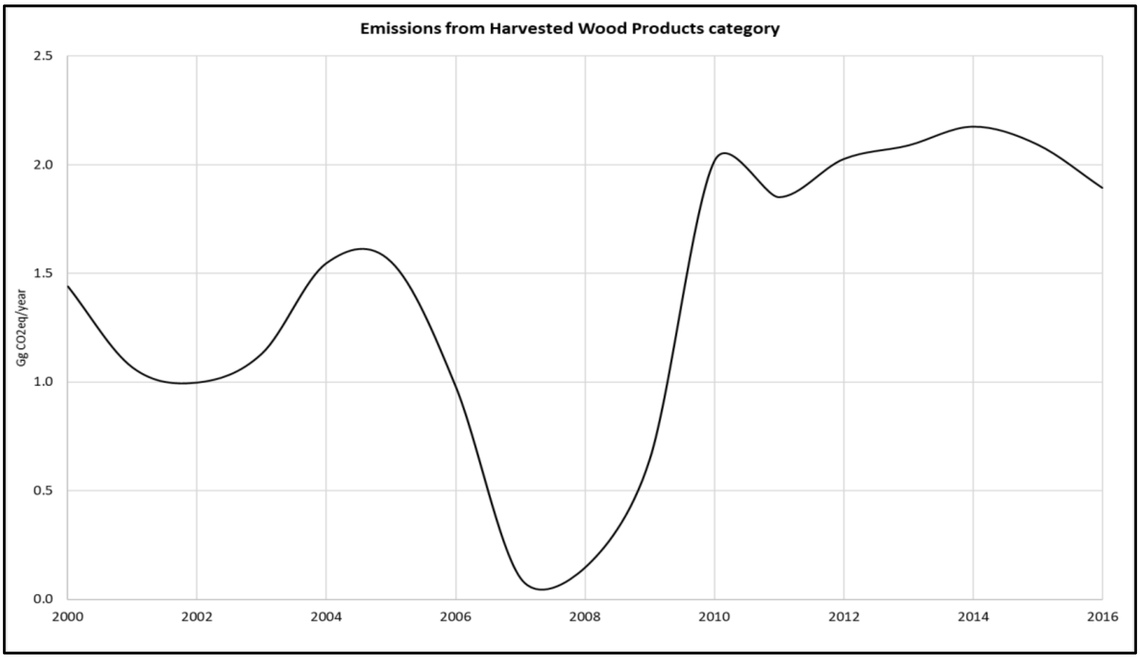


Figure 59. HWP contribution (Gg CO_2eq)

Net CO_2 emissions/removals show a notable variability throughout the inventory period with net emissions estimated at 1.44 Gg CO_2 eq in 2000 and 1.89 Gg CO_2 eq in 2016.

5.5.2 Methodological Issues

The 2006 IPCC Guidelines tier 1 methodology has been applied for estimating carbon stock changes from HWPs.

5.5.2.1 Calculations

$$C(i+1) = e^{-k} \bullet C(i) + \left[\frac{\left(1 - e^{-k}\right)}{k} \right] \bullet Inflow(i)$$

$$\Delta C(i) = C(i+1) - C(i)$$

Where,

- i = year
- C(i) = the carbon stock of the HWP pool in the beginning of year i, Gg C
- k = decay constant of first-order decay given in units, yr^{-1} (k = ln(2)/HL, where HL is half-life of the HWP pool in years.
- Inflow(i) = the inflow to the HWP pool during year i, Gg C yr^{-1}
- ΔC(i) = carbon stock change of the HWP pool during year i, Gg C yr^{-1}

5.5.2.2 Activity Data

Activity data were obtained from the FAOSTAT database (http://www.fao.org/faostat/en/#data/FO). The information comprises data for production, imports and exports of the different wood products from 1961 until 2016.

Table 109. HWP activity data for the different wood products

Year	Roundwood			Sawnwood			Wood-Based Panels			Paper&Paperboard			Rec. Paper(1669)	
	Production	Imports	Exports	Production	Imports	Exports	Production	Imports	Exports	Production	Imports	Exports	Imports	Exports
	m3	m3	m3	m3	m3	m3	m3	m3	m3	metric-t	metric-t	metric-t	metric-t	metric-t
1961	64000	100	0	2400	16800	0	0	1100	0	0	2100	0	0	0
1962	74000	0	0	4000	12900	0	0	700	0	0	1800	0	0	0
1963	97000	0	0	5000	11000	0	0	800	0	0	1900	0	0	0
1964	112000	200	0	5000	12700	0	0	800	0	0	1800	0	0	0
1965	75000	100	0	4000	9900	0	0	1200	0	0	2300	0	0	0
1966	23000	0	0	6000	9100	0	0	1000	0	0	2100	0	0	0
1967	35000	0	0	6000	11000	0	0	1500	0	0	2200	0	0	0
1968	36000	0	0	6000	7400	0	0	1400	0	0	1900	0	0	0
1969	36000	0	0	6000	5600	0	0	1400	0	0	2300	0	0	0
1970	37000	400	0	6000	5600	0	0	2621	0	0	2200	0	0	0
1971	37000	300	0	5000	8000	0	500	2221	0	0	2300	0	0	0
1972	39000	600	0	5000	6700	0	1000	2927	0	0	3200	0	0	0
1973	39000	700	0	4500	5900	0	1000	3021	0	0	3500	0	0	0
1974	33000	1000	0	1500	10100	0	800	3621	0	0	4900	0	0	0
1975	42300	1000	0	5600	7200	0	1300	3816	0	0	3700	0	0	0
1976	45000	1700	0	7000	10500	0	1600	4465	0	0	4800	0	0	0
1977	39000	2000	0	4000	12300	0	0	5082	0	0	6300	0	0	0
1978	45700	1100	0	6500	10600	0	0	5688	0	0	6100	0	0	0
1979	47600	1900	0	4500	16400	0	0	4488	0	0	5200	0	0	0
1980	41800	2900	0	4100	8600	0	0	3000	0	0	5200	0	0	0
1981	37000	2400	0	2800	8600	0	0	2100	0	0	5200	0	0	0
1982	33000	1000	0	3800	5700	0	0	4000	0	0	6600	0	0	0
1983	29800	800	0	3100	7800	0	0	3000	0	0	7100	0	0	0
1984	14500	800	0	400	7100	0	0	3300	0	0	5500	0	0	0
1985	16700	1200	0	1050	12200	0	0	4700	0	0	7600	0	0	0
1986	24300	1200	0	1400	7900	0	0	6500	0	0	8800	0	0	0
1987	32140	1700	0	3750	11400	0	0	6500	0	0	5700	0	0	0
1988	34140	1700	0	3850	13600	0	0	7800	0	0	17600	0	0	0
1989	31000	14500	0	4800	70900	0	0	9300	0	0	16200	0	0	0
1990	27100	0	0	3600	49000	0	0	9400	0	0	17300	0	0	0
1991	17300	23788	0	5130	30300	0	0	8500	0	0	19600	0	0	0
1992	15650	26304	2524	4190	30197	374	0	17595	103	0	21931	315	259	0
1993	24150	7540	0	4630	42500	1052	0	16200	0	0	23600	3	104	0
1994	18300	9400	0	4070	28200	300	0	50800	0	0	30600	100	200	0
1995	12390	3100	0	2400	29700	300	0	26300	0	0	30500	100	200	0
1996	14760	9000	0	3400	28200	300	0	26100	0	0	36400	100	200	0
1997	14760	4330	0	3400	8211	673	0	13102	0	0	11722	41	170	0
1998	22000	7271	299	5000	42400	154	0	27935	87	0	40186	2562	667	0
1999	25000	15641	1	5000	39600	0	0	35200	0	0	42200	1400	202	0
2000	18000	14441	0	3000	37000	0	0	22900	0	0	40100	2900	202	0
2001	17000	9000	0	3000	45300	0	0	42100	0	0	38600	1500	1001	0
2002	15100	6700	0	3000	42600	0	0	50500	0	0	38650	1500	901	0
2003	14000	10688	0	3000	38115	0	0	53491	0	0	39284	1500	1143	0
2004	14000	19863	536	3000	64871	960	0	59725	3258	0	47611	3398	2084	0
2005	12500	19863	536	3000	64871	960	0	59725	3258	0	47611	3398	2084	0
2006	16700	19863	536	4000	51700	960	0	48000	3258	0	40305	3398	1000	0
2007	15400	3726	536	3000	77084	960	0	61101	3258	0	39400	3398	1000	0
2008	15400	3676	477	3000	25297	273	0	24754	630	0	42785	1993	1033	0
2009	15000	2714	391	2050	16946	203	0	20149	400	0	39263	2224	757	0
2010	14000	27434	386	2090	22953	310	0	63480	23	0	45549	2163	1301	3
2011	11000	15325	530	1920	58394	2343	0	70701	297	0	40058	1122	711	3
2012	7200	16320	411	2000	37122	1401	0	57175	579	0	52484	880	821	3
2013	3500	10216	369	1000	41188	573	0	19293	522	0	40977	791	612	3
2014	2540	29247	94	800	38904	451	0	48385	556	0	40637	666	582	3
2015	2000	3346	329	600	22750	314	0	25347	221	0	28441	813	64	36
2016	6520	6031	175	960	20690	2516	0	30118	96	0	40213	689	64	36

Year	Industrial Roundwood '(1865)			Other Industrial Roundwood '(1871)				Chips and particles	
	Production	Imports	Exports	Production				Imports	Exports
	m3	m3	m3	m3				m3	m3
1961	21000	100	0	0	0	0		0	0
1962	25000	0	0	0	0	0		0	0
1963	26000	0	0	0	0	0		0	0
1964	16000	200	0	0	0	0		0	0
1965	9000	100	0	0	0	0		0	0
1966	15000	0	0	0	0	0		0	0
1967	16000	0	0	0	0	0		0	0
1968	16000	0	0	0	0	0		0	0
1969	16000	0	0	0	0	0		0	0
1970	16000	400	0	0	0	0		0	0
1971	16000	300	0	0	0	0		0	0
1972	18000	600	0	0	0	0		0	0
1973	18000	700	0	0	0	0		0	0
1974	11000	1000	0	0	0	0		0	0
1975	20300	600	0	0	0	0		0	0
1976	23000	1300	0	0	0	0		0	0
1977	16000	2000	0	0	0	0		0	0
1978	22700	1100	0	0	0	0		0	0
1979	24600	1900	0	0	0	0		0	0
1980	17800	2900	0	0	0	0		0	0
1981	13000	2400	0	0	0	0		0	0
1982	9000	1000	0	0	0	0		0	0
1983	7800	800	0	0	0	0		0	0
1984	2500	800	0	0	0	0		0	0
1985	4700	1200	0	0	0	0		0	0
1986	7300	1200	0	0	0	0		0	0
1987	11640	1700	0	0	0	0		0	0
1988	13340	1700	0	0	0	0		0	0
1989	14500	14500	0	0	0	0		0	0
1990	11100	0	0	0	0	0		0	0
1991	14100	23788	0	0	0	0		0	0
1992	12450	26240	2503	0	0	0		0	0
1993	12750	7540	0	0	0	0		0	0
1994	10800	9400	0	0	0	0		0	0
1995	6190	3100	0	0	0	0		0	0
1996	8260	9000	0	0	0	0		0	0
1997	8260	4330	0	0	0	0		0	0
1998	12000	7230	299	0	0	0		1501	0
1999	13000	15600	1	0	0	0		600	0
2000	8000	14400	0	0	0	0		50	0
2001	8000	9000	0	0	0	0		300	0
2002	6100	6700	0	0	0	0		0	0
2003	8000	10688	0	0	0	0		0	0
2004	8000	19861	536	0	0	0		244	0
2005	7500	19861	536	0	0	0		244	0
2006	9800	19861	536	0	0	0		244	0
2007	8500	3724	536	0	0	0		244	0
2008	8500	3670	472	0	0	0		500	0
2009	9500	2708	386	0	0	0		177	0
2010	5000	27432	381	0	0	0		26	0
2011	4400	15315	525	0	0	0		120	0
2012	2100	16258	406	0	0	0		5	0
2013	1500	10216	365	0	0	0		3	0
2014	240	29244	90	0	0	0		4	2
2015	200	3341	325	0	0	0		7	2
2016	1340	6029	171	0	0	0		9	2

5.5.2.3 Emission factors

The emission factors used for estimating carbon stock changes in HWP pool are 2006 IPCC defaults (volume 4, chapter 12) and are presented in Table 110 and Figure 61.

Table 110. 2006 IPCC default half-life values and decay rates for the different wood products

	Solidwood products	Paper products
Half-life (years)	30	2
Decay rate k *(k = ln(2)/half-life)*	0.023	0.347

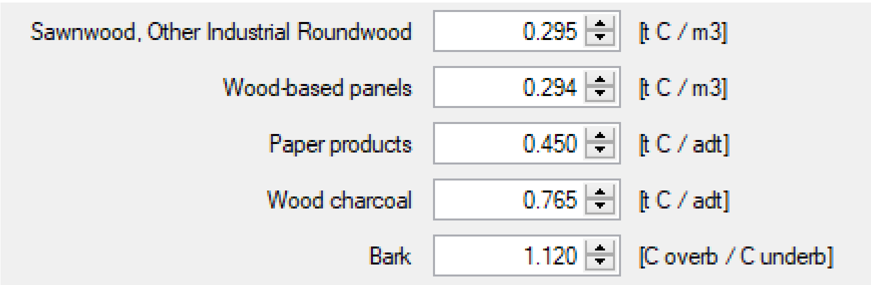


Figure 61. 2006 IPCC default factors to convert from product units to carbon.

6. Waste

6.1 Overview

Waste management is a major challenge faced worldwide, with this issue being even more pressing in SIDS, like the Republic of Mauritius. Economic growth, urbanization, improvement of living standards, coupled with change in consumption patterns, create an exponential growth in waste generation.

CH_4 emissions from SWDS are the largest source of greenhouse gas emissions in the Waste Sector, and CH_4 emissions from wastewater treatment and discharge may also be important. On the other hand, incineration and open burning of waste containing fossil carbon is the most important source of CO_2 emissions in the Waste Sector.

It is important to mention that:

- CO_2 is also produced in SWDS, wastewater treatment and burning of non-fossil waste, but this CO_2 is of biogenic origin and is therefore not included as a reporting item in this sector.
- All greenhouse gas emissions from waste-to-energy, where waste material is used directly as fuel or converted into a fuel (biogas), have been estimated and reported under the Energy Sector.

6.1.1 General Methodology

The general methodology used in the waste sector is collected in the following table:

Table 111. Methodology used for the Waste Sector

Category	Activity Data	Emission Factor	Activity Data Source
4.A - Solid Waste Disposal			
4.A.1 - Managed Waste Disposal Sites	T2	D	Solid Waste Management Division, Statistics Mauritius
4.B - Biological Treatment of Solid Waste	T1	D	Solid Waste Management Division, Statistics Mauritius
4.C - Incineration and Open Burning of Waste			
4.C.1 - Waste Incineration	T1	D	Solid Waste Management Division, Statistics Mauritius
4.D – Wastewater Treatment and Discharge			
4.D.1 - Domestic Wastewater Treatment and Discharge	T1/T2	D	Wastewater Management Authority, Statistics Mauritius
4.D.2 - Industrial Wastewater Treatment and Discharge	T1/T2	D	Wastewater Management Authority, Statistics Mauritius

T1: Tier 1; T2: Tier 2; D: Default; CS: Country Specific; NO: Not Occurring; NA: Not Applicable; NE: Not Estimated

6.2Solid Waste Disposal – Managed Waste Disposal Sites (Category 4A)

Treatment and disposal of municipal, industrial, and other solid waste produces significant amounts of methane (CH_4). Decomposition of organic material derived from biomass sources (e.g., crops, wood) is the primary source of CO_2 released from waste. These CO_2 emissions are not included in national totals, because the carbon is of biogenic origin.

The IPCC methodology for estimating CH_4 emissions from SWDS is based on the First Order Decay (FOD) method. This method assumes that the degradable organic component (degradable organic carbon, DOC) in waste decays slowly throughout a few decades, during which CH_4 and CO_2 are formed. If conditions are constant, the rate of CH_4 production depends solely on the amount of carbon remaining in the waste. As a result, emissions of CH_4 from waste deposited in a disposal site are highest in the first few years after deposition, then gradually decline as the degradable carbon in the waste is consumed by the bacteria responsible for the decay.

The FOD method requires data to be collected or estimated for historical disposals of waste over a period of 3 to 5 half-lives to achieve an acceptably accurate result. It is therefore good practice to use disposal data for at least 50 years as this time frame provides an acceptably accurate result for most typical disposal practices and conditions.

6.2.1 Source Category Description

The Solid Waste Management Division is responsible for the setting up and operation of waste management facilities, including landfill and transfer stations whilst Local Authorities, which operate under the aegis of the Ministry of Local Government, are responsible for the collection and conveyance of domestic wastes to the five transfer stations across the Mauritius island. Domestic wastes are stored in appropriate storage receptacles by households.

With increasing population and change in lifestyle of Mauritians, the number of solid wastes landfilled has increased. In the year 2000, the Government Policy on solid waste management primarily focused on the closure of open dump sites and on regular collection of municipal solid wastes for landfilling.

According to the Solid Waste Management Division, the sanitary landfill in RoM is modern and well managed, with capping works to minimise methane emissions and engineering installations to abstract landfill gas (methane) for flaring and power generation.

6.2.2 Methodological Issues

6.2.2.1 Calculation

The method presented in the 2006 IPCC Guidelines for calculation of CH_4 emissions from landfills is based on the "first order decay" method (FOD method). The IPCC software has been used, so all required data and parameters have been included here to obtain the final CH_4 emissions. As it was previously mentioned, it is therefore good practice to use disposal data for at least 50 years as this time frame, so activity data since 1960 have been considered.

The FOD method is described below, as well as the relevant activity data and parameters used for determining methane formation in landfills.

$$CH_4\ Emissions = [\Sigma\ CH_4\ generated_{x,T} - R_T] \bullet [1-OX_T]$$

Where:

- CH_4 Emissions = CH_4 emitted in year T, Gg
- T = inventory year
- x = waste category or type/material
- R_T = recovered CH_4 in year T, Gg
- OX_T = oxidation factor in year T, (fraction)

The amount of CH_4 formed from decomposable material is found by multiplying the CH_4 fraction in generated landfill gas and the CH_4 /C molecular weight ratio.

$$CH_4\ generated_T = DDOCm\ decomp_T \bullet F \bullet 16/12$$

Where:

- CH_4 generated$_T$ = amount of CH_4 generated from decomposable material
- DDOCm decomp$_T$ = DDOCm decomposed in year *T*, Gg
- F = fraction of CH_4, by volume, in generated landfill gas (fraction)
- 16/12 = molecular weight ratio CH_4/C (ratio)

The CH_4 potential that is generated throughout the years can be estimated based on the amounts and composition of the waste disposed into SWDS and the waste management practices at the disposal sites. The basis for the calculation is the amount of Decomposable Degradable Organic Carbon (DDOCm) as defined in next equation:

$$DDOCm = W \bullet DOC \bullet DOCf \bullet MCF$$

Where:

- DDOCm = mass of decomposable DOC deposited, Gg
- W = mass of waste deposited, Gg
- DOC = degradable organic carbon in the year of deposition, fraction, Gg C/Gg waste
- DOCf = fraction of DOC that can decompose (fraction)
- MCF = CH_4 correction factor for aerobic decomposition in the year of deposition (fraction)

With a first order reaction, the amount of product is always proportional to the amount of reactive material. This means that the year in which the waste material was deposited in the SWDS is irrelevant to the amount of CH_4 generated each year. It is only the total mass of decomposing material currently in the site that matters.

This also means that when it is known the amount of decomposing material in the SWDS at the start of the year, every year can be regarded as year number 1 in the estimation method, and the basic first order calculations can be done by these two simple equations, with the decay reaction beginning on the 1st of January the year after deposition.

For more detailed information about the FOD methodology, please refer to 2006 IPCC Guidelines, Vol 5, chapter 3.

6.2.2.2 Activity Data and parameters required

Table 112. Activity data for Solid waste disposal in Mauritius

Year	Population (capita)	Waste per capita (kg/capita)	Sludge - Landfill (t)	MSW - Landfill (t)
1960	652,703	156.48	0	102,135
1961	667,161	159.19	0	106,207
1962	681,619	161.91	0	110,358
1963	696,077	164.62	0	114,587
1964	710,535	167.33	0	118,895
1965	724,993	170.05	0	123,281
1966	739,451	172.76	0	127,746
1967	753,909	175.47	0	132,289
1968	768,367	178.18	0	136,911
1969	782,825	180.90	0	141,611
1970	797,283	183.61	0	146,389
1971	811,741	186.32	0	151,246
1972	826,199	189.04	0	156,181
1973	838,987	191.75	0	160,875
1974	851,774	194.46	0	165,638
1975	864,562	196.10	0	169,541
1976	877,350	199.89	0	175,372
1977	890,137	202.60	0	180,343
1978	902,925	205.31	0	185,383
1979	915,712	208.03	0	190,493
1980	928,500	210.74	0	195,672
1981	941,288	213.45	0	200,921
1982	954,075	216.17	0	206,239
1983	966,863	218.88	0	211,626
1984	974,805	221.59	0	216,009
1985	982,747	224.31	0	220,435
1986	990,689	227.02	0	224,904
1987	998,630	229.73	0	229,416
1988	1,006,572	232.44	0	233,972
1989	1,014,514	235.16	0	238,570
1990	1,022,456	237.87	0	243,212
1991	1,035,411	240.58	0	249,102
1992	1,048,367	243.30	0	255,063
1993	1,061,322	246.01	0	261,095
1994	1,074,278	251.30	0	269,966
1995	1,087,233	251.44	0	273,368
1996	1,100,189	254.15	0	279,611
1997	1,113,144	256.86	0	285,923
1998	1,125,118	259.57	0	292,051
1999	1,139,718	262.29	0	298,933
2000	1,151,094	262.36	0	302,000
2001	1,160,083	298.41	125	346,175
2002	1,167,995	320.34	48	374,152

2003	1,176,323	319.71	120	376,080
2004	1,183,533	325.98	189	385,811
2005	1,190,361	345.93	5,913	411,787
2006	1,195,676	333.69	8,056	398,983
2007	1,200,887	311.43	13,077	373,998
2008	1,204,955	321.46	12,148	387,340
2009	1,207,842	336.82	9,126	406,822
2010	1,210,391	344.40	10,949	416,853
2011	1,211,970	337.71	10,402	404,141
2012	1,214,987	341.85	7,370	380,556
2013	1,217,341	363.27	6,963	422,972
2014	1,219,265	371.80	5,191	412,287
2015	1,220,663	394.67	4,692	443,784
2016	1,221,213	392.00	4,284	440,411

Data sources:

- Population: Only direct information is available for years 1962, 1972, 1983, 1990, and 1998-2016 in Statistics Mauritius (Digest of Demographic 2018. Tables 1.3 and 1.19). Population data for the rest of the years have been estimated by interpolation.
- Waste per capita: Parameter estimated and facilitated by the Solid Waste Management Division for the whole period (1960-2016).
- Sludge: Activity data have been facilitated by the Solid Waste Management Division for 2000-2014 period. Data for 2015-2016 have been obtained from Statistic Mauritius. Data for the rest of the years have been assumed to be zero.
- MSW: Direct activity data have been obtained from the Solid Waste Management Division for 2000-2016 period. Based on waste per capita facilitated by the Solid Waste Management Division and the population data, the MSW data for 1960-1999 have been estimated.

Table 113. Activity Data for Solid Waste Disposal in Rodrigues

Year	Population (capita)	Waste per capita (kg/capita)	Sludge - Landfill (t)	MSW - Landfill (t)
1960	17,048	102.1	0	1,741
1961	17,692	102.1	0	1,806
1962	18,335	102.1	0	1,872
1963	18,978	102.1	0	1,938
1964	19,622	102.1	0	2,003
1965	20,265	102.1	0	2,069
1966	20,909	102.1	0	2,135
1967	21,552	102.1	0	2,200
1968	22,195	102.1	0	2,266
1969	22,839	102.1	0	2,332
1970	23,482	102.1	0	2,398
1971	24,126	102.1	0	2,463
1972	24,769	102.1	0	2,529
1973	25,525	102.1	0	2,606
1974	26,280	102.1	0	2,683
1975	27,036	102.1	0	2,760
1976	27,792	102.1	0	2,838

1977	28,548	102.1	0	2,915
1978	29,303	102.1	0	2,992
1979	30,059	102.1	0	3,069
1980	30,815	102.1	0	3,146
1981	31,571	102.1	0	3,223
1982	32,326	102.1	0	3,301
1983	33,082	102.1	0	3,378
1984	33,242	102.1	0	3,394
1985	33,403	102.1	0	3,410
1986	33,563	102.1	0	3,427
1987	33,723	102.1	0	3,443
1988	33,883	102.1	0	3,459
1989	34,044	102.1	0	3,476
1990	34,204	102.1	0	3,492
1991	34,355	102.1	0	3,508
1992	34,506	102.1	0	3,523
1993	34,657	102.1	0	3,538
1994	34,808	102.1	0	3,554
1995	34,958	102.1	0	3,569
1996	35,109	102.1	0	3,585
1997	35,260	102.1	0	3,600
1998	35,411	102.1	0	3,615
1999	35,640	102.1	0	3,639
2000	35,992	102.1	0	3,675
2001	36,414	102.1	0	3,718
2002	36,837	102.1	0	3,761
2003	37,258	102.1	0	3,804
2004	37,681	102.1	0	3,847
2005	38,106	102.1	0	3,891
2006	38,531	102.1	0	3,934
2007	38,954	102.1	0	3,977
2008	39,376	102.1	0	4,020
2009	39,798	102.1	0	4,063
2010	40,221	102.1	0	4,107
2011	40,663	102.1	0	4,152
2012	41,083	102.1	0	4,195
2013	41,504	102.1	0	4,238
2014	41,788	102.1	0	4,267
2015	42,058	102.1	0	4,294
2016	42,396	102.1	0	4,329

Data sources:

- Population: Only direct information is available for years 1962, 1972, 1983, 1990, and 1998-2016 in Digest of Statistics on Rodrigues 2018, tables 1.2 and 1.6. Population data for the rest of the years have been estimated by interpolation.
- Waste per capita: Only direct data for 2020 is available. Based on recommendation of the Solid Waste Management Division from Mauritius, this value has kept constant for the whole period (1960-2020).

