Republic of Mauritius

First Biennial Update Report (BUR1) to the United Nations Framework Convention on Climate Change

Ministry of Environment, Solid Waste Management and Climate Change

December 2021

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Foreword

The Republic of Mauritius is pleased to submit its First Biennial Update Report (BUR), despite the prevailing COVID-19 pandemic context, in fulfilment to its reporting requirements under Articles 4 and 12 to the United Nations Framework Convention on Climate Change.

Climate Change is a high priority issue on the Government agenda. Since the ratification of the Paris Agreement in 2016, Government has strengthened its multipronged approach towards enhancing climate change resilience and promoting a low carbon emission economy to achieve carbon neutrality by 2070.

The Government Programme 2020-2024 as well as the Mauritius Vision 2030, have put much emphasis on building a climate change resilient nation and have left no stone unturned to meet adaptation and mitigation objectives, in compliance with relevant obligations of climate related Multilateral Environmental Agreements.

In addition, besides promulgation of a series of climate-related legislation to support climate change mainstreaming across key sectors, Government has come up with a Climate Change Act 2020 which entered into force in April 2021. This legislative framework will support the mainstreaming and effective coordination of the climate change issues at the highest level. An Inter-Ministerial Council on Climate Change chaired by the Prime Minister will set national objectives, goals and targets with a view to making Mauritius a climate change-resilient and low emission country.

Over the past 5 years, the Government has mobilised considerable resources to support its climate change agenda. From financial perspective for the period 2016 to 2021, grant funding to the tune of USD around 90 M has been received. Since 2018, a special financial portfolio known as the National Environment and Climate Change Fund (NEF) has been set up to provide a budget of around Rs 2 billion (USD 50 M) on a yearly basis to support sectors such as flood management, coastal zone protection and disaster risk reduction measures.

It has also been estimated by the Public Environment Expenditure Review published in 2018 that Mauritius is spending the equivalent to 2% of its GDP (around USD 265 M) on environment and climate change related measures. The financial needs have been estimated to be USD 6.5 billion out of which 35% (USD 2.3 billion) was contributed from Government sources and the private sector. According the UN 'SIDS in Numbers Report 2017', it is estimated that in order to address impacts on *Small Island Developing States,* 15% of GDP would be required.

Our climate change agenda will be geared towards the implementation of measures listed under our Nationally Determined Contributions (NDC) which has been reviewed this year. In 2015, the first Mauritius NDC has pledged to achieve greenhouse gas emissions reduction of 30% by 2030 relative to the business-as-usual scenario. It was estimated that the implementation of our NDC would require the mobilisation of USD 5.5 billion, with USD 4 billion only for the adaptation measures. As per the updated 2021 NDC and based on current projections, Mauritius aims to reduce overall GHG emissions by 40% in 2030 compared to the Business-as-Usual scenario. Therefore, the reviewed NDC is more ambitious and would require more funding for implementation of measures and targets. Therefore, the implementation will be highly

dependent on the means of implementation which would be made available by developed country Parties of the UNFCCC and multilateral donor agencies.

The Republic of Mauritius remains committed to working constructively domestically and internationally to respond to the global challenge of climate change. It is in this context, that the Republic of Mauritius is pleased to present the First Biennial Update Report to the United Nations Framework Convention on Climate Change (UNFCCC), which follows on from its Third National Communication (2017).

Acknowledgements

The Government of Mauritius is very appreciative of all the financial and technical support that the Global Environment Facility and the United Nations Environment Programme have extended for the preparation of this First Biennial Update Report of the Republic of Mauritius. The Government of Mauritius would also like to thank and acknowledge stakeholders from the public sector, private sector and the academia for their assistance with data provision and development of the report.

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Acronyms and Abbreviations

AAP	Africa Adaptation Programme
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
AR4	Fourth Assessment Report
BAU	Business as Usual
BESS	Battery Energy Storage System
BUR	Biennial Update Report
CCIC	Climate Change Information Centre
CDM	Clean Development Mechanism
CEB	Central Electricity Board
CER	Certified Emission Reduction
CPEIR	Climate public expenditure and institutional review
DOWA	Deep Ocean Water Application
EE	Energy Efficiency
EEBCCS	Energy Efficiency Building Code Compliance Scheme
EF	Emission Factor
EST	Environmentally Sound Technologies
FAREI	Food and Agricultural Research & Extension Institute
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GNI	Gross National Income
GVA	Gross Value Added
GWP	Global Warming Potential
ICT	Information and Communication Technology
ICZM	Integrated Coastal Zone Management
IEF	Implicit Emission Factor
IOC	Indian Ocean Commission
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IPPs	Independent Power Producers
IPPU	Industrial Processes and Product Use
JCA	Japan International Cooperation Agency
LNG	Liquified Natural Gas
LPG	Liquid Petroleum Gas

LTO	Landing and Take-Offs
LULUCF	Land Use, Land-Use Change and Forestry
MIC	Upper-middle-income Country
MoESWMCC	Ministry of Environment, Solid Waste Management and Climate Change
MEPU	Ministry of Energy and Public Utilities
MRC	Mauritius Research Council
MRV	Measurement, Reporting and Verification
MSDG	Medium-Scale Distributed Generation
MUR	Mauritian Rupee
NAI	National Accounts and Investment
NAMA	Nationally Appropriate Mitigation Action
NCV	Net Calorific Value
NDC	Nationally Determined Contributions
NDRRMC	National Disaster Risk Reduction and Management Centre
NIR	National Inventory Report
NIS	National Inventory System
Non-Annex I	Parties not included in Annex I to the United Nations Framework Convention on Climate Change
NLTA	National Land Transport Authority
ODS	Ozone Depleting Substances
OEP	Outline Energy Policy
PV	Photovoltaic
QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RCMRD	Regional Centre for Mapping of Resources for Development
RE	Renewable Energy
RoM	Republic of Mauritius
SIDS	Small Island Development States
SLM	Sustainable Land Management
TAP	Technology Action Plans
TEU	Twenty-foot Equivalent Unit
TNA	Technology Needs Assessment
TNC	Third National Communication
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WB	World Bank
WTE	Waste-to-Energy

Executive Summary

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Executive Summary

E1. Introduction

The Republic of Mauritius (RoM) is among the first countries to ratify the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, followed by the Kyoto Protocol in 2001 and the Paris Agreement in 2016, thereby demonstrating its willingness to be part of the global community to address the challenges faced by climate change.

The first Biennial Update Report of the RoM has been prepared in line with decision 2/CP17 of the UNFCCC and provides an update to the Third National Communication submitted to the UNFCCC Secretariat in January 2017.

E2. National Circumstances

Located in the South West of the Indian Ocean, the Republic of Mauritius is a Small Island Developing State (SIDS) which 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 comprising the State of Mauritius. The RoM has an Exclusive Economic Zone (EEZ) of approximately 2.3 million km^2 (**Figure E.1**). It also shares a joint jurisdiction with the Republic of Seychelles over an extended continental shelf area of about 400, 000 km^2 in the Mascarene Plateau region.

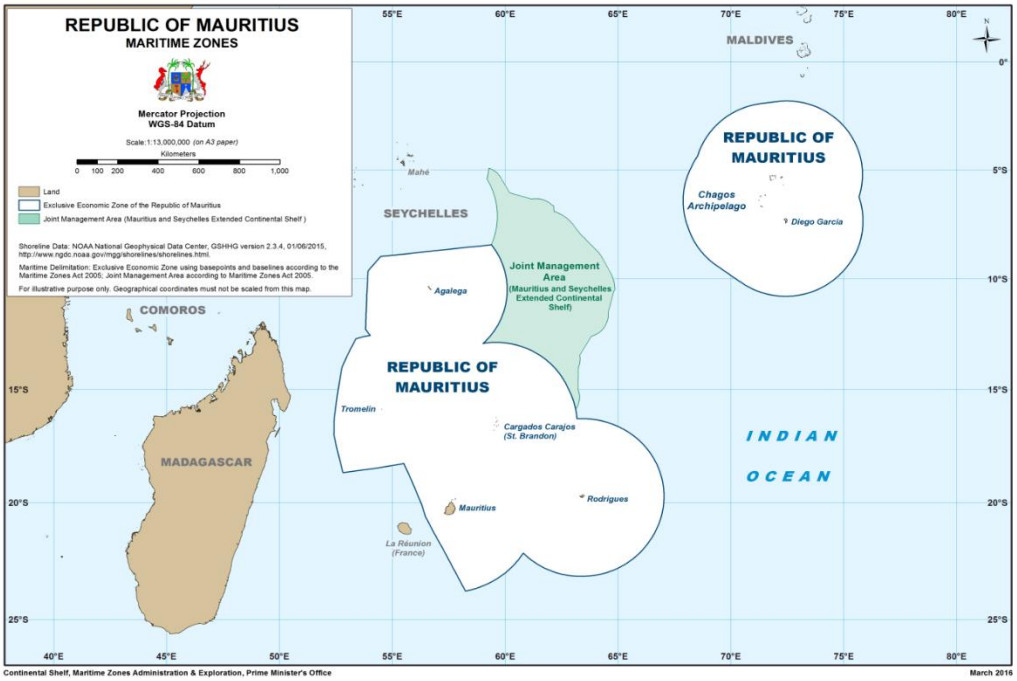


Figure E.1: Maritime Zone map of the Republic of Mauritius

(Source: Continental Shelf, Maritime Zones Administration & Exploration)

Some facts and figures on the Republic of Mauritius is given in Table E.1

Table E.1: Republic of Mauritius at a glance (dashboard)

Country	Republic of Mauritius
Government	Unicameral, Westminster system, Head of the Republic is the President. Executive powers rest with the Prime Minister and cabinet ministers. Rodrigues Island is autonomous and governed by the Chief Commissioner and other Commissioners.
Location, Coordinates	Western Indian Ocean, 20.3484 ^{o}S, 57.5522 ^{o}E
Constitution	Independence: 12 March 1968; Republic Status: 12 March 1992
Total Area	Land Area: 2,040 km^2, EEZ: 2.3 million km^2
Population (2019)	Island of Mauritius: 1,222,340; Island of Rodrigues: 43,371; Agalega & St. Brandon: 274
Economy	Upper middle income status with total GDP of $31.705 billion and GDP per capita of $25,029 (2019) Tourism, Financial and ICT sectors led economy
Other socio-economic parameters	Human Development Index (HDI) for 2019 – 0.804 Mauritius is a welfare state with, *inter alia*, free health service, free education up to tertiary level, universal pension for all over 60 years, minimum wage, negative income tax, free public transport for over 60 years, disabled persons and for students, a Carers Allowance for those looking after the disabled.
Forest area (2020)	47,011ha
Annual fresh water abstraction	595 Mm^3
Daily per capita domestic water consumption	181 litres
Daily per capita solid waste disposal at landfill	1.20 kg
Energy mix (2019)	Total electricity generated was 3236.6 GWh. The main energy source was fuel oil and diesel (41.7%), followed by coal (36.3%) and renewable sources (21.7%). Electricity generation from renewable sources: 13.6% Bagasse, 4.0% Photovoltaic, 3.0% Hydro, 0.6% landfill gas and 0.5% wind
National Total GHG Emission (excluding Forestry and Other Land Use) (2016)	5,211.06 Gg carbon dioxide equivalent (CO_2-eq)
Climate	Mild tropical maritime climate, with warm humid summers, and cool, dry winters. Mean annual rainfall (2019): 2, 130 mm Mean annual temperature (2019): 24.5 °C

As a SIDS, Mauritius is highly vulnerable to the impacts of climate change. In fact, the *2021 World Risk Report* had ranked Mauritius as the 51st country with the highest disaster risk among 181 countries. Key

economic sectors such as agriculture, fisheries, tourism and water are all being impacted. The figure below (Figure E.2) summarises the dominant climate change impacts in the country.

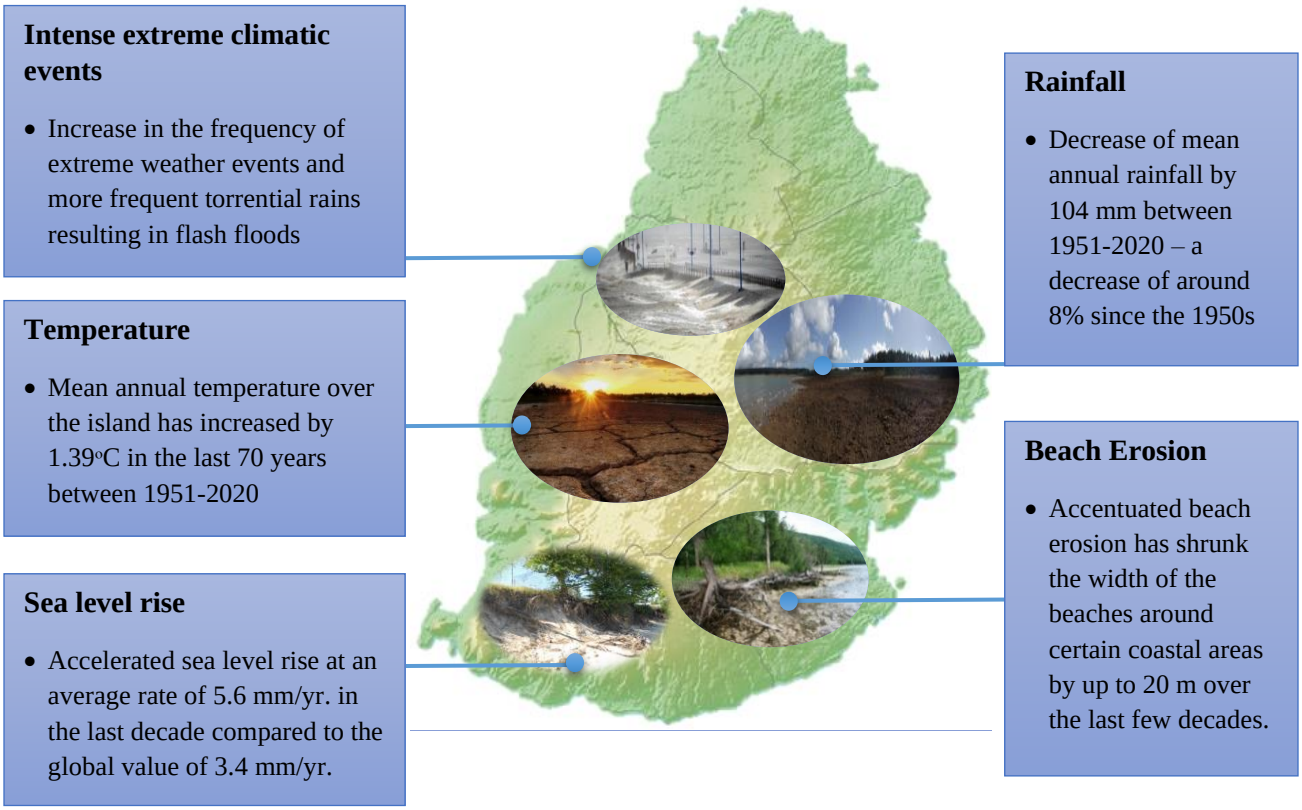


Figure E.2: Climate change impacts in key areas

Climate change trends at Rodrigues

Mean annual temperature at Rodrigues has warmed up by about 1.41°C over the last 70 years (1951-2020), compared to the base period 1961-1990, that is, average temperature at all stations is rising at the rate of about 0.20 °C per decade.

Rainfall trend at Rodrigues shows a decrease of 3.9 mm/year over the last 60 years (1961-2020).

Based on analysis of tide gauge data at Port Mathurin, sea level at Rodrigues has risen by 5.6 mm/yr for the period 1987 – 2020. (Source: Mauritius Meteorological Services)

In the wake of worsening climate change, RoM has developed a number of policy and legislative measures to strengthen the resilience to climate change impacts and engage on a low emission pathway. Some of the key legislative and policy measures set in place are as follows:

(i) Energy Efficiency Act 2011

(ii) Mauritius Renewable Energy Agency Act 2015

(iii) National Disasters Scheme (NDS) 2015
(iv) National Disaster Risk Reduction and Management Act 2016
(v) Marine Spatial Planning 2016
(vi) Land Drainage Authority Act 2017
(vii) Local Government (Amendment) Act 2018
(viii) Renewable Energy Strategic Plan (RESP) 2018-2023
(ix) Mauritius Meteorological Services Act 2019
(x) Renewable Energy Roadmap 2030 for the Electricity Sector in 2019 (under review)
(xi) 10 Year Electric Vehicle (EV) Integration Roadmap for Mauritius 2020
(xii) Updated Nationally Determined Contributions 2021

In an attempt to enhance climate change mainstreaming across key sectors, the Government has promulgated the Climate Change Act in November 2020. This legislative framework will support the mainstreaming and effective coordination of the climate change issues at the highest level. Further to the coming into force of the Climate Change Act on 22 April 2021, a dedicated Climate Change Department has been set up and an Inter-ministerial Council chaired by the Prime Minister has also been provided under this legislation.

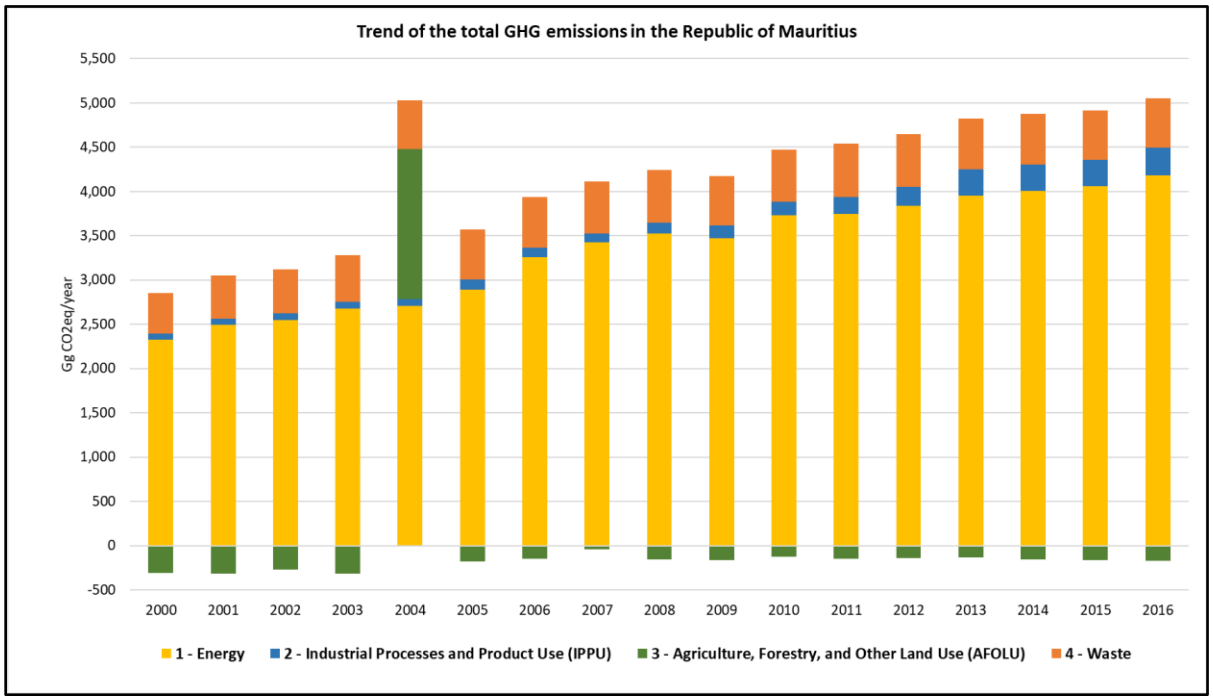
E3. National Greenhouse Gas Inventory

The Greenhouse Gas (GHG) Inventory covered the period 2000 to 2016 and the methodology adopted for the inventory was based on the principles of the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories. The GHG inventory was divided into four main sectors, namely, the energy sector (which includes the power generation, transport, manufacturing industries and construction); Industrial Processes and Product Use (IPPU); waste sector (solid and liquid); and Agriculture, Forestry and Other Land Use (AFOLU). The emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) as well as other minor gases were considered. The key findings are as follows:

- Total GHG emissions (excluding the LULUCF sector) in 2016 stood at 5,211.06 Gg CO_2eq, as compared to 3,000.34 Gg CO_2eq in 2000 representing an increase of 73.7%
- Total amount of net GHG emissions for 2016 was 4,881.36 Gg CO_2eq, as compared to 2,542.89 Gg CO_2eq in 2000 representing an increase of 92.0%
- Net GHG removal for 2016 was -171.62 Gg CO_2eq compared to -311.39 Gg CO_2eq in 2000 representing a decrease of 44.9%.

E3.1 Emission trend by sector

The Energy sector remains the biggest emitter of GHG emissions, amounting to 80.26% of overall GHG emissions of the country (4,182.62 Gg CO_2eq) in 2016 followed by the Waste sector with 10.73% of the total emissions (559.18 Gg CO_2eq). The Industrial Processes and Products Use (IPPU) contributed 5.97% to the total emissions (311.18 Gg CO_2eq) while the Agriculture sector represented 3.03% of the total emissions (158.08 Gg CO_2eq) in 2016.



***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 E.3: Total GHG Emissions by Sector from 2000 to 2016 (Gg CO2eq)

E3.1.1 Energy sector

The biggest emitter of the Energy sector corresponds to the Energy Industries category, representing the 57.9% of the total emissions in the sector in the year 2016 (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 (1,169.30 Gg CO_2eq), the Manufacturing Industries and Construction represent the 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 by 2016.

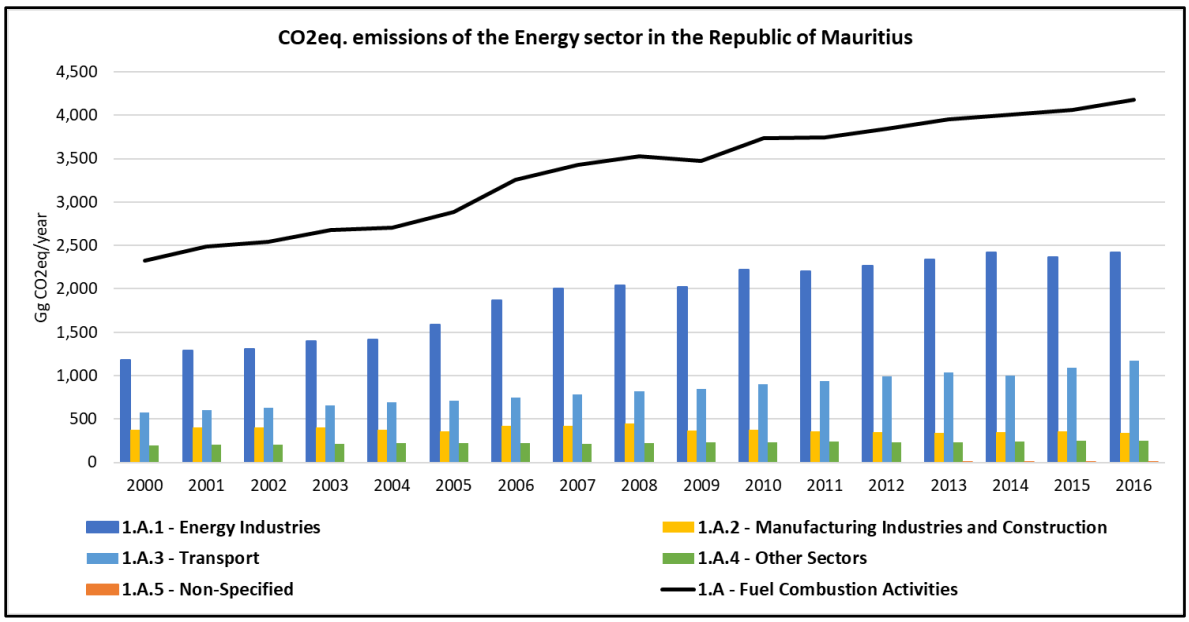


Figure E.4: GHG Emissions from Energy Sector 2000 – 2016 (Gg CO2eq)

E3.1.2 IPPU sector

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 refrigeration and air-conditioning (both stationary and mobile).

GHG emissions from this sector have increased 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 contribute to the increase of the emissions in the last 10 years is the product uses 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 sector in 2016, corresponding to the Refrigeration and Air conditioning category, stationary and mobile.

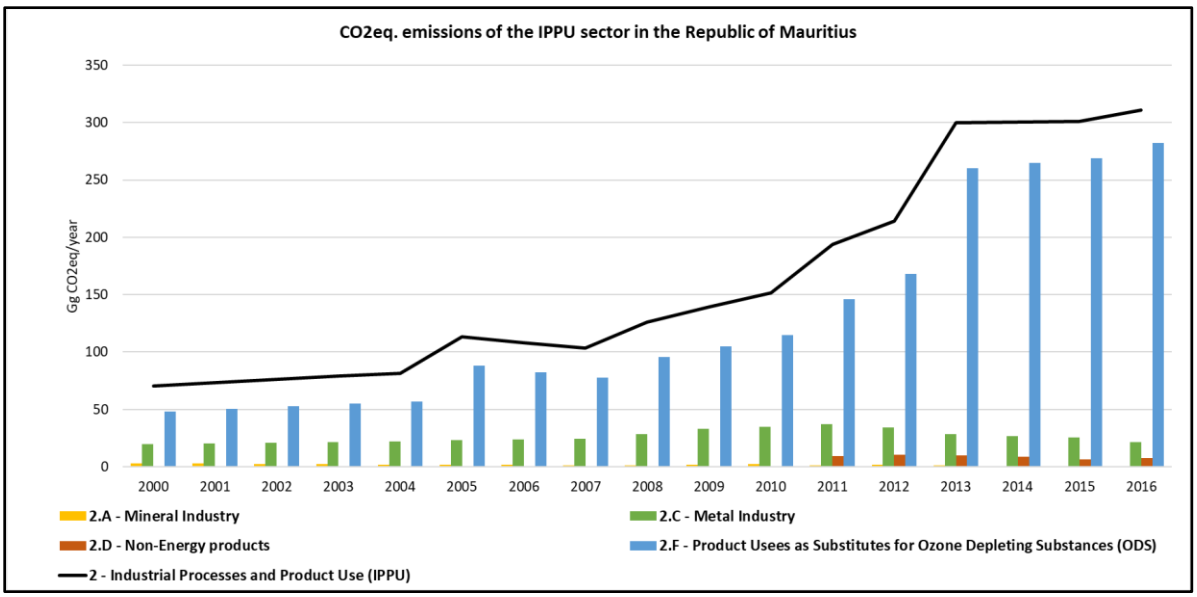


Figure E.5: GHG Emissions from IPPU Sector, 2000 – 2016 (Gg CO2eq/year)

E3.1.3 AFOLU sector

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 present 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 contributes to the remaining 23.74 % in 2016 (37.53 Gg CO_2eq).

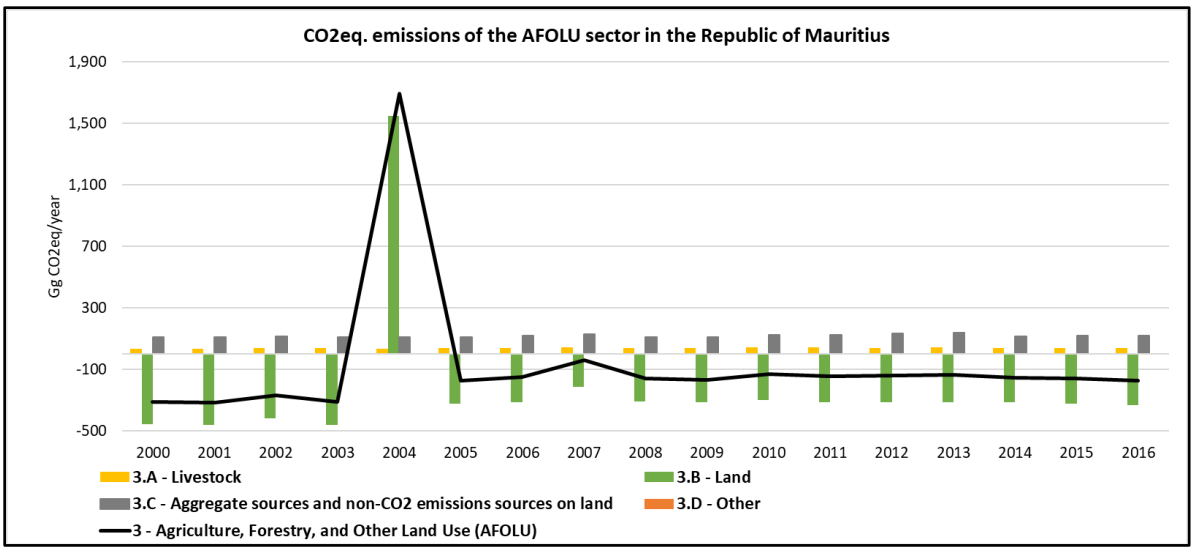


Figure E.6: GHG Emissions from AFOLU Sector, 2000 – 2016 (Gg CO2eq/year)

E3.1.4 Waste sector

GHG emissions from the waste sector increased from 460.81 GgCO_2eq in 2000 to 559.18 Gg CO_2eq in 2016, representing an increase of 21.3%. The most representative category in terms of emissions is the solid waste disposal representing 66.11% of the total Waste sector emissions in 2016 (369.68 Gg CO_2eq). On the other hand, the Wastewater treatment and discharge contributed to 32.67% of the total waste emissions (182.70 Gg CO_2eq in 2016), followed by emissions from the biological treatment of solid waste which corresponded to the 1.09% of the total emissions of the Waste sector (6.07 Gg CO_2eq in 2016) and lastly, the incineration and open burning of waste represented 0.13% of the total emissions of the sector in 2016 (0.74 Gg CO_2eq).

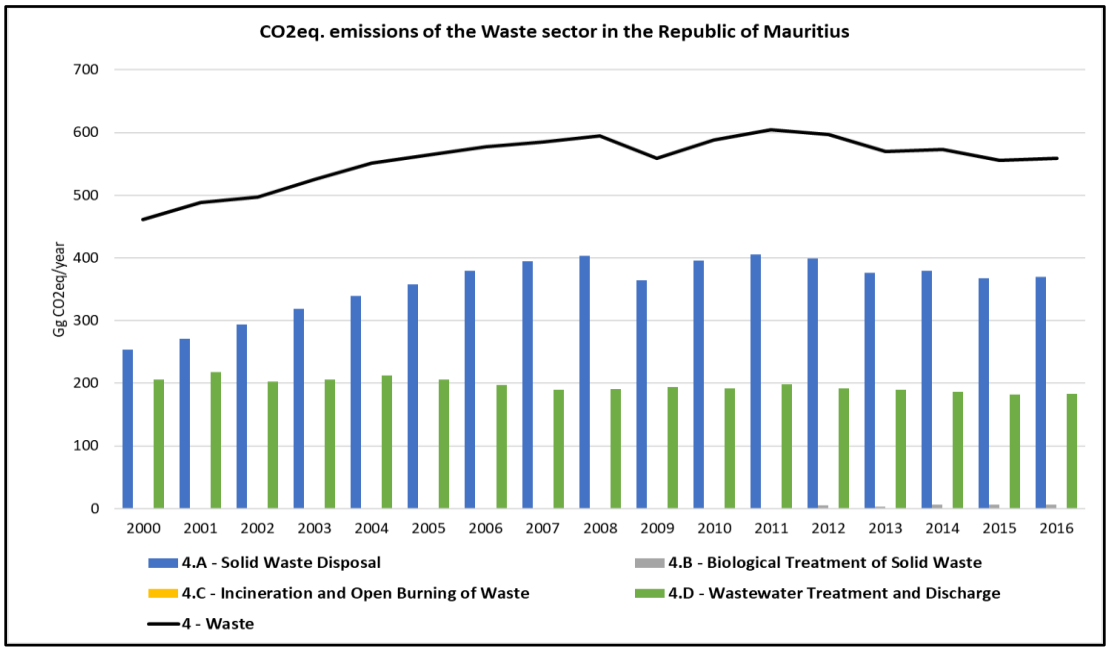


Figure E.7: GHG Emissions from Waste Sector, 2000 – 2016 (Gg CO2eq/year)

E4. Mitigation Actions and their Effects

As per the updated 2021 NDC and based on current projections, Mauritius aims to reduce overall GHG emissions by 40% in 2030 compared to Business as Usual (BAU) (equivalent to 2,893 ktCO2eq of avoided emissions). Compared to the 2015 INDC target of 30% GHG emissions reduction and in view of its national circumstances, the mitigation ambition of Mauritius is significantly enhanced.

This chapter describes the major mitigation actions that are under implementation in the energy, transport, waste and AFOLU sectors. The table below summarizes information on mitigation actions and their respective targets.

Table E.2: Information on mitigation actions for Mauritius

Mitigation Action	Sector	Quantitative targets (both GHG-related and non-GHG impacts)	Status
Accelerating the transformational shift to a low-carbon economy in the Republic of Mauritius	Energy	Reduction in greenhouse gas emissions of 4.27 million tCO2e over the lifetimes of the investments enabled	Under implementation
Mandatory energy labelling	Energy	Reduce energy consumption in households through a shift to more energy efficient appliances by 2030.	Under implementation
Modal shift to a mass transport system (Light Rail)	Transport	20% of bus commuters and 10% of personal vehicle users are expected to switch to using the LRT Metro Express system thereby reducing traffic congestion and carbon emission.	Under implementation
Standards for treated manure from animal waste	Agriculture	GHG emission reduction by around 20% of total accounted for by manure management.	Under implementation
Promotion of small species livestock projects at back yard level	Agriculture	GHG emission reduction by around 1-5% of the total livestock emission	Under implementation
Tree planting and Creation and maintenance of mini-forest, Nature Walk, urban forests, Parks and Garden, etc	FOLU	Planting of at least 100,000 trees annually (until 2024)	Under implementation
Forest restoration - Nature Reserves, Mountain, River Reserves, forest plantation	FOLU	75 ha of mountain reserves restored by 2030	Under implementation

Strategy and Action Plan for a new Solid Waste Management and Resource Recovery System for Mauritius	Waste	Not estimated. To be assessed during design and/or implementation phase of specific projects	Under implementation
Model Eco Village project Implementing a biomass to electricity chain in Rodrigues Island (Mauritius)	Energy	To be assessed during implementation phase	Under implementation

E5. Gaps and Constraints and Related Financial, Technical and Capacity Needs, including Support Needed and Received

Several pressing constraints and gaps and the related financial, technical, and capacity needs including support needed and received were identified, particularly with regards to GHG Inventory, MRV and mitigation sectors. ***Table E.3*** summarises the most pressing gaps and needs identified under the BUR 1, and the proposed recommendations.

Table E.3: Gap and constraints identified under BUR 1

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
GHG inventory	• Lack of Emission Factors to better represent national circumstances and provide for more accurate estimates even if this has started to be addressed for some key categories • No institution has yet been endorsed with the responsibility for collection of specific Activity Data needed for the estimation of emissions according to the IPCC on an annual basis • Some of the Activity Data archived are still not yet in the required format for feeding in the software to make the emission estimates • National experts are not yet ready to take over the full inventory compilation process which dictated the collaboration of Consultants	• Enhance capacity of researchers and relevant stakeholders as well as provide better laboratory facilities or collaborate with regional institutions and labs on determination of country specific emission factors • There is a need to institutionalize the GHG Inventory process
MRV	• Inadequacy of the present institutional arrangements for the components of the MRV system	• Existing institutional arrangements will have to be constantly reviewed,

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
	• No formal agreement between institutions and coordinating body to ensure a regular and smooth data transfer • There is no completed formal recording system for tracking mitigation actions within the institutions to report efficiently about the status and progress of activities implemented • There is no centralized database for data archiving by relevant institutions	strengthened and/or even initiated if still inexistent • Institutional arrangement also needs to be formalised to ensure ongoing and sustainable domestic MRV • The development and implementation of the proposed MRV system will demand for additional staff or a review of work structure within the Department of Climate Change and other institutions • Data structuring should be aligned with a QA/QC system • There is a need to build technical capacity of the national team to establish the technical bases and transfer of knowledge required for the design and implementation of the MRV system

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
Energy	• Inadequate energy audit exercises. However, to note that mandatory energy audits in private sector has been launched in January 2021. • Limited capacity for Grid Storage System as well as to accommodate more small power producer • Lack of projected data on energy demand and its impact on fossil fuel and RE requirement • The intermittency of RE electricity poses a challenge in terms of controlling and stabilising the frequency of the electricity grid, particularly to cater for any sudden fall in power output. This may impose a limit on the extent of intermittent RE absorption in the grid, even if batteries are being deployed to mitigate the problem • Mauritius has limited access to cleaner energy sources. Although Mauritius is endowed with sunshine and wind, there is a limitation in terms of availability of land for implementation of large-scale PV and wind farms. An offshore wind farm may be contemplated; however, there is lack of technology transfer. Financial resources are also a major constraint for the implementation and management of RE projects	• Training of Energy Auditors and enforcement of EE • Create enabling environment for IPP to move gradually to more renewable sources of energy, as per the Energy Outlook policy • Technology transfer on development of clean energy required
Transport	• Lack of EE data in relation to mass transport system, hybrid technologies, electric cars, compared to traditional transportation system	• Conduct EE studies in relation to green transportation system.
Industrial Processes and Product Use (IPPU)	• Non availability of a supply chain for certain type of natural refrigerants • Difficulty to certify local experienced technicians on new natural refrigerant technology	• Need to give a legal status to the Mauritian ISO standard on safety of refrigerants • Regulation on control of import of HFCs required

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
		• Technology transfer on ammonia, carbon dioxide and hydrocarbon as refrigerants
Forests	• No updated land use maps, soil maps and climate maps available to support the GHG inventory • No data on age distribution for natural forest including mountain reserves • No data for private forests	• Refine inventory system through the development of updated land use maps using IPCC categories • Acquire high resolution satellite imagery with near infrared band for Mauritius to undertake survey of private forests and accurate calculation of carbon sinks;
Agriculture	• Lack of trained staff on techniques for mitigation analysis and quantification of GHG emission reduction • No updated land cover maps and land acreage data under food crops, tea and fruits • The potential of GHG sequestration in tea plantation and orchards have not been adequately accounted for in the GHG inventory. No data available on fruit trees not bearing fruits and non-fruit trees as well as on age and species • No data on amount of fertilizer application in golf courses • Lack of country specific emission factors • Limited policies on climate smart agriculture.	• Capacity building on mitigation analysis and quantification of GHG emission • Update land cover maps and develop data collection strategy where there are data gaps • Capacity building on the development of country specific emission factors. • Develop and promote climate-smart agriculture (CSA) for crops and livestock in Mauritius, Rodrigues and Agalega based on policies and programmes for greater efficiency and coverage. • Further encourage the use of locally-produced organic compost, bio-fertilizers and organic fertilizers. • Enforcement of regulations to control the practice of burning agricultural residues to reduce CO2 emissions and to promote their conversion into composts. • Need to reactivate a National Remote Sensing Centre to generate plans, maps and tools inter alia for climate change analysis.

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
Solid Wastes	• Lack of data on industrial wastes • Lack of awareness on the suitability/viability of waste-to-energy technologies for Mauritius	• Setting-up of an industrial waste databank using the data collected from Industrial Waste Audit Reports under the Industrial Waste Audit Regulations 2008 • In-depth feasibility study concerning the appropriateness of waste-to-energy in Mauritius including the technical and financial viability, siting and design
Liquid Wastes	• Insufficient emissions data on treatment plants and extent of use, hence it is difficult to develop EFs • Absence of a real time flow monitoring system for sewers to obtain real time data and take remedial measures upfront • Limited areas connected to the sewage system • Use of renewable sources of energy has not been explored for the operation of wastewater treatment plants and pumping stations;	• Build human and institutional capacity to gather primary data and develop EFs; • Use renewable sources of energy to operate wastewater treatment plants and pumping stations; • Establish more sewage water treatment plants; • Develop and implement policies and legislation (e.g., all large industries and hotels should have a liquid treatment plant with approved disposal mechanism(s), followed by proper monitoring and inspection by local authorities).

E5.1 Financial Needs

E5.2 Domestic Public Funding

According to a study commissioned by the United Nations Development Programme Country Office (Tracking Public Sector Environmental Expenditure, 2018), an amount of Rs 10.28 billion was spent from the national budget on climate-related measures (77% on adaptation measures and 23% on mitigation measures), representing 2.15% of Gross Domestic Product (GDP) or 7.02 % of total Government expenditure.

In the 2021/2022 budget, Government has allocated Rs 2.2 billion for adaptation and mitigation projects under the National Environment Fund (NEF).

E5.2.1 Private Sector finance

Private sector invested in climate change mitigation namely in cane straw as an alternative source energy for power production. Other investments to be made by the private sector in climate change mitigation include recyclable paper and hybridisation projects with biomass and solar farm for power production have currently completed their feasibility study.

E5.2.2 Support received from International Donors

Mauritius has secured grants of the order of around USD 90 million over the period 2016-2021 from international funding agencies for the environmental sector. However, over time, Mauritius will need to mobilise much more funds to supplement public funding on environmental issues.

E5.2.3 Support required

In its updated 2021 NDC, the Government has indicated the need for international support to reach the mitigation and adaptation targets.

The total financial needs to reach the updated NDC targets are estimated at USD 6.5 billion. The total needs for implementing the mitigation and adaptation actions identified in the updated NDC are estimated respectively at 2 and 4.5 billion USD. The share for an unconditional contribution of USD 2.3 billion (from government and private sector) and a conditional amount of USD 4.2 billion represent 35 % and 65% respectively.

E6. Information on Support Received

Financial support for the preparation of the BUR was received from the Global Environment Facility (GEF) through UNEP as the implementing agency. This support received by Mauritius was timely and effectively and thus enabled the country to meet its reporting obligation. Alongside, capacity building and technical support were received in the preparation of BUR and these are summarized in the table below:

Table E.4: Capacity building and technical support received in the preparation of BUR

Project Component	Support Received	Source of support
MRV	Capacity building of 2 participants from Mauritius	Southern Africa Regional MRV Network
GHG Inventory	Waiving of Consultancy fee to the tune of USD 6 000 by the Regional Centre for Mapping Resource for Development (RCMRD) for a follow up Capacity Building Workshop on GIS, specifically on Geospatial Technique to assess Land Use, Land Use Change & Forestry.	Regional Centre of Mapping of Resources for Development

	To note that the request for waiving of consultancy fee was made by the Ministry of Housing and Lands, the focal point for RCMRD.	
Development of Country Specific Emission Factors for the crop sector	In-kind contribution by Food and Agricultural Research and Extension Institute (FAREI) for sampling across several regions of Mauritius. The samples were then oven-dried, packed, labelled and sent for required analyses. Note: Financial support for the analysis of plant samples for the determination of Emission Factor obtained under GEF.	Food and Agricultural Research and Extension Institute (FAREI)
Development of Country Specific Emission Factors for the solid waste sector	The Solid Waste Management Division of the Ministry provided cash contribution to the tune of Rs. 75, 600 for the payment of Consultancy services	Solid Waste Management Division

E7. Domestic MRV System

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.

a) MRV for GHG Inventory System

As Mauritius moves towards more frequent reporting, and the upcoming Fourth National Communication (FNC), there is a greater need for institutional continuity and systematic procedures, including deeper engagement with civil society and the private sector. There is a pressing need to build internal capacities

for data collection and GHG estimation to improve data supply and quality in the national GHG Inventory. Several improvements required for the GHG Inventory have been identified and elaborated.

One of the procedures to improve the GHG Inventory system is the development of a data archiving system to help make the national inventory transparent and reproducible and facilitates development of subsequent inventories by future inventory staff and category leads.

b) MRV of mitigation actions

As at date, there is no completed formal recording system for tracking mitigation actions within the RoM institutions, which would be used to report conveniently about the status and progress of activities implemented.

The RoM is working towards the development of a framework which ensures MRV approaches for individual mitigation actions and their effects while also tracking support received in implementing these actions.

c) MRV of support needed and support received

To ensure effective MRV of support needed and support received, the measurement dimension is important so that finance for project components that are not climate-relevant is not counted, while avoiding double counting.

Mauritius has some experience in measuring and reporting climate finance. In 2015, the Ministry of Finance implemented the Public Environment Expenditure Review (PEER) project which consisted of a preliminary estimate of Environment and climate change related expenditures from 2011 to 2014. Building on this report, in 2018, the Ministry of Finance, commissioned the report on "Tracking Public Sector Environment Expenditure" which focused on the tracking of public sector expenditure relating to environment, climate change, mitigation and adaptation for financial year 2017/18.

The templates produced during the above-mentioned studies may be used to further track climate finance. It is important to consider not only public but also private finance, at both domestic and international levels. The reporting should also include contributions to technology development and transfer and capacity building.
Avoiding double counting in reporting can be challenging and it is important to rely on strong accounting rules but also consider transparency as a means to enable a better understanding of the domestic MRV.