- Sludge: No sludge in landfills has been considered for Rodrigues.
- MSW: No direct data are available, so the values have been estimated my multiplying the population and the waste per capita.

Table 114. Total activity data for Solid waste disposal in RoM (Mauritius + Rodrigues)

Year	Population (capita)	Waste per capita (kg/capita)	Sludge - Landfill (t)	MSW - Landfill (t)
1960	669,751	155.1	0	103,876
1961	684,853	157.7	0	108,014
1962	699,954	160.3	0	112,230
1963	715,055	163.0	0	116,525
1964	730,157	165.6	0	120,899
1965	745,258	168.2	0	125,351
1966	760,360	170.8	0	129,881
1967	775,461	173.4	0	134,490
1968	790,562	176.0	0	139,177
1969	805,664	178.7	0	143,943
1970	820,765	181.3	0	148,787
1971	835,867	183.9	0	153,709
1972	850,968	186.5	0	158,710
1973	864,511	189.1	0	163,481
1974	878,055	191.7	0	168,321
1975	891,598	193.2	0	172,301
1976	905,141	196.9	0	178,209
1977	918,685	199.5	0	183,257
1978	932,228	202.1	0	188,375
1979	945,772	204.7	0	193,562
1980	959,315	207.3	0	198,818
1981	972,858	209.8	0	204,144
1982	986,402	212.4	0	209,539
1983	999,945	215.0	0	215,004
1984	1,008,047	217.7	0	219,403
1985	1,016,149	220.3	0	223,845
1986	1,024,251	222.9	0	228,331
1987	1,032,354	225.6	0	232,859
1988	1,040,456	228.2	0	237,431
1989	1,048,558	230.8	0	242,046
1990	1,056,660	233.5	0	246,704
1991	1,069,766	236.1	0	252,610
1992	1,082,873	238.8	0	258,586
1993	1,095,979	241.5	0	264,633
1994	1,109,085	246.6	0	273,520
1995	1,122,192	246.8	0	276,938
1996	1,135,298	249.4	0	283,195
1997	1,148,404	252.1	0	289,523
1998	1,160,529	254.8	0	295,667
1999	1,175,358	257.4	0	302,572
2000	1,187,086	257.5	0	305,675
2001	1,196,497	292.4	125	349,893
2002	1,204,832	313.7	48	377,913

2003	1,213,581	313.0	120	379,884
2004	1,221,214	319.1	189	389,658
2005	1,228,467	338.4	5,913	415,678
2006	1,234,207	326.5	8,056	402,917
2007	1,239,841	304.9	13,077	377,975
2008	1,244,331	314.5	12,148	391,360
2009	1,247,640	329.3	9,126	410,885
2010	1,250,612	336.6	10,949	420,960
2011	1,252,633	330.1	10,402	408,293
2012	1,256,070	334.0	7,370	384,751
2013	1,258,845	354.7	6,963	427,210
2014	1,261,053	362.9	5,191	416,554
2015	1,262,721	384.9	4,692	448,078
2016	1,263,609	382.3	4,284	444,740

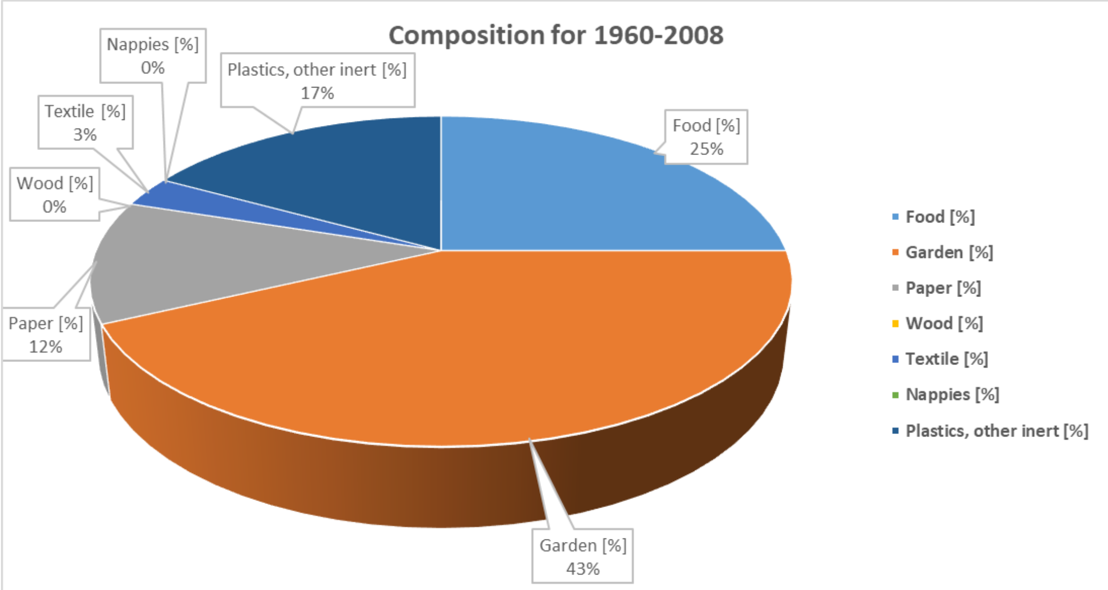
The following composition data has been applied for both islands, Mauritius and Rodrigues, since there are no specific values for the Rodrigues island.

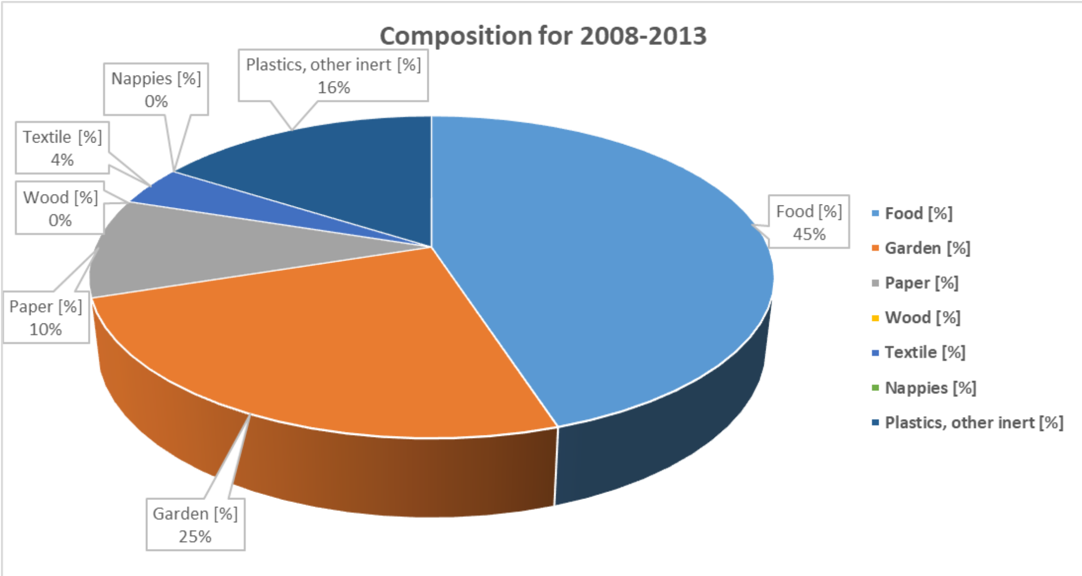
Table 115. Composition of Solid waste disposed at landfills in RoM. Data in percentage (%)

Year	Food	Garden	Paper	Wood	Textile	Nappies	Plastics, other inert	Total
1960	25	43	12	0	3	0	17	100
1961	25	43	12	0	3	0	17	100
1962	25	43	12	0	3	0	17	100
1963	25	43	12	0	3	0	17	100
1964	25	43	12	0	3	0	17	100
1965	25	43	12	0	3	0	17	100
1966	25	43	12	0	3	0	17	100
1967	25	43	12	0	3	0	17	100
1968	25	43	12	0	3	0	17	100
1969	25	43	12	0	3	0	17	100
1970	25	43	12	0	3	0	17	100
1971	25	43	12	0	3	0	17	100
1972	25	43	12	0	3	0	17	100
1973	25	43	12	0	3	0	17	100
1974	25	43	12	0	3	0	17	100
1975	25	43	12	0	3	0	17	100
1976	25	43	12	0	3	0	17	100
1977	25	43	12	0	3	0	17	100
1978	25	43	12	0	3	0	17	100
1979	25	43	12	0	3	0	17	100
1980	25	43	12	0	3	0	17	100
1981	25	43	12	0	3	0	17	100
1982	25	43	12	0	3	0	17	100
1983	25	43	12	0	3	0	17	100
1984	25	43	12	0	3	0	17	100
1985	25	43	12	0	3	0	17	100
1986	25	43	12	0	3	0	17	100
1987	25	43	12	0	3	0	17	100

1988	25	43	12	0	3	0	17	100
1989	25	43	12	0	3	0	17	100
1990	25	43	12	0	3	0	17	100
1991	25	43	12	0	3	0	17	100
1992	25	43	12	0	3	0	17	100
1993	25	43	12	0	3	0	17	100
1994	25	43	12	0	3	0	17	100
1995	25	43	12	0	3	0	17	100
1996	25	43	12	0	3	0	17	100
1997	25	43	12	0	3	0	17	100
1998	25	43	12	0	3	0	17	100
1999	25	43	12	0	3	0	17	100
2000	25	43	12	0	3	0	17	100
2001	25	43	12	0	3	0	17	100
2002	25	43	12	0	3	0	17	100
2003	25	43	12	0	3	0	17	100
2004	25	43	12	0	3	0	17	100
2005	25	43	12	0	3	0	17	100
2006	25	43	12	0	3	0	17	100
2007	25	43	12	0	3	0	17	100
2008	25	43	12	0	3	0	17	100
2009	45	25	10	0	4	0	16	100
2010	45	25	10	0	4	0	16	100
2011	45	25	10	0	4	0	16	100
2012	45	25	10	0	4	0	16	100
2013	45	25	10	0	4	0	16	100
2014	27	27	14	0	6	0	26	100
2015	27	27	14	0	6	0	26	100
2016	27	27	14	0	6	0	26	100

Data sources: composition data for 2000-2016 has been provided by the Solid Waste Management Division. There is no composition data for 1960-1999 period, so the same composition data for 2000 has been assumed for that 1960-1999 period.





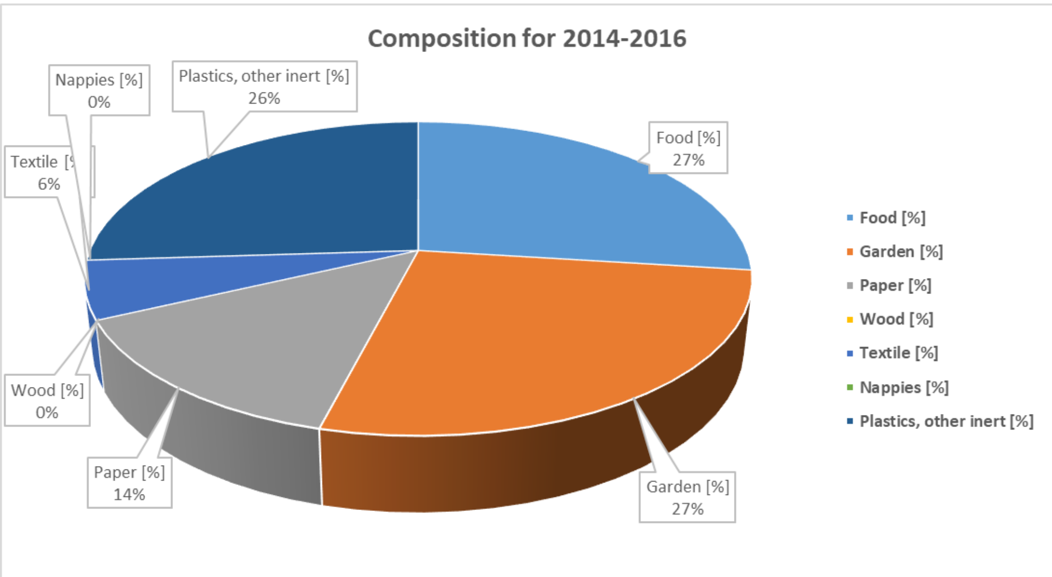


Figure 61. Solid Waste composition over the Inventory period

Table 116. DOC Values

Food	Garden	Paper	Wood	Textile	Nappies	Sewage sludge	Plastics, other inert
0.15	0.20	0.40	0.43	0.24	0.24	0.05	0

Source*: Default values provided by 2006 IPCC Guidelines, table 2.4, Vol 5, chapter 2.*

Table 117. Other Parameters assumed for Solid Waste Disposal Emissions Estimates

Parameter	Value	Unit
OX_T	0	Fraction
DOC_F	0.5	Fraction
Delay time	6	Months
F	0.5	fraction

Source*: Default values proposed by 2006 IPCC Guidelines, Vol 5, chapter 3.*

Regarding the MCF values, in the table below appears the distribution regarding the type of SWDS in both islands (Mauritius and Rodrigues).

Table 118. SWDS for both islands and their MCF values

Year	Mauritius		Rodrigues	RoM	
	Managed-Aerobic (MCF=1)	Uncategorised SWDS (MCF=0.6)	Uncategorised SWDS (MCF=0.6)	Managed-Aerobic (MCF=1)	Uncategorised SWDS (MCF=0.6)
1960	0%	100%	100%	0%	100%
1961	0%	100%	100%	0%	100%
1962	0%	100%	100%	0%	100%
1963	0%	100%	100%	0%	100%
1964	0%	100%	100%	0%	100%
1965	0%	100%	100%	0%	100%
1966	0%	100%	100%	0%	100%
1967	0%	100%	100%	0%	100%
1968	0%	100%	100%	0%	100%
1969	0%	100%	100%	0%	100%
1970	0%	100%	100%	0%	100%
1971	0%	100%	100%	0%	100%
1972	0%	100%	100%	0%	100%
1973	0%	100%	100%	0%	100%
1974	0%	100%	100%	0%	100%
1975	0%	100%	100%	0%	100%
1976	0%	100%	100%	0%	100%
1977	0%	100%	100%	0%	100%
1978	0%	100%	100%	0%	100%
1979	0%	100%	100%	0%	100%
1980	0%	100%	100%	0%	100%
1981	0%	100%	100%	0%	100%
1982	0%	100%	100%	0%	100%
1983	0%	100%	100%	0%	100%
1984	0%	100%	100%	0%	100%

1985	0%	100%	100%	0%	100%
1986	0%	100%	100%	0%	100%
1987	0%	100%	100%	0%	100%
1988	0%	100%	100%	0%	100%
1989	0%	100%	100%	0%	100%
1990	0%	100%	100%	0%	100%
1991	0%	100%	100%	0%	100%
1992	0%	100%	100%	0%	100%
1993	0%	100%	100%	0%	100%
1994	0%	100%	100%	0%	100%
1995	0%	100%	100%	0%	100%
1996	0%	100%	100%	0%	100%
1997	100%	0%	100%	98.8%	1.2%
1998	100%	0%	100%	98.8%	1.2%
1999	100%	0%	100%	98.8%	1.2%
2000	100%	0%	100%	98.8%	1.2%
2001	100%	0%	100%	98.9%	1.1%
2002	100%	0%	100%	99.0%	1.0%
2003	100%	0%	100%	99.0%	1.0%
2004	100%	0%	100%	99.0%	1.0%
2005	100%	0%	100%	99.1%	0.9%
2006	100%	0%	100%	99.0%	1.0%
2007	100%	0%	100%	98.9%	1.1%
2008	100%	0%	100%	99.0%	1.0%
2009	100%	0%	100%	99.0%	1.0%
2010	100%	0%	100%	99.0%	1.0%
2011	100%	0%	100%	99.0%	1.0%
2012	100%	0%	100%	98.9%	1.1%
2013	100%	0%	100%	99.0%	1.0%
2014	100%	0%	100%	99.0%	1.0%
2015	100%	0%	100%	99.0%	1.0%
2016	100%	0%	100%	99.0%	1.0%

Based on this distribution and the MCF values, the weight MCF value for RoM to be considered for the emissions estimates is the one presented in table below.

Table 119. Weight MCF value for RoM

Year	**RoM**
	Weight MCF
1960	0.6
1961	0.6
1962	0.6
1963	0.6
1964	0.6
1965	0.6
1966	0.6
1967	0.6
1968	0.6
1969	0.6
1970	0.6

1971	0.6
1972	0.6
1973	0.6
1974	0.6
1975	0.6
1976	0.6
1977	0.6
1978	0.6
1979	0.6
1980	0.6
1981	0.6
1982	0.6
1983	0.6
1984	0.6
1985	0.6
1986	0.6
1987	0.6
1988	0.6
1989	0.6
1990	0.6
1991	0.6
1992	0.6
1993	0.6
1994	0.6
1995	0.6
1996	0.6
1997	0.9952
1998	0.9952
1999	0.9952
2000	0.9952
2001	0.9956
2002	0.9960
2003	0.9960
2004	0.9960
2005	0.9964
2006	0.9960
2007	0.9956
2008	0.9960
2009	0.9960
2010	0.9960
2011	0.9960
2012	0.9956
2013	0.9960
2014	0.996
2015	0.996
2016	0.996

The half-life value, $t_{1/2}$ is the time taken for the DOCm in waste to decay to half its initial mass. In the FOD model, the reaction constant k is used. The relationship between k and $t_{1/2}$ is $k = \ln(2)/t_{1/2}$.

The half-life is affected by a wide variety of factors related with the composition of the waste, climatic conditions at the site where the SWDS is located, characteristics of the SWDS, waste disposal practices and others.

For the emissions estimates it is necessary to determine the climate zone, which will determine the k values to be considered for the estimates. For landfills in RoM the climate zone "Tropical wet" has been assumed, and default *k* values associated to this climate zone are presented in table below.

Table 120. Methane generation rate (*k*) values considered

Food	Garden	Paper	Wood	Textile	Nappies	Sewage sludge	Plastics, other inert
0.40	0.17	0.07	0.035	0.07	0.17	0.40	0

***Source**: Default values provided by 2006 IPCC Guidelines, table 3.3, Vol 5, chapter 3.*

Table 121. Landfill gas (LFG) and CH_4 data from solid waste disposal sites (2000 – 2016)

Year	LFG flared (Nm^3/year)	LFG to electricity (Nm^3/year)	TOTAL LFG Abstracted (Nm^3/year)	Total CH_4 abstracted (Nm^3/year) [15]	Total CH_4 abstracted (kg/year) [16]	Total CH_4 abstracted (Gg/year)
2009	7,060,962	0	7,060,962	3,530,481	2,315,996	2.32
2010	5,809,655	0	5,809,655	2,904,828	1,905,567	1.91
2011	6,977,828 (Incl. flaring and LGTE)		6,977,828	3,488,914	2,288,728	2.29
2012	507,495	8,510,785	9,018,280	4,509,140	2,957,996	2.96
2013	318,685	11,707,785	12,026,470	6,013,235	3,944,682	3.94
2014	26,632	12,846,801	12,873,433	6,436,717	4,222,486	4.22
2015	97,341	12,014,370	12,111,711	6,055,856	3,972,641	3.97
2016	50,324	11,004,192	11,054,516	5,527,258	3,625,881	3.63

***Source**: Data provided by the Solid Waste Management Division*

Table 122. CH_4 recovered, flared and energy recovery data from solid waste disposal sites (2000 – 2016)

Year	CH_4 recovered (t)	CH_4 flared (t)	CH_4 energy recovery (t)
2009	2,316	2,316	0
2010	1,906	1,906	0
2011	2,289	64	2,224
2012	2,958	166	2,792
2013	3,945	105	3,840

[15] Assuming a methane content of 50.0% in landfill gas (LFG)
[16] Assuming a methane density of 0.656 kg/m^3

2014	4,223	9	4,214
2015	3,973	32	3,941
2016	3,626	17	3,609

6.2.3 Results

CH_4 emissions from solid waste disposal increased from 253.87 Gg CO_2eq in the year 2000 to 369.68 Gg CO_2eq in 2016 which consist of an increase of 45.6%.

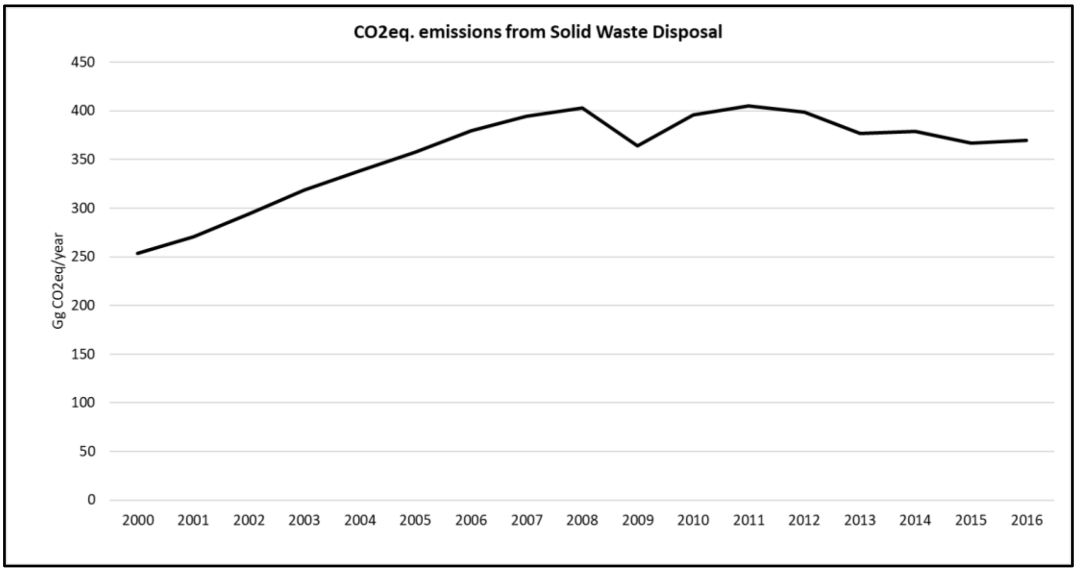


Figure 62. Evolution of the GHG Emissions from solid waste disposal (Gg CO_2eq)

Table 123. GHG Emissions from solid waste disposal (Gg CO_2eq)

Years	Total emissions from Waste	Solid waste disposal	Share for solid waste disposal (%)
2000	460.81	253.87	55.1%
2001	488.68	270.83	55.4%
2002	497.44	293.90	59.1%
2003	525.19	318.42	60.6%
2004	551.36	338.79	61.4%
2005	564.01	357.60	63.4%
2006	576.77	379.24	65.8%
2007	585.02	394.55	67.4%
2008	594.41	402.78	67.8%
2009	558.97	364.01	65.1%
2010	588.57	395.85	67.3%
2011	604.32	404.90	67.0%
2012	596.51	398.65	66.8%
2013	569.54	376.62	66.1%
2014	572.77	378.91	66.2%
2015	555.45	366.93	66.1%
2016	559.18	369.68	66.1%

6.2.4 Quality Control

Some quality control activities were implemented to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by Solid Waste Management Division and data reported in the national Statistics Mauritius.
- Consistency of the overall generating waste balance
- Cross verification between the GHG emissions estimated in the current inventory for solid waste disposal activity and the results obtained in the last reported national inventory of the RoM.
- Cross verification carried out by key stakeholders once emissions were estimates.

6.2.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for solid waste disposal category obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 124. Uncertainty Analysis of Solid waste disposal category (4.A) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
4.A – Solid Waste Disposal	CH_4	30.00	30.00	42.43

6.2.6 Recalculations

FOD method, applied through the IPCC software, has been implemented, including data since 1960. This aspect has improved the accuracy of the emissions but has also entails a notably CH_4 emissions update.

The amount of waste disposed and population from Mauritius and Rodrigues has been reviewed and updated.

6.2.7 Planned Improvements

There are no composition data for 1960-1999 period, and it has been assumed constant and equal to the composition in 2000. RoM will continue working to review and update these values to improve the accuracy of the estimates.

For Rodrigues, no direct data are available regarding waste landfilled so these values have estimated for this inventory based on only one value of waste per capita from 2020, which has kept constant for the whole period. RoM (Rodrigues) will continue working to improve the estimates by obtaining more accurate data.

6.3Biological Treatment of Solid Waste (Category 4B)

This activity includes the emissions deriving from the composting of organic waste. In urban centres of population with advanced treatments for municipal waste, the organic component of the waste is separated for its treatment in composting, which gives rise to a product that may be used again.

The waste streams that may potentially be used for this type of treatment include: a) municipal waste, excluding garden or green waste, b) garden waste; and c) sewage sludge from wastewater treatment plants. The main advantages provided by this type of treatment are: 1) the reduction in the bulk of the waste to be stored or processed using other techniques with a greater or smaller environmental impact; and 2) the production, as the outcome of the process, of a product known as compost with added value in several applications such as fertilization or soil amendments.

6.3.1 Source Category Description

A large-scale compost plant has been operational since October 2011. It is important to mention that, since November 2015, composting has started at Petit Verger Prison and to date nearly ten tons has been produced and used for organic gardening by the Ministry of Environment and other government agencies, in addition to use by Petit Verger Prison.

RoM is moving toward this biological waste treatment to reduce the amount of organic matter disposed at landfills, so it is expected that emissions from this activity continue increasing in the future years, but with the consequent emissions reduction from landfills.

6.3.2 Methodological Issues

6.3.2.1 Calculation

According to the 2006 IPCC Guidelines, the Tier 1 approach for emissions from compost production was adopted.

The methodology adopted for GHG emissions estimation consist of multiplying activity data (AD) by the relevant appropriate emission factor (EF).

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

To use a common unit for GHG emissions, the IPCC recommends the use of Global Warming Potentials (GWP) to convert GHG emissions other than CO_2 to the latter equivalent. CO_2 equivalent (CO_2e). The GWP values used in the current inventory are those adopted from the Second Assessment Report (SAR) as collected in the following table for each GHG reported in the National Inventory.

6.3.2.2 Activity Data

This activity started at RoM in 2011, and activity data, as shown in table below, has been obtained from the Solid Waste Management Division. All data are directly received from the plant, there is not any data gap so estimates have not been required.

Table 125. Activity Data for Composting

Years	Compost (tons)
2000	NO
2001	NO
2002	NO
2003	NO
2004	NO
2005	NO
2006	NO
2007	NO
2008	NO

2009	NO
2010	NO
2011	5,154
2012	34,785
2013	19,257
2014	41,032
2015	37,979
2016	38,308

NO: Not Occurring

6.3.2.3 Emission Factor

Emission factors for composting category were taken from 2006 IPCC Guidelines default emission factors.CO_2, in line with the IPCC methodology, is not included in the Inventory calculation as it comes from a renewable source of organic matter.

The emission factors (EF) considered are 4 g CH_4/kg waste treated (wet weight basis) and 0.24 g N_2O/kg waste treated (wet weight basis), according to the Table 4.1 from Volume 5, Chapter 4 from 2006 IPCC Guidelines.

6.3.3 Results

CH_4 and N_2O emissions from composting increased from 0.82 Gg CO_2eq in the year 2011 to 6.07 Gg CO_2eq in 2016 which consist of an increase of 643.3%.

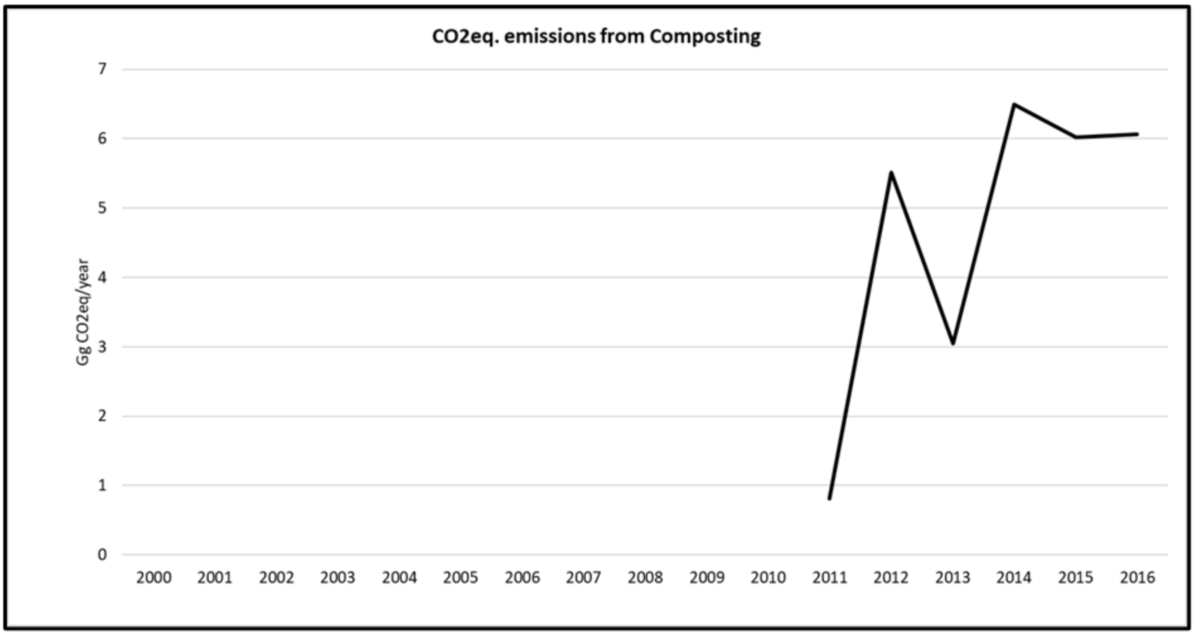


Figure 63. Evolution of the GHG Emissions from Composting (Gg CO_2eq)

Table 126. GHG Emissions from Composting (Gg CO_2eq)

Years	Total emissions from Waste	Composting	Share for composting (%)
2011	604.32	0.82	0.14%
2012	596.51	5.51	0.92%
2013	569.54	3.05	0.54%
2014	572.77	6.50	1.13%
2015	555.45	6.02	1.08%
2016	559.18	6.07	1.09%

6.3.4 Quality Control

Some quality control activities were implemented to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities (Solid Waste Management Division) and data reported in the national Statistics Mauritius.
- Consistency of the overall generating waste balance
- Cross verification between the GHG emissions estimated in the current inventory for composting activity and the results obtained in the last reported national inventory of the RoM.
- Cross verification carried out by key stakeholders once emissions were estimates.

6.3.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for biological treatment of solid waste (composting) category obtained from the 2006 IPCC software are reported in the following table for 2000 as base year:

Table 127. Uncertainty Analysis of Biological treatment of solid waste category (4.B) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
4.B – Biological treatment of solid waste	CH_4	10.00	30.00	31.62
	N_2O	10.00	30,00	31.62

6.3.6 Recalculations

No recalculations have been implemented for this category. Only new data have been incorporated for 2014-2016 period.

6.3.7 Planned Improvements

Since activity data are directly received from plants, to improve the accuracy of the inventory RoM could study the possibility to move to a higher tier by an emission factors country-specific determination. RoM will continue working to obtain plant level information for every year.

6.4 Incineration and Open Burning of Waste – Waste Incineration (Category 4C1)

Waste incineration is defined as the combustion of solid and liquid waste in controlled incineration facilities. Modern refuse combustors have tall stacks and specially designed combustion chambers, which provide high combustion temperatures, long residence times, and efficient waste agitation while introducing air for more complete combustion. Types of waste incinerated include municipal solid waste (MSW), industrial waste, hazardous waste, clinical waste, and sewage sludge.

Relevant gases emitted include CO_2, CH_4 and N_2O. Normally, emissions of CO_2 from waste incineration are more significant than CH_4 and N_2O emissions.

Emissions from waste incineration without energy recovery are reported in the Waste Sector, while emissions from incineration with energy recovery are reported in the Energy Sector, both with a distinction between fossil and biogenic carbon dioxide (CO_2) emissions.

6.4.1 Source Category Description

Based on information provided by relevant stakeholders from RoM, only clinical waste are incinerated in the country. These incinerators are placed at the hospitals[17] (Flacq, SSRN, A.G. Jeetoo, Victoria, Poudre D'or, Brown Sequard), and it is important to mention that very often, these facilities are in operation due to break down and poor maintenance.

Open burning of wastes is not permitted by law in RoM. Henceforth, GHG emissions from open burning of solid waste are considered negligible and have not been accounted for.

6.4.2 Methodological Issues

6.4.2.1 Calculation

According to the 2006 IPCC Guidelines, the Tier 1 approach for emissions from clinical waste incineration was adopted (Equation 5.1, Vol 5, chapter 5).

The methodology adopted for GHG emissions estimation consist of multiplying activity data (AD) by the relevant appropriate emission factor (EF).

$$CO_2\ Emissions\ (E) = \Sigma\ (SWi \times dmi \times CFi \times FCFi \times OFi) * 44/12$$

Where:

- CO_2 Emissions = CO_2 emissions in inventory year, Gg/yr
- SW_i = total amount of solid waste of type i (wet weight) incinerated or open-burned, Gg/yr
- dm_i = dry matter content in the waste (wet weight) incinerated or open-burned, (fraction)
- CF_i = fraction of carbon in the dry matter (total carbon content), (fraction)
- FCF_i = fraction of fossil carbon in the total carbon, (fraction)

[17] https://environment.govmu.org/Documents/eia/eiareports/2019/3005%20-%20VEOLIA/chap%204.pdf

- OF_i = oxidation factor, (fraction)
- 44/12 = conversion factor from C to CO_2
- i = type of waste incinerated

To use a common unit for GHG emissions, the IPCC recommends the use of Global Warming Potentials (GWP) to convert GHG emissions other than CO_2 to the latter equivalent. CO_2 equivalent (CO_2e). The GWP values used in the current inventory are those adopted from the Second Assessment Report (SAR) as collected in the following table for each GHG reported in the National Inventory.

6.4.2.2 Activity Data

Activity data for 2000-2013 and 2015 were directly received from the incinerators, so activity data for 2014 and 2016 have been estimated to solve the data gaps for that period.

Table 128. Activity Data for Clinical Waste Incineration

Years	Clinical waste (tons)
2000	641.09
2001	627.36
2002	635.10
2003	589.55
2004	594.66
2005	593.78
2006	622.98
2007	601.64
2008	611.09
2009	589.04
2010	598.49
2011	645.74
2012	645.74
2013	667.79
2014	753.90
2015	840.00
2016	840.38

6.4.2.3 Emission Factor

CO_2 emission factor for waste incineration category was taken from 2006 IPCC Guidelines default emission factors. CH_4 emissions have not been included in the Inventory calculation as only emissions factors for MSW are available at 2006 IPCC Guidelines. N_2O emissions have not been included in the Inventory calculation as only emissions factors for MSW, industrial waste, and sewage sludge are available at 2006 IPCC Guidelines.

The CO_2 emission factor (EF) parameters considered are from 2006 IPCC Guidelines, Table 5.2, Vol 5, Chapter 5.

Table 129. CO_2 emission factor parameters for clinical waste incineration

Parameters	Value (%)
Dry matter content in % of wet weight	NA
Total carbon content in % of dry weight	60
Fossil carbon fraction in % of total carbon content	40
Oxidation factor in % of carbon input	100

6.4.3 Results

CO_2 emissions from clinical waste incineration increased from 0.56 Gg CO_2-eq in the year 2000 to 0.74 Gg CO_2-eq in 2016 which consist of an increase of 31%.

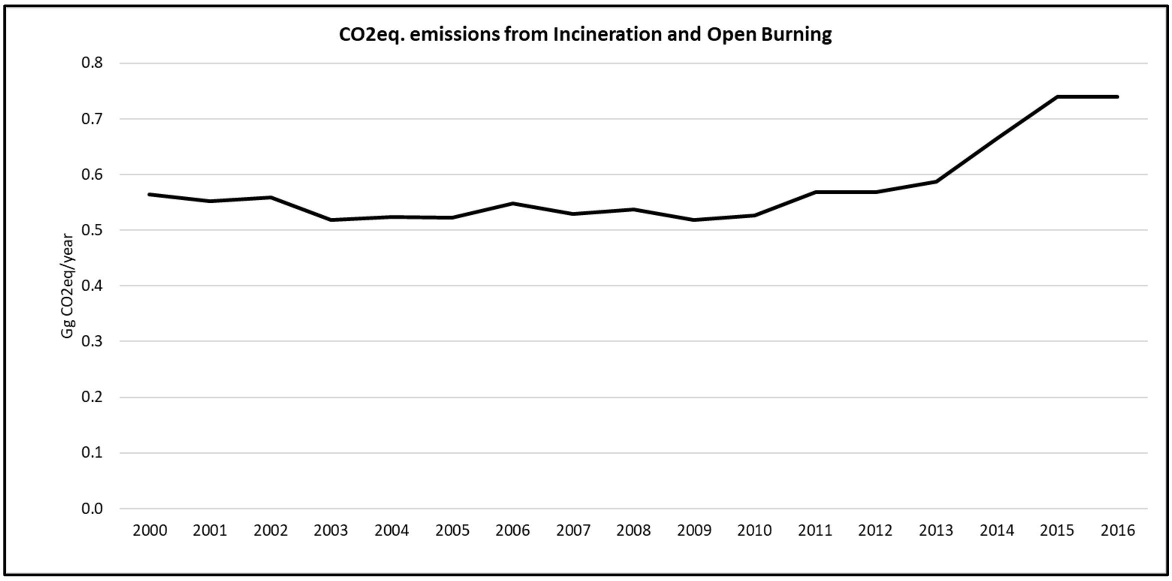


Figure 64. Evolution of the GHG Emissions from clinical waste incineration (Gg CO_2eq)

Table 130. GHG Emissions from clinical waste incineration (Gg CO_2eq)

Years	Total emissions from Waste	Clinical waste incineration	Share for Waste incineration (%)
2000	460.81	0.564	0.12%
2001	488.68	0.552	0.11%
2002	497.44	0.559	0.11%
2003	525.19	0.519	0.10%
2004	551.36	0.523	0.09%
2005	564.01	0.523	0.09%
2006	576.77	0.548	0.10%
2007	585.02	0.529	0.09%
2008	594.41	0.538	0.09%
2009	558.97	0.518	0.09%
2010	588.57	0.527	0.09%
2011	604.32	0.568	0.09%
2012	596.51	0.568	0.10%
2013	569.54	0.588	0.10%
2014	572.77	0.663	0.12%
2015	555.45	0.739	0.13%
2016	559.18	0.740	0.13%

6.4.4 Quality Control

Some quality control activities were implemented to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Consistency of the overall generating waste balance
- Cross verification between the GHG emissions estimated in the current inventory for clinical waste incineration activity and the results obtained in the last reported national inventory of the RoM.
- Cross verification carried out by key stakeholders once emissions were estimates.

6.4.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for waste incineration category obtained from the 2006 IPCC software are reported in the following table for 2000 as base year:

Table 131. Uncertainty Analysis of Waste Incineration category (4.C) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
4.C – Waste Incineration	CO_2	10.00	40.00	41.23
	CH_4	10.00	100.00	100.50
	N_2O	10.00	100.00	100.50

6.4.6 Recalculations

No recalculations have been implemented for this category. Only new data have been incorporated for 2014-2016 period.

6.4.7 Planned Improvements

To improve the accuracy of the inventory, RoM will gather the activity data for 2014 and 2016. In addition, RoM will continue working on collecting all the information regarding the technology that every incinerator uses. In line with this improvement, the activity data should be collected split by each technology.

6.5 Wastewater Treatment and Discharge (Category 4D)

Wastewater originates from a variety of domestic, commercial, and industrial sources and may be treated on site (uncollected), sewered to a centralized plant (collected) or disposed untreated nearby or via an outfall. Domestic wastewater is defined as wastewater from household water use, while industrial wastewater is from industrial practices only.

Wastewater can be a source of methane (CH_4) when treated or disposed anaerobically. It can also be a source of nitrous oxide (N_2O) emissions. Carbon dioxide (CO_2) emissions from wastewater are not considered because these are of biogenic origin and should not be included in national total emissions.

6.5.1 Source Category Description

Wastewater Management Authority (WMA) manages the public wastewater system, which consists of 591 km of sewer network, 72 pumping stations and 10 treatment plants, including 4 main treatment plants which are located at St. Martin, Grand-Baie, Baie-du-Tombeau, and Montagne Jacquot.

At the St. Martin WWTP, all primary and secondary sludge produced is anaerobically digested and the resulting methane is recovered and used for generating about 25% of the plant's requirement in electricity. Apart from the St. Martin wastewater treatment plant, the methane produced from other wastewater treatment plants is not recovered.

6.5.2 Methodological Issues

6.5.2.1 Domestic/Commercial wastewater

CH_4 emissions

Emissions are a function of the amount of organic waste generated and an emission factor that characterises the extent to which this waste generates CH_4.

The general equation to estimate CH_4 emissions from industrial wastewater is as follows:

$$CH_4\ Emissions = [\ \Sigma\ [(U_i \bullet T_{i,j} \bullet EF_j)] \bullet (TOW - S) - R$$

Where:

- CH_4 Emissions = CH_4 emissions in inventory year, kg CH_4/yr
- TOW = total organics in wastewater in inventory year, kg BOD/yr
- S = organic component removed as sludge in inventory year, kg BOD/yr
- U_i = fraction of population in income group *i* in inventory year
- $T_{i,j}$ = degree of utilization of treatment/discharge pathway or system, *j*, for each income group
- fraction *i* in inventory year.
- i = income group: rural, urban high income and urban low income
- j = each treatment/discharge pathway or system
- EF_j = emission factor, kg CH_4 / kg BOD
- R = amount of CH_4 recovered in inventory year, kg CH_4/yr

The activity data for this source category is the total amount of organically degradable material in the wastewater (TOW). This parameter is a function of human population and BOD generation per person. It is expressed in terms of biochemical oxygen demand (kg BOD/year). The equation for TOW is:

$$TOW = P \bullet BOD \bullet 0.001 \bullet I \bullet 365$$

Where:

- TOW = total organics in wastewater in inventory year, kg BOD/yr
- P = country population in inventory year, (person)
- BOD = country-specific per capita BOD in inventory year, g/person/day (a default value of 0.6 kg CH_4/kg BOD has been assumed)
- 0.001 = conversion from grams BOD to kg BOD
- I = correction factor for additional industrial BOD discharged into sewers (it has been assumed a default value of 1.00.)

The emission factor for a wastewater treatment and discharge pathway and system is a function of the maximum CH_4 producing potential (B_0) and the methane correction factor (MCF) for the wastewater treatment and discharge system.

$$EFj = B_0 \bullet MCF_j$$

Where:

- EF_j = emission factor, kg CH_4/kg BOD,

- j = each treatment/discharge pathway or system
- B_0 = maximum CH_4 producing capacity, kg CH_4/kg BOD
- MCF_j = methane correction factor (fraction)

Table 132. Activity data for domestic/commercial wastewater treatment in RoM

Years	Population (person)	BOD (kg/person/year)	TOW (kg BOD/yr)
2000	1,187,086	13.505	16,031,596
2001	1,196,497	13.505	16,158,692
2002	1,204,832	13.505	16,271,256
2003	1,213,581	13.505	16,389,411
2004	1,221,214	13.505	16,492,495
2005	1,228,467	13.505	16,590,447
2006	1,234,207	13.505	16,667,966
2007	1,239,841	13.505	16,744,053
2008	1,244,331	13.505	16,804,690
2009	1,247,640	13.505	16,849,378
2010	1,250,612	13.505	16,889,515
2011	1,252,633	13.505	16,916,809
2012	1,256,070	13.505	16,963,225
2013	1,258,845	13.505	17,000,702
2014	1,261,053	13.505	17,030,521
2015	1,262,721	13.505	17,053,047
2016	1,263,609	13.505	17,065,040

Data sources:

Population: This population is from RoM (Mauritius + Rodrigues). Population has been obtained from Statistics Mauritius, including population from Rodrigues[18]

BOD: a default value from 2006 IPCC Guidelines has been assumed (table 6.4, Vol 5, chapter 6). The BOD value to be considered here is the organic load contained into the wastewater, that is, the value at the entrance of the WWTP. This value depends on the population and the use of the water, but not on the treatment applied.

Table 133. Disaggregation of domestic/commercial wastewater by type of treatment in Mauritius (data in %)

Year	Centralized, aerobic treatment plant. Must be well managed	Anaerobic digester for sludge	Septic system	Latrine	TOTAL
2000	20.49	65.19	3.48	10.85	100
2001	20.49	65.19	3.48	10.85	100
2002	20.49	65.19	3.48	10.85	100
2003	20.49	65.19	3.48	10.85	100
2004	20.49	65.19	3.48	10.85	100
2005	20.49	65.19	3.48	10.85	100
2006	20.49	65.19	3.48	10.85	100

[18] DIGEST OF STATISTICS ON RODRIGUES 2018. Tables 1.2 and 1.6

2007	20.75	64.98	3.47	10.81	100
2008	21.01	64.75	3.46	10.77	100
2009	21.28	64.54	3.45	10.74	100
2010	21.37	64.46	3.44	10.73	100
2011	21.65	68.17	6.66	3.51	100
2012	22.75	67.22	6.57	3.46	100
2013	23.84	66.27	6.48	3.41	100
2014	25.10	65.32	6.39	3.18	100
2015	25.80	64.72	6.33	3.15	100
2016	27.10	63.59	6.22	3.10	100

Data sources: 2006-2016 data have been provided by the Wastewater Management Authority. 2000-2005 data are not available and have been considered equal to data for 2006.

Table 134. Disaggregation of domestic/commercial wastewater by type of treatment in Rodrigues (data in %)

Year	Untreated. Sea, river and lake discharge	Anaerobic digester for sludge	Septic system	Latrine	TOTAL
2000	3.4	43.61	6.79	46.2	100
2001	3.4	43.61	6.79	46.2	100
2002	3.4	43.61	6.79	46.2	100
2003	3.4	43.61	6.79	46.2	100
2004	3.4	43.61	6.79	46.2	100
2005	3.4	43.61	6.79	46.2	100
2006	3.4	43.61	6.79	46.2	100
2007	3.4	43.61	6.79	46.2	100
2008	3.4	43.61	6.79	46.2	100
2009	3.4	43.61	6.79	46.2	100
2010	3.4	43.61	6.79	46.2	100
2011	3.4	43.61	6.79	46.2	100
2012	3.4	43.61	6.79	46.2	100
2013	3.4	43.61	6.79	46.2	100
2014	3.4	43.61	6.79	46.2	100
2015	3.4	43.61	6.79	46.2	100
2016	3.4	43.61	6.79	46.2	100

Data sources: Data extracted from Housing Census 2011, Table HDU07 (page 198). No public information available for the rest of the years, so values for 2011 has been replicated for the rest of the inventory years.

Table 135. Disaggregation of domestic/commercial wastewater by type of treatment in RoM (data in %)

Year	Untreated. Sea, river and lake discharge	Centralized, aerobic treatment plant. Must be well managed	Anaerobic digester for sludge	Septic system	Latrine	TOTAL
2000	0.10	19.86	64.53	3.58	11.92	100
2001	0.10	19.86	64.53	3.58	11.92	100
2002	0.10	19.86	64.53	3.58	11.93	100
2003	0.10	19.86	64.52	3.59	11.93	100
2004	0.10	19.85	64.52	3.59	11.94	100
2005	0.11	19.85	64.52	3.59	11.94	100
2006	0.11	19.85	64.51	3.59	11.95	100
2007	0.11	20.09	64.30	3.58	11.92	100
2008	0.11	20.35	64.08	3.57	11.90	100
2009	0.11	20.60	63.87	3.56	11.87	100
2010	0.11	20.68	63.79	3.55	11.87	100
2011	0.11	20.95	67.38	6.67	4.90	100
2012	0.11	22.01	66.45	6.58	4.86	100
2013	0.11	23.06	65.52	6.49	4.82	100
2014	0.11	24.27	64.60	6.40	4.61	100
2015	0.11	24.94	64.02	6.34	4.59	100
2016	0.11	26.19	62.92	6.24	4.54	100

Data sources: these data have been estimated as weighted average percentage from Mauritius and Rodrigues data.

Table 136. MCF values considered for domestic/commercial wastewater treatments

Year	Untreated. Sea, river and lake discharge	Centralized, aerobic treatment plant. Must be well managed	Anaerobic digester for sludge	Septic system	Latrine
2000-2016	0.1	0	0.8	0.5	0.1

Source: *2006 IPCC Guidelines. Table 6.3. Vol 5, Chapter 6.*

Table 137. Amount of CH_4 recovered and flared in RoM

Year	CH_4 produced (t)	CH_4 recovered (t)	CH_4 flared (t)
2000	5,253.8	0.0	0.0
2001	5,295.3	0.0	0.0
2002	5,332.0	0.0	0.0
2003	5,370.6	0.0	0.0
2004	5,404.2	0.0	0.0
2005	5,436.1	0.0	0.0

2006	5,461.3	354.4	354.4
2007	5,468.7	354.4	354.4
2008	5,470.0	354.4	354.4
2009	5,466.4	354.4	354.4
2010	5,472.7	397.3	397.3
2011	5,860.1	395.3	395.3
2012	5,795.6	461.0	461.0
2013	5,727.8	489.1	489.1
2014	5,656.5	482.8	482.8
2015	5,612.7	478.9	478.9
2016	5,520.6	470.7	470.7

Data sources: 2006-2013 CH_4 recovered and flared data have been obtained from TNC. 2013-2016 data have been estimated keeping the proportion between CH_4 produced and flared in 2013. CH4 produced data (obtained from IPCC software) have been reported here to show how CH_4 recovered and flared data for 2014-2016 period have been estimated.

Hotel sector

Tourism in RoM is a truly relevant sector for the economy and general lifestyle in the country. This tourism produces, due to a large amount of people arriving the country, and among other things, an important volume of wastewater which need to be treated.

Table 138. Amount of tourist visiting RoM

Year	Tourists (person)
2000	656,453
2001	660,318
2002	681,648
2003	702,018
2004	718,861
2005	761,063
2006	788,276
2007	906,971
2008	930,456
2009	871,356
2010	934,827
2011	964,642
2012	965,441
2013	992,503
2014	1,038,334
2015	1,151,252
2016	1,275,227

Data sources: Statistics Mauritius. Data are for RoM (Mauritius + Rodrigues), but disaggregated data by islands are not available.

This wastewater, due to the characteristics of its origin, has a different BOD value. In addition, the methodology to be used to estimate CH_4 emissions must be different to the wastewater produced by people from RoM who lives the whole year in the country. In this sense, specific methodology was described in previous inventory as follows:

- The total water consumption for the tourist hotels was computed as follows (Source: SNC):
  (1.72 m^3/room per day) x (365 days/year) x (total number of hotel rooms in year) x 0.66
  The annual tourist nights, and numbers of tourists were obtained from Statistics Mauritius.
- The average raw BOD value for wastewater from tourist hotels was calculated from actual data for the 5 hotels referred to in the report of the Ministry of Environment and NDU (these values were obtained from the report on wastewater from the Hotel Sector prepared by the Ministry of Environment & NDU in 2004). The average raw BOD was computed as 187 mg/l. (Source: SNC)

It is important to consider this sector in the Inventory, however, it has been assumed that all wastewater produced at hotels where tourist stay is treated at centralized and well-managed aerobic treatment plants. This means that MCF to be applied is 0, so the emissions produced due to the treatment of this wastewater are 0.

N_2O emissions

In keeping with the method proposed by the 2006 IPCC Guidelines, the total emissions of nitrous oxide that are produced via domestic/commercial wastewater are determined as a combination of the direct nitrous oxide emissions (N_2O_{Plants}) and indirect nitrous oxide emissions ($N_2O_{Effluent}$).