E8. Any Other Information Relevant to the BUR Process

Mauritius has also undertaken a collection of additional work (over and above that reported in Chapters 1 – 7) to address climate change in the country which includes:

Renewable Energy Programmes	The Government has announced the following key measures in the budget 2021/2022: • the production of 60 percent of our country's energy needs from green sources by 2030; and • the total phase out of coal before 2030; the updated 2021 Nationally Determined Contributions (NDC) depicted a reduction of 1188 ktCO2eq in GHG emissions by 2030 for phasing out of coal in the energy sector (all existing power plants with 100% coal).
Capacity Building Initiative for Transparency	The aim of the project is to improve the quality of the national GHG inventory and the data collection, storage and dissemination processes associated, thereby improving reporting and transparency and providing a firmer basis for evidence-based-policy-making.
Nationally Appropriate Mitigation Actions for Low Carbon Island Development Strategy for Mauritius (NAMA)	The NAMA project aims at ensuring a low carbon path for Mauritius and is in line with the *Government Programme 2020-2024* in pursuing efforts to make Mauritius a cleaner and greener country in the context of meaningful ecological transition.
Development of Country Specific Emission Factors (CSEFs)	Under the BUR-1 project, Country Specific Emission Factors have been developed for the crop and solid waste sectors to improve the accuracy of the GHG Inventory.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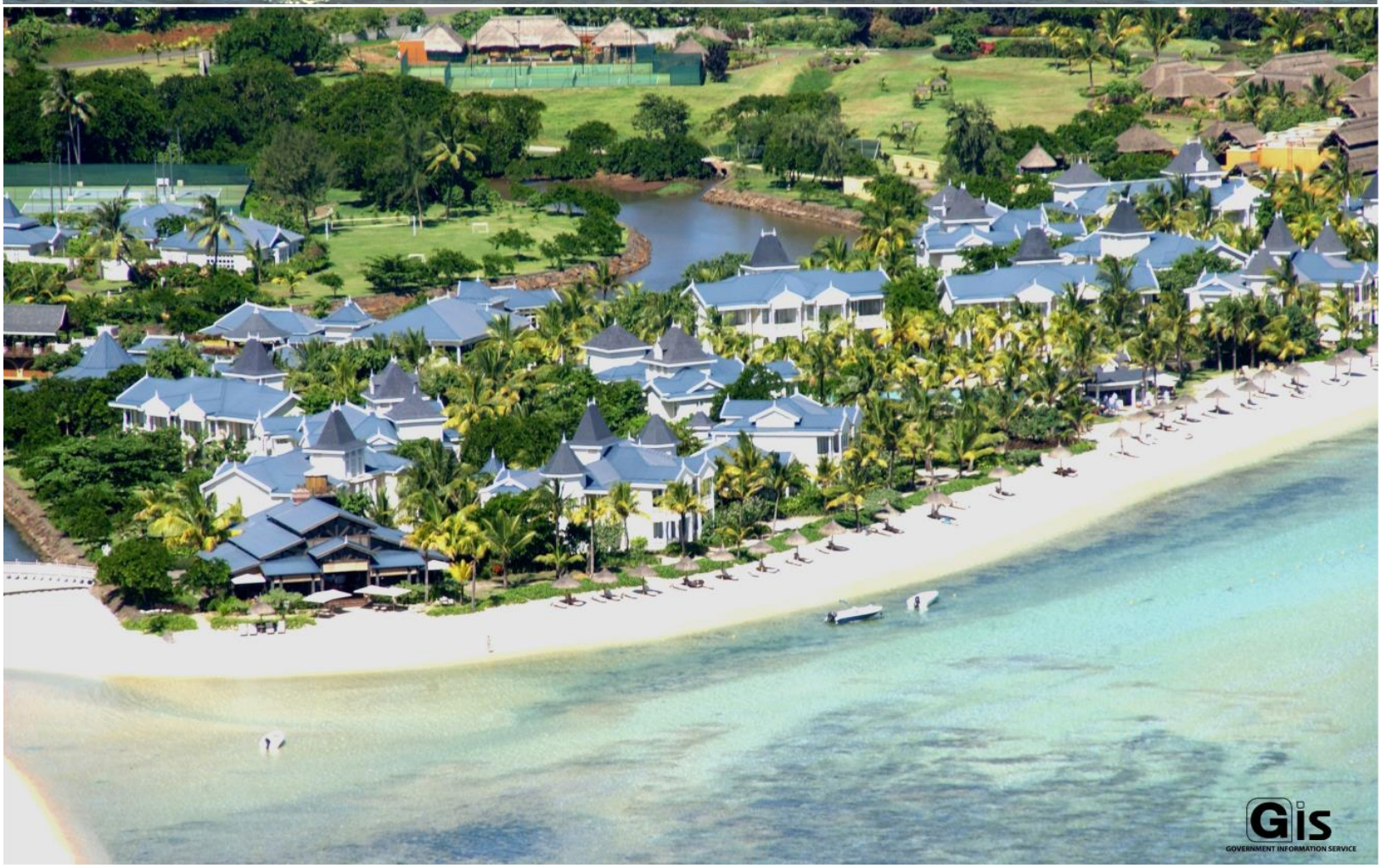
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Chapter 1
Introduction

Government House of Mauritius

1. Introduction

The Republic of Mauritius is among the first countries to ratify the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, followed by the Kyoto Protocol in 2001 and the Paris Agreement in 2016, recognising thus, the urgency for global climate effort.

In line with its reporting requirements under the UNFCCC, the Republic of Mauritius has prepared its first Biennial Update Report (BUR). BURs are National Reports to be submitted by non-Annex I Parties to the UNFCCC as per decision 2/CP.17, containing updates of national Greenhouse Gas (GHG) inventories, including a national inventory report and information on mitigation actions, needs and support received. The deadline for submission of the first BUR was December 2014 and every second year thereafter. However, in line with decisions adopted during COP 16, Mauritius being a SIDS has been given additional flexibility to submit BURs at its discretion.

The first BUR (BUR1) of the Republic of Mauritius provides an update to the Third National Communication which was submitted to the UNFCCC in January 2017. The BUR1 has been prepared in accordance with the required guidelines as a standalone report for submission to the UNFCCC secretariat by the end of 2021. Around 50 stakeholders from public institutions, private sectors and the academia were involved in the preparation of the BUR1. The report is structured as follows:

- Introduction – sets the scene and provides the background of the BUR1.
- National Circumstances and Institutional Arrangements – provides an overview of the existing status of the Republic of Mauritius with respect to climate change in the key sectors of the economy, as well as the legislations, policies and institutional set up.
- National Greenhouse Gas Inventory – presents the status of national emissions on a sectoral basis for the period 2000-2016.
- Mitigation Actions and their Effects – describes the range of mitigation actions taken and/or envisaged in the key sectors, and the economic and social consequences of the actions.
- Constraints and Gaps, and related financial, technical and capacity needs, including support needed and received – identifies technical support needs, capacity building support needs and financial support needs; and documents on the barriers, challenges and bottlenecks to access and mobilise technical assistance, capacity building support, and financial resources.
- Information on level of support received to enable preparation and submission of the BUR – outlines the financial resources, technology transfer, capacity building and technical support received from institutions for the preparation and submission of the BUR1.
- Domestic Measurement, Reporting and Verification (MRV) – provides an overview of the MRV implementation and prevailing status in the country as well as describes the proposed approach to be used for measurement and verification with respect to mitigation actions, inventory processes, support needed and received.

- Any other information relevant to the BUR process

Financial support for the preparation of the BUR1 was received from the Global Environment Facility (GEF) through the United Nations Environment Programme (UNEP) as the implementing agency.


COAST GUARD

Chapter 2
National Circumstances and Institutional Arrangements

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2 National Circumstances and Institutional Arrangements

2.1 Country Overview

The Republic of Mauritius 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 (**Figure 2.1**). It also shares joint jurisdiction with the Republic of Seychelles over an extended continental shelf area of about 400, 000 km^2 in the Mascarene Plateau region. On 22 May 2019, the UN General Assembly adopted resolution 73/295 which fully endorsed the determinations of the International Court of Justice (ICJ). By an overwhelming majority, UN Member States confirmed that the Chagos Archipelago is an integral part of the Republic of Mauritius.

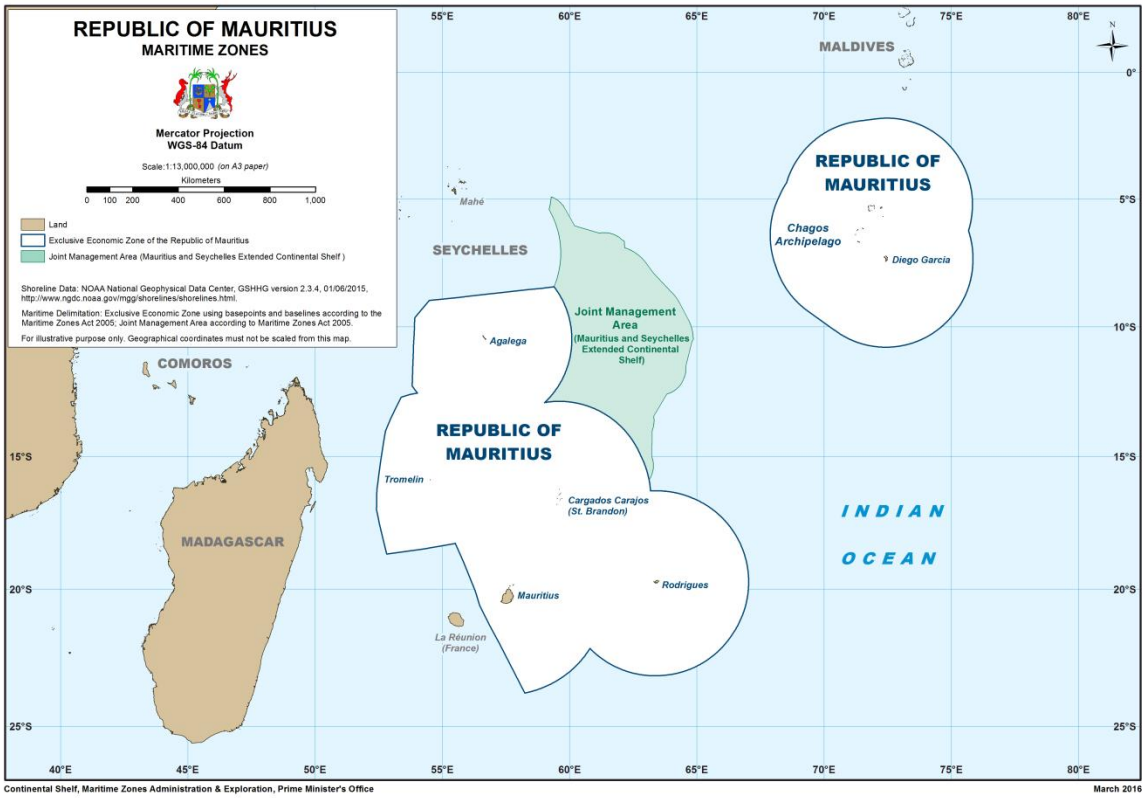


Figure 2.1: Maritime Zone map of the Republic of Mauritius

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 at 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 at 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.

The Cargados Carajos (St Brandon) is at approximately 400 km north of Mauritius, located between latitudes 16°14' and 16°51' south and longitudes 59°28' and 59°44' east.

Tromelin is at approximately 600 km to the north-west of Mauritius, located between latitudes 15°53' and 15°54' south and longitudes 54°31' and 54°32' east.

The Chagos Archipelago is at approximately 2,200 km to the north-east of Mauritius, located between latitudes 5° and 7°30' south and longitudes 71°10' and 72°30' east.

Table 2.1: Mauritius at a Glance (Dashboard)

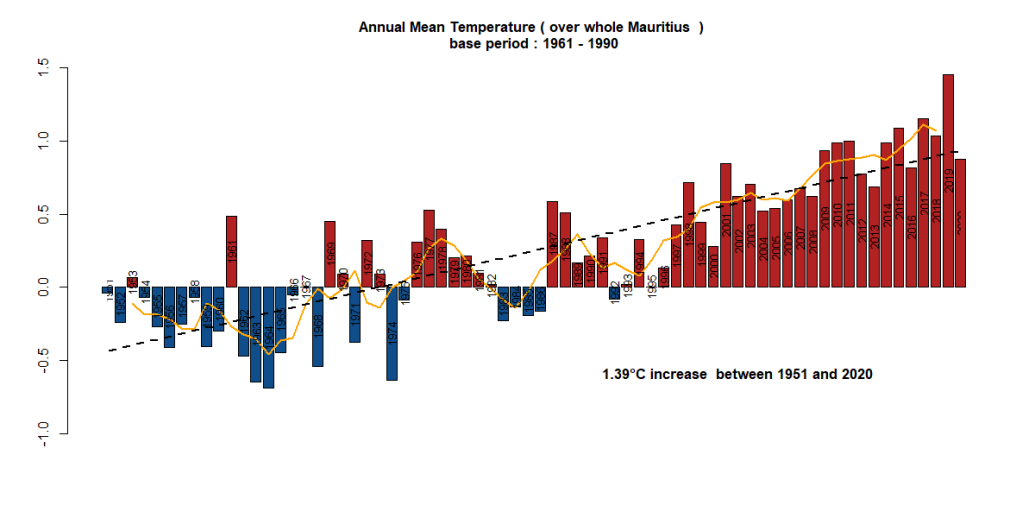
Country	Republic of Mauritius
Government	Unicameral, West Ministerial system, Head of the Republic is the President. Executive powers rest with the Prime Minister and cabinet ministers. Rodrigues Island is autonomous and governed by the Chief Commissioner and other Commissioners.
Location, Coordinates	Western Indian Ocean, 20.3484° S, 57.5522° E
Constitution	Independence: 12 March 1968; Republic Status: 12 March 1992
Total Area	Land Area: 2,040 km^2; EEZ: 2.3 million km^2
Population (2019)	Island of Mauritius: 1,222,340; Island of Rodrigues: 43,371; Agalega & St. Brandon: 274
Economy	Upper middle-income status with total GDP of $31.705 billion and GDP per capita of $25,029 (2019) Tourism, Financial and ICT sectors led economy
Other socio-economic parameters	Human Development Index (HDI) for 2019 – 0.804 Mauritius is a welfare state with, *inter alia*, free health service, free education up to tertiary level, universal pension for all over 60 years, minimum wage, negative income tax, free public transport for over 60

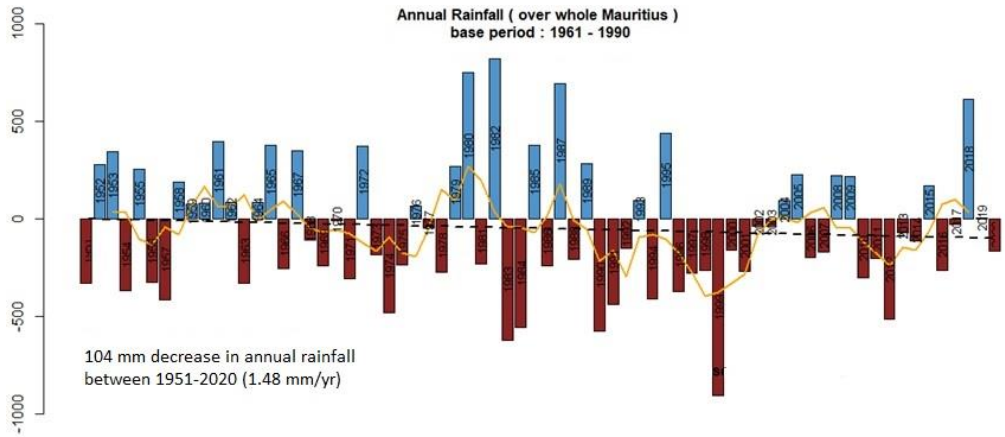
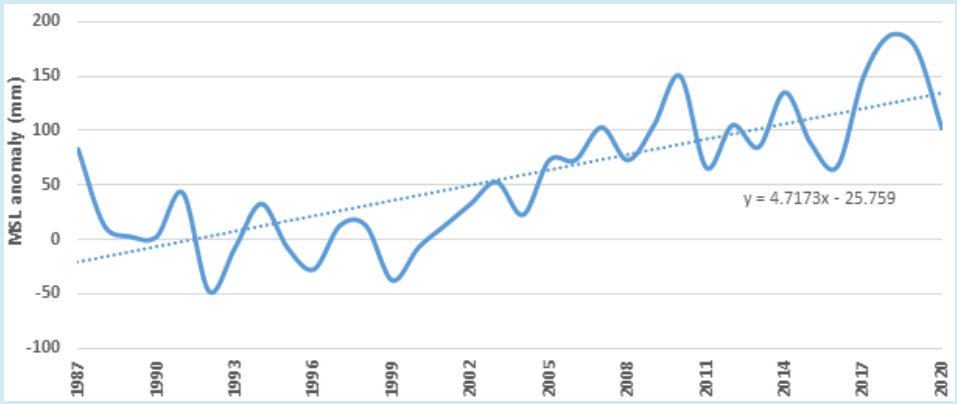
	years, disabled persons and for students, a Carers Allowance for those looking after the disabled.
Forest area	47,011ha
Annual fresh water abstraction	595 Mm^3
Daily per capita domestic water consumption	181 litres
Daily per capita solid waste disposal at landfill	1.20 kg
Energy mix (2019)	Total electricity generated was 3236.6 GWh. The main energy source was fuel oil and diesel (41.7%), followed by coal (36.3%) and renewable sources (21.7%). Electricity generation from renewable sources: 13.6% Bagasse, 4.0% Photovoltaic, 3.0% Hydro, 0.6% landfill gas and 0.5% wind
National Total GHG Emission (excluding Forestry and Other Land Use) (2016)	5,211.06 Gg carbon dioxide equivalent (CO_2-eq)
Climate	Mild tropical maritime climate, with warm humid summers, and cool, dry winters. Mean annual rainfall (2019) – 2, 130 mm Mean annual temperature (2019) - 24.5 degrees Celsius

2.2 Climate Change Impacts

As a Small Island Developing States, Mauritius is highly vulnerable to the impacts of climate change. In fact, the *2020 World Risk Report* had ranked Mauritius as the 53rd country with the highest disaster risk. Key economic sectors such as agriculture, fisheries, tourism and water are all being impacted. As described in the table below, figures for Mauritius are also alarming.

Table 2.2: climate change impacts in key areas

INDICATORS	IMPACTS OF CLIMATE CHANGE
Temperature	The mean annual temperature over the island has increased by 1.39°C in the last 70 years between 1951-2020, compared to the 1961-1990 climatological normal  *Source: Mauritius Meteorological Services (MMS), 2021* There is a projected temperature rise of up to **2ºC** by 2061 - 2070 (DRR, 2013). Rodrigues: The mean annual temperature over the island of Rodrigues has warmed by 1.41°C in the last 60 years between 1961-2020, compared to the 1961-1990 climatological normal.
Rainfall	According to the MMS, the mean annual rainfall over the island has decreased by 104 mm in the last 70 years between 1951-2020, compared to the 1961-1990 climatological normal. Decadal analysis shows a decrease of 7.7% in rainfall during last decade (2011-2020) compared to the decade 1951-1960 It is projected to have a reduction in amount of water by **13%** by 2050 (DRR, 2013).

INDICATORS	IMPACTS OF CLIMATE CHANGE
	 *Source: Mauritius Meteorological Services (MMS), 2021* <u>Rodrigues</u>: The mean annual rainfall over Rodrigues Island has decreased by 234 mm in the last 60 years between 1961-2020, compared to the 1961-1990 climatological normal.
Sea Level Rise	The data analysis from Port Louis tide gauge shows an increase of the sea level with a mean rise of **4.7 mm per year** during the last 33 years i.e., 1987-2020. At Port Louis during the last decade of 2011-2020, sea level has increased by 119 mm (11.9 cm) compared to the decade of 1991-2000.  *Source: MMS 2021* Sea level rise is projected to be of the order of **49 cm** by 2100. *(DRR, 2013)* Climate change-induced sea-level rise in **SIDS is estimated to be up to four times the global average according to UNEP** *(Emerging Issues for Small Islands Developing State, 2014)* The data analysis from Port Mathurin tide gauge shows an increase of the sea level with a mean rise of 6.4 mm per year during the last 32 years i.e., 1988-2020. At Port Mathurin during the last decade of 2011-2020, sea level has increased by 144 mm (14.4 cm) compared to the decade of 1991-2000.

INDICATORS	IMPACTS OF CLIMATE CHANGE
Beach Erosion	For Mauritius, accentuated beach erosion has shrunk the width of the beaches around certain coastal areas by **up to 20 m over the last few decades**. **17% of the coastline of Mauritius has eroded over the long-term (1967-2012)** which represent 13 km of coastline in Mauritius. Over the last decades **some 18 500 m^2 of beach area have been lost** at several beaches over the whole Island, namely at Flic en Flac, Le Morne, Trou aux Biches, Mon Choisy, Grand Bay and Pointe aux Sables.
Flash Flood	During the first five days of May 2017, Mauritius recorded a mean rainfall of 275 mm which represents 186% of the long term mean rainfall for the month. The Eastern part recorded almost 300% of its normal rainfall during those five days. The flash flood of May 2017 affected around 74 household in the Flacq region namely, Central Flacq and Poste de Flacq, Cite Hibiscus, Camp Poorun and Cite Débarcadére. Heavy rains on 10 December 2018 caused water accumulations in different regions. It is the northern region that has been most affected, with rescue operations in Cottage and Mount, among others. At Cottage, children were stranded in a day-care centre. Heavy to violent rain episode from 16 to 19 April 2021 resulted in flash floods to the southern coastal regions of Mauritius. On 16 April 2021, in less than 12 hours, Plaisance Meteorological Station recorded 383.6 mm of rainfall with peak intensity between 1200 to 1300hours. The abrupt rise in water level in the watercourse at Bambous Virieux caught 9 female sugarcane field workers on April 16, 2021. Due to road obstruction, 18 students from Bambous Virieux, Rivière des Creoles, and Falaise Rouge who were scheduled to take the SC and HSC exams were trapped. The Central Water Authority's home water supply was also impacted. In the south-eastern region, 54 homes and yards were inundated, with 2 rescue operations in Petit Bel Air and Mahebourg. According to the DRR report (2013), 19-30 km^2 of agricultural land, 5-70 km^2 of built-up land, 2.4-3 km of motorway, 18-29 km of main roads and 68-109 km of secondary roads are at risk of flooding. The damages to building and infrastructures have been estimated to be around USD 2 Billion in 50 years (2070 horizon).
Cyclones	Fortunately, no very intense tropical cyclone (VITC) has hit the island since 2012, despite the fact that an increased number of formations are reaching the intense or very intense tropical cyclone stage in the south-west Indian Ocean region. It is very likely that one such cyclone will occur in the near future. It is also observed that the rate of intensification of cyclones to super storm has increased. In April 2016, the South West Indian Ocean has experienced one of the strongest known cyclones which reached the very intense tropical cyclone intensity, namely, Fantala which had a maximum estimated gust of 345 km/h. The South West Indian Ocean Risk Assessment and Financing Initiative (RAFI) project (2016) suggested that on average Mauritius experiences over USS 110 million in combined

INDICATORS	IMPACTS OF CLIMATE CHANGE
	direct losses from floods and tropical cyclones each year. However, a specific event such as an intense tropical cyclone can produce significantly larger losses. For example, results suggest that a 100-year return period cyclone event could produce direct losses of $ 1.9 billion and may require approximately $ 430 million in emergency costs.
Vulnerability	Mauritius is highly vulnerable to adverse impacts of climate change. According to the World Risk Report of 2018, Mauritius is ranked as the 16th country with the highest disaster risk and ranked 10th on the list of countries most exposed to natural hazards. The *2020 World Risk Report* has ranked Mauritius as the 53rd country with the highest disaster risk, out of 181 countries. The *2021 World Risk Report* has ranked Mauritius as the 51st country with the highest disaster risk, out of 181 countries.

2.3 Key Development Policies Relevant to Climate Change

Climate Change is a high priority issue on Government agenda. ROM is also committed to fully support the international climate negotiation process. Mauritius was among the first countries to ratify the UNFCCC (1992), the Kyoto Protocol (2001) and the Paris Agreement (2016). Our first Nationally Determined Contributions (NDC) pledged to abate our greenhouse gas emissions by 30% by 2030 relative to the business-as-usual scenario of 7MtCO_2e. Our objectives are being reviewed and we are looking forward to having more ambitious targets and also deliver a timeline for carbon neutrality by at least 2070.

Since the ratification of the Paris Agreement in 2016, Government has strengthened its multipronged approach towards enhancing climate change resilience and embarking on a low carbon economy pathway.

The Government Programme 2020-2024 as well as the Vision 2030, have put much emphasis on building a climate change resilient nation and committed to leave no stone unturned to meet adaptation and mitigation objectives, and to abide to the relevant obligations of all climate related Multilateral Environmental Agreements.

In addition, Government has come up with a series of legislation to support climate change mainstreaming across key sectors and this culminated into the adoption of a Climate Change Act in November 2020. This legislative framework will support the mainstreaming and effective coordination of the climate change issues at the highest level. Further to the coming into force of the Climate Change Act on 22 April 2021, a dedicated Climate Change Department has been set up. An Inter-ministerial Council chaired by the Prime Minister has also been provided under this legislation. The National Environment Fund has been renamed as the National Environment and Climate Change Fund (NECCF) to ensure that funding of projects take into consideration the climate change needs as a criterion. The Budget 2021/22 has provided some Rs2.2 billion to the NECCF.

Our climate change agenda will be geared towards the implementation of measures listed under our reviewed Nationally Determined Contributions. We are looking forward to having more ambitious targets.

The forthcoming Master Plan on Environment, which will provide Policy Strategy for the next 10 year and a 5-year Action Plan, also has a dedicated component on climate change with key measures, which will support our objective to strengthen our resilience to climate change impacts and achieve a low carbon economy model.

Mauritius has demonstrated its serious commitment and has already implemented a series of measures on climate change adaptation and mitigation actions within its national development objectives. They relate, amongst others, to the following:

- the promotion of renewable energy technologies such as the solar water heaters and photovoltaic, bagasse, hydro and wind;
- the development of a Renewable Energy Roadmap 2030 for the Electricity Sector in 2019;
- the development of a 10 Year Electric Vehicle Integration Roadmap for Mauritius in 2020;
- the implementation of an alternative mode of mass transport system (Light Rail System by Metro Express Ltd);
- the development of a strategy to promote "circular economy" in the waste sector;
- the national tree planting campaigns;
- the implementation of coastal rehabilitation works;
- rain water harvesting schemes;
- land drainage management;
- disaster risk reduction; and
- Compost subsidy scheme with small planters of sugarcane, vegetables and flowers as beneficiaries.

Figure 2.2: Renewable Energy technologies, solar farm at Bambous and wind farm at Plaine des Roches

Along this line, some of the key legislative and policy measures set in place are summarized in Table 2.3.

Table 2.3: Relevant climate change related national policies, legislation and measures

Legislations/Measures/Instruments	Policy Focus
Mauritius Renewable Energy Agency Act 2015	The Act was promulgated with the setting up of Mauritius Renewable Energy Agency (MARENA) in 2016 to oversee the development of renewable energy in Mauritius
National Disasters Scheme (NDS) 2015	To support agencies and stakeholders in understanding and undertaking their roles, responsibilities and actions in emergencies
National Disaster Risk Reduction and Management Act (2016)	To support agencies and stakeholders in understanding and undertaking their roles, responsibilities and actions in emergencies
Marine Spatial Planning	In 2016, Cabinet agreed to the elaboration of a Marine Spatial Plan for the Exclusive Economic Zone (EEZ) of the Republic of Mauritius in view of the increasing demand for marine space in the EEZ for various purposes, particularly, agriculture, fisheries and aquaculture, tourism and leisure. The main purpose of the marine spatial planning is to identify the utilisation of the marine space for different sea uses in accordance with national policies and legislation, while taking into consideration the preservation, protection and improvement of marine environment, including resilience to climate change impacts. It will also contribute to the effective management of marine activities and the sustainable use of marine and coastal resources through the creation of a framework for consistent, transparent, sustainable and evidence-based decision making. The elaboration of the Marine Spatial Plan is in line with the implementation of the 2030 UN Agenda for Sustainable Development and the Sustainable Development Goals.
Land Drainage Authority Act 2017	To provide for the setting up of a Land Drainage Authority whose objects is to foresee the development and implementation of a Land Drainage Master Plan
Local Government (Amendment) Act 2018	To ensure adequate management of drains infrastructure at local level
Renewable Energy Strategic Plan (RESP) 2018-2023	To provide a keystone reference for execution of critical national policy and goals. It consists of 8 strategic goals, namely: - SG1: Increasing On-Grid RE Technologies; - SG2: Boosting Off-Grid RE Technologies; - SG3: Smartening the Grid;

	- SG4: Accelerating the Development of Sustainable Transportation. - SG5: Research Development & Demonstration and Capacity Building; - SG6: Fostering a dynamic RE Economy; - SG7: Strengthening International and Regional Linkages; - SG8: Developing Coherent and Effective Communication Pathways.
Mauritius Meteorological Services Act 2019	To ensure that proper surveillance and monitoring of meteorological parameters
Renewable Energy Roadmap 2030 for the Electricity Sector in 2019	Formulated in 2019 for the electricity sector, the roadmap is geared towards enabling the optimum production of energy from renewable resources and ensuring a transition towards greener and cleaner energy. The roadmap charts a clear strategy to achieve the target of 35% RE by 2025 and 40% RE in 2030. It also provides significant information on short and long term investment opportunities in renewable energy, namely solar, biomass, including bagasse and cane trash, waste-to-energy, onshore wind, hydro, offshore wind and wave: (a) in 2025, the target of 35% renewable energy in the electricity mix will be achieved with an additional of 396 GWh of renewable energy over the period 2020-2025. (b) in 2030, the target of 40% can be achieved, provided that the appropriate wave energy technology is commercialized and the cost of offshore wind goes down; (c) the contribution of solar energy in the electricity mix is expected to increase from 1.7% in 2018 to 10.2% in 2025 and 13.7% in 2030; (d) onshore wind is forecast to increase from 0.4% in 2018 to 2.3% in 2030; (e) biomass energy using bagasse and cane trash is expected to increase from 312 GWh in 2018 to 508 GWh in 2025 and 532 GWh in 2030. In terms of percentage share in the mix, it would be around 14-15% over the period 2025-2030. (f) hydropower will not evolve significantly, as most of hydro power resources are already being exploited; (g) offshore wind is not expected to be developed until 2030, when the technology advances further and

	prices become competitive. It can contribute to about 2.4% in 2030; and (h) wave energy is expected to come into play by horizon 2030, if the technology becomes mature and commercially viable. In the Budget 2021/2022, Government has announced that 60% of our country's energy needs will be produced from green sources by 2030 and the use of coal will be totally phased out by 2030. Accordingly, the Roadmap is being revisited based on new development in the energy market
10 Year Electric Vehicle (EV) Integration Roadmap for Mauritius (2020)	The roadmap prepares the market conditions for a sustainable integration of electric cars at a pace that strikes the right balance between costs and benefits. The roadmap report addresses the current situation of mainly fossil fuel-based electricity production and planned integration of renewables over time. It also considers the vital importance of a reliable and cost-effective electricity grid on the island and possible impact of EVs on the electricity grid. The scope of this study is limited to Battery Electric Vehicles (BEV) and Plug-in hybrid electric vehicles (PHEV).
National policy plan for organic farming for Mauritius (2018-2027)	For the promotion of ecological farming methods and climate-smart agriculture

2.4 Institutional Arrangements

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 sub–Technical Working Groups were set up are illustrated at Figure 2.2 and 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). Tables 2.4 and 2.5 give the composition of the different sub–Technical Working Groups.

The above-mentioned sectors for which sub–Technical Working Groups have been set up are as per the 2006 IPCC categories for reporting emissions and removals.

Figure 2.3: Institutional arrangement used for the preparation of the First Biennial Update Report

Table 2.4a: Institutional arrangements in the energy sector describing role of key institutions

Institution	Role
Central Electricity Board (CEB), Chair	Provides data on fuel consumption for electricity generation and information/data on mitigation projects
Ministry of Energy and Public Utilities (MEPU)	Provides information on all matters related to energy, including e-mobility
Independent Power Producers (Alteo, Omnicane, Terragen)	Provides data/information for GHG inventory and on mitigation projects
Mauritius Renewable Energy Agency (MARENA)	Is the nodal agency for Renewable Energy and the Executing Agency for renewable energy policies
State Trading Corporation (STC)	Provides activity data on importation of coal, crude oil and petroleum products including their Net Calorific Value
Statistics Mauritius	Provides data/information for GHG inventory, including quality checks and uncertainty

Table 2.4b: Institutional arrangements in the transport sector describing role of key institutions

Institution	Role
National Land Transport Authority, Chair	Provides data for the road transportation, including, fleet of registered vehicles by type, make and rating (new and second-hand, hybrid, electric)
Department of Civil Aviation	Provides data for aviation on yearly fuel consumption for domestic flights (Mauritius to Rodrigues) as well as bunker fuels
Mauritius Ports Authority (MPA)	Provides information on relevant mitigation projects and on diesel consumption by MPA tugs
Mauritius Shipping Corporation Ltd	Provides consumption of fuel for the Mauritius Trochetia (Mauritius to Agalega, Mauritius to Rodrigues)
Tourism Authority	Provides information on approximate fuel consumption for private and commercial pleasure crafts
Statistics Mauritius	Provides data/information for GHG inventory and quality checks
Ministry of Blue Economy, Marine Resources, Fisheries & Shipping (Albion Fisheries Research Centre)	Provides data on fuel consumption by artisanal fishing boats
Ministry of Land Transport & Light Rail	Provides information on road transportation including the light rail system in Mauritius as well as traffic management measures and e-mobility
Ministry of Blue Economy, Marine Resources, Fisheries & Shipping (Shipping Division)	Provides information with respect to GHG inventories and mitigation measures
Ministry of Environment, Solid Waste Management and Climate Change (Coordination and Project Implementation Division)	Provides information on Display of Fuel Consumption and CO2 Emission Label) Regulations 2019. with respect to fuel consumption and level of CO2 emission

Table 2.4c: Institutional arrangements in the energy and other sector describing role of key institutions

Institution	Role
Statistics Mauritius, Chair	Provides data for fuel consumption in residential, commercial, institutional as well as for manufacturing industries and construction
Energy Efficiency Management Office (EEMO)	Provides information on mitigation projects in relation with energy efficiency and conservation in all sectors of the economy
Business Mauritius	Provides information on projects and initiatives taken in greenhouse gas mitigation in the form of 'Programme National d'Efficacité Energétique' (PNEE)

Table 2.4d: Institutional arrangements in the industrial processes & product use sector describing role of key institutions

Institution	Role
Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division), Chair	Provides information on IPPU sector and activity data on industrial processes, also on iron and steel production
Statistics Mauritius	Provides activity data on hydrated lime production
Ministry of Environment, Solid Waste Management and Climate Change (National Ozone Unit)	Provides activity data on imports and exports of HFCs and information on control of Ozone Depleting Substances in Mauritius under the Montreal Protocol
Samlo Ltd	Provides data on production of steel

Table 2.4e: Institutional arrangements in the agriculture and other land use sector describing role of key institutions

Institution	Role
Food and Agricultural Research and Extension Institute (Crop) (Co-chair)	Provides data on non-sugar sector, i.e., on Production of Crops (Banana, Pineapple, Tea, Food crops, Mixed vegetables, Potato, Tomato, Onions and Other Food crops) and information on crop sector and mitigation actions.
Forestry Services (Co-chair)	Provides activity data on land area of major forest type and age distribution, woody biomass removal data for each forest type and information on the forestry sector and mitigation actions undertaken
Statistics Mauritius	Provides specific parameters pertaining to crop and livestock sectors, including uncertainty
Food and Agricultural Research and Extension Institute (Livestock)	Provide data and information on livestock sector and mitigation actions
Mauritius Cane Industry Authority	Provides data on sugar crop sector (plantation, processing, and energy production related to sugar cane, consumption of fertilisers and cane burning)
Mauritius Chemical and Fertiliser Industry Ltd, Desbro Trading Ltd, Island Fertilisers and Mauritius Cooperative Agricultural Federation Ltd	Provides data on amount of fertilisers by types/ grades imported annually
Ministry of Agro Industry & Food Security	Provides information on protected area and extent of conservation management area
Ministry of Blue Economy, Marine Resources, Fisheries, and Shipping (Albion Fisheries Research Centre)	Provides information and data on extent of mangrove plantation
Ministry of Housing and Land Use Planning (Cartography Section)	Provides land use data

Table 2.4f: Institutional arrangements in the waste (solid & liquid) sector describing role of key institutions

Institution	Role
Ministry of Environment, Solid Waste Management and Climate Change (Solid Waste Management Division) (Co- chair)	Provides activity data on solid waste and information on solid waste management, including mitigation actions and Waste Regulations.
Wastewater Management Authority (Co-chair)	Provides activity data on wastewater and information on wastewater treatment and management
Statistics Mauritius	Provides information for GHG inventory, including quality checks
Ministry of Environment, Solid Waste Management and Climate Change (Pollution, Prevention, and Control Division)	Provides information related to Industrial Waste Audit Regulations

Table 2.5. Detailed composition of the different sub–Technical Working Groups under the Mauritius BUR -1

Energy Industries &Sub-TWG	Transport Sub-TWG (Road Transportation, Civil Aviation & Water-borne Navigation)	Energy Other Sector Sub-TWG (Residential, Commercial/ Institutional, Manufacturing Industries & Construction and Agriculture/Forestry/ Fishing)	Industrial Processes & Product Use Sub-TWG	Agriculture, Forestry & Other Land Use Sub-TWG	Waste (Solid & Liquid) Sub-TWG
Central Electricity Board (Chair)	National Land Transport Authority (Chair)	Statistics Mauritius (Chair)	Ministry of Industrial Development, SMEs and Cooperatives (Industrial Development Division) - Chair	Food and Agricultural Research and Extension Institute	MoESWMCC (Solid Waste Management Division)
Statistics Mauritius	Statistics Mauritius	Ministry of Commerce and Consumer Protection (Commerce Division)	Statistics Mauritius	Forestry Services	Wastewater Management Authority
Ministry of Energy and Public Utilities	Department of Civil Aviation	AHRIM	MoESWMCC (National Ozone Unit)	Statistics Mauritius	Statistics Mauritius
MARENA	Air Mauritius Ltd	Economic Development Board Mauritius (Enterprise Mauritius)	Mauritius Chamber of Industry and Commerce	Ministry of Agro Industry and Food Security (Land Use Division)	Ministry of Health and Wellness
Omnicane Ltd	Ministry of Land Transport and Light Rail	Energy Efficiency Management Office (EEMO)	Samlo Ltd	Mauritius Meat Association	National Environment Laboratory
Terragen Ltd	Ministry of National Infrastructure and Community Development (Mechanical Engineering Division)	Business Mauritius	Mauritius Chemical and Fertilizer Industry Limited	Ministry of Housing and Land Use Planning (Cartography Section)	AHRIM
Alteo Ltd	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping (Shipping Division)	Mauritius Export Association (MEXA)	MoESWMCC (Department of Climate Change)	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping (Albion Fisheries Research Centre)	Sotravic Ltd
State Trading Corporation	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping (Albion Fisheries Research Centre)	MoESWMCC (Sustainable Development Division)		Mauritius Cane Industry Authority (MSIRI)	MoESWMCC (Pollution, Prevention and Control Division)
University of Mauritius	Mauritius Shipping Corporation Ltd	MoESWMCC (Department of Climate Change)		Omnicane Ltd	MoESWMCC (Department of Climate Change)
University Technology of Mauritius	Mauritius Ports Authority			Ministry of Agro Industry and Food Security (Veterinary Services Division)	
Mauritius Standards Bureau	Airports of Mauritius Ltd			Mauritius Chemical and Fertilizer Industry Limited	
Mauritius Cane Industry Authority	Tourism Authority			Desbro Trading Ltd	
MoESWMCC (Pollution, Prevention and Control Division)	MoESWMCC(Coordination and Project Implementation Division)			Island Fertilizers	
Post EIA monitoring	MoESWMCC (Department of Climate Change)			Mauritius Co-operative Agricultural Federation Ltd	
MoESWMCC (Department of Climate Change)				Mauritius Chamber of Agriculture	
				MoESWMCC (Department of Climate Change)	

Rodrigues Regional Assembly

Chapter 3

The National Greenhouse Gas Inventory

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3 The National Greenhouse Gas Inventory

3.1 Inventory overview

3.1.1 Overview

Under Article 4.1 (a) of the United National Framework Convention on Climate Change (UNFCCC), each Party has to develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all GHG not controlled by the Montreal Protocol, using comparable methodologies to be agreed by the Conference of the Parties.

Undertaking an Inventory is a cyclical task and is built on the results of the previous cycle. The following figure shows the example of the implementation cycle of a GHG Inventory, as shown in the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines. This cycle has been applied to obtain the necessary inputs for the development of the GHG inventory and Mitigation Actions.

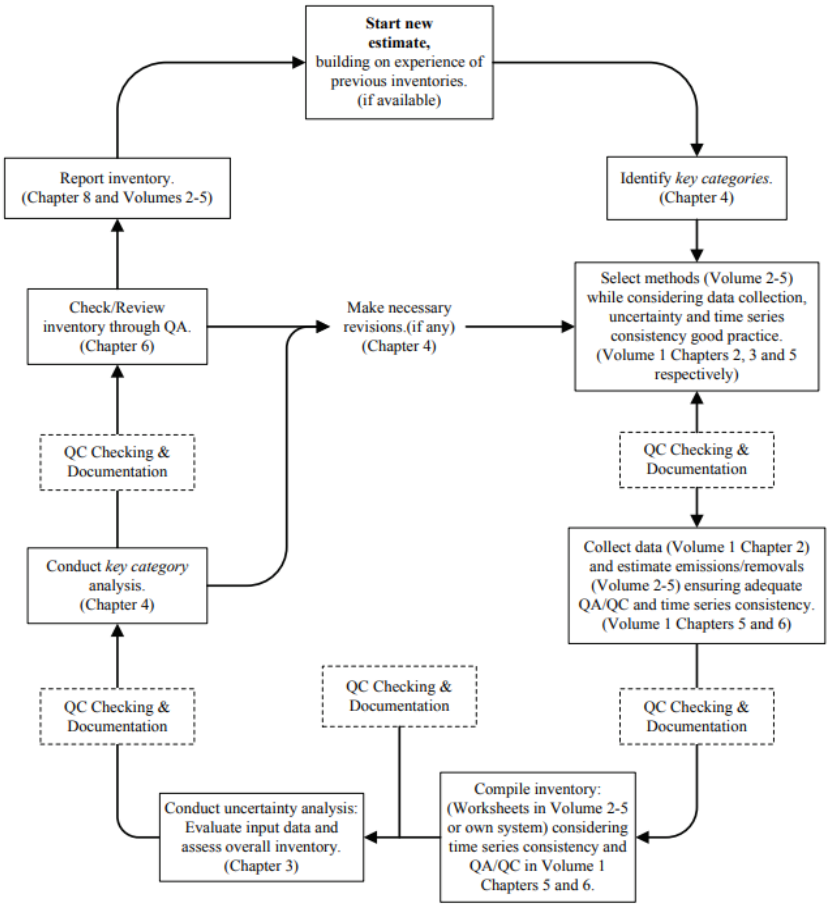

Figure 3.1: GHG emission inventory development cycle

Source: *Volume 1, Chapter 1 of the IPCC 2006 Guidelines.*
https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_1_Ch1_Introduction.pdf

The RoM submitted its first National GHG Emission Inventory as part of its First National Communication in April 1999. An improvement in the national inventory was made during the Second National Communication in November 2010 and reported in the National Inventory Report (NIR). Country's last national inventory was developed in 2017 and reported in the NIR as part of Third National Communication (TNC)[1].

3.1.2 Institutional arrangements and inventory preparation

The institutional arrangements used for the elaboration of the GHG emission inventory for the first Biennial Update Report is in line with the institutional arrangement used for the NIR. Six sub-technical working groups contain assigned experts and have been established to oversee the technical implementation of data collection, quality control and GHG Inventory. These sub-technical working groups are namely: energy industries, transport and energy other sectors, AFOLU and waste.

For the inventory preparation, the Department of the Climate Change of the Environment and Climate Change Division was responsible of coordinating the data collection, identification of stakeholders and organising capacity buildings.

3.1.3 Key category analysis

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 IPCC 2006 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 sign, the total contribution/level can be larger than a country's total emissions less removal.

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

- 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.

[1] GHG Inventories (2010 and 2017) and National Communications (NC1, NC2 and NC3) are available in the following link https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/national-communications-and-biennial-update-reports-non-annex-i-parties/national-communication-submissions-from-non-annex-i-parties

The results for the level assessment for the year 2016 are presented in the Table 3. below:

Table 3.1: Key Categories analysis for the year 2016 – 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, 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 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

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 IPCC 2006 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

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

The trend assessment for the period 2000-2016 resulted in the following gases and sectors as key sources/sinks of GHGs:

Table 3.2: Key Categories analysis for the period 2000 – 2016 – Approach 1 – 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

3.1.4 Methodological issues

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 IPCC in their 2006 Guidelines for GHG emission estimation to be in line with Good Practices.

Generally, 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)

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.

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 3.3: GWP values for 100-year time horizon according to the Second Assessment Report of IPCC (SAR)

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).*

The GHG Inventory for the BUR1 includes the trend of emissions over the period 2000 – 2016.

3.1.5 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 control 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.

3.1.6 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.

3.1.7 Completeness assessment

The following table provides the completeness of the inventory.

Table 3.4: 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 CO2	NO					
1.C.2 – Injection and Storage	NO					
1.C.3 – Other	NO					

Category	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
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						

Category	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
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 – N2O 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 N2O emissions from managed soils			X			
3.C.5 – Indirect N2O emissions from managed soils			X			
3.C.6 – Indirect N2O emissions from Manure soils			X			
3.C.7 – Rice Cultivations		NO				
3.C.8 – Other		NO	NO			
3.D – Other						

Category	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
3.D.1 – Harvested Wood products	X	NA				
3.D.2 – Other	NO	NO	NO			
4 – Waste						
4.A – Solid Waste Disposal		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 N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			NA			
5.B – Other	NA	NA	NA			

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

3.1.8 Recalculations

Recalculations made in the current inventory cycle are detailed in each sections' category below and in the NIR.

3.1.9 Time series consistency

This section summarises the GHG emissions trends from 2000 to 2016. Despite the results of GHG emissions from the NIR under the TNC were taken as valid, the GHG emissions have been calculated for all the period 2000-2016 in the current national inventory under the first BUR.

Furthermore, activity data for all period has been abstracted from the same data source has been used throughout the full time series. This enabled a consistent time series to be built with a good level of confidence in the trends of emissions.

More information is collected in the specific sectorial sections below.