Currently, RoM only has indirect emissions, so following equations proposed by 2006 IPCC Guidelines have been applied:

$$N_2O\ Emissions = N_{EFFLUENT} \bullet EF_{EFFLUENT} \bullet 44 / 28$$

Where:

- N_2O emissions = N_2O emissions in inventory year, kg N_2O/yr
- $N_{EFFLUENT}$ = nitrogen in the effluent discharged to aquatic environments, kg N/yr
- $EF_{EFFLUENT}$ = emission factor for N_2O emissions from discharged to wastewater, kg N_2O-N/kg N
- The factor 44/28 is the conversion of kg N_2O-N into kg N_2O

$$N_{EFFLUENT} = P \bullet Protein \bullet F_{NPR} \bullet F_{NON-CON} \bullet F_{IND-COM} - N_{SLUDGE}$$

Where:

- $N_{EFFLUENT}$ = total annual amount of nitrogen in the wastewater effluent, kg N/yr
- P = human population
- Protein = annual per capita protein consumption, kg/person/yr
- F_{NPR} = fraction of nitrogen in protein, default = 0.16, kg N/kg protein
- $F_{NON-CON}$ = factor for non-consumed protein added to the wastewater
- $F_{IND-COM}$ = factor for industrial and commercial co-discharged protein into the sewer system
- N_{SLUDGE} = nitrogen removed with sludge (default = zero), kg N/yr

Table 139. RoM population and annual per capita protein consumption (kg/person/year)

Years	Population	Protein consumption
2000	1,187,086	28.67
2001	1,196,497	29.15
2002	1,204,832	29.92
2003	1,213,581	30.33
2004	1,221,214	31.15
2005	1,228,467	30.65
2006	1,234,207	30.35
2007	1,239,841	31.65
2008	1,244,331	30.86
2009	1,247,640	32.75
2010	1,250,612	32.87
2011	1,252,633	32.50
2012	1,256,070	32.08
2013	1,258,845	32.25
2014	1,261,053	31.29
2015	1,262,721	31.62
2016	1,263,609	31.84

Data sources:

Population: This population is from RoM (Mauritius + Rodrigues). Population has been obtained from Statistics Mauritius, including population from Rodrigues[19]

Protein consumption: **http://www.fao.org/faostat/en/#data/FBS/visualize**

Table 140. Parameters assumed for N_2O emissions estimates (default values)

Parameter	Value	Unit
$EF_{EFFLUENT}$	0.005	kg N_2O-N/kg N
F_{NPR}	0.16	kg N/kg protein
$F_{NON-CON}$	1.1	Fraction
$F_{IND-COM}$	1.25	Fraction
N_{SLUDGE}	0	kg N/yr

Source: *2006 IPCC Guidelines*

6.5.2.2 Industrial wastewater

The general equation to estimate CH_4 emissions from industrial wastewater is as follows:

$$CH_4\ Emissions = \Sigma\ [(TOW_i - S_i) \bullet EF_i - R_i]$$

Where:

- CH_4 Emissions = CH_4 emissions in inventory year, kg CH_4/yr
- TOW_i = total organically degradable material in wastewater from industry I in inventory year, kg COD/yr
- i = industrial sector

[19] DIGEST OF STATISTICS ON RODRIGUES 2018. Tables 1.2 and 1.6

- S_i = organic component removed as sludge in inventory year, kg COD/yr
- EF_i = emission factor for industry i, kg CH_4/kg COD for treatment/discharge pathway or system(s) used in inventory year
- R_i = amount of CH_4 recovered in inventory year, kg CH_4/yr

The activity data for this source category is the amount of organically degradable material in the wastewater (TOW).

$$TOW_i = P_i \cdot W_i \cdot COD_i$$

Where:

- TOW_i = total organically degradable material in wastewater for industry i, kg COD/yr
- i = industrial sector
- P_i = total industrial product for industrial sector i, t/yr
- W_i = wastewater generated, m^3/t product
- COD_i = chemical oxygen demand (industrial degradable organic component in wastewater),
- kg COD/m^3

There are significant differences in the CH_4 emitting potential of different types of industrial wastewater. To the extent possible, data should be collected to determine the maximum CH4 producing capacity (B_0) in each industry. The MCF indicates the extent to which the CH_4 producing potential (B_0) is realized in each type of treatment method. Thus, it is an indication of the degree to which the system is anaerobic

$$EFj = Bo \cdot MCF_j$$

Where:

- EF_j = emission factor for each treatment/discharge pathway or system, kg CH_4/kg COD,
- j = each treatment/discharge pathway or system
- B_0 = maximum CH_4 producing capacity, kg CH_4/kg COD (a default value of 0.25 kg CH_4/kg COD has been assumed)
- MCF_j = methane correction factor (fraction)

Table 141. Activity Data for Sugar Industry

Years	P (t)	W (m^3/t produced)	Wastewater produced (m^3)	COD (kg/m^3)	TOW (kg COD/yr)
2000	569,289	8	4,554,312	5	22,771,560
2001	645,597	8	5,164,776	5	25,823,880
2002	520,887	8	4,167,096	5	20,835,480
2003	537,155	8	4,297,240	5	21,486,200
2004	572,316	8	4,578,528	5	22,892,640
2005	519,816	8	4,158,528	5	20,792,640
2006	504,857	8	4,038,856	5	20,194,280
2007	435,972	8	3,487,776	5	17,438,880
2008	452,062	8	3,616,496	5	18,082,480
2009	467,234	8	3,737,872	5	18,689,360
2010	452,473	8	3,619,784	5	18,098,920
2011	435,310	8	3,482,480	5	17,412,400
2012	409,200	8	3,273,600	5	16,368,000
2013	404,713	8	3,237,704	5	16,188,520

2014	400,173	8	3,201,384	5	16,006,920
2015	366,070	8	2,928,559	5	14,642,795
2016	386,277	8	3,090,218	5	15,451,090

Data sources:

- P: Statistics Mauritius (2000-2016)
- W: This figure was obtained from a report entitled "Implementation of the Multi-Annual Adaptation Strategy for the Mauritian Sugar Cane Cluster (2006-2015) – Strategic Environmental Assessment – Final Draft Report" (Agreco Consortium, 2006).
- COD: This was obtained from EIA report for production of granulated refined sugar (Arup SIGMA 2004).

Table 142. Activity data for Poultry Industry

Years	P (t)	W (m^3/t produced)	Wastewater produced (m^3)	COD (kg/m^3)	TOW (kg COD/yr)
2000	41,276	8.60	354,974	3.5	1,242,407.6
2001	41,276	8.60	354,974	3.5	1,242,407.6
2002	41,276	8.60	354,974	3.5	1,242,407.6
2003	41,276	8.60	354,974	3.5	1,242,407.6
2004	41,276	8.60	354,974	3.5	1,242,407.6
2005	41,276	8.60	354,974	3.5	1,242,407.6
2006	41,276	8.60	354,974	3.5	1,242,407.6
2007	46,700	8.60	401,620	3.5	1,405,670.0
2008	42,000	8.60	361,200	3.5	1,264,200.0
2009	44,000	8.60	378,400	3.5	1,324,400.0
2010	46,600	8.60	400,760	3.5	1,402,660.0
2011	47,000	8.60	404,200	3.5	1,414,700.0
2012	47,200	8.60	405,920	3.5	1,420,720.0
2013	46,700	8.60	401,620	3.5	1,405,670.0
2014	46,550	8.60	400,330	3.5	1,401,155.0
2015	46,400	8.60	399,040	3.5	1,396,640.0
2016	45,800	8.60	393,880	3.5	1,378,580.0

Data sources:

- P: TNC (2006-2013) and Statistics Mauritius (2000-2016). For 2000-2005 period, same value than 2006 has been considered, and data for 2014 has been estimated as the average value from 2013 and 2015.
- W: The volume of wastewater per tonne of poultry processed was obtained from the two largest poultry processing plants in RoM
- COD: This figure was obtained from actual test results reported for the design of a wastewater treatment plant for one major poultry processing plant

Table 143. Activity Data for Beer Industry

Years	P (t)	W (m^3/t produced)	Wastewater produced (m^3)	COD (kg/m^3)	TOW (kg COD/yr)
2000	37,370	6.3	235,431	2.9	682,749.9
2001	37,370	6.3	235,431	2.9	682,749.9
2002	37,370	6.3	235,431	2.9	682,749.9
2003	37,370	6.3	235,431	2.9	682,749.9
2004	37,370	6.3	235,431	2.9	682,749.9
2005	37,370	6.3	235,431	2.9	682,749.9
2006	37,370	6.3	235,431	2.9	682,749.9
2007	37,370	6.3	235,431	2.9	682,749.9
2008	37,370	6.3	235,431	2.9	682,749.9
2009	37,370	6.3	235,431	2.9	682,749.9
2010	37,370	6.3	235,431	2.9	682,749.9
2011	37,370	6.3	235,431	2.9	682,749.9
2012	36,855	6.3	232,187	2.9	673,340.9
2013	36,340	6.3	228,942	2.9	663,931.8
2014	35,825	6.3	225,698	2.9	654,522.8
2015	35,310	6.3	222,453	2.9	645,113.7
2016	36,070	6.3	227,241	2.9	658,998.9

Data sources:

- P: Statistics Mauritius (2011, 2015, 2016). Data in Statistics Mauritius are in m^3, but a density value like water has been used to convert data into tonnes. For 2000-2010 period, same value from 2011 has been assumed, and for 2012-2014 an interpolation has been applied.
- W: Default values from 2006 IPCC Guidelines (table 6.9, Vol5, chapter 6)
- COD: Default values from 2006 IPCC Guidelines (table 6.9, Vol5, chapter 6)

Table 144. Disaggregation of industrial wastewater treated by type of treatment

Years	Industry sector	Aerobic treatment plant (%)	Anaerobic digester for sludge (%)	TOTAL (%)
2000-2016	Sugar	25	75	100
	Poultry	25	75	100
	Beer	25	75	100

Based on 2006 IPCC Guidelines (Vol 5, chapter 6), other default values considered for the emissions estimates:

- Aerobic treatment plant: MCF = 0
- Anaerobic digester for sludge: MCF = 0.8
- Si: 0 kg COD/yr (all years)
- Ri: 0 kg CH_4/yr (all years)

6.5.3 Results

Regarding domestic/commercial wastewater, CH_4 emissions decreased from 110.33 Gg CO_2eq in the year 2000 to 106.05 Gg CO_2eq in 2016, which consist in a decrease of 3.8%. In addition, N_2O emissions increase from 18.24 Gg CO_2eq in the year 2000 to 21.56 Gg CO_2eq in 2016, which consist in an increase of 18.2%.

Regarding industrial wastewater, CH_4 emissions decreased from 77.79 Gg CO_2eq in the year 2000 to 55.09 Gg CO_2eq in 2016, representing a decrease of 29.2%.

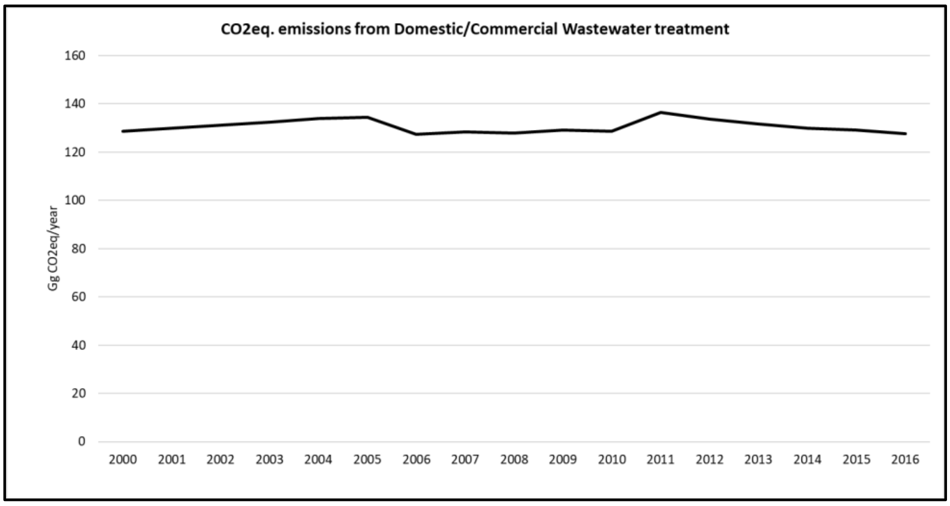


Figure 65. Evolution of the GHG Emissions from domestic/commercial wastewater (Gg CO_2eq)

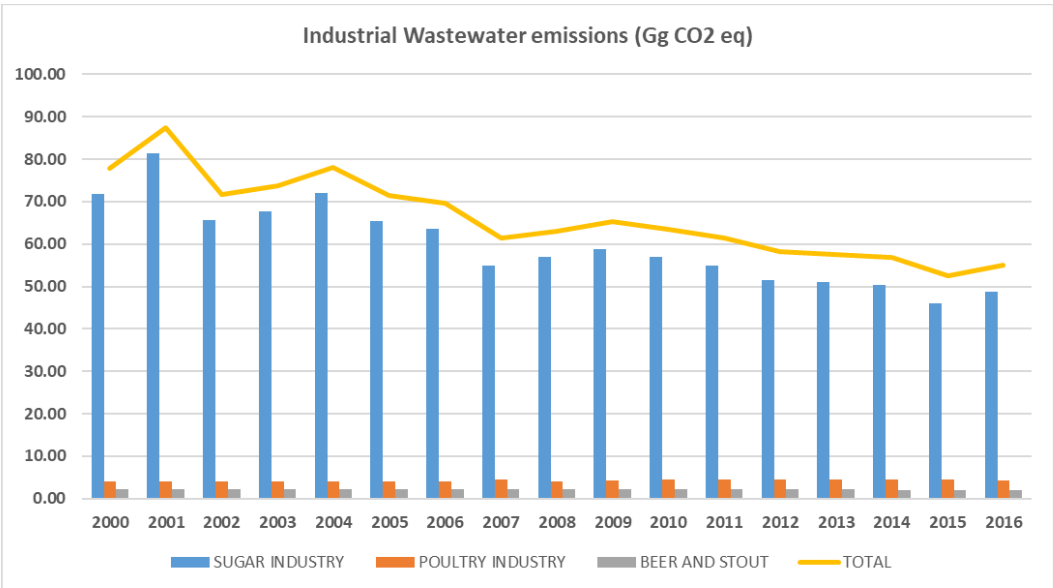


Figure 66. Evolution of the GHG Emissions from industrial wastewater (Gg CO_2eq)

Table 145. GHG Emissions from domestic/commercial wastewater (Gg CO_2eq)

Years	CH_4 (Gg CO_2 eq)	N_2O (Gg CO_2 eq)	TOTAL
2000	110.33	18.24	128.57
2001	111.20	18.69	129.89
2002	111.97	19.31	131.29
2003	112.78	19.72	132.50
2004	113.49	20.38	133.87
2005	114.16	20.18	134.33
2006	107.24	20.07	127.31
2007	107.40	21.03	128.43
2008	107.43	20.58	128.00
2009	107.35	21.89	129.25
2010	106.58	22.03	128.61
2011	114.76	21.81	136.57
2012	112.03	21.59	133.62
2013	110.01	21.76	131.77
2014	108.65	21.15	129.79
2015	107.81	21.40	129.21
2016	106.05	21.56	127.61

Table 146. GHG Emissions from industrial wastewater (Gg CO_2eq)

Years	Sugar industry	Poultry industry	Beer industry	TOTAL
2000	71.73	3.91	2.15	77.79
2001	81.35	3.91	2.15	87.41
2002	65.63	3.91	2.15	71.70
2003	67.68	3.91	2.15	73.75
2004	72.11	3.91	2.15	78.18
2005	65.50	3.91	2.15	71.56
2006	63.61	3.91	2.15	69.68
2007	54.93	4.43	2.15	61.51
2008	56.96	3.98	2.15	63.09
2009	58.87	4.17	2.15	65.19
2010	57.01	4.42	2.15	63.58
2011	54.85	4.46	2.15	61.46
2012	51.56	4.48	2.12	58.16
2013	50.99	4.43	2.09	57.51
2014	50.42	4.41	2.06	56.90
2015	46.12	4.40	2.03	52.56
2016	48.67	4.34	2.08	55.09

Table 147. GHG Emissions from total wastewater (domestic/commercial + industrial) (Gg CO_2eq)

Years	Total emissions from Waste	Total wastewater	Share for total wastewater (%)
2000	460.81	206.37	44.78%
2001	488.68	217.30	44.47%
2002	497.44	202.98	40.81%
2003	525.19	206.25	39.27%
2004	551.36	212.05	38.46%
2005	564.01	205.89	36.51%
2006	576.77	196.99	34.15%
2007	585.02	189.94	32.47%
2008	594.41	191.10	32.15%
2009	558.97	194.44	34.79%
2010	588.57	192.19	32.65%
2011	604.32	198.03	32.77%
2012	596.51	191.78	32.15%
2013	569.54	189.28	33.23%
2014	572.77	186.69	32.59%
2015	555.45	181.76	32.72%
2016	559.18	182.70	32.67%

6.5.4 Quality Control

Some quality control activities were implemented to ensure the use of right data in the inventory. The QC implemented during the data collection and GHG emission estimation is listed below:

- Cross verification between data provided via mail by institutional authorities (Wastewater Management Authority) and data reported in the national Statistics Mauritius.
- Cross verification between the GHG emissions estimated in the current inventory for wastewater activity and the results obtained in the last reported national inventory of the RoM.
- Cross verification carried out by key stakeholders once emissions were estimates.

6.5.5 Uncertainty Assessment and Time-series Consistency

The uncertainty analysis results for wastewater treatment and discharge category obtained from the IPCC software are reported in the following table for 2000 as base year:

Table 148. Uncertainty Analysis of Wastewater Treatment and Discharge category (4.D) for the period 2000 – 2016

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
4.D – Wastewater Treatment and Discharge	CH_4	107.35	42.43	115.43
	N_2O	95.00	0.00	95.00

6.5.6 Recalculations

6.5.6.1 Domestic/Commercial wastewater

Wastewater emissions from Rodrigues have been included for this Inventory. These emissions (CH_4 and N_2O) have supposed an increase regarding previous Inventory edition.

A recalculation related to N_2O emissions has been implemented as the protein consumption values used for previous inventory were not found at FAO Statistics, and a slightly update has been implemented with the new values found at FAO database statistics[20].

6.5.6.2 Industrial wastewater

For this inventory edition (2000-2016), a new type of industry (beer production) has been considered due to the relevancy in the country. The emissions estimated from this new industry have produced a recalculation in this category.

In addition, the MCF value considered for all the wastewater treated in previous inventory (0.5) has been reviewed and updated. For this inventory edition, two different types of treatments have been considered based on information provided by stakeholders so 25% of wastewater has been treated at aerobic treatment plants (MCF value = 0) and 75% of wastewater has been treated by anaerobic digester for sludge (MCF = 0.8).

6.5.7 Planned Improvements

6.5.7.1 Domestic/Commercial wastewater

For Mauritius, data for distribution of wastewater by treatments for 2000-2005 period are not available and have been considered equal to data for 2006. RoM will continue working to obtained more accurate data for 2000-2005 period.

Additionally, the amounts of CH_4 captured and flared for 2014-2016 period have not been available for this inventory edition and has had to be estimated. RoM will continue working to obtain more accurate data for next inventory cycle.

For Rodrigues, only wastewater distribution data for 2011 is available, so the data for the rest of the inventory period has been replicated. RoM will continue working to obtained more accurate data for 2000-2005 period.

BOD value considered is a default value from 2006 IPCC Guidelines. It is known that the Wastewater Management Authority has worked to get a country-specific value, however, the

[20] http://www.fao.org/faostat/en/#data/FBS/visualize

current available information cannot be included as part of the inventory due to some formatting and conceptual aspects to be solved and be aligned with 2006 IPCC Guidelines. The Wastewater Management Authority will continue actively working with the Inventory team for next Inventory cycle, and a country-specific BOD value will be considered.

6.5.7.2 Industrial wastewater

RoM will continue working on improving the information related to the amount of wastewater treated under each type of treatment for every year, and for every type of industry. For this inventory it has been assumed that the percentage of wastewater treated by each treatment has been the same for all the years of the inventory period, but it is possible that the industries have upgraded their processes and technologies over the years.

Regarding the poultry industry, activity data from 2006-2013 were obtained from the TNC, and from 2015-2016 from Statistics Mauritius. The activity data for the rest of the inventory period have been estimated, that is, for 2000-2005 period same value than 2006 and data for 2014 has been estimated as the average value from 2013 and 2015. RoM will continue working on reviewing and updating the estimated data through a closer collaboration with industrial facilities and/or with industry associations.

Regarding beer production, only data for 2011, 2015 and 2016 were available from Statistics Mauritius. For 2000-2010 period same value from 2011 has been assumed, and for 2012-2014 an interpolation has been applied. RoM will continue working on reviewing and improving the estimated data through a closer collaboration with industrial facilities and/or with industry associations.

On the other hand, the beer production industries are already licensed to discharge their wastewaters into the public sewer network for domestic and commercial wastewater. The industrial wastewaters that are discharged into the domestic/commercial wastewater collector, shall report their emissions together with the domestic wastewater emissions. For that reason, the Wastewater Management Authority will continue working to identify the wastewater discharge licenses of each industry in the RoM to know where the industrial wastewaters are discharged to increase the accuracy of the national emission inventory. The Wastewater Management Authority will continue actively working with the Inventory team for the next Inventory cycle to improve this aspect.

Additionally, for the beer production industry, default IPCC values have been considered (m^3 wastewater /t produced and kg COD/m^3 wastewater). RoM will work to determine country-specific values for these parameters as already has for the sugar and poultry industries.

7. Archiving

Archives refer to a collection of records that have been created during the development of the inventory (references, methodological choice, expert comments, revisions, etc.), as well as document the location where these records are kept. The Archiving System is a critical component of the inventory development process and is important for sustaining the National Inventory System of the Republic of Moldova. An Archiving System helps make a national inventory transparent and reproducible, and facilitates development of subsequent inventories by future inventory staff and sector/category leads (individuals responsible for developing estimates within a particular sector). Each new inventory cycle will benefit from effective data and document management during development of the previous inventory.

All information used to create the inventory is archived in a single location in both electronic and hard copy (paper) storage so that future inventory managers can reference all relevant files to respond to reviewer feedback including questions about methodologies. Archived information includes all emission factors and activity data at the most detailed level, and documentation of how these factors and data have been generated and aggregated for the preparation of the inventory. This information also includes internal documentation on QA/QC procedures, external and internal reviews, documentation of annual key categories and key category identification, and planned inventory improvements. Copies of archived documents are kept in multiple locations to reduce the risk of losing all records due to theft or disaster (e.g., fire, earthquake, or flooding).

7.1 Archiving Procedures

The documents and files available for the BUR-1 GHG inventory cycle are archived as follows:

- GHG Inventory documents (both draft and final) are stored both electronically in computers, portable hard drives, pendrives as well as CD ROMs
- Hard copies of activity data received from institutions are scanned and kept in electronic format in sectoral folders
- Hard Copies (sectoral activity data, emission factors as well as chapters, including all data requests and emails/correspondences are filed according to the 2006 IPCC Categories as below:
    - Energy: GEF/UNEP/BUR/ENER
    - Transport: GEF/UNEP/BUR/TRANS
    - Industrial Process and Product Use: GEF/UNEP/BUR/IPPU
    - Agriculture, Forestry and Other Land Use: GEF/UNEP/BUR/AFOLU
    - Waste (Solid and Liquid): GEF/UNEP/BUR/WSL
    - Rodrigues Island: GEF/UNEP/BUR/RRG
- The information is stored in the:
    - Department of Climate Change at: 7th Floor, Ken Lee Tower, Corner St Georges and Barracks Streets, Port Louis , Mauritius
    - Environment Statistics Unit at: 4th Floor, Ken Lee Tower, Corner St Georges and Barracks Streets, Port Louis , Mauritius

8. Improvement Plan

This Chapter highlights the plan of improvement not indicated in specific sectoral chapters of this report. For sectoral plan of improvement, please refer to the end of each sectoral chapter or in its parts (sub-chapters). The National GHG inventory requires continuous improvement, GHG inventory reporting requires detailed activity data collection and estimation of country-specific emission factors.

8.1 Strategies for Long Term Improvement in the National Inventory System

The Republic of Mauritius has an obligation to submit BUR as well as NC on a regular basis. It is vital that the process be strengthened, and a system is developed and maintained in a robust manner to ensure that it functions on a continuous basis to meet RoM reporting requirement. There is a need to strengthen the existing institutional arrangements.

It is recommended that, during the upcoming development of future Biennial Update Reports (BURs) and National Communications, the methodology is improved further, considering the development of national emissions factors in key sectors for GHG emissions and use of data from the emissions monitoring systems. In addition, the development of a sustainable national inventory system involving key organisations, in the regular update and improvement of the GHG inventory needs to be established.

8.1.1 Institutional Arrangements

The National Inventory Report (NIR) was coordinated as a component under the BUR1 project by the Climate Change Division.

According to Article 4 of UNFCCC, Parties are committed to communicate regularly the following information:

- Anthropogenic emissions and removals;
- Established measures and related policies to mitigate climate change;
- Established measures and related policies to adapt to climate change impacts;
- Existing and planned research and systematic observation; and
- Existing and planned programmes of education, training and public awareness.

These institutional arrangements (via a National Systems) should ensure that the GHG inventory is continuously improved, and that institutional memory is retained and developed.

8.1.2 Capacity Building & Development of Technical Know-how and Institutional Memory

Despite the knowledge acquired during the preparation of the BUR1, there are still need for more capacity building and empowerment of staff and institutions. The training could include theoretical training and practical exercises and could cover, among others:

- Data collection and how to proceed in case of lack of activity data;
- Methodology development, including for deriving EFs;
- Use of IPCC software, and GIS software for AFOLU sector; and
- International reporting and its requirements.
- Implementation of the MRV framework

Concerning the information sharing it is recommended to:

- Create national registry/website/database or clearinghouse for the GHG inventory with tools, among others; and
- Open website for gathering public and private reviews.

8.1.3 Quality Assurance and Quality Controls

It is recommended that, as part of the National System, Mauritius develops an efficient, transparent and pragmatic QC and verification system. For upcoming Greenhouse gases inventory, it is recommended for RoM to develop a detailed QA and QC. Therefore, required information for QC and QA shall be recorded in templates located in Appendix 4 and 5 accordingly.

It is important to mention that different QC have been carried out for this Inventory since all the key stakeholders reviewed the activity data used and the emissions estimated. In addition, a QA process was carried out by an international consultant, obtaining a report with some suggestions about improvements, which have been implemented into this Inventory (others have been included as part of the improvement plans).

8.2 Planned Improvement on the Methodology

The level of inventory reporting depends on the data quality and methodology employed. This is indicated as the Tier used (e.g. 1 = simplest and least accurate, 2 or 3 as the most complex and accurate) as per the IPCC 2006 Guidelines. Despite the comprehensive initiation of activities under the BUR1 project, there is considerable scope for improvement. Where possible, and for key categories as a priority, GHG estimates should be made at Tier 2 or 3 levels.

To achieve this, sub-sectoral level estimates of activity data and emission factors (EF) must be developed. Similar and consistent formats must be adopted for data reporting and ensuring consistency in generating activity data by organisations for collation of the GHG inventory into a centralised system.

Considering that the country counts on its own NCV values for several fuels, it is recommendable including as part of the NIR the methodology considered to determine those NCV values as well as to determine the country specific NCV value of the rest of fuels consumed in the country.

A recommendation has been obtained, in line with the comment above, in the QA analysis developed to the inventory. Considering that Mauritius has determined its own NCV values for all fuels, the measured programme could be extended to include the measurement of carbon content of the fuels. In this manner, the country-specific CO_2 emission factor could be obtained for all fuels assuming a 100% oxidation of the fuels (in line with the assumptions of the default EF taken in the 2006 IPCC guidelines).

During the QA analysis, it was also detected the necessity of the Republic of Mauritius to improve the completeness of the inventory by investigating the use of lubricants as additives to gasoline in the other sectors. It is also stated that this investigation must also consider the non-energy use of feedstocks for reporting in the IPPU sector.

In order to improve the accuracy and completeness of the information, the Republic of Mauritius must work on the comparison and consolidation of all the available information from different sources. This activity should ensure the identification of all the energy consumptions in the country and all the emitting activities, in order to achieve a complete and accurate inventory report.

In line with the comment above, the RoM must work in the data gathering of those categories that are not reported in their national statistics, such as International water-borne navigation, international aviation and non-energy product consumption, among others.

The detailed planned improvements on data collection, research and emission factors with priority action, responsibility and expected timeframe are detailed in sectoral chapters of the National Inventory Report (above).

For future improvement, a full recalculation staring from 1990 using 2006 IPCC Guidelines and its 2019 refinement will be conducted.

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Appendix 1: Key Category Analysis

Table 149. Key Category Analysis using Approach 1 Trend Assessment method from IPCC 2006 Guidelines for the National Inventory for the period 2000 – 2016

IPCC Category code	IPCC Category	GHG	2000 Year Estimate Ex0 (Gg CO2 Eq)	2016 Year Estimate Ext (Gg CO2 Eq)	Trend Assessment (Txt)	% Contribution to Trend	Cumulative Total of Column G
1.A.1	**Energy Industries - Solid Fuels**	**CO_2**	**561.54**	**1,694.13**	**0.18**	**0.22**	**0.22**
1.A.1	**Energy Industries - Liquid Fuels**	**CO_2**	**597.72**	**703.03**	**0.13**	**0.16**	**0.39**
3.B.1.a	**Forest land Remaining Forest land**	**CO_2**	**-458.89**	**-394.36**	**0.10**	**0.13**	**0.52**
1.A.2	**Manufacturing Industries and Construction - Liquid Fuels**	**CO_2**	**303.60**	**261.45**	**0.09**	**0.12**	**0.63**
4.D	**Wastewater Treatment and Discharge**	**CH_4**	**188.13**	**161.14**	**0.06**	**0.07**	**0.71**
2.F.1	**Refrigeration and Air Conditioning**	**HFCs, PFCs**	**47.99**	**282.10**	**0.05**	**0.07**	**0.77**
1.A.4	**Other Sectors - Liquid Fuels**	**CO_2**	**195.81**	**245.73**	**0.04**	**0.05**	**0.82**
4.A	**Solid Waste Disposal**	**CH_4**	**253.87**	**369.68**	**0.03**	**0.04**	**0.86**
3.C.4	**Direct N2O Emissions from managed soils**	**N_2O**	**75.15**	**78.38**	**0.02**	**0.02**	**0.89**
3.B.6.b	**Land Converted to Other land**	**CO_2**	**0.00**	**62.64**	**0.02**	**0.02**	**0.91**
1.A.3.b	**Road Transportation**	**CO_2**	**528.48**	**1,071.80**	**0.02**	**0.02**	**0.93**
1.A.2	**Manufacturing Industries and Construction - Solid Fuels**	**CO_2**	**60.11**	**77.35**	**0.01**	**0.01**	**0.95**
3.A.1	**Enteric Fermentation**	**CH_4**	**25.94**	**23.60**	**0.01**	**0.01**	**0.96**
3.C.5	Indirect N2O Emissions from managed soils	N_2O	23.97	25.54	0.01	0.01	0.96
2.C.1	Iron and Steel Production	CO_2	19.57	21.41	0.00	0.01	0.97
4.D	Wastewater Treatment and Discharge	N_2O	18.24	21.56	0.00	0.00	0.97
1.A.1	Energy Industries - Biomass	N_2O	9.01	9.40	0.00	0.00	0.98
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	4.72	1.34	0.00	0.00	0.98
2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	0.00	7.66	0.00	0.00	0.98
1.A.3.d	Water-borne Navigation - Liquid Fuels	CO_2	30.49	64.83	0.00	0.00	0.98
2.A.2	Lime production	CO_2	2.75	0.00	0.00	0.00	0.99
3.A.2	Manure Management	N_2O	7.38	9.89	0.00	0.00	0.99
1.A.1	Energy Industries - Biomass	CH_4	4.58	4.77	0.00	0.00	0.99
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	2.40	0.68	0.00	0.00	0.99
3.C.1	Emissions from biomass burning	CH_4	3.52	3.51	0.00	0.00	0.99
4.B	Biological Treatment of Solid Waste	CH_4	0.00	3.22	0.00	0.00	0.99

1.A.1	Energy Industries - Solid Fuels	N_2O	2.72	8.20	0.00	0.00	0.99
4.B	Biological Treatment of Solid Waste	N_2O	0.00	2.85	0.00	0.00	1.00
1.A.4	Other Sectors - Biomass	CH_4	1.63	1.40	0.00	0.00	1.00
3.A.2	Manure Management	CH_4	2.83	4.03	0.00	0.00	1.00
3.C.1	Emissions from biomass burning	N_2O	1.37	1.44	0.00	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	N_2O	1.45	1.69	0.00	0.00	1.00
3.D.1	Harvested Wood Products	CO_2	1.44	1.89	0.00	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CO_2	0.00	0.87	0.00	0.00	1.00
1.A.3.b	Road Transportation	N_2O	8.16	16.47	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	0.72	0.61	0.00	0.00	1.00
1.A.3.b	Road Transportation	CH_4	2.62	5.69	0.00	0.00	1.00
1.A.3.a	Civil Aviation	CO_2	4.77	9.71	0.00	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.49	0.57	0.00	0.00	1.00
3.C.6	Indirect N2O Emissions from manure management	N_2O	5.90	11.67	0.00	0.00	1.00
4.C	Incineration and Open Burning of Waste	CO_2	0.56	0.74	0.00	0.00	1.00
1.A.4	Other Sectors - Biomass	N_2O	0.31	0.27	0.00	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	CH_4	0.42	0.47	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.25	0.21	0.00	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	N_2O	0.25	0.23	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	0.29	0.37	0.00	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	CH_4	0.12	0.37	0.00	0.00	1.00
3.B.2.b	Land Converted to Cropland	CO_2	0.00	0.12	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.13	0.17	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.27	0.58	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.06	0.14	0.00	0.00	1.00
1.A.3.a	Civil Aviation	N_2O	0.04	0.08	0.00	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
3.B.5.b	Land Converted to Settlements	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.a	Civil Aviation	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.00	0.00	0.00	0.00	1.00

1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Biomass	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.c	Railways	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.c	Railways	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.c	Railways	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0.00	0.00	0.00	0.00	1.00

1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Biomass	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Peat	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Peat	CH_4	0.00	0.00	0.00	0.00	1.00

1.A.5	Non-Specified - Peat	N_2O	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	CO_2	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	CH_4	0.00	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	N_2O	0.00	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	CO_2	0.00	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	CH_4	0.00	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	N_2O	0.00	0.00	0.00	0.00	1.00
1.B.2.a	Oil	CO_2	0.00	0.00	0.00	0.00	1.00
1.B.2.a	Oil	CH_4	0.00	0.00	0.00	0.00	1.00
1.B.2.a	Oil	N_2O	0.00	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	CO_2	0.00	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	CH_4	0.00	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	N_2O	0.00	0.00	0.00	0.00	1.00
1.C	Carbon dioxide Transport and Storage	CO_2	0.00	0.00	0.00	0.00	1.00
2.A.1	Cement production	CO_2	0.00	0.00	0.00	0.00	1.00
2.A.3	Glass Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.A.4	Other Process Uses of Carbonates	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.1	Ammonia Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.2	Nitric Acid Production	N_2O	0.00	0.00	0.00	0.00	1.00
2.B.3	Adipic Acid Production	N_2O	0.00	0.00	0.00	0.00	1.00
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0.00	0.00	0.00	0.00	1.00
2.B.5	Carbide Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.5	Carbide Production	CH_4	0.00	0.00	0.00	0.00	1.00
2.B.6	Titanium Dioxide Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.7	Soda Ash Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.8	Petrochemical and Carbon Black Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.B.8	Petrochemical and Carbon Black Production	CH_4	0.00	0.00	0.00	0.00	1.00
2.B.9	Fluorochemical Production	SF6, PFCs, HFCs and other	0.00	0.00	0.00	0.00	1.00
2.C.1	Iron and Steel Production	CH_4	0.00	0.00	0.00	0.00	1.00
2.C.2	Ferroalloys Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.C.2	Ferroalloys Production	CH_4	0.00	0.00	0.00	0.00	1.00
2.C.3	Aluminium production	CO_2	0.00	0.00	0.00	0.00	1.00
2.C.3	Aluminium production	PFCs	0.00	0.00	0.00	0.00	1.00

2.C.4	Magnesium production	CO_2	0.00	0.00	0.00	0.00	1.00
2.C.4	Magnesium production	SF6	0.00	0.00	0.00	0.00	1.00
2.C.5	Lead Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.C.6	Zinc Production	CO_2	0.00	0.00	0.00	0.00	1.00
2.E	Electronics Industry	SF6, PFCs, HFCs and other	0.00	0.00	0.00	0.00	1.00
2.F.2	Foam Blowing Agents	HFCs	0.00	0.00	0.00	0.00	1.00
2.F.3	Fire Protection	HFCs, PFCs	0.00	0.00	0.00	0.00	1.00
2.F.4	Aerosols	HFCs, PFCs	0.00	0.00	0.00	0.00	1.00
2.F.5	Solvents	HFCs, PFCs	0.00	0.00	0.00	0.00	1.00
2.F.6	Other Applications (please specify)	HFCs, PFCs	0.00	0.00	0.00	0.00	1.00
2.G	Other Product Manufacture and Use	SF6, PFCs	0.00	0.00	0.00	0.00	1.00
2.G	Other Product Manufacture and Use	N_2O	0.00	0.00	0.00	0.00	1.00
3.B.1.b	Land Converted to Forest land	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.2.a	Cropland Remaining Cropland	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.3.a	Grassland Remaining Grassland	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.3.b	Land Converted to Grassland	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.4.a.i	Peatlands remaining peatlands	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.4.a.i	Peatlands remaining peatlands	N_2O	0.00	0.00	0.00	0.00	1.00
3.B.4.b	Land Converted to Wetlands	N_2O	0.00	0.00	0.00	0.00	1.00
3.B.4.b	Land Converted to Wetlands	CO_2	0.00	0.00	0.00	0.00	1.00
3.B.5.a	Settlements Remaining Settlements	CO_2	0.00	0.00	0.00	0.00	1.00
3.C.2	Liming	CO_2	0.00	0.00	0.00	0.00	1.00
3.C.3	Urea application	CO_2	0.00	0.00	0.00	0.00	1.00
3.C.7	Rice cultivation	CH_4	0.00	0.00	0.00	0.00	1.00
4.C	Incineration and Open Burning of Waste	CH_4	0.00	0.00	0.00	0.00	1.00
4.C	Incineration and Open Burning of Waste	N_2O	0.00	0.00	0.00	0.00	1.00
Total							
			2,542.89	4,881.36	0.79	1	

Table 150. Key Category Analysis using Approach 1 Level Assessment method from IPCC 2006 Guidelines for the National Inventory for the period 2000 – 2016

IPCC Category code	IPCC Category	GHG	2016 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
1.A.1	**Energy Industries - Solid Fuels**	**CO_2**	**1,694.13**	**1,694.13**	**0.30**	**0.30**
1.A.3.b	**Road Transportation**	**CO_2**	**1,071.80**	**1,071.80**	**0.19**	**0.49**
1.A.1	**Energy Industries - Liquid Fuels**	**CO_2**	**703.03**	**703.03**	**0.12**	**0.61**
3.B.1.a	**Forest land Remaining Forest land**	**CO_2**	**-394.36**	**394.36**	**0.07**	**0.68**
4.A	**Solid Waste Disposal**	**CH_4**	**369.68**	**369.68**	**0.07**	**0.75**
2.F.1	**Refrigeration and Air Conditioning**	**HFCs, PFCs**	**282.10**	**282.10**	**0.05**	**0.80**
1.A.2	**Manufacturing Industries and Construction - Liquid Fuels**	**CO_2**	**261.45**	**261.45**	**0.05**	**0.84**
1.A.4	**Other Sectors - Liquid Fuels**	**CO_2**	**245.73**	**245.73**	**0.04**	**0.89**
4.D	**Wastewater Treatment and Discharge**	**CH_4**	**161.14**	**161.14**	**0.03**	**0.91**
3.C.4	**Direct N2O Emissions from managed soils**	**N_2O**	**78.38**	**78.38**	**0.01**	**0.93**
1.A.2	**Manufacturing Industries and Construction - Solid Fuels**	**CO_2**	**77.35**	**77.35**	**0.01**	**0.94**
1.A.3.d	**Water-borne Navigation - Liquid Fuels**	**CO_2**	**64.83**	**64.83**	**0.01**	**0.95**
3.B.6.b	Land Converted to Other land	CO_2	62.64	62.64	0.01	0.96
3.C.5	Indirect N2O Emissions from managed soils	N_2O	25.54	25.54	0.00	0.97
3.A.1	Enteric Fermentation	CH_4	23.60	23.60	0.00	0.97
4.D	Wastewater Treatment and Discharge	N_2O	21.56	21.56	0.00	0.98
2.C.1	Iron and Steel Production	CO_2	21.41	21.41	0.00	0.98
1.A.3.b	Road Transportation	N_2O	16.47	16.47	0.00	0.98
3.C.6	Indirect N2O Emissions from manure management	N_2O	11.67	11.67	0.00	0.99
3.A.2	Manure Management	N_2O	9.89	9.89	0.00	0.99
1.A.3.a	Civil Aviation	CO_2	9.71	9.71	0.00	0.99
1.A.1	Energy Industries - Biomass	N_2O	9.40	9.40	0.00	0.99
1.A.1	Energy Industries - Solid Fuels	N_2O	8.20	8.20	0.00	0.99

2.D	Non-Energy Products from Fuels and Solvent Use	CO_2	7.66	7.66	0.00	0.99
1.A.3.b	Road Transportation	CH_4	5.69	5.69	0.00	0.99
1.A.1	Energy Industries - Biomass	CH_4	4.77	4.77	0.00	1.00
3.A.2	Manure Management	CH_4	4.03	4.03	0.00	1.00
3.C.1	Emissions from biomass burning	CH_4	3.51	3.51	0.00	1.00
4.B	Biological Treatment of Solid Waste	CH_4	3.22	3.22	0.00	1.00
4.B	Biological Treatment of Solid Waste	N_2O	2.85	2.85	0.00	1.00
3.D.1	Harvested Wood Products	CO_2	1.89	1.89	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	N_2O	1.69	1.69	0.00	1.00
3.C.1	Emissions from biomass burning	N_2O	1.44	1.44	0.00	1.00
1.A.4	Other Sectors - Biomass	CH_4	1.40	1.40	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	N_2O	1.34	1.34	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CO_2	0.87	0.87	0.00	1.00
4.C	Incineration and Open Burning of Waste	CO_2	0.74	0.74	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	CH_4	0.68	0.68	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	N_2O	0.61	0.61	0.00	1.00
1.A.3.d	Water-borne Navigation - Liquid Fuels	N_2O	0.58	0.58	0.00	1.00
1.A.1	Energy Industries - Liquid Fuels	CH_4	0.57	0.57	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	CH_4	0.47	0.47	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	N_2O	0.37	0.37	0.00	1.00
1.A.1	Energy Industries - Solid Fuels	CH_4	0.37	0.37	0.00	1.00
1.A.4	Other Sectors - Biomass	N_2O	0.27	0.27	0.00	1.00
1.A.4	Other Sectors - Liquid Fuels	N_2O	0.23	0.23	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CH_4	0.21	0.21	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Solid Fuels	CH_4	0.17	0.17	0.00	1.00

1.A.3.d	Water-borne Navigation - Liquid Fuels	CH_4	0.14	0.14	0.00	1.00
3.B.2.b	Land Converted to Cropland	CO_2	0.12	0.12	0.00	1.00
1.A.3.a	Civil Aviation	N_2O	0.08	0.08	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.3.a	Civil Aviation	CH_4	0.00	0.00	0.00	1.00
3.B.5.b	Land Converted to Settlements	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Liquid Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Gaseous Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Other Fossil Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	CO_2	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	CH_4	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Peat	N_2O	0.00	0.00	0.00	1.00
1.A.1	Energy Industries - Biomass	CO_2	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Gaseous Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Other Fossil Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Peat	CO_2	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Peat	CH_4	0.00	0.00	0.00	1.00

1.A.2	Manufacturing Industries and Construction - Peat	N_2O	0.00	0.00	0.00	1.00
1.A.2	Manufacturing Industries and Construction - Biomass	CO_2	0.00	0.00	0.00	1.00
1.A.3.c	Railways	CO_2	0.00	0.00	0.00	1.00
1.A.3.c	Railways	CH_4	0.00	0.00	0.00	1.00
1.A.3.c	Railways	N_2O	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Solid Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Gaseous Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Other Fossil Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	CO_2	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	CH_4	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Peat	N_2O	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	CO_2	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	CH_4	0.00	0.00	0.00	1.00
1.A.3.d	Water-borne Navigation - Biomass	N_2O	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	CO_2	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	CH_4	0.00	0.00	0.00	1.00
1.A.3.e	Other Transportation	N_2O	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Solid Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Gaseous Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Other Fossil Fuels	CO_2	0.00	0.00	0.00	1.00

1.A.4	Other Sectors - Other Fossil Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Other Fossil Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	CO_2	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	CH_4	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Peat	N_2O	0.00	0.00	0.00	1.00
1.A.4	Other Sectors - Biomass	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Solid Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Gaseous Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	CH_4	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Other Fossil Fuels	N_2O	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Peat	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Peat	CH_4	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Peat	N_2O	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	CO_2	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	CH_4	0.00	0.00	0.00	1.00
1.A.5	Non-Specified - Biomass	N_2O	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	CO_2	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	CH_4	0.00	0.00	0.00	1.00
1.B.1	Solid Fuels	N_2O	0.00	0.00	0.00	1.00
1.B.2.a	Oil	CO_2	0.00	0.00	0.00	1.00
1.B.2.a	Oil	CH_4	0.00	0.00	0.00	1.00
1.B.2.a	Oil	N_2O	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	CO_2	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	CH_4	0.00	0.00	0.00	1.00
1.B.2.b	Natural Gas	N_2O	0.00	0.00	0.00	1.00
1.C	Carbon dioxide Transport and Storage	CO_2	0.00	0.00	0.00	1.00

2.A.1	Cement production	CO_2	0.00	0.00	0.00	1.00
2.A.2	Lime production	CO_2	0.00	0.00	0.00	1.00
2.A.3	Glass Production	CO_2	0.00	0.00	0.00	1.00
2.A.4	Other Process Uses of Carbonates	CO_2	0.00	0.00	0.00	1.00
2.B.1	Ammonia Production	CO_2	0.00	0.00	0.00	1.00
2.B.2	Nitric Acid Production	N_2O	0.00	0.00	0.00	1.00
2.B.3	Adipic Acid Production	N_2O	0.00	0.00	0.00	1.00
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production	N_2O	0.00	0.00	0.00	1.00
2.B.5	Carbide Production	CO_2	0.00	0.00	0.00	1.00
2.B.5	Carbide Production	CH_4	0.00	0.00	0.00	1.00
2.B.6	Titanium Dioxide Production	CO_2	0.00	0.00	0.00	1.00
2.B.7	Soda Ash Production	CO_2	0.00	0.00	0.00	1.00
2.B.8	Petrochemical and Carbon Black Production	CO_2	0.00	0.00	0.00	1.00
2.B.8	Petrochemical and Carbon Black Production	CH_4	0.00	0.00	0.00	1.00
2.B.9	Fluorochemical Production	SF6, PFCs, HFCs and other	0.00	0.00	0.00	1.00
2.C.1	Iron and Steel Production	CH_4	0.00	0.00	0.00	1.00
2.C.2	Ferroalloys Production	CO_2	0.00	0.00	0.00	1.00
2.C.2	Ferroalloys Production	CH_4	0.00	0.00	0.00	1.00
2.C.3	Aluminium production	CO_2	0.00	0.00	0.00	1.00
2.C.3	Aluminium production	PFCs	0.00	0.00	0.00	1.00
2.C.4	Magnesium production	CO_2	0.00	0.00	0.00	1.00
2.C.4	Magnesium production	SF6	0.00	0.00	0.00	1.00
2.C.5	Lead Production	CO_2	0.00	0.00	0.00	1.00
2.C.6	Zinc Production	CO_2	0.00	0.00	0.00	1.00
2.E	Electronics Industry	SF6, PFCs, HFCs and other	0.00	0.00	0.00	1.00
2.F.2	Foam Blowing Agents	HFCs	0.00	0.00	0.00	1.00

2.F.3	Fire Protection	HFCs, PFCs	0.00	0.00	0.00	1.00
2.F.4	Aerosols	HFCs, PFCs	0.00	0.00	0.00	1.00
2.F.5	Solvents	HFCs, PFCs	0.00	0.00	0.00	1.00
2.F.6	Other Applications (please specify)	HFCs, PFCs	0.00	0.00	0.00	1.00
2.G	Other Product Manufacture and Use	SF6, PFCs	0.00	0.00	0.00	1.00
2.G	Other Product Manufacture and Use	N_2O	0.00	0.00	0.00	1.00
3.B.1.b	Land Converted to Forest land	CO_2	0.00	0.00	0.00	1.00
3.B.2.a	Cropland Remaining Cropland	CO_2	0.00	0.00	0.00	1.00
3.B.3.a	Grassland Remaining Grassland	CO_2	0.00	0.00	0.00	1.00
3.B.3.b	Land Converted to Grassland	CO_2	0.00	0.00	0.00	1.00
3.B.4.a.i	Peatlands remaining peatlands	CO_2	0.00	0.00	0.00	1.00
3.B.4.a.i	Peatlands remaining peatlands	N_2O	0.00	0.00	0.00	1.00
3.B.4.b	Land Converted to Wetlands	N_2O	0.00	0.00	0.00	1.00
3.B.4.b	Land Converted to Wetlands	CO_2	0.00	0.00	0.00	1.00
3.B.5.a	Settlements Remaining Settlements	CO_2	0.00	0.00	0.00	1.00
3.C.2	Liming	CO_2	0.00	0.00	0.00	1.00
3.C.3	Urea application	CO_2	0.00	0.00	0.00	1.00
3.C.7	Rice cultivation	CH_4	0.00	0.00	0.00	1.00
4.C	Incineration and Open Burning of Waste	CH_4	0.00	0.00	0.00	1.00
4.C	Incineration and Open Burning of Waste	N_2O	0.00	0.00	0.00	1.00
Total						
			4,881.36	**5,670.07**	**1**	

Appendix 2: Uncertainty Assessment

Table 151. Uncertainty Assessment in Trend 2000 – 2016 of the National Inventory

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2eq)	Year T emissions or removals (Gg CO2eq)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO_2	597.72	703.03	5.00	6.14	7.92	0.48	0.04	0.13	0.22	0.92	0.90
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH_4	0.49	0.57	5.00	228.79	228.84	0.00	0.00	0.00	0.01	0.00	0.00
1.A.1.a.i - Electricity Generation - Liquid Fuels	N_2O	1.45	1.69	5.00	228.79	228.84	0.00	0.00	0.00	0.02	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	CO_2	561.54	1694.13	5.00	12.41	13.38	7.97	0.16	0.32	1.97	2.23	8.86
1.A.1.a.i - Electricity Generation - Solid Fuels	CH_4	0.12	0.37	5.00	200.00	200.06	0.00	0.00	0.00	0.01	0.00	0.00
1.A.1.a.i - Electricity Generation - Solid Fuels	N_2O	2.72	8.20	5.00	222.22	222.28	0.05	0.00	0.00	0.17	0.01	0.03
1.A.1.a.i - Electricity Generation - Biomass	CO_2	726.29	757.92	5.00	18.69	19.35	3.34	0.06	0.14	1.14	1.00	2.28
1.A.1.a.i - Electricity Generation - Biomass	CH_4	4.58	4.77	5.00	245.45	245.51	0.02	0.00	0.00	0.09	0.01	0.01
1.A.1.a.i - Electricity Generation -	N_2O	9.01	9.40	5.00	304.55	304.59	0.13	0.00	0.00	0.23	0.01	0.05

Biomass												
1.A.2.a - Iron and Steel - Liquid Fuels	CO_2	1.77	1.78	5.00	6.14	7.92	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	CH_4	0.00	0.00	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.a - Iron and Steel - Liquid Fuels	N_2O	0.00	0.00	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	CO_2	13.88	11.93	5.00	6.14	7.92	0.00	0.00	0.00	0.01	0.02	0.00
1.A.2.c - Chemicals - Liquid Fuels	CH_4	0.01	0.01	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Liquid Fuels	N_2O	0.03	0.03	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Solid Fuels	CO_2	8.59	8.61	5.00	12.46	13.43	0.00	0.00	0.00	0.01	0.01	0.00
1.A.2.c - Chemicals - Solid Fuels	CH_4	0.02	0.02	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.c - Chemicals - Solid Fuels	N_2O	0.04	0.04	5.00	222.22	222.28	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CO_2	1.68	1.38	5.00	6.14	7.92	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	CH_4	0.00	0.00	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.d - Pulp, Paper and Print - Liquid Fuels	N_2O	0.00	0.00	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO_2	47.16	39.98	5.00	6.14	7.92	0.00	0.01	0.01	0.03	0.05	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH_4	0.04	0.03	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N_2O	0.12	0.10	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	8.59	11.46	5.00	12.46	13.43	0.00	0.00	0.00	0.00	0.02	0.00
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CH_4	0.02	0.03	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.e - Food Processing,	N_2O	0.04	0.06	5.00	222.22	222.28	0.00	0.00	0.00	0.00	0.00	0.00