Table 3.5: Total aggregate GHG emissions and removals by year and gas (Gg GHG)

Gas	2000	2005	2010	2014	2015	2016	Percentage change between 2000 and 2016
CO_2	1,847.96	2,546.43	3,421.47	3,681.98	3,715.13	3,829.01	107.2%
CH_4	23.19	28.06	29.43	29.36	27.50	27.60	18.9%
N_2O	0.52	0.54	0.61	0.59	0.62	0.61	19.0%
HFCs[2]	47.99	88.26	114.58	264.64	269.03	282.10	487.8%
PFCs	-	-	-	-	-	-	-
SF_6	-	-	-	-	-	-	-

Table 3.6: GHG Emissions and removals by year and sector (Gg CO_2eq)

Sector	2000	2005	2010	2014	2015	2016	Percentage change between 2000 and 2016
Energy	2,323.15	2,889.79	3,731.18	4,005.75	4,057.65	4,182.62	80.0%
IPPU	70.32	113.16	151.71	300.78	300.96	311.18	342.5%
AFOLU	-311.39	-174.91	-128.48	-153.90	-160.54	-171.62	-44.9%
Waste	460.81	564.01	588.57	572.77	555.45	559.18	21.2%
Total (excl LULUCF)	**3,000.34**	**3,715.95**	**4,639.63**	**5,035.66**	**5,075.07**	**5,211.06**	**73.7%**
Total (incl LULUCF)	**2,542.89**	**3,392.04**	**4,342.98**	**4,725.39**	**4,753.51**	**4,881.36**	**91.9%**

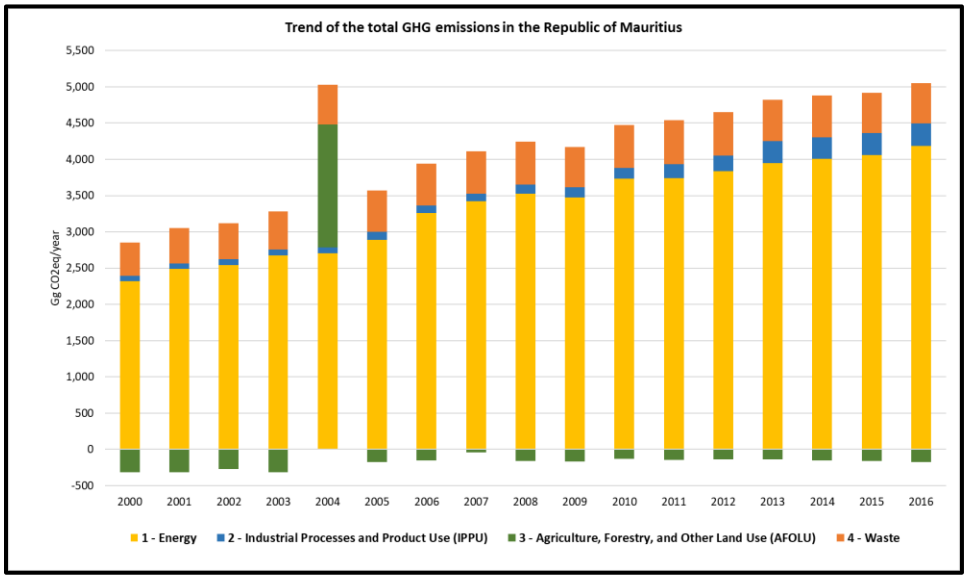

Figure 3.2 National GHG emissions by sector (including LULUCF)

***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.*

[2] Emissions are reported in Gg CO_2eq for HFCs.

The trend of the carbon dioxide equivalent (CO_2eq) emissions is clearly rising along the last 17 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**).

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 present 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).

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).

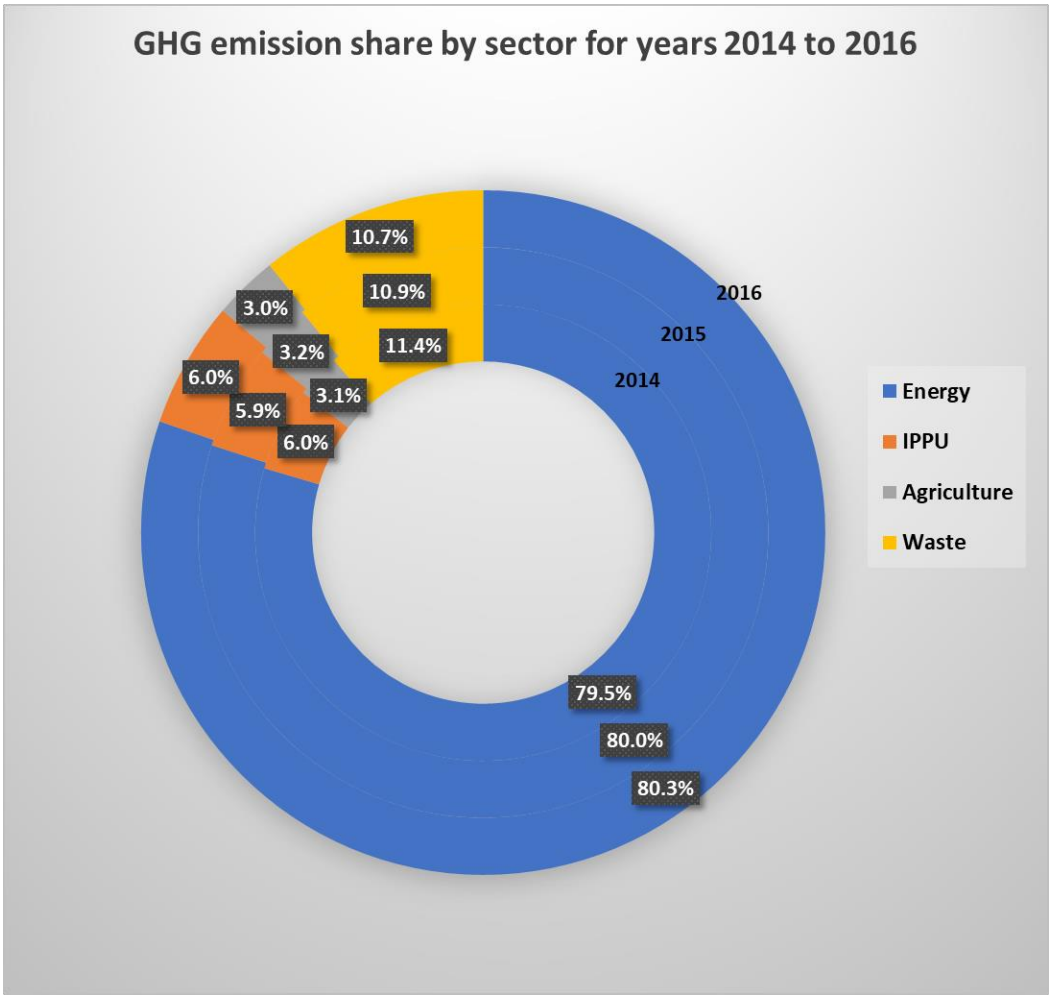

Figure 3.3. National GHG emission shares by sector for years 2014, 2015 and 2016

As seen in the figure above, the sector that most contribute to the total GHG emissions in the country, is the energy sector, which correspond to approximately 80% of the total GHG emissions in the country (year 2016).

3.2 Energy sector

3.2.1 Trends of GHG Emissions

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 emissions of the energy sector (342.18 Gg CO_2eq).

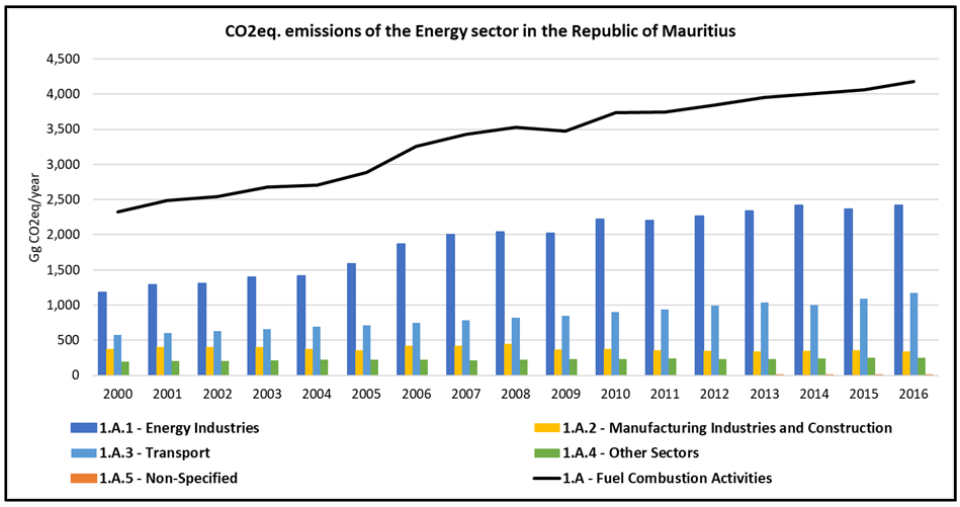

Figure 3.4. Evolution of the GHG Emissions for Energy sector (Gg CO2eq)

Table 3.7: GHG Emissions for Energy sector (Gg CO_2eq)

Category	2000	2005	2010	2016
1 – Energy	**2,323.15**	**2,889.79**	**3,731.18**	**4,182.62**
1.A – Fuel Combustion Activities	**2,323.15**	**2,889.79**	**3,731.18**	**4,182.62**
1.A.1 – Energy Industries	1,177.61	1,587.64	2,220.34	2,422.16
1.A.1.a.i – Electricity generation by	1,177.61	1,587.64	2,220.34	2,422.16

Energy Industries				
1.A.2 – Manufacturing Industries and Construction	372.22	359.33	377.90	342.18
1.A.2.a – Iron and Steel	1.77	1.78	1.78	1.78
1.A.2.c – Chemicals	22.57	21.72	23.36	20.64
1.A.2.d – Pulp, Paper and Print	1.68	1.60	1.56	1.38
1.A.2.e – Food processing, Beverages and Tobacco	55.97	54.26	58.21	51.65
1.A.2.k – Construction	36.01	35.06	37.27	30.33
1.A.2.l – Textile and Leather	199.94	193.12	203.00	184.60
1.A.2.m – Other	54.23	51.78	52.71	51.80
1.A.3 – Transport Sector	574.91	715.66	896.85	1,169.30
1.A.3.a – Civil Aviation	4.81	5.43	5.87	9.79
1.A.3.b – Road Transport	539.27	675.42	849.86	1,093.96
1.A.3.d – Water-borne Navigation	30.83	34.81	41.13	65.55
1.A.4 – Other Sector	198.41	227.16	236.09	248.10
1.A.4.a – Commercial / Institutional	12.45	20.94	32.74	48.16
1.A.4.b – Residential	144.91	161.93	139.20	149.75
1.A.4.c – Agriculture	41.05	44.28	64.15	50.18
1.A.4.c.ii – Off-road Vehicles and Other Machinery	7.92	9.66	10.56	7.31
1.A.4.c.iii – Fishing (mobile combustion)	33.13	34.62	53.59	42.87
1.A.4.d – Other	NA	NA	NA	0.87
Memo Items	**1,308.99**	**1,336.73**	**1,480.64**	**1,997.25**
1.A.a.i – International Aviation	610.74	728.44	728.44	925.66
1.A.d.i – International Water-borne Navigation	698.25	608.29	752.21	1,071.59

NA: Not Applicable

3.2.2 Sectoral Methodology

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

Table 3.8: 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				

Category	Activity Data	Emission Factor	Conversion Factor / NCV	Activity Data Source
1.A.3.a.i – International Aviation	T1	D/T1	D	International Energy Agency
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	National Land Transport Authority and Transport Toolkit v17.1
1.A.3.d.i – International Water-borne Navigation	T1	D/T1	D	International Energy Agency
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 (MoESWMCC), Data for Energy Other Sectors
1.A.4.b – Residential	T1	D/T1	CS	Ministry of Environment (MoESWMCC), Data for Energy Other Sectors
1.A.4.c – Agriculture	T1	D/T1	CS	Ministry of Environment (MoESWMCC), Data for Energy Other Sectors
1.A.4.d – Other	T1	D/T1	CS	Ministry of Environment (MoESWMCC), 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

More detailed information on activity data, emission factors, methodology used, and assumptions considered is available in the NIR.
The efforts to estimate GHG emissions have been focused on those categories identified as key during the key category analysis developed at the beginning of the preparation of the Inventory.

Different activity data have been received from diverse sources for the categories under the Energy sector, for the development of the national inventory, those that present less uncertainty, those that seemed to be more consistent and have data for a greater number of years, have been considered.

3.2.3 Quality Assurance / Quality Control (QA/QC)

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 Energy sector.
- Cross verification between 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 sector and the results obtained in the las reported national inventory of the RoM.
- The reference approach has been developed. The results of the reference approach can be analysed in the NIR document.

3.2.4 Recalculations

Some recalculations have been made to improve the GHG emission calculation. For that purpose, some of the most relevant recalculations developed for this emission inventory range from updates in the EF and NCV values to the use of new activity data or modifications in the methodologies used. Some of them are listed below:

- EFs updated for some fuels used in Manufacturing Industries and Construction, Water-borne navigation and Residential (Energy other sector).
- NCV values were modified considering the data availability improvements made by the country for the coal and bagasse fuels, as the country set annual NCV values for those fuels.
- For civil aviation and water-borne navigation categories the activity data used differs from the data used in the last national GHG emission inventory. The activity data used in the current inventory better reflect the national situation and are also more consistent.
- Improvements in methodology used for road transport. This improvement corresponds to specific tools that were developed during the elaboration of the TNC, which contains more transparent, consistent, and accurate country specific values.

More detailed information on the recalculations made in the Energy sector are available in the NIR.

3.2.5 Challenges

During the elaboration of this national inventory different challenges have been identified:

The Net Calorific Value (NCV) for the different fuels used in the country, may vary slightly from year to year. The country has start considering in the current inventory the annual value of the NCV for coal and bagasse, and they will continue working for the rest of the fuels.

The activity data used for most of the categories 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 specific plant EF, RoM will work on this aspect for the future.

During the elaboration of the national inventory for the TNC, a road transport toolkit was developed able to calculate GHG emissions and projections for different scenarios proposed in the TNC of the country.

The elaborated toolkit turns out to be a very useful instrument for the GHG emission calculation for the road transport category since the methodology used is close to a tier 2 approach. Despite this, the toolkit presents some challenges:

1. The toolkit only takes into consideration the Island of Mauritius, not the Island of Rodrigues.
2. The parameters used for the GHG emission estimates are not set for all vehicles and fuel types
3. The calculations made for the GHG estimates cannot be tracked in the tool which results in difficulties when recreating GHG emissions and its inclusion into reports to improve their transparency.
4. There are inconsistencies between data included into the toolkit, data available in the Statistics of Mauritius, and data facilitated by the stakeholders.
5. As a result of the quality control developed for the energy sector analysing the reference approach, it has been identified the necessity of an improvement of the energy balance and the analysis of its consistency with the activity data and data sources considered for the inventory.

3.2.6 Sectoral Uncertainties

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

Table 3.9: Uncertainty analysis of the Energy sector for the trend 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
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 Fuels	N_2O	5.00	228.79	228.84
1.A.2.e - Food Processing, Beverages and Tobacco - Solid Fuels	CO_2	5.00	12.46	13.43

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
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
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.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	25.00	25.50
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N_2O	5.00	60.00	60.21
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO_2	5.00	5.00	7.07
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH_4	5.00	5.00	7.07
1.A.3.b.iv - Motorcycles - Liquid Fuels	N_2O	5.00	5.00	7.07
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO_2	5.00	4.30	6.60

IPCC Category	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
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
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
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_2O	5.00	297.73	297.77
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
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 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 Industrial Processes and Product Use (IPPU)

3.3.1 Trends of GHG Emissions

As represented in the following figure and table, the GHG emissions from IPPU Sector has 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 increase annually, more moderately between 2000 and 2004 (15.54%) and more pronounced from 2004 to 2016 (283%). The category that most contribute to the increase of the emissions in the last 10 years is the product uses 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 the 97% of this category, while the 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, contribute to the 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 Mineral Industry, more specifically from Lime production, represent the 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.

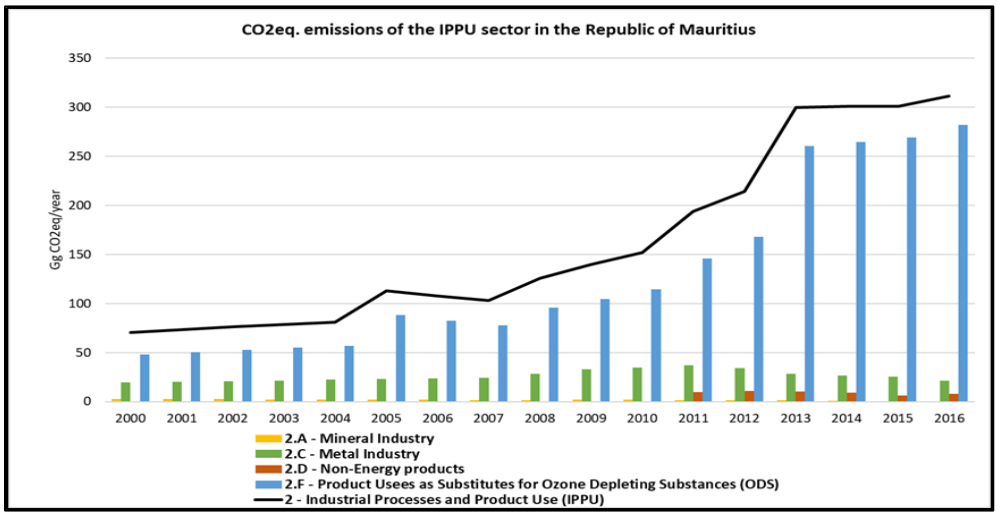

Figure 3.5 Evolution of the GHG Emissions for IPPU sector (Gg CO2eq)

Table 3.10: GHG Emissions for IPPU sector (Gg CO_2eq)

Category	2000	2005	2010	2016
2 – Industrial Processes and Product Use (IPPU)	**70.32**	**113.16**	**151.71**	**311.18**
2.A – Mineral Industry	**2.75**	**1.97**	**2.16**	**0.00**
2.A.2 – Lime production	2.75	1.97	2.16	0.00
2.C – Metal Industry	**19.57**	**22.92**	**34.98**	**21.41**
2.C.1 – Iron and steel production	19.57	22.92	34.98	21.41
2.D - Non-Energy Products from Fuels and Solvent Use	**0.00**	**0.00**	**0.00**	**7.66**
2.D.1 - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00	7.66
2.F – Product Use as Substitutes for ODS	**47.99**	**88.26**	**114.58**	**282.10**
2.F.1.a – Stationary Refrigeration and Air Conditioning	47.56	86.32	108.58	282.10
2.F.1.b – Mobile Air Conditioning	0.43	1.94	6.00	8.95

More detailed information on activity data, emission factors, methodology used, and assumptions considered is available in the NIR.

The efforts to estimate GHG emissions have been focused on those categories identified as key during the key category analysis developed at the beginning of the preparation of the Inventory.

3.3.2 Sectoral 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 3.11: 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[3], institutional authority which facilitated the collection of data/information
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, institutional authority which facilitated the collection of data/information
2.D – Non-Energy Products from Fuels and Solvent Use			
2.D.1 – Non-Energy Products from Fuels and Solvent Use	T1	D (CO_2)	International Energy Agency (IEA)
2.E – Electronics Industry			

[3] Environmental and Sustainable Development Division

2.E – Electronics Industry	NO	NO	-
2.F – Product Uses as Substitutes for Ozone Depleting Substances (ODS)			
2.F.1 – Refrigeration and Air Conditioning			
2.F.1.a – Refrigeration and Stationary Air Conditioning	T1	D (HFCs)	Statistics Unit of the ESDD, institutional authority which facilitated the collection of data/information
2.F.1.b – Mobile Air Conditioning	T1	D (HFCs)	Statistics Unit of the ESDD, institutional authority which facilitated the collection of data/information
2.G – Other Product Manufacture and Use			
2.G – Other Product Manufacture and Use	NO	NO	-
2.H – Other			
2.H – Other	NO	NO	-

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

The efforts to estimate GHG emissions have been focused on those categories identified as key during the key category analysis developed at the beginning of the preparation of the Inventory.
Different activity data have been received from diverse sources for the categories under the IPPU sector, for the development of the national inventory, those that present less uncertainty, those that seemed to be more consistent and have data for a greater number of years, have been considered.

3.3.3 Quality Assurance / Quality Control (QA/QC)

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 las reported national inventory of the RoM.

3.3.4 Recalculations

Some recalculations have been made to improve the GHG emission calculation. For that purpose, some of the most relevant recalculations developed for this emission inventory range from updates in the EF and NCV values to the use of new activity data or modifications in the methodologies used. Some of them are listed below.

- EFs updated for Metal Industry category to reflect real national circumstances in terms of the technology used.
- For Lime production and Iron and Steel production, the activity data have been updated. Data used for current inventory have been obtained from more accurate and consistent data sources.
- Improvements in methodology used for Product Uses as Substitutes for Ozone Depleting Substances (ODS) category to be aligned with the IPCC 2006 Guidelines.

More detailed information on the recalculations made in the IPPU sector are available in the NIR.

3.3.5 Challenges

During the elaboration of this national inventory different challenges have been identified for all IPPU categories:
The activity data used for most of the categories 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 specific plant EF, RoM will work on this aspect for the future.
In addition, a review of the activity data for category 2D and its alignment to the national energy balance should be carried out for next inventory cycle to ensure whether emissions from paraffin and solvents are occurring or not.

3.3.6 Sectoral Uncertainties

The results of both uncertainty analysis for the categories considered in the IPPU sector are reported in the following table:

Table 3.12: Uncertainty analysis of the IPPU sector for the trend 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
2.C.1 - Iron and Steel Production	CO_2	10.00	0.00	10.00
2.D.1 - Non-Energy Products from Fuels and Solvent Use	CO_2	10,00	0,00	10,00
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

3.4 Agriculture, Forestry and Other Land Use (AFOLU)

3.4.1 Trends of GHG Emissions

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[4]) show an increase from 2000 to 2016 of

[4] 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.

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) decrease 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 consist 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 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 present 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).

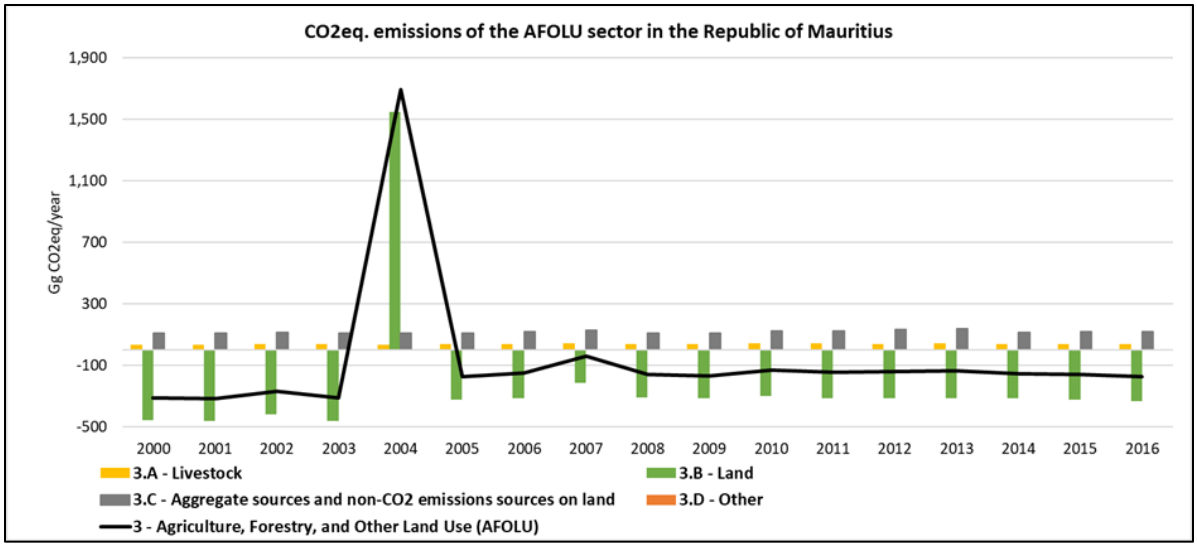

Figure 3.6. CO_2-eq emissions of the AFOLU sector

Table 3.13: 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	27.22	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	-360.49	-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	2.26
3.C.4 - Direct N2O Emissions from managed soils	75.15	74.70	78.96	78.38
3.C.5 - Indirect N2O Emissions from managed soils	23.98	23.78	25.91	25.54
3.C.6 - Indirect N2O Emissions from manure management	5.90	8.912	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

More detailed information on activity data, emission factors, methodology used, and assumptions considered is available in the NIR.

3.4.2 Sectoral Methodology

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

Table 3.14: GHG emissions for 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	Central Statistical Office
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	Central Statistical Office
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

Category	Methodology	Emission Factor	Activity Data source
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 Mauritius
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

3.4.3 Quality Assurance / Quality Control (QA/QC)

Livestock (3.A) and Aggregate sources and non-CO_2 emissions sources on land (3.C) 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. In addition, several cross-verification exercises with the main data providers were developed.

Land (3.B) field data collected (e.g., Plantation sites, area, silvicultural practices, diameter at breast height (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.

3.4.4 Recalculations

Some recalculations have been made to improve the GHG emission calculation. For that purpose, some of the most relevant recalculations developed for this emission inventory range from updates in the EF and AD values to the estimation of new methodologies or modifications in the methodologies used. Some of them are listed below.

For category 3.A Livestock:

- Estimations 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 timeseries.

For category 3.B Land:

- 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.

For category 3.C. Aggregate sources and non-CO_2 emissions sources on land:

- N_2O emissions from biomass burning have been estimated for the first time in this GHGI.
- Update in the parameters to estimate CH4 emissions from biomass burning of sugar cane.
- Direct N_2O emissions from managed soils has 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.

3.4.5 Challenges

During the elaboration of this national inventory different challenges have been identified for several AFOLU categories.

Regarding category 3.A Livestock:

- Timeseries of number of animals are not complete, completely consistent and were estimated based on assumptions. In addition, previous GHGI information on number of animals

disaggregated by region show not clearly explained changes (e.g., distribution of other cattle by region in 2005-2006). Therefore, it is needed to analyse and verify the existing information, as well as raising the missing information to ensure consistent timeseries of number of animals.

- 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. It is needed to update the estimates to Tier 2 for the most significant categories.
- Information on manure management systems only cover 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.

Regarding category 3.B Land, 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 SOM pool in cropland remaining cropland and grassland remaining grassland categories.
- Estimation of direct and indirect N_2O emissions from N mineralisation associated with the loss of soil organic matter resulting from change of land use or management of mineral soils.

Regarding category 3.C Aggregate sources and non-CO_2 emissions sources on land:

- Several categories were not estimated due to the lack of activity data. It is needed to raise information for enhancing the completeness of this category.

- Activity data timeseries are not complete (e.g., synthetic fertilizers). It is needed to put in place a system to collect periodically updated data.

3.4.6 Sectoral Uncertainties

In the AFOLU sector, only the uncertainties from category 3.A livestock have been estimated. The uncertainty analysis of categories 3.B, 3.C and 3.D could not be performed due to the lack of uncertainty with AD.

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

Table 3.15: 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.

3.5 Waste

3.5.1 Trends of GHG Emissions

As represented in the following figure and table, the GHG emissions from Waste Sector has experiment an increase along the time series from 2000 to 2016.

The most significant category, in terms of GHG emissions, is the solid waste disposal at landfills, followed by the wastewater treatment and discharge category.

GHG emissions of this sector have two different trends over the inventory years (2000-2016). From 2000 to 2011 an upward trend can be observed, with a maximum in 2011. It is relevant to mention the notably downward observed in 2009, which was due to a combination of different factors all affecting the emissions from solid waste disposal. Since 2011, emissions are suffering a downward trend due to a decrease in emissions from solid waste disposal and from wastewater treatment, especially industrial wastewater. The category that most contribute to the increase of the emissions in the last 17 years is the solid waste disposal.

Figure 3.7: Efficient wastewater treatment (Courtesy GIS)

Wastewater represents the 32.67% of the total GHG emissions of the sector in 2016, corresponding 22.82% to domestic/commercial wastewater and 9.85% to industrial wastewater. This category experienced a slight decrease throughout the studied 2000-2016 period of 11.47%, from 206.37 Gg CO_2eq in 2000 to 182.70 Gg CO_2eq in 2016.

Solid waste disposal represents the 66.11% of the total GHG emissions of the sector in 2016, corresponding to the managed waste disposal sites category. This category experienced an increase throughout the studied 2000-2016 period of 45.6%, from 253.87 Gg CO_2eq in 2000 to 369.68 Gg CO_2eq in 2016.

Biological treatment of solid waste represents the 1.09% of the total GHG emissions of the sector in 2016, corresponding to the composting category, which started in RoM in 2011. This category experienced a notable increase throughout the 2011-2016 period of 643.27%, from 0.82 Gg CO_2eq in 2011 to 6.07 Gg CO_2eq in 2016.

Regarding the category related to incineration and open burning of waste, only clinical wastes have been incinerated in RoM over the inventory period (2000-2016), with an insignificant contribution. These emissions represent the 0.13% of the total GHG emissions of the sector in 2016. This category has remained broadly constant throughout the studied 2000-2016 period, from 0.56 Gg CO_2eq in 2000 to 0.74 Gg CO_2eq in 2016.

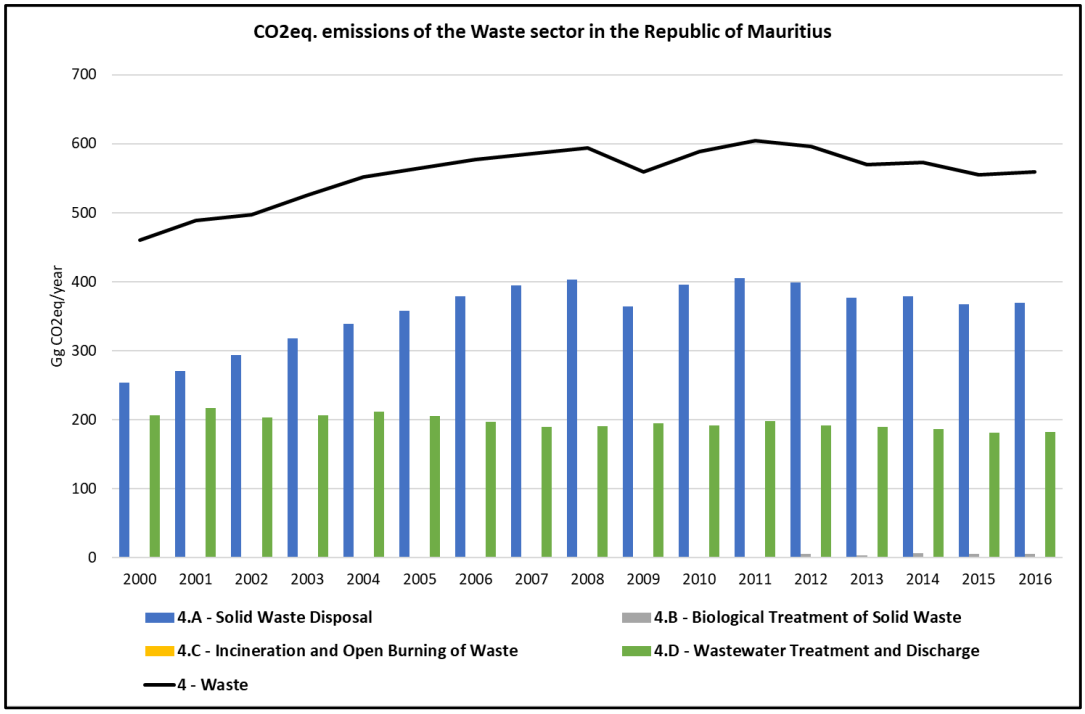

Figure 3.8: Evolution of the GHG Emissions for Waste sector (Gg CO2eq)

Table 3.16: GHG Emissions for Waste sector (Gg CO_2eq)

Category	2000	2005	2010	2016
4 – Waste	**460.81**	**564.01**	**588.57**	**559.18**
4.A - Solid Waste Disposal	**253.87**	**357.60**	**395.85**	**369.68**
4.A.1 - Managed Waste Disposal Sites	253.87	357.60	395.85	369.680
4.B - Biological Treatment of Solid Waste	**0**	**0**	**0**	**6.07**
4.C - Incineration and Open Burning of Waste	**0.56**	**0.52**	**0.53**	**0.74**
4.C.1 - Waste Incineration	0.56	0.52	0.53	0.74
4.D – Wastewater Treatment and Discharge	**206.37**	**205.89**	**192.19**	**182.70**
4.D.1 - Domestic Wastewater Treatment and Discharge	128.57	134.33	128.61	127.61
4.D.2 - Industrial Wastewater Treatment and Discharge	77.79	71.56	63.58	55.09

More detailed information on activity data, emission factors, methodology used, and assumptions considered is available in the NIR.

3.5.2 Sectoral Methodology

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

Table 3.17: 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

The efforts to estimate GHG emissions have been focused on those categories identified as key during the key category analysis developed at the beginning of the preparation of the Inventory.

Different activity data have been received from diverse sources for the categories under the Waste sector, for the development of the national inventory, those that present less uncertainty, those that seemed to be more consistent and have data for a greater number of years, have been considered.

3.5.3 Quality Assurance / Quality Control (QA/QC)

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 and data reported in the national Statistics reports.
- Cross verification between EF values provided by institutional authorities and the default values proposed by the IPCC 2006 Guidelines for Waste sector.
- Cross verification between the GHG emissions estimated in the current inventory for Waste sector and the results obtained in the las reported national inventory of the RoM.
- Cross verification carried out by key stakeholders once emissions were estimates.

3.5.4 Recalculations

Some recalculations have been made to improve the GHG emission estimates. Some of them are listed below.

- Solid waste disposal: 2006 IPCC Guidelines suggests that, based on FOD methodology, waste landfilled 50 years ago can produce CH_4 emissions nowadays. Based on that aspect, this inventory edition has considered all the aspects required regarding of waste landfilled in RoM since 1960 (amount of waste, composition, etc) to obtain a more accurate emissions estimate.
- Composting: N_2O emissions have been estimated for all the inventory period (2000-2016).
- Incineration: CO_2 emissions have been updated due to a correction in the EF used for the previous Inventory.
- Domestic/commercial wastewater: some adjustments regarding BOD and MCF values have been updated.
- Industrial wastewater: a new relevant industry sector has been considered (beer production). CH_4 emissions for this new industry has been estimated for the whole inventory period (2000-2016)

More detailed information on the recalculations made in the Waste sector are available in the NIR.

3.5.5 Challenges

During the elaboration of this national inventory, different challenges have been identified for Waste categories:

The activity data used for most of the categories are quite detailed for solid waste, however, this information is solely available for the period 2000-2016. To achieve a more accurate and complete inventory, a review of the assumptions considered for solid waste disposal for the period 1960-2000 would be necessary, especially for Rodrigues data.

In addition, data regarding wastewater need to be reviewed and adjusted, especially regarding the types of treatments applied to industrial wastewater over the years and the type of treatments applied to domestic/commercial wastewater for the 2000-2005 period.

More planned improvements by sector are available in the NIR.

3.5.6 Sectoral Uncertainties

The results for the uncertainty analysis (IPCC software) for the categories considered in the Waste sector are reported in the following table:

Table 3.18: Uncertainty analysis of the IPPU sector for the trend 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
4.B - Biological Treatment of Solid Waste	CH_4	10.00	30.00	31.62
4.B - Biological Treatment of Solid Waste	N_2O	10.00	30,00	31.62
4.C - Incineration and Open Burning of Waste	CO_2	10.00	40.00	41.23
4.C - Incineration and Open Burning of Waste	CH_4	10.00	100.00	100.50
4.C - Incineration and Open Burning of Waste	N_2O	10.00	100.00	100.50
4.D - Wastewater Treatment and Discharge	N_2O	95.00	0.00	95.00
4.D - Wastewater Treatment and Discharge	CH_4	107.36	42.43	115.43

3.6 Archiving

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, pen drives 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.
- 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

3.7 Gaps, Constraints and Needs

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

The following problems were encountered during the preparation of this national inventory of GHG:

- Information required for the inventory were obtained from various sources as no institution has yet been endorsed with the responsibility for collection of specific AD needed for the estimation of emissions according to IPCC on an annual basis.
- There were frequent inconsistencies when data were collected from different sources.
- Some of the AD are still not yet in the required format for feeding in the software to make the emission estimates.
- Some categories have not been estimated due to the lack of information (AD).
- Lack of EFs and parameter to better represent national circumstances and provide for more accurate estimates even if this has started to be addressed for some key categories.
- National experts are not yet ready to take over the full inventory compilation process which dictated the collaboration of an international consultant.
- National experts were provided with further capacity building and this will be pursued in the future until they are fully conversant with the whole process.

Lack of a GHGI system and a clear roadmap for following updates of the GHGI.

3.8 Improvement plans

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

- Upgrading of the National Inventory System (NIS). This NIS is responsible for the development periodically the country's national GHG inventory as well as the projections of GHG emissions and absorptions to the atmosphere, which allows to evaluate the compliance of the acquired commitments entered by the country. Moreover, the system is the basis for the policy making and emission mitigation measures development, as well as for assessing their effectiveness in achieving the objectives.
- Land use and land use changes matrixes needs to be updated using Approach 2 of the 2006 IPCC Guidelines to ensure consistency, completeness, and accuracy in the estimates.
- Development of emission factors (EFs) and parameters more representative of the national context given the national insular circumstances.
- Develop a capacity building and strengthening of technical know-how and institutional arrangements within the National Inventory System to improve the coordination in the implementation of the GHG Inventory cycle. Capacity building and the development of technical know-how would improve the data collection, development of methodology, determine country specific EFs and reporting, among other.
- Improve the existing QA/QC system to reduce uncertainty and improve inventory quality.
- Institutionalize the archiving system.


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Chapter 4

Mitigation Actions and Their Effects

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4.0 Mitigation Actions and Their Effects

4.1 Overview

This chapter provides the details concerning mitigation actions for the RoM in energy sector (energy industries and transport); and non-energy sectors [Industrial Processes and Product Use (IPPU); waste; agriculture; and Forestry and Other Land Use (FOLU)].

As per the 2021 NDC and based on current projections, Mauritius aims to reduce overall GHG emissions by 40% in 2030 compared to Business as Usual (BAU) (equivalent to around 2800 $ktCO_2eq$ of avoided emissions). Compared to the 2015 INDC target of 30% GHG emissions reduction, the mitigation ambition of Mauritius is significantly enhanced.

The tables below present the Mauritian mitigation routes/actions according to the guidance established by Decision 2/CP17, Annex III, and includes: name, status of the action, implementing institution, period, sector/subsector, scope, quantitative targets, gases, general objective, description, methodology and assumptions, results, and progress indicators.

4.2 Mitigation Actions for the Energy sector

Mitigation policies for the Energy Industries sector considers 3 main objectives:

- Reduce dependency on fossil fuels
- Encourage the use of renewable sources
- Manage demand through energy efficiency measures while ensuring energy security

Mauritius developed a **Renewable Energy Roadmap 2030 for the Electricity Sector** in 2019, which charts the way for the development of renewable energy technologies, diversifying the electricity mix of the country and adopting cleaner sources energy. The main target of the Roadmap was to achieve 35% of renewable energy in 2025 and 40% by 2030. However, in the Budget 2021/2022, Government has announced that 60% of our country's energy needs will be produced from green sources by 2030 and the use of coal will be totally phased out by 2030.

On-going mitigation projects being undertaken by the Central Electricity Board;

- Small-Scale Distributed Generation (SSDG) scheme which caters for low voltage connected renewable energy systems, with capacities of less than 50 kW. Under the SSDG Schemes with a project duration, 9.356 MW of PV systems has been integrated into the electricity grid for Mauritius and 261 kW for Rodrigues. (Source: Statistics Mauritius 2020).
- Medium-Scale Distributed Generation (MSDG) scheme for renewable energy projects with capacities of greater than 50 kW and which have to be connected to the medium voltage network (22kV). Under the MSDG Scheme, 6.589 MW has been integrated into the electricity grid. (Source: Statistics Mauritius 2020).

- SME schemes: CEB Green Energy Scheme for SMEs in Tariff 215 Category. As at 2020,1.748 MW has been connected to the CEB grid for Mauritius and 92kW for Rodrigues. (Source: Statistics Mauritius 2020).
- Home Solar Project. The project aims at installing solar photovoltaic systems on rooftops of 10 000 households of low-income group. Though this project phased over a period of five years, the Government seeks to install 2000 kits each year, hence 10 000 by 2024. As at 2020, 887 kW has been connected to the CEB grid in Mauritius and 91 kW for Rodrigues (Source: Statistics Mauritius 2020)

Figure 4.1: Photovoltaic solar panel on rooftop, an incentive to reduce dependency on fossil fuel. (Courtesy: GIS)

4.2.1 Mitigation Action 1 – Energy Industries Sector

Table 4.1: Mitigation Action 1 – Energy Industries Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Accelerating the transformational shift to a low-carbon economy in the Republic of Mauritius	Under implementation	Ministry of Finance Economic Planning and Development - Government of Mauritius	2017-2025	Energy - Electricity Generation	National	Reduction in greenhouse gas emissions of 4.27 million tCO2e over the lifetimes of the investments enabled	CO_2, CH_4, N_2O
	Objective of the mitigation action						
	The project will provide the enabling environment for the scaling up of renewable energy in Mauritius thereby bringing the transformational change advocated by the Green Climate Fund (GCF). The project will curtail both the regulatory and infrastructural barriers for a paradigm shift in power generation in Mauritius.						
	Brief description and activities planned under the mitigation action						
	The project is being implemented in two phases with the following three components: ➢ Component 1: Institutional strengthening for renewable energy (Phase 1) ➢ Component 2: Improving grid absorption capacity followed by PV deployment (Phase 1 & 2) ➢ Component 3: PV mini-grids on the Outer Island of Agalega (Phase 2) The principal outcome of Component 1 will be the emergence of a strengthened institutional and regulatory system for renewable energy i.e., of the Mauritius Renewable Energy Agency (MARENA), which will directly facilitate the implementation of Component 2. By the end of Component 1 (2021), the Government will have the required legal texts, systems and institutional capability to effectively manage the evolution and growth of the renewable energy sector. With the assistance of the GCF project, Central Electricity Board (CEB) will acquire and install equipment to absorb 185 MW of intermittent renewable energy into the grid without jeopardising the grid stability. Currently, 4MW of Battery Energy Storage System (BESS) has already been commissioned for the reinforcement of the grid. Another 14 MW is under implementation and will be commissioned in the third quarter of 2021. Under the GCF Phase 2 project, 25MW of solar PV system will be installed as follows: i. households supplying 10 MW; ii. public buildings 11 MW; and iii. NGOs 4 MW.						
	Estimated outcomes and estimated emission reductions						

	By the end of Component 2,161,600 tCO_{2e} will have been directly avoided due to the installation of 25 MW PV directly assisted by the GCF project. An additional of 3.2 million tCO_{2e} are expected to be indirectly avoided as a result of expansion of intermittent renewables permitted by the grid strengthening activities. Taken over the entire population of Mauritius and Rodrigues (396,335 households), Component 2 will enable one-third (129,500) of households to have access to low-emission energy.
	Methodologies and Assumptions
	The overall approach used to meet the project targets is described in the project's Theory of Change which can be summarised as follows: If bottlenecks to deployment and scale-up of renewable energy are removed; then the country will be able to use more low emission renewable energy technologies; resulting in the country being able to meet its target of using 60% of renewable energy in the electricity grid by 2030. The following main assumptions have been considered in the project design: 1. Government has established Mauritius Renewable Energy Agency (MARENA) to promote Renewable Energy (RE) 2. Government maintains policy of promoting RE 3. Government acknowledges the power stability benefits of smart grids and is keen to invest further 4. Price of fossil fuels does not fall markedly in the medium-term 5. OIDC is able to provide the budget for long-term maintenance and is supported by the Ministry of Ocean Economy 6. The use of coal in the generation of electricity is phased out by 2030 7. Charging Electric Vehicles through Solar PV sources will be promoted to support the transition to zero emission road transport by

4.2.2 Mitigation Action 2 – Energy Efficiency Sector

Table 4.2: Mitigation Action 2 – Energy Efficiency Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Mandatory Energy Labelling	Under implementation	Ministry of Energy and Public Utilities (Energy Efficiency Management Office)	2017-2022 (Ongoing)	Energy industries – Energy Efficiency	National	Reduce energy consumption in households through a shift to more energy efficient appliances by 2030.	CO_2, CH_4, N_2O
	Objective of the mitigation action						
	• Provide information on energy performance of appliances to allow consumers to make informed purchase decisions • Reduce energy consumption and fossil fuel imports through a shift to more energy efficient household appliances. • Improvement in energy efficiency gains through adoption of rescaled energy labels • Reduce GHG emission						
	Brief description and activities planned under the mitigation action						
	• Energy Efficiency (Labelling of Regulated Machinery) Regulations 2017 for refrigerator, oven and dishwasher. Air conditioners and washing machine are the next electrical appliances to be regulated. • Amend Energy Efficiency (Labelling of Regulated Machinery) Regulations 2017. • Carry out media campaign to inform the public. • Issue guidelines for the proper installation and maintenance of air conditioners. • Ban on importation of fixed speed compressor air conditioners in a phased manner by 2024, starting with those with capacity of at least 36,000 BTU as from January 2022. • Ban on importation of all incandescent light bulbs used for general lighting in order to pave the way for more energy efficient lighting. • Establish procedures to monitor energy efficiency and consumption to enable public institutions to reduce their electricity consumption by at least 5% of its current electricity consumption						
	Estimated outcomes and estimated emission reductions						
	Reduce energy consumption through the purchase of energy efficient household appliances by the general public						

4.3 Mitigation Actions for the Transport Sector

Road transport is the most important mode of transport in Mauritius. Rail transport is new with the current light rail project (Metro Express). The country has an existing road transport network of over 2,000 km, of which nearly 50% are classified as main/primary roads, 29% are secondary roads, 3.6% as motorways. Approximately 600,000 vehicles are registered by the National Land Transport Authority (NLTA). Buses are the principal form of public transport in Mauritius and both public transport and private transport buses account for about 7% of the country's entire vehicle fleet. Over 60% of the population uses buses at least once a week.