Beverages and Tobacco - Solid Fuels												
1.A.2.k - Construction - Liquid Fuels	CO_2	35.94	30.23	5.00	6.14	7.92	0.00	0.00	0.01	0.03	0.04	0.00
1.A.2.k - Construction - Liquid Fuels	CH_4	0.03	0.03	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.k - Construction - Liquid Fuels	N_2O	0.09	0.07	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	CO_2	173.45	149.53	5.00	6.14	7.92	0.02	0.02	0.03	0.12	0.20	0.05
1.A.2.l - Textile and Leather - Liquid Fuels	CH_4	0.14	0.12	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Liquid Fuels	N_2O	0.41	0.34	5.00	228.79	228.84	0.00	0.00	0.00	0.01	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CO_2	25.76	34.37	5.00	12.46	13.43	0.00	0.00	0.01	0.01	0.05	0.00
1.A.2.l - Textile and Leather - Solid Fuels	CH_4	0.06	0.08	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.l - Textile and Leather - Solid Fuels	N_2O	0.12	0.17	5.00	222.22	222.28	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CO_2	29.72	26.63	5.00	6.14	7.92	0.00	0.00	0.00	0.02	0.04	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	CH_4	0.02	0.02	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Liquid Fuels	N_2O	0.07	0.06	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CO_2	17.18	22.91	5.00	12.46	13.43	0.00	0.00	0.00	0.01	0.03	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	CH_4	0.04	0.05	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Solid Fuels	N_2O	0.08	0.11	5.00	222.22	222.28	0.00	0.00	0.00	0.00	0.00	0.00
1.A.2.m - Non-specified Industry - Biomass	CO_2	380.73	108.48	5.00	18.69	19.35	0.07	0.09	0.02	1.60	0.14	2.58
1.A.2.m - Non-specified Industry - Biomass	CH_4	2.40	0.68	5.00	245.45	245.51	0.00	0.00	0.00	0.13	0.00	0.02
1.A.2.m - Non-specified Industry - Biomass	N_2O	4.72	1.34	5.00	281.82	281.86	0.00	0.00	0.00	0.30	0.00	0.09

1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO_2	605.40	917.57	5.00	4.17	6.51	0.55	0.00	0.17	0.01	1.21	1.46
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH_4	0.09	0.13	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N_2O	5.25	7.96	5.00	150.00	150.08	0.02	0.00	0.00	0.00	0.01	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO_2	4.77	9.71	5.00	4.17	6.51	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH_4	0.00	0.00	5.00	100.00	100.12	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N_2O	0.04	0.08	5.00	150.00	150.08	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CO_2	93.72	230.20	5.00	3.07	5.87	0.03	0.02	0.04	0.05	0.30	0.09
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	CH_4	0.84	2.10	5.00	244.69	244.74	0.00	0.00	0.00	0.04	0.00	0.00
1.A.3.b.i.1 - Passenger cars with 3-way catalysts - Liquid Fuels	N_2O	1.36	3.34	5.00	209.94	210.00	0.01	0.00	0.00	0.05	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CO_2	115.40	245.30	5.00	3.07	5.87	0.03	0.01	0.05	0.04	0.32	0.11
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	CH_4	1.00	2.14	5.00	244.69	244.74	0.00	0.00	0.00	0.03	0.00	0.00
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts - Liquid Fuels	N_2O	1.68	3.58	5.00	209.94	210.00	0.01	0.00	0.00	0.04	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO_2	37.60	78.42	5.00	5.00	7.07	0.00	0.00	0.01	0.02	0.10	0.01
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH_4	0.05	0.11	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid	N_2O	0.61	1.27	5.00	60.00	60.21	0.00	0.00	0.00	0.00	0.00	0.00

Fuels												
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO_2	88.09	161.39	5.00	5.00	7.07	0.02	0.01	0.03	0.03	0.21	0.05
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH_4	0.19	0.33	5.00	25.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	1.42	2.60	5.00	60.00	60.21	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	157.05	286.54	5.00	5.00	7.07	0.06	0.01	0.05	0.05	0.38	0.14
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	0.17	0.32	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	2.56	4.68	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.01	0.00
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO_2	36.62	69.96	5.00	3.07	5.87	0.00	0.00	0.01	0.01	0.09	0.01
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CH_4	0.37	0.70	5.00	244.69	244.74	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	N_2O	0.52	1.00	5.00	209.94	210.00	0.00	0.00	0.00	0.01	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO_2	691.17	1060.91	5.00	4.30	6.60	0.76	0.01	0.20	0.02	1.40	1.95
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH_4	1.36	2.05	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N_2O	5.72	8.63	5.00	140.00	140.09	0.02	0.00	0.00	0.00	0.01	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO_2	30.49	64.83	5.00	4.30	6.60	0.00	0.00	0.01	0.02	0.09	0.01
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH_4	0.06	0.14	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Liquid Fuels	N_2O	0.27	0.58	5.00	140.00	140.09	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.a - Commercial/Institutional - Biomass	CO_2	12.39	48.00	5.00	6.14	7.92	0.00	0.01	0.01	0.03	0.06	0.01
1.A.4.a - Commercial/Institutional - Biomass	CH_4	0.02	0.08	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00

1.A.4.a - Commercial/Institutional - Biomass	N_2O	0.01	0.02	5.00	228.79	228.84	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CO_2	0.99	1.39	5.00	18.69	19.35	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	CH_4	0.04	0.05	5.00	227.27	227.33	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Liquid Fuels	N_2O	0.00	0.00	5.00	297.73	297.77	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.b - Residential - Biomass	CO_2	142.60	147.83	5.00	6.14	7.92	0.02	0.01	0.03	0.07	0.19	0.04
1.A.4.b - Residential - Biomass	CH_4	0.28	0.25	5.00	200.00	200.06	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.b - Residential - Biomass	N_2O	0.13	0.07	5.00	236.36	236.42	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CO_2	28.45	24.01	5.00	18.69	19.35	0.00	0.00	0.00	0.06	0.03	0.01
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	CH_4	1.59	1.34	5.00	227.27	227.33	0.00	0.00	0.00	0.04	0.00	0.00
1.A.4.c.ii - Off-road Vehicles and Other Machinery - Liquid Fuels	N_2O	0.31	0.26	5.00	297.73	297.77	0.00	0.00	0.00	0.01	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CO_2	7.88	7.27	5.00	6.14	7.92	0.00	0.00	0.00	0.01	0.01	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	CH_4	0.02	0.02	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.4.c.iii - Fishing (mobile combustion) - Liquid Fuels	N_2O	0.02	0.02	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	CO_2	32.94	42.63	5.00	6.14	7.92	0.00	0.00	0.01	0.01	0.06	0.00
1.A.5.a - Stationary - Liquid Fuels	CH_4	0.10	0.13	5.00	200.00	200.06	0.00	0.00	0.00	0.00	0.00	0.00
1.A.5.a - Stationary - Liquid Fuels	N_2O	0.09	0.11	5.00	236.36	236.42	0.00	0.00	0.00	0.00	0.00	0.00
1.A.3.b.vi - Urea-based catalysts	CO_2	0.00	0.87	5.00	5.00	7.07	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Fugitive Emissions from Fuels - Solid Fuels												
1.B.1.a.i.1 - Mining	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.1 - Mining	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.2 - Post-mining seam gas emissions	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.3 - Abandoned underground mines	CH_4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00

1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CH_4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.1 - Mining	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1.a.ii.2 - Post-mining seam gas emissions	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.2 - Fugitive Emissions from Fuels - Oil and Natural Gas												
1.C - CO2 Transport Injection and Storage												
1.C.1.a - Pipelines	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.b - Ships	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1.c - Other (please specify)	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.a - Injection	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.2.b - Storage	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.3 - Other	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A - Mineral Industry												
2.A.1 - Cement production	CO_2	0.00	0.00	35.00	0.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.2 - Lime production	CO_2	2.75	0.00	15.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.3 - Glass Production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.a - Ceramics	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.b - Other Uses of Soda Ash	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.c - Non Metallurgical Magnesia Production	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.4.d - Other (please specify)	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B - Chemical Industry												
2.B.1 - Ammonia Production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.2 - Nitric Acid Production	N_2O	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.3 - Adipic Acid Production	N_2O	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.4 - Caprolactam, Glyoxal and	N_2O	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

Glyoxylic Acid Production												
2.B.5 - Carbide Production	CO_2	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.5 - Carbide Production	CH_4	0.00	0.00	5.00	10.00	11.18	0.00	0.00	0.00	0.00	0.00	0.00
2.B.6 - Titanium Dioxide Production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.7 - Soda Ash Production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.a - Methanol	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.b - Ethylene	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.d - Ethylene Oxide	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.e - Acrylonitrile	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.8.f - Carbon Black	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2F2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCHFCF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH3CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHF2CH2F	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CHFCF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3CH2CF3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2FCF2CHF2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF4	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00

2.B.9.a - By-product emissions	C2F6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C3F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C4F10	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	c-C4F8	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C5F12	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	C6F14	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	SF6	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CHCl3	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CH2Cl2	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.9.a - By-product emissions	CF3 I	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry												
2.C.1 - Iron and Steel Production	CO_2	19.57	21.41	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.06	0.00
2.C.1 - Iron and Steel Production	CH_4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	CH_4	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CO_2	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	CF4	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	C2F6	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	CO_2	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	SF6	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.5 - Lead Production	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C.6 - Zinc Production	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO_2	0.00	7.66	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.02	0.00
2.D.2 - Paraffin Wax Use	CO_2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E - Electronics Industry												
2.E.1 - Integrated Circuit or Semiconductor	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.E.1 - Integrated Circuit or Semiconductor	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.3 - Photovoltaics	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.4 - Heat Transfer Fluid	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF3	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2F2	0.56	6.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CHF2CF3	13.73	108.56	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	15.15	19.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1.a - Refrigeration and Stationary Air Conditioning	CF3CH3	18.11	137.80	0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00
2.F.1.b - Mobile Air Conditioning	CH2FCF3	0.43	8.95	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.01	0.00
2.F.4 - Aerosols	CH2FCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CH3CHF2	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	0.00	10.00	10.00	14.14	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.5 - Solvents	C6F14	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2F2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCHFCF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00

2.F.6 - Other Applications (please specify)	CHF2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH3CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CHF2CH2F	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CHFCF3	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF3CH2CF3	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CH2FCF2CHF2	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C2F6	0.00	0.00	10.00	50.00	50.99	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G - Electrical Equipment												
2.G.1.a - Manufacture of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00

Electrical Equipment												
2.G.1.a - Manufacture of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.a - Manufacture of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	SF6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	CF4	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C2F6	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C3F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C4F10	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	c-C4F8	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C5F12	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.b - Use of Electrical Equipment	C6F14	0.00	0.00	30.00	30.00	42.43	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	SF6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	CF4	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C2F6	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C3F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C4F10	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical	c-C4F8	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00

Equipment												
2.G.1.c - Disposal of Electrical Equipment	C5F12	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1.c - Disposal of Electrical Equipment	C6F14	0.00	0.00	40.00	40.00	56.57	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.a - Military Applications	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	SF6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	CF4	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C2F6	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C3F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C4F10	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	c-C4F8	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C5F12	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.b - Accelerators	C6F14	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	SF6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	CF4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C2F6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C3F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C4F10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	c-C4F8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C5F12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.2.c - Other (please specify)	C6F14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.a - Medical Applications	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.b - Propellant for pressure and aerosol products	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.3.c - Other (Please specify)	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other												
3.A - Livestock												

3.A.1.a.i - Dairy Cows	CH_4	7.49	5.93	7.50	50.00	50.56	0.00	0.00	0.00	0.06	0.01	0.00
3.A.1.a.ii - Other Cattle	CH_4	8.13	7.22	7.50	50.00	50.56	0.00	0.00	0.00	0.05	0.02	0.00
3.A.1.b - Buffalo	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.c - Sheep	CH_4	0.65	1.55	7.50	50.00	50.56	0.00	0.00	0.00	0.01	0.00	0.00
3.A.1.d - Goats	CH_4	2.46	4.48	7.50	50.00	50.56	0.00	0.00	0.00	0.01	0.01	0.00
3.A.1.e - Camels	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.f - Horses	CH_4	0.21	0.32	6.00	50.00	50.36	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.g - Mules and Asses	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.h - Swine	CH_4	0.70	0.74	5.00	50.00	50.25	0.00	0.00	0.00	0.00	0.00	0.00
3.A.1.j - Other (please specify)	CH_4	6.30	3.36	2.00	50.00	50.04	0.00	0.00	0.00	0.06	0.00	0.00
3.A.2.a.i - Dairy cows	CH_4	0.16	0.13	50.56	30.00	58.79	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.i - Dairy cows	N_2O	2.06	1.63	50.56	100.00	112.05	0.00	0.00	0.00	0.03	0.02	0.00
3.A.2.a.ii - Other cattle	CH_4	0.26	0.23	50.56	30.00	58.79	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.a.ii - Other cattle	N_2O	0.76	2.36	50.56	100.00	112.05	0.00	0.00	0.00	0.02	0.03	0.00
3.A.2.b - Buffalo	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.b - Buffalo	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	CH_4	0.02	0.05	50.56	30.00	58.79	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.c - Sheep	N_2O	0.13	0.36	50.56	100.00	112.05	0.00	0.00	0.00	0.00	0.01	0.00
3.A.2.d - Goats	CH_4	0.08	0.15	50.56	30.00	58.79	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.d - Goats	N_2O	0.65	1.28	50.56	100.00	112.05	0.00	0.00	0.00	0.01	0.02	0.00
3.A.2.e - Camels	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.e - Camels	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	CH_4	0.02	0.03	50.36	30.00	58.62	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.f - Horses	N_2O	0.00	0.00	50.36	100.00	111.96	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.g - Mules and Asses	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.h - Swine	CH_4	0.70	0.74	50.25	30.00	58.52	0.00	0.00	0.00	0.00	0.01	0.00
3.A.2.h - Swine	N_2O	2.72	2.24	50.25	100.00	111.92	0.00	0.00	0.00	0.04	0.03	0.00
3.A.2.i - Poultry	CH_4	1.51	2.67	50.99	30.00	59.16	0.00	0.00	0.00	0.00	0.04	0.00
3.A.2.i - Poultry	N_2O	1.07	2.02	50.99	100.00	112.25	0.00	0.00	0.00	0.01	0.03	0.00
3.A.2.j - Other (please specify)	CH_4	0.07	0.04	50.04	30.00	58.34	0.00	0.00	0.00	0.00	0.00	0.00
3.A.2.j - Other (please specify)	N_2O	0.00	0.00	50.04	100.00	111.82	0.00	0.00	0.00	0.00	0.00	0.00
3.B - Land												
3.B.1.a - Forest land Remaining Forest land	CO_2	-458.89	-394.36	0.00	0.00	0.00	0.00	0.06	0.08	0.00	0.00	0.00

3.B.1.b.i - Cropland converted to Forest Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.ii - Grassland converted to Forest Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.iii - Wetlands converted to Forest Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.iv - Settlements converted to Forest Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1.b.v - Other Land converted to Forest Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.a - Cropland Remaining Cropland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.i - Forest Land converted to Cropland	CO_2	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.ii - Grassland converted to Cropland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.iii - Wetlands converted to Cropland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.iv - Settlements converted to Cropland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.2.b.v - Other Land converted to Cropland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.a - Grassland Remaining Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.i - Forest Land converted to Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.ii - Cropland converted to Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.iii - Wetlands converted to Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.iv - Settlements converted to Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.3.b.v - Other Land converted to Grassland	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.a.i - Peatlands remaining peatlands	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.B.4.b.i - Land converted for peat extraction	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4.b.ii - Land converted to flooded land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.a - Settlements Remaining Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.i - Forest Land converted to Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.ii - Cropland converted to Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.iii - Grassland converted to Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.iv - Wetlands converted to Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5.b.v - Other Land converted to Settlements	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.i - Forest Land converted to Other Land	CO_2	0.00	62.64	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00
3.B.6.b.ii - Cropland converted to Other Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.iii - Grassland converted to Other Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.iv - Wetlands converted to Other Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6.b.v - Settlements converted to Other Land	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C - Aggregate sources and non-CO2 emissions sources on land												
3.C.1.a - Biomass burning in forest lands	CH_4	0.39	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.a - Biomass burning in forest lands	N_2O	0.17	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	CH_4	3.13	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.b - Biomass burning in croplands	N_2O	1.20	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.c - Biomass burning in	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

grasslands												
3.C.1.c - Biomass burning in grasslands	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.1.d - Biomass burning in all other land	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.2 - Liming	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.4 - Direct N2O Emissions from managed soils	N_2O	75.15	78.38	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00
3.C.5 - Indirect N2O Emissions from managed soils	N_2O	23.97	25.54	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
3.C.6 - Indirect N2O Emissions from manure management	N_2O	5.90	11.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.7 - Rice cultivation	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other												
3.D.1 - Harvested Wood Products	CO_2	1.44	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal												
4.A - Solid Waste Disposal	CH_4	253.87	369.68	30.00	30.00	42.43	4.40	0.01	0.08	0.26	3.39	11.55
4.B - Biological Treatment of Solid Waste												
4.B - Biological Treatment of Solid Waste	CH_4	0.00	3.22	10.00	30.00	31.62	0.00	0.00	0.00	0.02	0.01	0.00
4.B - Biological Treatment of Solid Waste	N_2O	0.00	2.85	10.00	30.00	31.62	0.00	0.00	0.00	0.02	0.01	0.00
4.C - Incineration and Open Burning of Waste												
4.C.1 - Waste Incineration	CO_2	0.56	0.74	10.00	40.00	41.23	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	CH_4	0.00	0.00	10.00	100.00	100.50	0.00	0.00	0.00	0.00	0.00	0.00
4.C.1 - Waste Incineration	N_2O	0.00	0.00	10.00	100.00	100.50	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	CH_4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C.2 - Open Burning of Waste	N_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewaster	CH_4	18.24	21.56	95.00	0.00	95.00	0.07	0.00	0.00	0.00	0.58	0.34

Treatment and Discharge												
4.D.1 - Domestic Wastewaster Treatment and Discharge	N_2O	110.33	106.05	95.00	30.00	99.62	1.85	0.01	0.02	0.40	2.86	8.31
4.D.2 - Industrial Wastewater Treatment and Discharge	CH_4	77.79	55.09	50.00	30.00	58.31	0.17	0.01	0.01	0.40	0.78	0.77
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 4,988.34	**Sum(D): 7,770.20**				**Sum(H): 22.76**					Sum(M): 41.62
							Uncertainty in total inventory: 4.56					**Trend uncertainty: 6.45**

Appendix 3: National Inventory

Appendix 3.1: GHG Emissions Inventory for the Time Series 2000 – 2016

Table 152. GHG Emissions Inventory (Gg CO_2eq) Time-series 2000 – 2007

Categories	2000	2001	2002	2003	2004	2005	2006	2007
1 - Energy	**2,323.15**	**2,492.10**	**2,544.85**	**2,678.11**	**2,704.03**	**2,889.79**	**3,255.86**	**3,423.66**
1.A - Fuel Combustion Activities	**2,323.15**	**2,492.10**	**2,544.85**	**2,678.11**	**2,704.03**	**2,889.79**	**3,255.86**	**3,423.66**
1.A.1 - Energy Industries	**1,177.61**	**1,289.30**	**1,310.80**	**1,400.80**	**1,416.17**	**1,587.64**	**1,865.46**	**2,006.65**
1.A.1.a - Main Activity Electricity and Heat Production	1,177.61	1,289.30	1,310.80	1,400.80	1,416.17	1,587.64	1,865.46	2,006.65
1.A.1.a.i - Electricity Generation	1,177.61	1,289.30	1,310.80	1,400.80	1,416.17	1,587.64	1,865.46	2,006.65
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	-	-	-	-	-	-	-	-
1.A.1.a.iii - Heat Plants	-	-	-	-	-	-	-	-
1.A.1.b - Petroleum Refining	-	-	-	-	-	-	-	-
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	-	-	-	-
1.A.1.c.i - Manufacture of Solid Fuels	-	-	-	-	-	-	-	-
1.A.1.c.ii - Other Energy Industries	-	-	-	-	-	-	-	-
1.A.2 - Manufacturing Industries and Construction	372.22	401.62	402.38	402.04	377.99	359.33	422.80	419.98
1.A.2.a - Iron and Steel	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	-	-	-
1.A.2.c - Chemicals	22.57	23.47	23.54	24.70	22.81	21.72	24.21	23.57
1.A.2.d - Pulp. Paper and Print	1.68	2.11	2.14	1.92	1.72	1.60	2.02	2.10
1.A.2.e - Food Processing. Beverages and Tobacco	55.97	58.36	58.58	59.84	57.34	54.26	64.22	63.50
1.A.2.f - Non-Metallic Minerals	-	-	-	-	-	-	-	-
1.A.2.g - Transport Equipment	-	-	-	-	-	-	-	-
1.A.2.h - Machinery	-	-	-	-	-	-	-	-
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	-	-	-	-	-
1.A.2.j - Wood and wood products	-	-	-	-	-	-	-	-
1.A.2.k - Construction	36.06	38.33	38.54	38.24	37.26	35.06	43.21	43.27
1.A.2.l - Textile and Leather	199.94	221.04	222.34	217.45	203.04	193.12	230.62	231.40
1.A.2.m - Non-specified Industry	54.23	56.52	55.47	58.11	54.04	51.78	56.74	54.36

1.A.3 - Transport	574.91	600.43	630.83	657.31	689.22	715.66	748.51	786.15
1.A.3.a - Civil Aviation	4.81	5.10	5.96	6.35	6.07	5.43	5.64	6.31
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-
1.A.3.a.ii - Domestic Aviation	4.81	5.10	5.96	6.35	6.07	5.43	5.64	6.31
1.A.3.b - Road Transportation	539.27	562.67	586.66	610.31	644.29	675.42	706.77	739.45
1.A.3.b.i - Cars	214.02	223.20	232.60	241.86	255.23	267.44	279.70	292.59
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	95.93	100.03	104.23	108.37	114.35	119.81	125.28	131.06
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	118.09	123.17	128.37	133.49	140.88	147.63	154.41	161.54
1.A.3.b.ii - Light-duty trucks	127.95	133.49	139.19	144.79	152.85	160.22	167.64	175.39
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts	38.26	39.92	41.64	43.31	45.73	47.94	50.17	52.49
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	89.69	93.57	97.55	101.48	107.12	112.28	117.48	122.90
1.A.3.b.iii - Heavy-duty trucks and buses	159.79	166.83	174.04	181.16	191.34	200.71	210.18	219.93
1.A.3.b.iv - Motorcycles	37.51	39.15	40.83	42.49	44.87	47.05	49.24	51.53
1.A.3.b.v - Evaporative emissions from vehicles	-	-	-	-	-	-	-	-
1.A.3.b.vi - Urea-based catalysts	-	-	-	-	-	-	-	-
1.A.3.c - Railways	-	-	-	-	-	-	-	-
1.A.3.d - Water-borne Navigation	30.83	32.66	38.20	40.65	38.86	34.81	36.10	40.39
1.A.3.d.i - International water-borne navigation (International bunkers)	-	-	-	-	-	-	-	-
1.A.3.d.ii - Domestic Water-borne Navigation	30.83	32.66	38.20	40.65	38.86	34.81	36.10	40.39
1.A.3.e - Other Transportation	-	-	-	-	-	-	-	-
1.A.3.e.i - Pipeline Transport	-	-	-	-	-	-	-	-
1.A.3.e.ii - Off-road	-	-	-	-	-	-	-	-
1.A.4 - Other Sectors	**198.41**	**200.74**	**200.83**	**217.96**	**220.65**	**227.16**	**219.09**	**210.88**
1.A.4.a - Commercial/Institutional	12.45	13.35	13.68	17.24	19.11	20.94	34.26	32.74
1.A.4.b - Residential	144.91	144.94	145.07	149.20	157.54	161.93	138.85	131.86
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	41.05	42.45	42.08	51.52	44.00	44.28	45.99	46.29

1.A.4.c.i - Stationary	-	-	-	-	-	-	-	-
1.A.4.c.ii - Off-road Vehicles and Other Machinery	7.92	9.00	8.87	9.45	10.15	9.66	9.84	10.01
1.A.4.c.iii - Fishing (mobile combustion)	33.13	33.44	33.21	42.07	33.85	34.62	36.15	36.27
1.A.5 - Non-Specified	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
1.A.5.a - Stationary	NA	NA	NA	NA	NA	NA	NA	NA
1.A.5.b - Mobile	-	-	-	-	-	-	-	-
1.A.5.b.i - Mobile (aviation component)	-	-	-	-	-	-	-	-
1.A.5.b.ii - Mobile (water-borne component)	-	-	-	-	-	-	-	-
1.A.5.b.iii - Mobile (Other)	-	-	-	-	-	-	-	-
1.A.5.c - Multilateral Operations	-	-	-	-	-	-	-	-
1.B - Fugitive emissions from fuels	-	-	-	-	-	-	-	-
1.B.1 - Solid Fuels	-	-	-	-	-	-	-	-
1.B.1.a - Coal mining and handling	-	-	-	-	-	-	-	-
1.B.1.a.i - Underground mines	-	-	-	-	-	-	-	-
1.B.1.a.i.1 - Mining	-	-	-	-	-	-	-	-
1.B.1.a.i.2 - Post-mining seam gas emissions	-	-	-	-	-	-	-	-
1.B.1.a.i.3 - Abandoned underground mines	-	-	-	-	-	-	-	-
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2	-	-	-	-	-	-	-	-
1.B.1.a.ii - Surface mines	-	-	-	-	-	-	-	-
1.B.1.a.ii.1 - Mining	-	-	-	-	-	-	-	-
1.B.1.a.ii.2 - Post-mining seam gas emissions	-	-	-	-	-	-	-	-
1.B.1.b - Uncontrolled combustion and burning coal dumps	-	-	-	-	-	-	-	-
1.B.1.c - Solid fuel transformation	-	-	-	-	-	-	-	-
1.B.2 - Oil and Natural Gas	-	-	-	-	-	-	-	-
1.B.2.a - Oil	-	-	-	-	-	-	-	-
1.B.2.a.i - Venting	-	-	-	-	-	-	-	-
1.B.2.a.ii - Flaring	-	-	-	-	-	-	-	-
1.B.2.a.iii - All Other	-	-	-	-	-	-	-	-
1.B.2.a.iii.1 - Exploration	-	-	-	-	-	-	-	-
1.B.2.a.iii.2 - Production and Upgrading	-	-	-	-	-	-	-	-

1.B.2.a.iii.3 - Transport	-	-	-	-	-	-	-	-
1.B.2.a.iii.4 - Refining	-	-	-	-	-	-	-	-
1.B.2.a.iii.5 - Distribution of oil products	-	-	-	-	-	-	-	-
1.B.2.a.iii.6 - Other	-	-	-	-	-	-	-	-
1.B.2.b - Natural Gas	-	-	-	-	-	-	-	-
1.B.2.b.i - Venting	-	-	-	-	-	-	-	-
1.B.2.b.ii - Flaring	-	-	-	-	-	-	-	-
1.B.2.b.iii - All Other	-	-	-	-	-	-	-	-
1.B.2.b.iii.1 - Exploration	-	-	-	-	-	-	-	-
1.B.2.b.iii.2 - Production	-	-	-	-	-	-	-	-
1.B.2.b.iii.3 - Processing	-	-	-	-	-	-	-	-
1.B.2.b.iii.4 - Transmission and Storage	-	-	-	-	-	-	-	-
1.B.2.b.iii.5 - Distribution	-	-	-	-	-	-	-	-
1.B.2.b.iii.6 - Other	-	-	-	-	-	-	-	-
1.B.3 - Other emissions from Energy Production	-	-	-	-	-	-	-	-
1.C - Carbon dioxide Transport and Storage	-	-	-	-	-	-	-	-
1.C.1 - Transport of CO2	-	-	-	-	-	-	-	-
1.C.1.a - Pipelines	-	-	-	-	-	-	-	-
1.C.1.b - Ships	-	-	-	-	-	-	-	-
1.C.1.c - Other (please specify)	-	-	-	-	-	-	-	-
1.C.2 - Injection and Storage	-	-	-	-	-	-	-	-
1.C.2.a - Injection	-	-	-	-	-	-	-	-
1.C.2.b - Storage	-	-	-	-	-	-	-	-
1.C.3 - Other	-	-	-	-	-	-	-	-
2 - Industrial Processes and Product Use	**70.32**	**73.46**	**76.15**	**78.88**	**81.25**	**113.16**	**108.04**	**103.25**
2.A - Mineral Industry	**2.75**	**2.70**	**2.47**	**2.35**	**1.92**	**1.97**	**2.04**	**1.44**
2.A.1 - Cement production	-	-	-	-	-	-	-	-
2.A.2 - Lime production	2.75	2.70	2.47	2.35	1.92	1.97	2.04	1.44
2.A.3 - Glass Production	-	-	-	-	-	-	-	-
2.A.4 - Other Process Uses of Carbonates	-	-	-	-	-	-	-	-
2.A.4.a - Ceramics	-	-	-	-	-	-	-	-
2.A.4.b - Other Uses of Soda Ash	-	-	-	-	-	-	-	-
2.A.4.c - Non Metallurgical Magnesia Production	-	-	-	-	-	-	-	-

2.A.4.d - Other (please specify)	-	-	-	-	-	-	-	-
2.A.5 - Other (please specify)	-	-	-	-	-	-	-	-
2.B - Chemical Industry	-	-	-	-	-	-	-	-
2.B.1 - Ammonia Production	-	-	-	-	-	-	-	-
2.B.2 - Nitric Acid Production	-	-	-	-	-	-	-	-
2.B.3 - Adipic Acid Production	-	-	-	-	-	-	-	-
2.B.4 - Caprolactam. Glyoxal and Glyoxylic Acid Production	-	-	-	-	-	-	-	-
2.B.5 - Carbide Production	-	-	-	-	-	-	-	-
2.B.6 - Titanium Dioxide Production	-	-	-	-	-	-	-	-
2.B.7 - Soda Ash Production	-	-	-	-	-	-	-	-
2.B.8 - Petrochemical and Carbon Black Production	-	-	-	-	-	-	-	-
2.B.8.a - Methanol	-	-	-	-	-	-	-	-
2.B.8.b - Ethylene	-	-	-	-	-	-	-	-
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	-	-	-	-	-	-	-	-
2.B.8.d - Ethylene Oxide	-	-	-	-	-	-	-	-
2.B.8.e - Acrylonitrile	-	-	-	-	-	-	-	-
2.B.8.f - Carbon Black	-	-	-	-	-	-	-	-
2.B.9 - Fluorochemical Production	-	-	-	-	-	-	-	-
2.B.9.a - By-product emissions	-	-	-	-	-	-	-	-
2.B.9.b - Fugitive Emissions	-	-	-	-	-	-	-	-
2.B.10 - Other (Please specify)	-	-	-	-	-	-	-	-
2.C - Metal Industry	**2.75**	**2.70**	**2.47**	**2.35**	**1.92**	**1.97**	**2.04**	**1.44**
2.C.1 - Iron and Steel Production	2.75	2.70	2.47	2.35	1.92	1.97	2.04	1.44
2.C.2 - Ferroalloys Production	-	-	-	-	-	-	-	-
2.C.3 - Aluminium production	-	-	-	-	-	-	-	-
2.C.4 - Magnesium production	-	-	-	-	-	-	-	-
2.C.5 - Lead Production	-	-	-	-	-	-	-	-
2.C.6 - Zinc Production	-	-	-	-	-	-	-	-
2.C.7 - Other (please specify)	-	-	-	-	-	-	-	-
2.D - Non-Energy Products from Fuels and Solvent Use	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
2.D.1 - Lubricant Use	NO	NO	NO	NO	NO	NO	NO	NO

2.D.2 - Paraffin Wax Use	-	-	-	-	-	-	-	-
2.D.3 - Solvent Use	-	-	-	-	-	-	-	-
2.D.4 - Other (please specify)	-	-	-	-	-	-	-	-
2.E - Electronics Industry	-	-	-	-	-	-	-	-
2.E.1 - Integrated Circuit or Semiconductor	-	-	-	-	-	-	-	-
2.E.2 - TFT Flat Panel Display	-	-	-	-	-	-	-	-
2.E.3 - Photovoltaics	-	-	-	-	-	-	-	-
2.E.4 - Heat Transfer Fluid	-	-	-	-	-	-	-	-
2.E.5 - Other (please specify)	-	-	-	-	-	-	-	-
2.F - Product Uses as Substitutes for Ozone Depleting Substances	**47.99**	**50.54**	**52.78**	**54.96**	**57.08**	**88.26**	**82.40**	**77.54**
2.F.1 - Refrigeration and Air Conditioning	47.99	50.54	52.78	54.96	57.08	88.26	82.40	77.54
2.F.1.a - Refrigeration and Stationary Air Conditioning	47.56	49.74	51.64	53.53	55.38	86.32	80.25	74.84
2.F.1.b - Mobile Air Conditioning	0.43	0.80	1.13	1.43	1.70	1.94	2.15	2.70
2.F.2 - Foam Blowing Agents	-	-	-	-	-	-	-	-
2.F.3 - Fire Protection	-	-	-	-	-	-	-	-
2.F.4 - Aerosols	-	-	-	-	-	-	-	-
2.F.5 - Solvents	-	-	-	-	-	-	-	-
2.F.6 - Other Applications (please specify)	-	-	-	-	-	-	-	-
2.G - Other Product Manufacture and Use	-	-	-	-	-	-	-	-
2.G.1 - Electrical Equipment	-	-	-	-	-	-	-	-
2.G.1.a - Manufacture of Electrical Equipment	-	-	-	-	-	-	-	-
2.G.1.b - Use of Electrical Equipment	-	-	-	-	-	-	-	-
2.G.1.c - Disposal of Electrical Equipment	-	-	-	-	-	-	-	-
2.G.2 - SF6 and PFCs from Other Product Uses	-	-	-	-	-	-	-	-
2.G.2.a - Military Applications	-	-	-	-	-	-	-	-
2.G.2.b - Accelerators	-	-	-	-	-	-	-	-
2.G.2.c - Other (please specify)	-	-	-	-	-	-	-	-
2.G.3 - N2O from Product Uses	-	-	-	-	-	-	-	-
2.G.3.a - Medical Applications	-	-	-	-	-	-	-	-
2.G.3.b - Propellant for pressure and aerosol products	-	-	-	-	-	-	-	-
2.G.3.c - Other (Please specify)	-	-	-	-	-	-	-	-
2.G.4 - Other (Please specify)	-	-	-	-	-	-	-	-

2.H - Other	-	-	-	-	-	-	-	-
3 - Agriculture, Forestry, and Other Land Use (AFOLU)	-311.39	-315.58	-267.42	-312.88	1,694.58	-174.91	-150.40	-41.91
3.A – Livestock	**36.15**	**36.29**	**36.98**	**36.60**	**34.89**	**36.74**	**40.12**	**42.51**
3.A.1 - Enteric Fermentation	25.94	26.25	26.51	26.17	24.49	25.77	26.68	27.77
3.A.2 - Manure Management	10.21	10.04	10.47	10.43	10.40	10.97	13.45	14.74
3.B - Land	**-458.89**	**-461.65**	**-419.77**	**-461.02**	**1,547.75**	**-325.46**	**-312.41**	**-213.94**
3.B.1 - Forest land	-458.89	-461.65	-419.77	-468.12	-390.90	-392.09	-375.50	-277.40
3.B.2 - Cropland	0.00	0.00	0.00	0.00	0.00	0.00	1.41	1.78
3.B.3 - Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4 - Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.5 - Settlements	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.6 - Other land	0.00	0.00	0.00	7.10	1,938.65	66.62	61.67	61.67
3.C - Aggregate sources and non-CO2 emissions sources on land	**109.91**	**108.71**	**114.37**	**110.40**	**110.39**	**112.25**	**120.91**	**129.41**
3.C.1 - Emissions from biomass burning	4.89	4.91	9.10	4.97	4.76	4.85	7.77	14.70
3.C.2 - Liming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.4 - Direct N2O Emissions from managed soils	75.15	72.76	73.52	73.62	73.70	74.70	77.67	78.25
3.C.5 - Indirect N2O Emissions from managed soils	23.97	22.96	23.28	23.32	23.36	23.78	24.84	25.09
3.C.6 - Indirect N2O Emissions from manure management	5.90	8.09	8.47	8.48	8.56	8.92	10.63	11.37
3.C.7 - Rice cultivations	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.8 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other	**1.44**	**1.07**	**1.00**	**1.13**	**1.55**	**1.55**	**0.98**	**0.10**
3.D.1 - Harvested Wood Products	1.44	1.07	1.00	1.13	1.55	1.55	0.98	0.10
3.D.2 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 - Waste	460.81	488.68	497.44	525.19	551.36	564.01	576.77	585.02
4.A - Solid Waste Disposal	253.87	270.83	293.90	318.42	338.79	357.60	379.24	394.55
4.B - Biological Treatment of Solid Waste	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4.C - Incineration and Open Burning of Waste	**0.56**	**0.55**	**0.56**	**0.52**	**0.52**	**0.52**	**0.55**	**0.53**
4.C.1 - Waste Incineration	0.56	0.55	0.56	0.52	0.52	0.52	0.55	0.53
4.C.2 - Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	**206.37**	**217.30**	**202.98**	**206.25**	**212.05**	**205.89**	**196.99**	**189.94**
4.D.1 - Domestic Wastewater Treatment and Discharge	128.57	129.89	131.29	132.50	133.87	134.33	127.31	128.43
4.D.2 - Industrial Wastewater Treatment and Discharge	77.79	87.41	71.70	73.75	78.18	71.56	69.68	61.51
4.E - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5 - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5.A - Indirect N2O emissions from the atmospephric deposition of nitrogen in Nox and NH3	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5.B - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Memo Items	**1,308.99**	**1,267.84**	**1,162.57**	**1,090.84**	**1,167.33**	**1,336.73**	**1,298.20**	**1,415.12**
1.A.3.a.i – International Aviation	610.74	623.47	629.83	664.82	702.99	728.44	750.71	795.24
1.A.3.d.i -International Water-borne Navigation	698.25	644.38	532.74	426.02	464.34	608.29	547.49	619.88
TOTAL excluding LULUCF	**3,000.34**	**3,199.24**	**3,269.79**	**3,429.19**	**3,481.92**	**3,715.95**	**4,101.70**	**4,283.86**
TOTAL including LULUCF	**2,542.89**	**2,738.66**	**2,851.02**	**2,969.30**	**5,031.22**	**3,392.04**	**3,790.27**	**4,070.02**

Table 153. GHG Emissions Inventory (Gg CO_2eq) Time-series 2008 – 2016

Categories	2008	2009	2010	2011	2012	2013	2014	2015	2016
1 - Energy	**3,524.63**	**3,472.88**	**3,731.18**	**3,742.36**	**3,839.69**	**3,949.45**	**4,005.75**	**4,057.65**	**4,182.62**
1.A - Fuel Combustion Activities	**3,524.63**	**3,472.88**	**3,731.18**	**3,742.36**	**3,839.69**	**3,949.45**	**4,005.75**	**4,057.65**	**4,182.62**
1.A.1 - Energy Industries	**2,037.72**	**2,019.24**	**2,220.34**	**2,204.72**	**2,265.14**	**2,338.84**	**2,418.53**	**2,365.06**	**2,422.16**
1.A.1.a - Main Activity Electricity and Heat Production	2,037.72	2,019.24	2,220.34	2,204.72	2,265.14	2,338.84	2,418.53	2,365.06	2,422.16
1.A.1.a.i - Electricity Generation	2,037.72	2,019.24	2,220.34	2,204.72	2,265.14	2,338.84	2,418.53	2,365.06	2,422.16
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	-	-	-	-	-	-	-	-	-
1.A.1.a.iii - Heat Plants	-	-	-	-	-	-	-	-	-
1.A.1.b - Petroleum Refining	-	-	-	-	-	-	-	-	-
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	-	-	-	-	-
1.A.1.c.i - Manufacture of Solid Fuels	-	-	-	-	-	-	-	-	-
1.A.1.c.ii - Other Energy Industries	-	-	-	-	-	-	-	-	-
1.A.2 - Manufacturing Industries and Construction	**446.47**	**372.13**	**377.90**	**361.19**	**353.89**	**339.42**	**352.22**	**357.44**	**342.18**
1.A.2.a - Iron and Steel	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	-	-	-	-
1.A.2.c - Chemicals	30.17	22.21	23.36	22.35	22.29	21.71	20.69	24.69	20.64
1.A.2.d - Pulp. Paper and Print	1.89	1.61	1.56	1.52	1.46	1.47	1.52	1.40	1.38
1.A.2.e - Food Processing. Beverages and Tobacco	67.54	57.22	58.21	55.22	53.92	50.62	52.88	53.57	51.65
1.A.2.f - Non-Metallic Minerals	-	-	-	-	-	-	-	-	-
1.A.2.g - Transport Equipment	-	-	-	-	-	-	-	-	-
1.A.2.h - Machinery	-	-	-	-	-	-	-	-	-
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	-	-	-	-	-	-
1.A.2.j - Wood and wood products	-	-	-	-	-	-	-	-	-

1.A.2.k - Construction	40.37	37.54	37.27	35.24	33.92	31.25	32.04	31.08	30.33
1.A.2.l - Textile and Leather	240.06	201.87	203.00	194.68	190.53	183.61	191.53	190.27	184.60
1.A.2.m - Non-specified Industry	66.18	49.90	52.71	50.40	49.99	48.97	51.77	54.65	51.80
1.A.3 - Transport	**819.46**	**850.74**	**896.85**	**937.99**	**987.12**	**1,037.11**	**997.44**	**1,087.43**	**1,169.30**
1.A.3.a - Civil Aviation	5.64	4.29	5.87	6.39	6.79	6.97	7.21	8.56	9.79
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-	-
1.A.3.a.ii - Domestic Aviation	5.64	4.29	5.87	6.39	6.79	6.97	7.21	8.56	9.79
1.A.3.b - Road Transportation	777.70	811.05	849.86	887.27	934.12	982.40	942.64	1,022.44	1,093.96
1.A.3.b.i - Cars	307.71	320.94	336.33	351.07	369.50	388.45	373.17	436.37	486.65
1.A.3.b.i.1 - Passenger cars with 3-way catalysts	137.83	143.75	150.65	157.25	165.49	173.96	150.70	194.11	235.64
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	169.88	177.18	185.68	193.82	204.01	214.49	222.47	242.26	251.01
1.A.3.b.ii - Light-duty trucks	184.47	192.39	201.59	210.45	221.57	233.02	207.40	229.87	244.13
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts	55.21	57.58	60.33	62.98	66.31	69.75	55.51	64.13	79.81
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	129.26	134.81	141.27	147.47	155.26	163.27	151.88	165.74	164.32
1.A.3.b.iii - Heavy-duty trucks and buses	231.32	241.22	252.72	263.92	277.95	292.44	313.95	291.50	291.53
1.A.3.b.iv - Motorcycles	54.19	56.51	59.22	61.83	65.11	68.48	48.13	64.70	71.66
1.A.3.b.v - Evaporative emissions from vehicles	-	-	-	-	-	-	-	-	-
1.A.3.b.vi - Urea-based catalysts	-	-	-	-	-	-	-	-	-
1.A.3.c - Railways	-	-	-	-	-	-	-	-	-
1.A.3.d - Water-borne Navigation	36.12	35.39	41.13	44.33	46.21	47.74	47.59	56.42	65.55
1.A.3.d.i - International water-borne navigation (International bunkers)	-	-	-	-	-	-	-	-	-
1.A.3.d.ii - Domestic Water-borne Navigation	36.12	35.39	41.13	44.33	46.21	47.74	47.59	56.42	65.55

1.A.3.e - Other Transportation	-	-	-	-	-	-	-	-	-
1.A.3.e.i - Pipeline Transport	-	-	-	-	-	-	-	-	-
1.A.3.e.ii - Off-road	-	-	-	-	-	-	-	-	-
1.A.4 - Other Sectors	**220.97**	**230.77**	**236.09**	**238.46**	**233.54**	**233.30**	**236.75**	**246.87**	**248.10**
1.A.4.a - Commercial/Institutional	30.25	31.69	32.74	33.74	35.71	39.80	42.02	45.22	48.16
1.A.4.b - Residential	134.36	135.94	139.20	137.08	138.24	141.14	144.49	148.87	149.75
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	56.36	63.14	64.15	67.64	59.59	52.37	50.23	52.78	50.18
1.A.4.c.i - Stationary	-	-	-	-	-	-	-	-	-
1.A.4.c.ii - Off-road Vehicles and Other Machinery	10.19	10.38	10.56	10.75	10.95	11.15	7.36	7.44	7.31
1.A.4.c.iii - Fishing (mobile combustion)	46.17	52.76	53.59	56.88	48.64	41.22	42.87	45.34	42.87
1.A.5 - Non-Specified	**NA**	**NA**	**NA**	**NA**	**NA**	**0.77**	**0.81**	**0.85**	**0.87**
1.A.5.a - Stationary	NA	NA	NA	NA	NA	0.77	0.81	0.85	0.87
1.A.5.b - Mobile	-	-	-	-	-	-	-	-	-
1.A.5.b.i - Mobile (aviation component)	-	-	-	-	-	-	-	-	-
1.A.5.b.ii - Mobile (water-borne component)	-	-	-	-	-	-	-	-	-
1.A.5.b.iii - Mobile (Other)	-	-	-	-	-	-	-	-	-
1.A.5.c - Multilateral Operations	-	-	-	-	-	-	-	-	-
1.B - Fugitive emissions from fuels	-	-	-	-	-	-	-	-	-
1.B.1 - Solid Fuels	-	-	-	-	-	-	-	-	-
1.B.1.a - Coal mining and handling	-	-	-	-	-	-	-	-	-
1.B.1.a.i - Underground mines	-	-	-	-	-	-	-	-	-
1.B.1.a.i.1 - Mining	-	-	-	-	-	-	-	-	-
1.B.1.a.i.2 - Post-mining seam gas emissions	-	-	-	-	-	-	-	-	-
1.B.1.a.i.3 - Abandoned underground mines	-	-	-	-	-	-	-	-	-
1.B.1.a.i.4 - Flaring of drained methane or	-	-	-	-	-	-	-	-	-

conversion of methane to CO2									
1.B.1.a.ii - Surface mines	-	-	-	-	-	-	-	-	-
1.B.1.a.ii.1 - Mining	-	-	-	-	-	-	-	-	-
1.B.1.a.ii.2 - Post-mining seam gas emissions	-	-	-	-	-	-	-	-	-
1.B.1.b - Uncontrolled combustion and burning coal dumps	-	-	-	-	-	-	-	-	-
1.B.1.c - Solid fuel transformation	-	-	-	-	-	-	-	-	-
1.B.2 - Oil and Natural Gas	-	-	-	-	-	-	-	-	-
1.B.2.a - Oil	-	-	-	-	-	-	-	-	-
1.B.2.a.i - Venting	-	-	-	-	-	-	-	-	-
1.B.2.a.ii - Flaring	-	-	-	-	-	-	-	-	-
1.B.2.a.iii - All Other	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.1 - Exploration	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.2 - Production and Upgrading	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.3 - Transport	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.4 - Refining	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.5 - Distribution of oil products	-	-	-	-	-	-	-	-	-
1.B.2.a.iii.6 - Other	-	-	-	-	-	-	-	-	-
1.B.2.b - Natural Gas	-	-	-	-	-	-	-	-	-
1.B.2.b.i - Venting	-	-	-	-	-	-	-	-	-
1.B.2.b.ii - Flaring	-	-	-	-	-	-	-	-	-
1.B.2.b.iii - All Other	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.1 - Exploration	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.2 - Production	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.3 - Processing	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.4 - Transmission and Storage	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.5 - Distribution	-	-	-	-	-	-	-	-	-
1.B.2.b.iii.6 - Other	-	-	-	-	-	-	-	-	-

1.B.3 - Other emissions from Energy Production	-	-	-	-	-	-	-	-	-
1.C - Carbon dioxide Transport and Storage	-	-	-	-	-	-	-	-	-
1.C.1 - Transport of CO2	-	-	-	-	-	-	-	-	-
1.C.1.a - Pipelines	-	-	-	-	-	-	-	-	-
1.C.1.b - Ships	-	-	-	-	-	-	-	-	-
1.C.1.c - Other (please specify)	-	-	-	-	-	-	-	-	-
1.C.2 - Injection and Storage	-	-	-	-	-	-	-	-	-
1.C.2.a - Injection	-	-	-	-	-	-	-	-	-
1.C.2.b - Storage	-	-	-	-	-	-	-	-	-
1.C.3 - Other	-	-	-	-	-	-	-	-	-
2 - Industrial Processes and Product Use	**125.87**	**139.56**	**151.71**	**193.95**	**214.43**	**300.00**	**300.78**	**300.96**	**311.18**
2.A - Mineral Industry	**1.36**	**1.95**	**2.16**	**1.37**	**1.79**	**1.29**	**0.80**	**0.00**	**0.00**
2.A.1 - Cement production	-	-	-	-	-	-	-	-	-
2.A.2 - Lime production	1.36	1.95	2.16	1.37	1.79	1.29	0.80	0.00	0.00
2.A.3 - Glass Production	-	-	-	-	-	-	-	-	-
2.A.4 - Other Process Uses of Carbonates	-	-	-	-	-	-	-	-	-
2.A.4.a - Ceramics	-	-	-	-	-	-	-	-	-
2.A.4.b - Other Uses of Soda Ash	-	-	-	-	-	-	-	-	-
2.A.4.c - Non Metallurgical Magnesia Production	-	-	-	-	-	-	-	-	-
2.A.4.d - Other (please specify)	-	-	-	-	-	-	-	-	-
2.A.5 - Other (please specify)	-	-	-	-	-	-	-	-	-
2.B - Chemical Industry	-	-	-	-	-	-	-	-	-
2.B.1 - Ammonia Production	-	-	-	-	-	-	-	-	-
2.B.2 - Nitric Acid Production	-	-	-	-	-	-	-	-	-
2.B.3 - Adipic Acid Production	-	-	-	-	-	-	-	-	-
2.B.4 - Caprolactam. Glyoxal and Glyoxylic Acid Production	-	-	-	-	-	-	-	-	-
2.B.5 - Carbide Production	-	-	-	-	-	-	-	-	-
2.B.6 - Titanium Dioxide	-	-	-	-	-	-	-	-	-

Production									
2.B.7 - Soda Ash Production	-	-	-	-	-	-	-	-	-
2.B.8 - Petrochemical and Carbon Black Production	-	-	-	-	-	-	-	-	-
2.B.8.a - Methanol	-	-	-	-	-	-	-	-	-
2.B.8.b - Ethylene	-	-	-	-	-	-	-	-	-
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	-	-	-	-	-	-	-	-	-
2.B.8.d - Ethylene Oxide	-	-	-	-	-	-	-	-	-
2.B.8.e - Acrylonitrile	-	-	-	-	-	-	-	-	-
2.B.8.f - Carbon Black	-	-	-	-	-	-	-	-	-
2.B.9 - Fluorochemical Production	-	-	-	-	-	-	-	-	-
2.B.9.a - By-product emissions	-	-	-	-	-	-	-	-	-
2.B.9.b - Fugitive Emissions	-	-	-	-	-	-	-	-	-
2.B.10 - Other (Please specify)	-	-	-	-	-	-	-	-	-
2.C - Metal Industry	**28.57**	**32.86**	**34.98**	**37.10**	**34.13**	**28.30**	**26.50**	**25.44**	**21.41**
2.C.1 - Iron and Steel Production	28.57	32.86	34.98	37.10	34.13	28.30	26.50	25.44	21.41
2.C.2 - Ferroalloys Production	-	-	-	-	-	-	-	-	-
2.C.3 - Aluminium production	-	-	-	-	-	-	-	-	-
2.C.4 - Magnesium production	-	-	-	-	-	-	-	-	-
2.C.5 - Lead Production	-	-	-	-	-	-	-	-	-
2.C.6 - Zinc Production	-	-	-	-	-	-	-	-	-
2.C.7 - Other (please specify)	-	-	-	-	-	-	-	-	-
2.D - Non-Energy Products from Fuels and Solvent Use	**NO**	**NO**	**NO**	**9.43**	**10.61**	**10.02**	**8.84**	**6.49**	**7.66**
2.D.1 - Lubricant Use	-	-	-	-	-	-	-	-	-
2.D.2 - Paraffin Wax Use	-	-	-	-	-	-	-	-	-
2.D.3 - Solvent Use	-	-	-	-	-	-	-	-	-
2.D.4 - Other (please specify)	-	-	-	-	-	-	-	-	-
2.E - Electronics Industry	-	-	-	-	-	-	-	-	-
2.E.1 - Integrated Circuit or Semiconductor	-	-	-	-	-	-	-	-	-
2.E.2 - TFT Flat Panel Display	-	-	-	-	-	-	-	-	-
2.E.3 - Photovoltaics	-	-	-	-	-	-	-	-	-
2.E.4 - Heat Transfer Fluid	-	-	-	-	-	-	-	-	-