To stimulate the transition towards electric mobility, the Ministry of Energy and Public Utilities (MEPU) has prepared a **10 Year Electric Vehicle (EV) Integration Roadmap for Mauritius** (2020). The roadmap presents the market conditions for a sustainable integration of electric cars at a pace that strikes the right balance between costs and benefits. The roadmap also addresses the current situation of mainly fossil fuel-based electricity production and planned integration of renewables over time. It also considers the vital importance of a reliable and cost-effective electricity grid on the island and possible impact of EVs on the electricity grid. The scope of that study was limited to Battery Electric Vehicles (BEV) and Plug-in hybrid electric vehicles (PHEV).

The Metro Express Project is the first Light Rail Transit (LRT) system in Mauritius, an alignment of 26-km in length from Curepipe to Port Louis, to serve as a new, environmentally-friendly, alternative and sustainable mode of transport by significantly reducing carbon emission for each kilometre travelled. With the main objective of alleviating traffic congestion (which is costing the Mauritian economy about Rs 4 billion annually and projected to reach around Rs 10 billion by 2030), it will provide a rapid mode of public transport along the corridor of Curepipe to Port Louis.

With a view to incentivising fleet replacement, a **Bus Modernisation Scheme (BMS)** has been put in place by Government through the NLTA to financially assist bus operators to replace their ageing fleet with modern buses. Since its inception in September 2014 and as at 30 June 2021, a total of 383 semi-low floor buses had been subsidized through the BMS including 9 buses for Rodrigues. Two electric buses have in that context been procured by Rose Hill Transport Bus Services Ltd.

Figure 4.2: Two electric buses were procured by Rose-Hill Transport Bus Services in an endeavour to mitigate CO2 emission. (Courtesy RHT)

4.3.1 Mitigation Action 3 – Transport Sector

Table 4.3: Mitigation Action 3 – Transport Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Modal shift to a mass transport system (Light Rail)	Phase 1 Completed on September 2019: Port Louis Victoria Central to Rose Hill Central (12.4 km) Phase 2A Completed at the end of June 2021: Port Louis Victoria Central to Quatre Bornes Central (2.65 km) Works for the remaining stretch up to Curepipe Central and Immigration Square are ongoing and is expected to be completed by the end of 2022.	Ministry of Land Transport and Light Rail (Metro Express Ltd)	2017 – 2022 Construction for the Metro Express Project started in 2017. End of 2022: Full delivery of Metro Express Project up to Curepipe Central including Immigration Square End of 2022: Rose Hill Central to Reduit through Ebene	Energy – Land Transport	National	April 2022: Metro Express Operations up to Vacoas Central December 2022: Full delivery of Metro Express Project up to Curepipe Central including Immigration Square End of 2022: Extension of Metro Express Alignment from Rose Hill Central Interchange to Reduit Embellishment Project along the Metro Express Alignment is ongoing End of 2021: Implementation of Shuttle Services in Quatre Bornes	CO_2, CH_4, N_2O

	Extension of the Metro Express Alignment from Rose Hill Central to Reduit through Ebene started in May 2021 and is expected to be completed by the end of 2022.					November 2021: Implementation of sustainable solar energy Ebene Recreational Park Start of 2022: Mobile Application Project Mid 2022/End of 2022: MEL intends to implement sustainable solar energy at Coromandel Park & Ride Station (Budget to be sought by MLTLR) End of 2023: MEL intends to implement a solar farm on land available near Barkly to cater for its whole energy demand (Budget to be sought by MLTLR)	
	Objective of the mitigation action						
	• To collaboratively develop and operate an economically and environmentally sustainable light rail network by reducing traffic congestion and carbon emission. • To provide an alternate mode of transport that is inclusive, comfortable, safe, secure, reliable, and accessible to all members of society.						
	Brief description and activities planned under the mitigation action						
	Metro Express Project • While the implementation of this Light Rail System is already contributing to the reduction of traffic congestion, moreover its infrastructure itself is designed and built to last a century and the whole system runs purely on electricity only, thereby reducing						

air as well as noise pollution. At the same time, this mode of transport is enhancing mobility of commuters who have a viable choice combining the use of public transport with the usage of private vehicles, including the use of purpose-built pedestrian walkways and cycle tracks.

- Metro Express LRVs are equipped with a regenerative braking system and hence helps to reduce the power consumption. Kinetic energy from the electrodynamic brakes returned back to the catenary for other LRVs. This energy is used for auxiliary systems of the LRVs, which reduce consumption from the CEB grid for power consumption.
- The LRVs use electricity from the National grid which has 15% Renewable Energy part (bagasse, solar & wind) in the total energy mix.
- The level of noise pollution is relatively low and is according to European norms.
- The Depot is equipped with:
    - Wash plant – Recycled water to wash the LRVs through a wash plant has been constructed at the Depot
    - Solar water heaters – The maintenance workshop is equipped with three solar water heaters for the showers. The total tank capacity of the solar water heater is 900 Litres.
    - Waste oil tank - The depot will be equipped with a used oil tank of capacity 1000 litres. All used oil will be disposed to the Approved Authority as advised by the Ministry of Environment.
    - Waste segregation - MEL is currently finalizing the design of a waste skip area for Depot. Four compartments have been proposed to segregate plastic, metal, hazardous and general waste.

Solar Energy

- Vision 2030 enunciates that "Government will aim at ensuring energy security by promoting cleaner and sustainable energy through the development of renewable energy and energy efficient technologies."
- In line with Government Vision 2030 and taking sustainability seriously, MEL is intending to implement a Photovoltaic system at Coromandel Park & Ride Station. (Budget to be sought by MLTLR). This will greatly contribute to offset the overall electricity consumption of the Metro Station.
- MEL also intends to implement a solar farm on land available near Barkly to cater for its whole energy demand thus reducing drastically reliance from the National Grid. MEL intends to work with the Ministry of Energy and Public Utilities and the Central Electricity Board (CEB) for a modus operandi in developing this alternative renewable energy. (Budget to be sought by MLTLR)

Embellishment Project

- The Embellishment Project is ongoing with the intent to beautify the light rail corridor, improve the urban setup and landscape along the alignment to achieve inclusiveness, sustainable development and community engagement and maximise commercial opportunities along the corridor.

Ebene Recreational Park by Metro Express Ltd

	• MEL led the creation of a new leisure and recreational park, the 'Ebene Recreational Park', located approximately 500 metres from Rose Hill Central Station to preserve the environment and enhance the well-being of the population. The Park was created after the closure of the Roland Armand Promenade between Rose Hill and Beau Bassin to make way for the Metro Express project. • Furthermore, MEL is planning to implement a Photovoltaic system at the park to offset its electricity consumption. Mobile application • MEL has made a proactive sustainable step to launch a transactional mobile application and website with the intention to reduce paper usage. This will allow Metro Express Passengers to buy tickets online and to participate in interactive surveys. This is chance for every passenger to leave a smaller footprint. Shuttle Services • The implementation of Shuttle Services in Quatre Bornes is to enhance connectivity of the passengers to and from the light rail stations by offering a multimodal transportation service to the public, hence contributing in the reduction of private vehicle use and therefore further alleviating traffic congestion. •
	Estimated outcomes and estimated emission reductions
	• With the introduction of a Light Rail Transit System, a shift from private vehicle use to a faster and reliable alternative mode of transport will be feasible resulting in significant reduction in private car use and hence lowering the carbon footprint. With the extension of the light rail to Curepipe and other parts of the island, a further modal shift is expected. • With the introduction of the Metro Express LRVs operation, 20% of bus commuters and 10% of personal vehicle users are expected to switch to using the LRT Metro Express system. • With the completion of Phase 1 of the Metro Express project and modal shift from private cars to light rail, the carbon emission along this corridor has reduced. • With the completion of Phase 2A and connection to Curepipe, carbon emission, along the alignment is expected to be further reduced. The updated Nationally Determined Contributions (NDC) reported a reduction of 28 ktCO2eq in GHG emissions by 2030 for the light rail system.

4.4 Mitigation Actions for the IPPU sector

The Industrial Processes and Product Use (IPPU) Sector in Mauritius comprises mainly the Refrigeration and Air-Conditioning (RAC) sector and one industry involves in the recycling of metals including the manufacture of steel. Mauritius, through the National Ozone Unit of the MESWMCC, in collaboration with other stakeholders, have been very active, under the Montreal Protocol, in phasing out the import of conventional refrigerants like CFCs and HCFCs. These refrigerants are both global warming and ozone depleting substances. The import of CFCs was completely banned in 2005. HCFCs are being gradually phased out under the Hydrochlorofluorocarbons Phase-Out Management Plan (HPMP) (2011-2025). Additionally, with the ratification of the Kigali Amendment in 2019, Mauritius will soon embark on the formulation of an HFC Phase-down Management Plan. HFCs are another class of refrigerants which are global warming gases, they were introduced as transition in replacement of CFCs and HCFCs. The mitigation potential for the RAC sector is that the alternatives to these conventional refrigerants namely, hydrocarbons, carbon dioxide and ammonia, in addition of being climate and ozone friendly, they are also energy efficient. A summary of past actions taken and course of actions for the RAC sector are as follows:

Projects carried out to phase out Chlorofluorocarbons (CFCs):

- Country Programme: The main achievement of the Country Programme has been the elimination of **32 Ozone Depleting Potential (ODP) tons** in the Aerosol and the domestic refrigerator manufacturing sectors in late 1990s.
    - Countrywide survey on the supply-demand scenario of Ozone Depleting Substances (ODS) use in Mauritius
    - Analysis of future requirements and the limits imposed by the Protocol.
    - Assessment of options available for changing over to alternative technologies and substances in each sector and sub-sector
    - Assessment of the actions to be undertaken to implement phase-out of CFC
    - The banning on imports of all CFC based appliances since 1999 and HCFCs based ones since 2013.
    - The ban on import of aerosol containing CFC, excluding medical aerosols.
    - The institution of an import licensing system for controlling the import of CFCs.
    - The Ban on imports of halons.
    - Constitution of a steering committee with representation of all concerned ministries to guide the phase out process in Mauritius
- Refrigeration Management Plan: Phase out the use of CFCs in the servicing and maintaining of refrigeration equipment
    - Training in good practices (Trainers, Refrigeration technicians and Customs officials).
    - Recovery and Recycling of CFC's.
    - Initiation of Legislative Measures.
    - Initiation of Policy Measures including economic instruments.
    - Conversion projects including Retrofitting
- Terminal Phase out Management Plan: Achieve complete phase out of CFCs earlier than scheduled by the provisions of the Protocol, through a strict control, monitoring and gradual reduction of imports of the ODS as well as appliances containing substances. There was also training of customs officers, technicians and hydrocarbons Technology.

- Several legislations measures have been put in place to control ozone depleting substances (ODS) and these are:
    - The Consumer Protection Regulations 1999: Control of imports of all equipment/ appliances containing controlled refrigerants
    - The Dangerous Chemicals Control Act 2004: provides in its different schedules for the control of ozone depleting substances as well as their substitutes
    - The Environment Protection Act 2002: the issue of EIA licenses for scheduled undertakings
    - Customs Tariff Regulations to provide tax rebate on alternatives to CFCs

Projects carried out under the HPMP to phase out Hydrochlorofluorocarbons (HCFCs):

- Institutional set up – coordination by Ministry of Environment, Solid Waste Management and Climate Change (Focal point)
- Legal framework
- Public and private sector participation
- the HCFC policy instrument which serves to control the import of HCFCs through a quota system and imposition of a ban on import of all HCFC appliances as from January 2013;
- Intensive awareness raising by the NOU;
- Training in the technical and enforcement fields (e.g.: training of trainers, provision of equipment to training institutions, training of technicians, training of customs, DCCB, environment officers)
- setting up of a licensing system to control the import and export of refrigerants
- Training equipment such as leak detectors and related tools for the technicians are provided to training centres
- Facilitate training of technicians by trained trainers from the government and private sectors. Some training sessions have been conducted: training of technicians on hydrocarbon technology, training of customs officers and training of technicians on carbon dioxide
- Demonstration project on Ammonia carbon dioxide cascade system under the HPMP. The equipment has been installed at Université Des Mascareignes and is used for training purposes (refrigeration and air conditioning technicians)
- Retrofitting (training of technicians – e.g.: Training on hydrocarbon technology)

Under Green Cooling Initiative for Africa (GCIA), a survey on alternatives to HFC appliances was done. The findings were presented in a workshop in June 2017 to eventually prepare an HFC phase out management plan in the future.

4.5 Mitigation Actions for the Agriculture Sector

Agriculture Sector

Over the years, the agricultural sector has played a pivotal, economic role and served as a driver in the development of Mauritius. Since the early 1970s however, the contribution of agricultural production to Gross Domestic Product (GDP) has been declining steadily from around 30% to only 3.4% in 2013, largely as a result of the successful diversification of the economy into the manufacturing and services sectors. Out of these 3.4%, some 2.2% are generated by the sugar subsector. 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 44,200 persons[5].

The Ministry of Agro-Industry and Food Security has developed its Strategy for the period 2016-2020 using a participatory approach and taking on board the need for sustainable agricultural development in a climate-friendly mode as well as safeguarding farmer's livelihoods.

Figure 4.3a: M 1334/84, a sugar-model high biomass cane. Figure4.3b: Biofarming and organic farming

Non-sugar crops

The non-sugar crops sub-sector covers food crops, fruits and ornamentals and is driven mainly by 8,000 small growers and 375 hydroponic producers. Close to 100% self-sufficiency is achieved for fresh vegetables and tropical fruits, except for off-season imports of selected vegetables such as potato, onion and garlic. For food crop production, the shift towards bio-farming will ensure the production of safe and quality food, with standards and norms defined.

[5]*Strategic Plan 2016 – 2020 for the Non-Sugar Sector*

Livestock

The Livestock sub-sector has made little progress in recent years, mainly because of high costs of production, limited access to land and breeding animals, lack of an organized market structure, and difficulties to comply with environmental regulations. Emerging issues relate to competition from cheap imports, high cost of quality inputs and the increasing consumer concern over food safety and animal welfare.

Mitigations actions being taken, and other climate projects being implemented for the reduction of greenhouse gas emissions;

1. Development of Bio farming/ organic package and Agri-waste recycling and composting
2. Improving the Resilience of Small Farmers to Climate Change "Development of an integrated sheltered farming system comprising of roof-top rainwater harvesting structure, a solar water pump coupled with a pressurized drip fertigation system or a gravity-fed drip irrigation system for vegetable crops production"
3. Development of an Interplanetary Naming System (IPNS) as an eco-friendly approach to optimize fertilizer use and management of soil fertility in crop production.
4. Enhancing crop nutrition and soil and water management and technology transfer in irrigated systems for increased food production and income generation"
5. Optimising fertiliser use in tea cultivation "Review fertilizer recommendation of existing and new tea plantation"
6. Testing of new products "Testing of new products as substitutes to chemical fertilizer and for sustaining crop production"
7. Development and promotion of the Agro forestry sector to optimize forest land for agricultural purpose, under Organic and Natural techniques.
8. Development of high biomass sugarcane varieties as a renewable source of energy.

4.5.1 Mitigation Action 4 – Agriculture Sector (Livestock)

Table 4.4: Mitigation Action 4 – Agriculture Sector Livestock

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Standards for treated manure from animal waste	Under implementation	Food and Agricultural Research and Extension Institute (FAREI) Mauritius Standard Bureau University of Mauritius	2018- 2021	Agriculture-Livestock	National	Reduction of CH4 and N2O to be assessed during implementation	CO_2, CH_4, N_2O
	Objective of the mitigation action						
	To develop treated manure standards using proven locally adapted technology through dehydration and solarisation to reduce GHG emission.						
	Brief description of activities under the mitigation action						
	• Implementation Committee set up under the chairmanship of MSB to develop technology to meet published standards • Specifications for treated farm animal manure published under Standards MS 196 in November 2018 • Action plan and Protocol for sanitation of cattle and poultry manure trial developed. • Experimental trials started in in October 2019 by FAREI in collaboration of University of Mauritius and MSB. Two methods (solar drying and dehydration) were assessed using cattle and poultry manure. In solarisation trial, transparent plastic of 50µ thickness was effective in sanitisation of both poultry and cattle manure within one week and both treated manure complied with chemical and microbiological standards as set in MS 196-201. For solar dehydration, preliminary findings showed that cattle and poultry manure can be sanitised within 5 weeks • Flyer distribution and sensitisation workshop done on "solarisation as a method for sanitisation of cattle and poultry manure" with various stakeholders on 21st January 2021 at Wooton, Farmer Training School , FAREI.						
	Estimated outcomes and estimated emission reductions						
	• Sanitised manure for poultry and cattle (this is an output of the trials undertaken) • GHG emission reduction by around 20% of total accounted for by manure management.						
	Methodologies and assumptions						
	• Protocol agreed by FAREI, Mauritius Standard Bureau and University of Mauritius • Endorsement by Implementation Committee. • Farmers training						

4.5.2 Mitigation Action 5 – Agriculture Sector (Livestock)

Table 4.5: Mitigation Action 5 – Agriculture Sector Livestock

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Promotion of small livestock projects at back yard level	Under implementation	FAREI	On-going since 2018	Agriculture-Livestock	National	Reduction GHGs gases by controlled rearing of livestock animals	CH_4, N_2O
	Objective of the mitigation action						
	• To reduce GHG emission by encouraging farmers to engage in backyard production through rearing of small livestock species such as rabbit, duck and quail						
	Brief description and activities planned under the mitigation action						
	• Set up of a nucleus rabbit unit at FAREI Curepipe Livestock Research Station with the objective to produce breeding animals for farmers • Promoting the use of electric artificial incubators to improve hatchability of eggs at farm levels • Publish a booklet on Quail Production in Mauritius, in 2018 • Conduct awareness campaign on quail production through diffusion of a clip on national TV • One trial undertaken in 2019 to evaluate the laying capability of 4 types of quails. The Jumbo type quail is found to be very promising with a daily feed intake of around 40g per day, giving 1 egg (weighing 12 g) per day over a laying cycle of 33 weeks.						
	Estimated outcomes and estimated emission reductions						
	• Increase in the number of backyard production for small livestock category • Ensuring food security • GHG emission reduction by around 1-5% of the total livestock emission						
	Methodologies and assumptions						
	• Free technical support from FAREI to encourage farmers to embark on rearing of small livestock category for domestic purpose. • Developing technical information on rearing of small livestock species • Farmers training						

4.6 Mitigation Actions for the FOLU (Forestry) Sector

Forestry Sector

Being a Small Island Developing State, with limited land resources, Mauritius is particularly vulnerable to the impact of climate change. Sustainable Forest Management (SFM) can help to reduce the risk of damage and possible losses from changing climatic conditions and also to undertake effective mitigation actions. When well-managed, the forests of Mauritius not only have the potential to reduce the country's GHG emission but also contribute to environmental rehabilitation, create job opportunities, improve the supply of forest produce, increase food security, develop ecotourism and improve recreation and national well-being.

Various legislation has been enacted to protect forests. These include: the Forests and Reserves Act (1983, amended 1986 & 2003), the Shooting and Fishing Leases Act (1966) and the Native Terrestrial Biodiversity and National Parks (2015). In addition to these Acts, a plethora of strategies and action plans have already been prepared to halt and reverse the trend of forest loss and degradation. These plans adopt, a multi-faceted approach for sustainable management of forest resources based on education and awareness, conservation of biodiversity and increase in the tree cover through national tree planting campaign and promotion of urban forestry. A Forests and Reserves Bill is under preparation to provide for the protection, conservation and sustainable management of forests, reserves and related areas in the Republic of Mauritius for present and future generations.

The main mitigation activities undertaken by the Forestry Service include:

(a) Reforestation/Afforestation and tree planting
(b) Forest protection (Creation and Maintenance of Firebreaks in Forest - At least 30 km of firebreaks created and maintained annually
(c) Forest restoration (& biodiversity conservation) in Nature Reserves, Mountain Reserves, River Reserves and State Forest Land
(d) Agroforestry

Projects related to sustainable land management:

- The Global Environment Facility (GEF) funded Project "Mainstreaming Sustainable Land Management and Biodiversity Conservation" which is being finalized for implementation will also create and rehabilitate riverine biodiversity and increase tree cover for carbon sequestration.
- The Strategic Plan for the Food Crop, Livestock and Forestry Sectors of the Ministry of Agro Industry and Food Security is being reviewed for next five years. As part of the Strategy, tree planting to increase tree cover will be a core activity of the Forestry Service.
- The GEF funded CBIT Project which has been approved is projected to undertake an inventory the trees outside forests and provide capacity building for the calculation of country specific local emission factor of the major plantation species.

- Development of Agroforestry Project: The FAO is providing technical assistance to Mauritius for the development of agroforestry under the project 'enhancing rural livelihoods and agriculture productivity through agroforestry development in Mauritius'. The project aims to enhance the livelihoods of people through identifying, testing and adopting good agroforestry options in underutilized/abandoned agricultural land and promoting agroforestry enterprises. The project is on-going.

4.6.1 Mitigation Action 6 – Forestry sector

Table 4.6: Mitigation Action 6 – Forestry Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Tree planting and Creation and maintenance of mini-forest, Nature Walk, urban forests, Parks and Garden, etc	Under implement ation	Forestry Service NPCS Ministry of Environment District Council Municipalities NGOs	2016- 2024	Forestry	National	Planting of at least 100,000 trees annually (until 2024)	CO_2
	Objective of the mitigation action						
	• Increase Carbon sequestration; • Improve environment and ecological benefits; • Improve local microclimate; • Improve soil, water quality and air quality; and • Mitigate the impact of natural calamities such as flood.						
	Brief description of activities under the mitigation action						
	• Plant Production in Forest nurseries • Site selection for tree planting • Site selection for creation of new mini-forests/garden/parks. • Tree planting programme throughout the island • Restoration and maintenance of mini-forests						
	Estimated outcomes and estimated emission reductions						
	• Planting of at least 100, 000 trees annually (until 2024) • Restoration and maintenance of nature walk and mini forests. • Creation of at least one new mini-forest/urban forest by 2030 • Creation of three new endemic forests by 2024						

4.6.2 Mitigation Action 7 – Forestry sector

Table 4.7: Mitigation Action 7– Forestry Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Forest restoration - Nature Reserves, Mountain, River Reserves, forest plantation	Under implementation	Forestry Service, NPCS, private land owners, NGOs	2020-2030	Forestry	National	75 ha of mountain reserves restored	CO_2
	Objective of the mitigation action						
	• Reduce forest degradation. • Improve environmental and ecosystem Services						
	Brief description and activities planned under the mitigation action						
	• Weeding/removal of invasive alien species • Re-introduction of native species • Filling of gaps in plantation forest • Provision of incentive for the restoration of privately owned river and mountain reserves						
	Estimated outcomes and estimated emission reductions						
	• 75 ha of mountain reserves restored • 500 ha of degraded riverine reserves restored and benefiting from enrichment planting of native trees • Restoration of Terrestrial and Islet Nature Reserves • 1,000 ha of plantation forest and native forest restored						

4.7 Mitigation Actions for the Waste sector

The Solid Waste Management Division is coordinating the design and implementation of the new Strategy and Action Plan for a new Solid Waste Management and Resource Recovery System for Mauritius (detailed described in table below).
Other relevant actions that RoM considering are:

- the vertical expansion of the Mare Chicose landfill, which will increase the capacity for landfill gas abstraction and power generation.
- It is under consideration the option of an anaerobic digestion process for treatment of the high organic fraction of MSW in Mauritius. This will contribute to increase the biogas production that can be combusted for electricity production. As a major constraint/gap, financial and technical assistance for an in-depth feasibility study on the technology are required.