2.E.5 - Other (please specify)	-	-	-	-	-	-	-	-	-
2.F - Product Uses as Substitutes for Ozone Depleting Substances	**95.94**	**104.75**	**114.58**	**146.05**	**167.89**	**260.38**	**264.64**	**269.03**	**282.10**
2.F.1 - Refrigeration and Air Conditioning	95.94	104.75	114.58	146.05	167.89	260.38	264.64	269.03	282.10
2.F.1.a - Refrigeration and Stationary Air Conditioning	90.32	98.82	108.58	139.15	160.91	253.48	257.70	260.36	273.16
2.F.1.b - Mobile Air Conditioning	5.62	5.93	6.00	6.90	6.98	6.91	6.93	8.67	8.95
2.F.2 - Foam Blowing Agents	-	-	-	-	-	-	-	-	-
2.F.3 - Fire Protection	-	-	-	-	-	-	-	-	-
2.F.4 - Aerosols	-	-	-	-	-	-	-	-	-
2.F.5 - Solvents	-	-	-	-	-	-	-	-	-
2.F.6 - Other Applications (please specify)	-	-	-	-	-	-	-	-	-
2.G - Other Product Manufacture and Use	-	-	-	-	-	-	-	-	-
2.G.1 - Electrical Equipment	-	-	-	-	-	-	-	-	-
2.G.1.a - Manufacture of Electrical Equipment	-	-	-	-	-	-	-	-	-
2.G.1.b - Use of Electrical Equipment	-	-	-	-	-	-	-	-	-
2.G.1.c - Disposal of Electrical Equipment	-	-	-	-	-	-	-	-	-
2.G.2 - SF6 and PFCs from Other Product Uses	-	-	-	-	-	-	-	-	-
2.G.2.a - Military Applications	-	-	-	-	-	-	-	-	-
2.G.2.b - Accelerators	-	-	-	-	-	-	-	-	-
2.G.2.c - Other (please specify)	-	-	-	-	-	-	-	-	-
2.G.3 - N2O from Product Uses	-	-	-	-	-	-	-	-	-
2.G.3.a - Medical Applications	-	-	-	-	-	-	-	-	-
2.G.3.b - Propellant for pressure and aerosol products	-	-	-	-	-	-	-	-	-
2.G.3.c - Other (Please specify)	-	-	-	-	-	-	-	-	-
2.G.4 - Other (Please specify)	-	-	-	-	-	-	-	-	-
2.H - Other	-	-	-	-	-	-	-	-	-

3 - Agriculture, Forestry, and Other Land Use (AFOLU)	-158.32	-166.65	-128.48	-145.20	-137.88	-134.67	-153.90	-160.54	-171.62
3.A - Livestock	**37.49**	**37.22**	**41.94**	**42.41**	**40.66**	**41.55**	**39.88**	**38.90**	**37.53**
3.A.1 - Enteric Fermentation	24.10	23.91	27.23	27.72	26.48	27.23	25.08	24.46	23.60
3.A.2 - Manure Management	13.39	13.31	14.72	14.69	14.18	14.32	14.80	14.43	13.93
3.B - Land	**-308.30**	**-316.11**	**-298.67**	**-314.12**	**-315.70**	**-315.59**	**-312.45**	**-323.65**	**-331.60**
3.B.1 - Forest land	-376.02	-377.89	-360.45	-381.97	-377.63	-382.21	-375.24	-397.03	-394.36
3.B.2 - Cropland	6.04	0.11	0.11	0.43	0.12	0.12	0.12	0.12	0.12
3.B.3 - Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.B.4 - Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.22	0.00
3.B.5 - Settlements	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
3.B.6 - Other land	61.67	61.67	61.67	67.42	61.81	66.37	62.67	62.03	62.64
3.C - Aggregate sources and non-CO2 emissions sources on land	**112.35**	**111.59**	**126.23**	**124.66**	**135.14**	**137.28**	**116.49**	**122.12**	**120.55**
3.C.1 - Emissions from biomass burning	5.28	6.57	9.34	3.89	6.72	6.69	7.47	5.50	4.95
3.C.2 - Liming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.3 - Urea application	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.4 - Direct N2O Emissions from managed soils	72.31	70.64	78.96	81.62	87.57	89.42	72.74	79.06	78.38
3.C.5 - Indirect N2O Emissions from managed soils	23.51	23.04	25.91	26.76	28.76	29.29	24.05	25.75	25.54
3.C.6 - Indirect N2O Emissions from manure management	11.25	11.34	12.02	12.38	12.09	11.87	12.22	11.81	11.67
3.C.7 - Rice cultivations	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.C.8 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D - Other	**0.15**	**0.64**	**2.02**	**1.85**	**2.03**	**2.09**	**2.18**	**2.09**	**1.89**
3.D.1 - Harvested Wood Products	0.15	0.64	2.02	1.85	2.03	2.09	2.18	2.09	1.89
3.D.2 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 - Waste	594.41	558.97	588.57	604.32	596.51	569.54	572.77	555.45	559.18
4.A - Solid Waste Disposal	**402.78**	**364.01**	**395.85**	**404.90**	**398.65**	**376.62**	**378.91**	**366.93**	**369.68**
4.B - Biological Treatment of Solid Waste	**0.00**	**0.00**	**0.00**	**0.82**	**5.51**	**3.05**	**6.50**	**6.02**	**6.07**
4.C - Incineration and Open Burning of Waste	**0.54**	**0.52**	**0.53**	**0.57**	**0.57**	**0.59**	**0.66**	**0.74**	**0.74**

4.C.1 - Waste Incineration	0.54	0.52	0.53	0.57	0.57	0.59	0.66	0.74	0.74
4.C.2 - Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	**191.10**	**194.44**	**192.19**	**198.03**	**191.78**	**189.28**	**186.69**	**181.76**	**182.70**
4.D.1 - Domestic Wastewater Treatment and Discharge	128.00	129.25	128.61	136.57	133.62	131.77	129.79	129.21	127.61
4.D.2 - Industrial Wastewater Treatment and Discharge	63.09	65.19	63.58	61.46	58.16	57.51	56.90	52.56	55.09
4.E - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5 - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5.A - Indirect N2O emissions from the atmospehric deposition of nitrogten in Nox and NH3	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5.B - Other	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Memo Items	**1.481.42**	**1.353.60**	**1.480.64**	**1.675.94**	**1.638.39**	**1.591.26**	**1.686.46**	**1.724.68**	**1.997.25**
1.A.3.a.i – International Aviation	801.60	661.64	728.44	769.79	792.06	731.62	769.79	823.87	925.66
1.A.3.d.i – International Water-borne Navigation	679.82	691.96	752.21	906.15	846.33	859.64	916.66	900.81	1.071.59
TOTAL excluding LULUCF	**4,394.75**	**4,320.22**	**4,639.63**	**4,707.69**	**4,826.42**	**4,997.82**	**5,035.66**	**5,075.07**	**5,211.06**
TOTAL including LULUCF	**4,086.59**	**4,004.75**	**4,342.98**	**4,395.42**	**4,512.75**	**4,684.32**	**4,725.39**	**4,753.51**	**4,881.36**

Appendix 3.2: Summary report for GHG Emissions Inventory

Table 154. Summary Report for GHG Emissions Inventory Year 2000

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	1,847.96	23.19	0.52	47.99	0.00	0.00	0.00
1 - Energy	2,282.52	0.60	0.09	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	2,282.52	0.60	0.09	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	1,159.26	0.25	0.04				
1.A.2 - Manufacturing Industries and Construction	363.71	0.13	0.02				
1.A.3 - Transport	563.74	0.13	0.03				
1.A.4 - Other Sectors	195.81	0.10	0.00				
1.A.5 - Non-Specified	0.00	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	22.33	0.00	0.00	47.99	0.00	0.00	0.00
2.A - Mineral Industry	2.75	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	2.75						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				

2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				
2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	19.57	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	19.57	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	0.00						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	47.99	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				47.99			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		

2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	
2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-457.45	1.54	0.37	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.37	0.02	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.24					
3.A.2 - Manure Management		0.13	0.02				
3.B - Land	-458.89	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-458.89						
3.B.2 - Cropland	0.00						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	0.00		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	0.00						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.17	0.34	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.17	0.00				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.24				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.02				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	1.44	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	1.44						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.56	21.05	0.06	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	12.09	0.00	0.00	0.00	0.00	0.00

4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.56	0.00	0.00	0.00	0.00	0.00	0.00
4.D - Wastewater Treatment and Discharge	0.00	8.96	0.06	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,296.58	0.07	0.04	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	605.40	0.00	0.02				
1.A.3.d.i - International water-borne navigation (International bunkers)	691.17	0.06	0.02				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 155. Summary Report for GHG Emissions Inventory Year 2005

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	2,546.43	28.06	0.54	88.26	0.00	0.00	0.00
1 - Energy	2,844.92	0.64	0.10	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	2,844.92	0.64	0.10	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	1,567.12	0.26	0.05				
1.A.2 - Manufacturing Industries and Construction	351.66	0.12	0.02				
1.A.3 - Transport	701.73	0.16	0.03				
1.A.4 - Other Sectors	224.40	0.10	0.00				
1.A.5 - Non-Specified	0.00	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	24.89	0.00	0.00	88.26	0.00	0.00	0.00
2.A - Mineral Industry	1.97	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	1.97						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				
2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				

2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	22.92	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	22.92	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	0.00						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	88.26	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				88.26			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	

2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-323.91	1.54	0.38	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.38	0.03	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.23					
3.A.2 - Manure Management		0.15	0.03				
3.B - Land	-325.46	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-392.09						
3.B.2 - Cropland	0.00						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	0.00		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	66.62						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.17	0.35	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.17	0.00				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.24				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.03				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	1.55	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	1.55						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.52	25.87	0.07	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	17.03	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.52	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	0.00	8.84	0.07	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,324.20	0.06	0.04	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	722.07	0.01	0.02				
1.A.3.d.i - International water-borne navigation (International bunkers)	602.13	0.06	0.02				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 156. Summary Report for GHG Emissions Inventory Year 2010

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	3,421.47	29.43	0.61	114.58	0.00	0.00	0.00
1 - Energy	3,680.46	0.67	0.12	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	3,680.46	0.67	0.12	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	2,194.94	0.29	0.06				
1.A.2 - Manufacturing Industries and Construction	372.84	0.08	0.01				
1.A.3 - Transport	879.36	0.20	0.04				
1.A.4 - Other Sectors	233.32	0.10	0.00				
1.A.5 - Non-Specified	0.00	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	37.14	0.00	0.00	114.58	0.00	0.00	0.00
2.A - Mineral Industry	2.16	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	2.16						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				
2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				

2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	34.98	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	34.98	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	0.00						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	114.58	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				114.58			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	

2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-296.65	1.80	0.42	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.49	0.03	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.30					
3.A.2 - Manure Management		0.19	0.03				
3.B - Land	-298.67	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-360.45						
3.B.2 - Cropland	0.11						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	0.00		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	61.67						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.31	0.39	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.31	0.01				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.25				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.04				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	2.02	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	2.02						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.53	26.95	0.07	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	18.85	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.53	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	0.00	8.10	0.07	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,466.74	0.07	0.04	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	722.07	0.01	0.02				
1.A.3.d.i - International water-borne navigation (International bunkers)	744.67	0.07	0.02				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 157. Summary Report for GHG Emissions Inventory Year 2014

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	3,681.98	28.36	0.59	264.64	0.00	0.00	0.00
1 - Energy	3,955.44	0.63	0.12	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	3,955.44	0.63	0.12	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	2,393.79	0.27	0.06				
1.A.2 - Manufacturing Industries and Construction	348.41	0.06	0.01				
1.A.3 - Transport	978.15	0.21	0.05				
1.A.4 - Other Sectors	234.28	0.09	0.00				
1.A.5 - Non-Specified	0.81	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	36.15	0.00	0.00	264.64	0.00	0.00	0.00
2.A - Mineral Industry	0.80	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	0.80						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				
2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				

2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	26.50	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	26.50	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	8.84	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	8.84						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	264.64	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				264.64			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	

2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-310.27	1.64	0.39	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.39	0.03	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.19					
3.A.2 - Manure Management		0.20	0.03				
3.B - Land	-312.45	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-375.24						
3.B.2 - Cropland	0.12						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	0.00		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	62.67						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.25	0.36	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.25	0.01				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.23				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.04				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	2.18	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	2.18						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.66	26.09	0.08	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	18.04	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.16	0.01	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.66	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	0.00	7.88	0.07	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,670.57	0.09	0.05	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	763.06	0.01	0.02				
1.A.3.d.i - International water-borne navigation (International bunkers)	907.51	0.08	0.02				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 158. Summary Report for GHG Emissions Inventory Year 2015

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	3,715.13	27.50	0.62	269.03	0.00	0.00	0.00
1 - Energy	4,004.03	0.70	0.13	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	4,004.03	0.70	0.13	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	2,339.08	0.29	0.06				
1.A.2 - Manufacturing Industries and Construction	353.50	0.06	0.01				
1.A.3 - Transport	1,066.11	0.25	0.05				
1.A.4 - Other Sectors	244.49	0.09	0.00				
1.A.5 - Non-Specified	0.85	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	31.93	0.00	0.00	269.03	0.00	0.00	0.00
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	0.00						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				
2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				

2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	25.44	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	25.44	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	6.49	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	6.49						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	269.03	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				269.03			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	

2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-321.56	1.54	0.41	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.36	0.03	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.16					
3.A.2 - Manure Management		0.19	0.03				
3.B - Land	-323.65	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-397.03						
3.B.2 - Cropland	0.12						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	11.22		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	62.03						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.19	0.38	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.19	0.01				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.26				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.04				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	2.09	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	2.09						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.74	25.26	0.08	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	17.47	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.15	0.01	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.74	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	0.00	7.64	0.07	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,708.48	0.09	0.05	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	816.67	0.01	0.02				
1.A.3.d.i - International water-borne navigation (International bunkers)	891.81	0.08	0.02				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 159. Summary Report for GHG Emissions Inventory Year 2016

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			
	Net CO_2	CH_4	N_2O	HFCs	PFCs	SF6	Other halogenated gases with CO_2 equivalent conversion factors
Total National Emissions and Removals	3,829.01	27.60	0.61	282.10	0.00	0.00	0.00
1 - Energy	4,128.90	0.69	0.13	0.00	0.00	0.00	0.00
1.A - Fuel Combustion Activities	4,128.90	0.69	0.13	0.00	0.00	0.00	0.00
1.A.1 - Energy Industries	2,397.16	0.27	0.06				
1.A.2 - Manufacturing Industries and Construction	338.80	0.05	0.01				
1.A.3 - Transport	1,146.34	0.28	0.06				
1.A.4 - Other Sectors	245.73	0.09	0.00				
1.A.5 - Non-Specified	0.87	0.00	0.00				
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.B.1 - Solid Fuels	0.00	0.00	0.00				
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				
1.C - Carbon dioxide Transport and Storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.C.1 - Transport of CO2	0.00						
1.C.2 - Injection and Storage	0.00						
1.C.3 - Other	0.00						
2 - Industrial Processes and Product Use	29.08	0.00	0.00	282.10	0.00	0.00	0.00
2.A - Mineral Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.A.1 - Cement production	0.00						
2.A.2 - Lime production	0.00						
2.A.3 - Glass Production	0.00						
2.A.4 - Other Process Uses of Carbonates	0.00						
2.A.5 - Other (please specify)	0.00	0.00	0.00				
2.B - Chemical Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	0.00						
2.B.2 - Nitric Acid Production			0.00				
2.B.3 - Adipic Acid Production			0.00				
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0.00				

2.B.5 - Carbide Production	0.00	0.00					
2.B.6 - Titanium Dioxide Production	0.00						
2.B.7 - Soda Ash Production	0.00						
2.B.8 - Petrochemical and Carbon Black Production	0.00	0.00					
2.B.9 - Fluorochemical Production				0.00	0.00	0.00	0.00
2.B.10 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.C - Metal Industry	21.41	0.00	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	21.41	0.00					
2.C.2 - Ferroalloys Production	0.00	0.00					
2.C.3 - Aluminium production	0.00				0.00		
2.C.4 - Magnesium production	0.00					0.00	
2.C.5 - Lead Production	0.00						
2.C.6 - Zinc Production	0.00						
2.C.7 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D - Non-Energy Products from Fuels and Solvent Use	7.66	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	7.66						
2.D.2 - Paraffin Wax Use	0.00						
2.D.3 - Solvent Use							
2.D.4 - Other (please specify)	0.00	0.00	0.00				
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.E.1 - Integrated Circuit or Semiconductor				0.00	0.00	0.00	0.00
2.E.2 - TFT Flat Panel Display					0.00	0.00	0.00
2.E.3 - Photovoltaics					0.00		
2.E.4 - Heat Transfer Fluid					0.00		
2.E.5 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	282.10	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning				282.10			
2.F.2 - Foam Blowing Agents				0.00			
2.F.3 - Fire Protection				0.00	0.00		
2.F.4 - Aerosols				0.00			
2.F.5 - Solvents				0.00	0.00		
2.F.6 - Other Applications (please specify)				0.00	0.00		
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					0.00	0.00	

2.G.2 - SF6 and PFCs from Other Product Uses					0.00	0.00	
2.G.3 - N2O from Product Uses			0.00				
2.G.4 - Other (Please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry	0.00	0.00					
2.H.2 - Food and Beverages Industry	0.00	0.00					
2.H.3 - Other (please specify)	0.00	0.00	0.00				
3 - Agriculture, Forestry, and Other Land Use	-329.70	1.48	0.41	0.00	0.00	0.00	0.00
3.A - Livestock	0.00	1.32	0.03	0.00	0.00	0.00	0.00
3.A.1 - Enteric Fermentation		1.12					
3.A.2 - Manure Management		0.19	0.03				
3.B - Land	-331.60	0.00	0.00	0.00	0.00	0.00	0.00
3.B.1 - Forest land	-394.36						
3.B.2 - Cropland	0.12						
3.B.3 - Grassland	0.00						
3.B.4 - Wetlands	0.00		0.00				
3.B.5 - Settlements	0.00						
3.B.6 - Other Land	62.64						
3.C - Aggregate sources and non-CO2 emissions sources on land	0.00	0.17	0.38	0.00	0.00	0.00	0.00
3.C.1 - Emissions from biomass burning		0.17	0.00				
3.C.2 - Liming	0.00						
3.C.3 - Urea application	0.00						
3.C.4 - Direct N2O Emissions from managed soils			0.25				
3.C.5 - Indirect N2O Emissions from managed soils			0.08				
3.C.6 - Indirect N2O Emissions from manure management			0.04				
3.C.7 - Rice cultivations		0.00					
3.C.8 - Other (please specify)		0.00	0.00				
3.D - Other	1.89	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	1.89						
3.D.2 - Other (please specify)	0.00	0.00	0.00				
4 - Waste	0.74	25.43	0.08	0.00	0.00	0.00	0.00
4.A - Solid Waste Disposal	0.00	17.60	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.15	0.01	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	0.74	0.00	0.00	0.00	0.00	0.00	0.00

4.D - Wastewater Treatment and Discharge	0.00	7.67	0.07	0.00	0.00	0.00	0.00
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Memo Items (5)							
International Bunkers	1,978.47	0.10	0.05	0.00	0.00	0.00	0.00
1.A.3.a.i - International Aviation (International Bunkers)	917.57	0.01	0.03				
1.A.3.d.i - International water-borne navigation (International bunkers)	1,060.91	0.10	0.03				
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 4: Land Use Conversion Matrix

Area Entry Table | Land-Use Conversion Matrix | Annual increase in carbon stocks in biomass | Loss of carbon from wood removals | Loss of carbon from fuelwood removals | Loss of carbon from disturbance | Annual carbon loss from drained organic soils

Worksheet

Sector: Agriculture, Forestry and Other Land Use
Category: 3.B.1.a - Forest land Remaining Forest land
Sheet: Land-Use Conversion Matrix

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Data

View Area Entry Table

Initial		Forest Land						Cropland		Grassland		Wetlands		Settlements	Other Land			
	Final	Forest TD LAC	Forest TD SAN	Forest TMs LAC	Forest TW HAC	Rodrigues Forest TD SAN	Unmanaged	Crops TMs LAC	Crops TW HAC	Grass TW HAC	Unmanaged	Wetland TW HAC	Unmanaged	Settlements TD SAN	Other land TD SAN	Other land TW HAC	Unmanaged	Final Area
Forest Land	Forest TD LAC	1064																1064
	Forest TD SAN		20839											0	0			20839
	Forest TMs LAC			6399				0										6399
	Forest TW HAC				28327				0	0		0				0		28327
	Rodrigues Forest TD SAN					4000												4000
	Unmanaged						0											0
Cropland	Crops TMs LAC			0				45158										45158
	Crops TW HAC				0	0			45137	0		0				0		45137
Grassland	Grass TW HAC				0				0	1779		0				0		1779
	Unmanaged										0							0
Wetlands	Wetland TW HAC				0				0	0		3690				0		3690
	Unmanaged												0					0
Settlements	Settlements TD SAN		0											2879	0			2879
Other Land	Other land TD SAN		0											0	12258			12258
	Other land TW HAC				0	0			0	0		0				15010		15010
	Unmanaged																0	0
	Initial Area	1064	20839	6399	28327	4000	0	45158	45137	1779	0	3690	0	2879	12258	15010	0	186540
	Net Change	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Land Type Manager

Appendix 5: QC Category-specific Procedures

Table 160. QC Procedures

Nº	QC Activity	Procedures	Task Completed		Corrective Measure Taken	
			Name/ Initials	**Date**	**Supporting Documents (List Document Name)**	**Date**
1	Assess the applicability of IPCC default factors	● Evaluate whether national conditions are similar to those used to develop the IPCC default factors ● Compare default factors to site or plant-level factors ● Consider options for obtaining country-specific factors ● Document results of this assessment				
2	Review measurements	● Determine if national or international (e.g. ISO) standards were used in measurements ● Ensure measurement equipment is calibrated and maintained properly ● Compare direct measurements with estimates using a factor; document any significant discrepancies				
3	Check that parameters and units are correctly recorded and that appropriate conversion factors are used.	● Check that units are properly labelled in calculation sheets. ● Check that units are correctly carried through from beginning to end of calculations. ● Check that conversion factors are correct. ● Check that temporal and spatial adjustment factors are used correctly.				
4	Check the integrity of database files.	Examine the included intrinsic documentation to: ● Confirm that the appropriate data processing steps are correctly represented in the database; ● Confirm that data relationships are correctly represented in the database; ● Ensure that data fields are properly labelled and have the correct design specifications; ● Ensure that adequate documentation of database and model structure and operation are archived.				
5	Check for consistency in data between	Identify parameters (e.g. activity data. constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emission/removal				

	categories.	calculations.				
6	Check that the inventory data among processing steps is correct.	• Check that emissions and removals data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries • Check that emissions and removals data are correctly transcribed between different intermediate products.				
7	Check completeness.	• Confirm that estimates are reported for all categories and for all years from the appropriate base year to the period of the current inventory. • For subcategories. confirm that entire category is being covered. • Provide clear definition of „Other" type categories. • Check that known data gaps that result in incomplete estimates are documented. including a qualitative evaluation of the importance of the estimate in relation to total emissions				
8	QC uncertainty estimates	• Apply QC techniques to uncertainty estimates • Review uncertainty calculations • Document uncertainty assumptions and qualifications of any experts consulted				

Appendix 6: Quality Assurance Procedures

Following is the checklist used by the external expert to review the whole process of GHG inventory.

Table 161. Cross-Cutting Checks for Overall Inventory Quality

Activities	Task Completed		Recommendation
	Findings	**Date**	
1.Emission Calculations Across GHG Emission and Removal Categories			
Identify parameters that are common across categories (e.g. conversion factors. carbon content coefficients. etc.) and check for consistency			
Check that using same data inputs (e.g. animal population data) report comparable values (i.e. analogous in magnitude)			
Check across categories that same electronic data set is used for common data (e.g. linking animal population data to the enteric fermentation and manure management calculations)			
Check that the number of significant digits or decimal places for common parameters. conversion factors. emission factors. or activity data is consistent across categories			
Check that total emissions are reported consistently (in terms of significant digits or decimal places) across categories			
Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels			
Other (specify):			
2. Documentation			
Check if internal documentation practices are consistent across categories			
Other (specify):			
3. Completeness			
Check for completeness across categories and years			
Check that data gaps are identified and reported as required			
Compare current national inventory estimates with previous years			
Other (specify):			
4. Maintaining Master Inventory File: Spreadsheets and Inventory Document			
Have file control procedures been followed?			
Other (specify):			

Table 162. Detailed Checklist for Inventory Document

Activities	Task Completed		Recommendation
	Findings	**Date**	
1. Front Section			
Cover page has correct date. title. and contact address			
Tables of contents/tables/figures are accurate: titles match document. page #s match; numbers run consecutively and have correct punctuation			
The Executive Summary and Introduction are updated with appropriate years and discussion of trends			
Other (specify):			
2. Tables and Figures			
All numbers in tables match numbers in spreadsheets			
Check that all tables have correct number of significant digits			
Check alignment in columns and labels			
Check that table formatting is consistent			
Check that all figures are updated with new data and referenced in the text			
Check table and figure titles for accuracy and consistency with content			
Other (specify):			
3. Equations			
Check for consistency in equations			
Check that variables used in equations are defined following the equation			
Other (specify):			
4. References			
Check consistency of references. and that in text citations and references match			
Other (specify):			
5. General Format			
All fonts in text. headings. titles. and subheadings are consistent			
All highlighting. notes. and comments are removed from document			
Size. style. and indenting of bullets are consistent			
Spell check is complete			
Other (specify):			
6. Other Issues			
Check that each section is updated with current year (or most recent year that inventory report includes)			
Other (specify):			