Regarding wastewater sector, the Wastewater Management Authority (WMA) is the entity responsible for wastewater Management. Based on the Annual Report 2017-2018, during the 2017-2018 period, four (4) wastewater capital projects were successfully completed as per hereunder:

- Plaines Wilhems Sewerage Project – Lot 1A, marks the part completion of the Plaines Wilhems Sewerage Project identified in the National Sewerage Programme
- Design and Construction of Sewer Reticulation and House Connection at Cipaye Brulé, Vallée des Prêtres
- Rehabilitation/Provision of Sewerage Infrastructure at Residence Palmerstone, Phoenix
- Rehabilitation/Provision of Sewerage Infrastructure at Residence La Cure, Port Louis

And the defined key actions for 2019-2020, with potential mitigation actions, were:

- Implementation of the Pailles Guibies Phase II Sewerage Project and the Grand Baie Phase IB Sewerage Project, thereby connecting around 7,000 new households
- Implementation of the Framework Agreement (House Connections and Operations & Maintenance Works)
- Procurement of Specialised Vehicles and Equipment for Operation and Maintenance of Public Sewers, Wastewater Treatment Plants and Pumping Stations

In line with the stated mission of the Government to connect 50% of the population by 2030, the WMA is committed to meet the target set with the completion of the ongoing projects in the region of Plaines Wilhems, Parisot, Verger Bissambar and the forthcoming projects in the Pailles-Guibies region.

RoM, through the WMA, is working hard in continue improving the wastewater in the country, and many projects and initiatives have been implemented and additional projects are planned. However, although some of these projects/initiatives could imply a potential emissions reduction, the available information is not enough to quantify those emissions reductions. This happens because data tracking system required to determine their mitigation potential is not available. RoM will work to be able to estimate and report mitigation projects regarding wastewater in future NCs/BTRs.

It is also important to mention that not all projects developed regarding wastewater imply emissions reductions. It is important that all wastewaters are piped and treated from a health and environmental perspective. However, based on MCF values provided by 2006 IPCC Guidelines, depending on the treatment applied and how well it is operated, the emissions can be higher when wastewaters are treated.

4.7.1 Mitigation Action 8 – Waste Sector

Table 4.8: Mitigation Action 8 - Waste Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Strategy and Action Plan for a new Solid Waste Management and Resource Recovery System for Mauritius	Under implementation	Solid Waste Management Division – Government of Mauritius	5 years	MSW	National - Mauritius	Not estimated. To be assessed during design and/or implementation phase of specific projects	CO_2 CH_4 N_2O
	Objective of the mitigation action						
	Maximising resource recovery and recycling in the short to medium term, while also tapping the energy recovery potential from wastes in the long term.						
	Brief description and activities planned under the mitigation action						
	Proposed Strategy focuses on five key areas: **Strategic Area I: "Prevention and Environmentally Responsible Consumption"** Emphasis is laid on the minimization of the impacts of wastes by reducing the quantities of wastes generated. Concrete actions that can be implemented at low costs and in the short-term include home composting, deposit on post-consumer products, among others. The use of legal instruments and enforcement to discourage bad behaviour and to prohibit non-environmental friendly products has also been recommended. **Strategic Area II: "Increase in Resource Recovery"** This Strategic Area proposes ways and means to efficiently recover such resources that are otherwise being wasted by throwing away of recyclables with intrinsic economic value, such as organic matter, wastepaper, plastic, glass and metal. Separation of waste at source is viewed to be of paramount importance for this initiative to succeed. The introduction of a systematic segregation and material recovery system for waste generated at, but not limited to, household level, such as wood waste, bulky waste, small hazardous waste, is being recommended, with accompanying legal and financial measures. This will ensure the continuous supply of non-contaminated resources to the recycling industry, reduce the quantity of wastes to be landfilled and stimulates the economy with the creation of new green jobs. **Strategic Area III: "Adequate Technologies for Energy Recovery"** The setting up of Waste-to-Energy infrastructure can only be envisaged for implementation in the long-term, that is, after successful implementation of resource recovery and recycling projects. Thus, it is proposed that an assessment of the potential of waste-to-energy technologies be carried out in the medium term, as this would not be relevant in the short term. **Strategic Area IV: "Provision of Adequate Disposal Infrastructure"**						

	It is reckoned that despite all efforts to minimize wastes, to recycle resources and to recover energy, a landfill will still be needed to dispose of residual wastes. This area focuses at short- and medium-term on the extension or further optimization of the existing Mare Chicose landfill, while also considering the eventual option of a new landfill. **Strategic Area V: "Information, Education and Communication"** Commitment and engagement of all stakeholders are essential in the sustained implementation of the Strategy over the next five years. A lot of focus is thus laid on capacity building of important stakeholders and awareness-raising on new waste practices in general.
	Estimated outcomes and estimated emission reductions
	While all the Strategic Areas are fundamental to the successful implementation of this new solid waste management system, Strategic Area II on "Resource Recovery" is the cornerstone of this Strategy and Action Plan. An advanced resource recovery will be obtained only by introducing a systematic segregation and material recovery of domestic wastes into the habits of Mauritians. The development of two Pilot Projects in the South and West of Mauritius will serve as the catalyst to the new solid waste management system for Mauritius. These pilot projects, which will initially focus on 25% of each pilot region, will consist of a Material Recovery Facility (MRF) that may be composed of a compost plant, a Sorting Unit (SU) and a Civic Amenity Centre (CAC). The SU will act as a platform for the reception of recyclables while the compost plant will accept only organic and yard wastes. The CAC will accept household wastes such as waste oil, household hazardous wastes, bulky wastes and construction and demolition wastes. There is no emission reduction estimates due to this Strategy and Action Plan yet. It is a Strategy and Action Plan, which will be defined by the implementation of specific mitigation projects, will have a specific scope, so mitigation potentials will be able to be estimated for each specific project, at a later stage.
	Methodologies and assumptions
	The Action Plan emanating from the Strategy covers the different waste streams generated at, but not limited to, household including organic and yard waste, paper and cardboard, plastics, glass, metal, bulky waste, wood waste, construction and demolition waste, waste oil and household hazardous wastes. Implementation of this Strategy and Action Plan will ascertain that Mauritius is no more dependent on landfilling while also ensuring that one of the targets of Sustainable Development Goal 12 (Ensure sustainable consumption and production patterns) "By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse" is achieved. The approval of this Strategy and Action Plan will also assist in the implementation of good practices and the eventual shift towards a 'Zero Waste' society.

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4.8 Mitigations Actions in Rodrigues

A. Forest Restoration

Over the past decade, the Commission for Environment of the Rodrigues Regional Assembly has established a programme of experimental control of invasive woody plants, combined with replanting of seedlings of selected endemic and other indigenous plants, including a number of threatened species. The principal aims of this programme, which is managed by the Rodrigues Forestry Services, are to:

1. Reduce the prevalence of selected highly invasive woody species, which are currently spreading rapidly in different zones of the island

2. Re-establish native forest across a variety of habitats, in state-managed protected areas such as Cascades Pigeon, Anse Quitor and Montagne Limon

3. Increase the populations of threatened endemic plants and provide additional habitat for endemic animals.

Recent restoration projects:

Two projects co -financed by the European Union and the RRA are listed below:

a. Preparation and Testing of a comprehensive model for preventing and managing the spread of invasive species on island ecosystems. In this project 20 Hectares were restored at a cost of MUR 5 million

b. Setting up of a Nature Reserve at Cascade Pigeon, 20Hectares were tested and restored at a cost of MUR 7 million

Community forest restoration projects

Since 2013 the local Community has been involved in forest restoration projects and more than 300 000 native, endemic and economic plants have been planted over an extent of about 25 hectares of land. The Commission for Environment provided support thereto in terms of fence and plant materials.

B. Agroforestry Projects

The Commission for environment has launched a scheme to promote the development of green businesses in the field of agro-forestry as a means to reforest bare land surfaces, address the problem of soil erosion and lagoon sedimentation.

In the first instance some 200 hectares of land is targeted in the region of the South East

Port Mathurin, Rodrigues

Marine Parks Area (SEMPA) and some funding has been provided by the UNDP to the tune of USD 150 000. Purchases of fencing materials and preparation of plant materials have already started.

C. Awareness Raising

Sensitization campaign on plant biodiversity conservation is being done by the Forest Services as follows:

- Radio talks
- Talks at school with students
- Marking important events such as World Forest Day, World Biodiversity Day, through aggressive Biodiversity campaigns
- Production of pamphlets on Biodiversity
- Production of films.

4.8.1 Mitigation Action 9 – Model Eco Village project in Rodrigues

Table 4.9: Mitigation Action 9- Model Eco Village, project in Rodrigues

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Model Eco Village project	completed	EU under the IOC ENERGIES Programme	August 2017 to August 2020	Energy, Agri	Rodrigues Regional Assembly		CO_2, CH_4,
	Objective of the mitigation action						
	To (i) facilitate the conditions of access to development, investment and sustainable management of renewable energies; (ii) increase the energy efficiency of the various economic sectors.						
	Brief description and activities planned under the mitigation action						
	The different activities under the project are: (a) Procurement of an electric car and setting up of a solar charging station						

	The objective is to demonstrate the use of renewable energy in the transport industry. The electric car, which is the first in Rodrigues, will be used to sensitise the population on the ecological importance and availability of this technology. (b) Constructions of six bio digesters. The use of biogas for cooking purposes is a very good ecological way of living. The use of bottled LPG gas is the most common source of energy for cooking purposes. Most of the Rodriguans are back yard breeders so that raw materials to feed the bio digesters are readily available. The bio digesters are constructed using local materials and with very little technological knowhow which can be easily replicated across the island. (c) Procurement of Solar Street Lightings. Actually, most of the street lightings across the island are connected to the grid. They consume quite a considerable amount of electricity. The objective of the activity is to showcase the use of solar lightings to replace the grid connected ones that will help to reduce energy consumption from fossil fuels. (d) Setting up of a community solar PV farm. Actually the use of renewable energy across the island is around 10 % which is basically from the wind farm. A solar PV farm of capacity 60 kWp has been set up in the western part of the island to power a desalination plant. The use of solar energy is quite restricted to individual households. A solar PV farm of capacity 100 kWp will be set up in the village of Riviere Coco. The farm will be grid connected and as per the SSDG Scheme developed by the Central Electricity Board, the village will benefit from revenue derived from the project. At the same time the PV farm will reduce the dependency on fossil fuels in supplying electricity. The objective of this activity is to replicate same across the other villages which will contribute towards the energy policy of the island. The vision of the Rodrigues Regional Assembly is to achieve the use of renewable energy at 100 % by the year 2030.
	Estimated outcomes and estimated emission reductions
	Methodologies and assumptions
	The technological choices and the scaling of a bioelectricity production facility (and more generally of a whole production chain) are based on several criteria ➢ electricity demand (grid connection or decentralized electrification, power ...)

4.8.2 Mitigation Action 10 – Energy sector in Rodrigues

Table 4.10: Mitigation Action 10- Energy Sector in Rodrigues

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Implementing a biomass to electricity chain in Rodrigues	Feasibility study	EU under the IOC ENERGIES Programme		Energy, Agri Biomass	Rodrigues Regional Assembly	To be assessed during implementation phase	CO_2, CH_4,
	Objective of the mitigation action						
	To (i) facilitate the conditions of access to development, investment and sustainable management of renewable energies; (ii) increase the energy efficiency of the various economic sectors.						
	Brief description and activities planned under the mitigation action						
	Power production from woody biomass may contribute to a better energy autonomy of the IOC member states: (i) biomass resources, although unequally distributed over the territories, are globally under-exploited; (ii) it may be a base or semi-base energy and thus be complementary to intermittent renewable energies such as solar and wind energy; (iii) it is potentially a source of additional income for agriculture and agro-industry / agribusiness sectors						
	Estimated outcomes and estimated emission reductions						
	➢ Inventory of available woody biomass, with particular attention to forest resources, invasive species, green wastes and agricultural residues; ➢ Evaluation of possible routes for bioelectricity production through thermochemical conversion of woody species identified. ➢ Preliminary scaling of a bioelectricity plant, taking into account the available biomass potential; ➢ Technical and socio-économic analysis of constraints and opportunities related to the supply of the plant associated with plans for the eradication or management of invasive species.						
	Methodologies and assumptions						
	The technological choices and the scaling of a bioelectricity production facility (and more generally of a whole production chain) are based on several criteria: ➢ performance and reliability of the production technology; ➢ regular supply of biomass, with controlled quantity and quality; ➢ regulatory framework regarding for biomass supply chain and electricity generation; ➢ production costs along the whole chain.						

4.9 List of Forthcoming Mitigation Measures

- Production of 60% of the country's energy needs from green sources by 2030. The use of coal will be totally phased out before 2030.
- Setting up of a National Biomass Framework
- Renewal of Alteo coal bagasse contract to a dedicated biomass contract
- Development of high biomass sugar cane varieties as a renewable source of energy.
- Setting up of 3x10 MW Solar PV farm project on Independent Power Producer basis
- Installation of 10 MW roof top solar for Public Institutions
- Installation of 15 MW roof top solar for Smart Cities
- Decreasing amount of dumping at landfill and generate electricity from waste
- A National Cycling Policy Framework to be developed to encourage cycling for leisure and recreation as well as for transport and tourism. Dedicated cycle lanes will be included as a component of road infrastructure development plans.
- Reach target of 15% for electric vehicles by 2030 according to the EV Roadmap recommended scenario
- Promoting Low-carbon Electric Public Bus Transport in Mauritius by promoting the deployment of solar powered electric buses in Mauritius on a pilot basis (funding being sought from GCF funding through Global Environment Facility)
- Government will purchase 25 electric buses for the National Transport Corporation to renew its fleet
- Waste diversion of 70% from the landfill by 2030 through composting plants, sorting units, biogas plants and waste-to-energy plant.

Planned activities to phase-down HFCs:

- Adapting existing laws or introducing new ones to achieve the HFC phase-down
- Extend the ODS import and export licensing system to cover HFCs
- Put in place, where appropriate, any practical arrangements that may be required for customs officers to assume extra responsibilities concerning HFCs
- Surveying existing HFC consumption and production
- Develop the resources to report under the amendment
- Develop a strategy for HFC phase-down, including monitoring and enforcement
- Make reference to Annex F in the Montreal Protocol which includes a list of HFCs
- Import and export licensing systems for HFCs must be in place by 1 January 2019, except that an Article 5 party that decides it is not in a position to meet that deadline may delay until 1 January 2021
- Trade with states that have not ratified the Amendment must be banned from 1 January 2033
- Monitoring and reporting of HFC production and consumption, and HFC-23 emissions where relevant

4.10 International Market Mechanism

4.10.1 Clean Development Mechanism

Mauritius acceded to the Kyoto Protocol on 09 May 2001. The Protocol entered into force in February 2005. Through participation in the Clean Development Mechanism (CDM) under this Protocol, Mauritius has benefited from investments in GHG emission reduction projects which have contributed towards the overall improvement of the environment in line with its national sustainable development goals.

As of November 2019, Mauritius has a total of 8 CDM projects. The table below shows the distribution of CDM project activities, categorised according to project type, along with their potential annual emission reductions and reported investments.

Table 4.11: Distribution of CDM project activities

SN	Project Name	Scope	Status	Registered date	Crediting starts	CERs (t CO 2e/yr) (1st period)	Crediting Period
1.	9 MW Wind Farm at Plaine Des Roches by AEROWATT Mauritius Ltd	Energy Industries (renewable sources)	Registered	14 September 2011	01 Jan 2015	12,062	01 Jan 15 – 31 Dec 21 (Renewable)
2.	3 MW Landfill Gas to Energy at Mare Chicose Landfill by Sotravic Limited	Waste handling and disposal	Registered	30 March 2012	01 April 2019	183, 370 (2nd period)	01 Apr 19 – 31 Mar 26 (Renewable)
3.	CO2 production from biomass for use in industrial processes by Gaz Carbonique Limited	Chemical Industries	Registered	09 May 2016	09 May 2016	11, 283	09 May 16 – 08 May 26 (Fixed)
4.	15 MW Solar PV Farm at La Ferme, Bambous by Sarako PVP Co. Ltd	Energy industries (renewable - / non-renewable sources)	Registered	05 Aug 2016	01 October 2016	21,878	05 Aug 16 – 04 Aug 26 (Fixed)
5.	17.5 MW Solar PV Farm at Henrietta by Akuo Energy (Mauritius) Ltd	Energy industries (renewable - / non-renewable sources)	Registered	31 May 2019	15 May 2019	26, 246	31 May 19 – 30 May 26 (Renewable)

SN	Project Name	Scope	Status	Registered date	Crediting starts	CERs (t CO 2e/yr) (1st period)	Crediting Period
6.	16 MW Solar PV Farm at Solitude by Voltas Yellow Ltd	Energy industries (renewable- / non-renewable sources)	Registered	31 May 2019	16 May 2019	28,882	31 May 19 – 30 May 26 (Renewable)
7.	12 MW Solar based power generation at Queen Victoria, FUEL, by Voltas Green Ltd	Energy industries (renewable- / non-renewable sources)	Registered	22 November 2019	25 November 2019	22, 690	25 Nov 19 – 20 Nov 26 (Renewable)
8.	10 MW solar PV based power generation by Helios Beau Champ Limited in Mauritius	Energy industries (renewable- / non-renewable sources)	Registered	30 November 2019	30 November 2019	14,539	30 Nov 19 – 29 Nov 26 (Renewable)


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Chapter 5
Constraints and gaps, and related financial, technical and capacity needs, including support needed and received

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5. Constraints and Gaps, and Related Financial, Technical and Capacity Needs, Including Support Needed and Received

To create an enabling environment for the nation to move towards a low carbon economy and to make the environment and society more climate resilient, it is essential to understand the gaps and constraints that exist in the various sectors of the economy with a view to overcoming them. This chapter looks into the most pressing constraints and gaps identified under the BUR1 and the related financial, technical and capacity needs including support needed and received.

5.1 Constraints and gaps, and related technical and capacity needs

To address the most pressing gaps and needs identified under the BUR 1, several recommendations are proposed and summarized at Table 5.1.

As far as Rodrigues is concerned, the major constraint identified is limited data in most sectors including livestock, crop, forest cover, and fuel consumption from fishing vessels and pleasure boats. This has been an important barrier to improve the GHG inventory. It is proposed that the Rodrigues Climate Change Committee as per the Climate Change Act 2020 discuss and take appropriate action to address the issue.

5.2 Financial needs

The Republic of Mauritius is committed to mobilise the resources that are necessary to overcome the challenges in mitigating and adapting to climate change. The different distribution channels in the financial system, such as domestic public finance, private sector finance and international climate finance sources are important development partners for the Government to be able to adapt to and mitigate climate change impacts.

As far as financial needs are concerned, Mauritius mobilises fund from international sources to add to the national budget in combating climate change. Climate finance sources can be classified into four different categories; bilateral finance, multilateral finance, domestic public finance and private sector finance. The Global Environment facility (GEF) is the traditional source of grant for climate change initiatives in Mauritius and the Green Climate Fund (GCF) also have been added to the list of sources for mobilising climate finance. The BUR1 contain updates on the financial and resources that were mobilized as from 2016 (The TNC which is the last national communication report submitted to the UNFCCC provides information up to 2016 for this sector). The information is reported in the subsequent sections in a tabular format.

Moreover, additional resources that the country still needs to effectively respond to climate change are also highlighted.

5.2.1 Domestic Public Funding

In 2018, there has been the revamping and consolidation of the National Environment Fund (NEF) into a centrally managed vehicle, giving the NEF a new impetus. In the 2018/2019 Budget exercise, a Supplementary Appropriation (2017-2018) Bill was passed in Parliament, whereby the NEF was capitalised with Rs 2 billion for the financial years 2018-2020 with a view to addressing a wider scope of projects island-wide.

However, according to a study commissioned by the United Nations Development Programme Country Office (Tracking Public Sector Environmental Expenditure, 2018), despite spending a massive amount of Rs 10.28 billion from the national budget on climate-related measures (77% on adaptation measures and 23% on mitigation measures), representing 2.15% of Gross Domestic Product (GDP) or 7.02 % of total Government expenditure, the goodwill of Government will not suffice. For instance, the Rs 2 billion injected in the NEF is nothing near the scale of funding required to implement the Mauritius INDCs under the Paris Agreement, whereby it was estimated that the implementation of climate change mitigation and adaptation measures will cost around USD 5.5 billion (representing around Rs 190 billion).

In the 2021/2022 budget, Government has allocated Rs 2.2 billion to the National Environment Fund (NEF). ***Table 5.2a*** provides information on Funds Allocated for Adaptation and Mitigation Projects under National Environment Fund (2019/2020**)** and ***Table 5.2b*** provides information on Funds Allocated for Adaptation and Mitigation Projects Under National Environment Fund (2020/2021).

5.2.2 Private Sector Funding

An estimate of private sector funding for key sectors as from 2016 is given at ***Table 5.3***

5.2.3 Support received from International Donors

Mauritius has secured grants of the order of around USD 90 million over the period 2016-2021 for the environmental sector. ***Table 5.4*** provides details on resources mobilised from international funding agencies as from 2016 to 2021.

However, over time, Mauritius will need to mobilise much more funds to supplement public funding on environmental issues.

5.2.4 Support required

The implementation of mitigation and adaptation actions as identified in the 2021 NDC is unconditional as well as conditional on external financial support received.

The total financial needs to implement the NDC targets are estimated at **USD 6.5 billion**. The total needs for implementing the **mitigation** and **adaptation** actions identified in this reviewed NDC are estimated respectively at **USD 2 billion** and **USD 4.5 billion**.

The share for the unconditional[6] and conditional contributions for the USD 6.5 billion is as follows:

a. **Unconditional** amount of **USD 2.3 billion** (from government and private sector) representing 35%; and

b. **Conditional** amount of **USD 4.2 billion** (from international sources and donor agencies) representing 65%.

[6] Unconditional refers to *"national effort"*, that is, what a country can implement without any conditions and based on its own resources and capabilities, both public and private sector contributions.

Table 5.1: Summary of the Constraints and Gaps, and Related Technical and Capacity Needs

Sector	Key area where gaps and constraints identified	Proposed actions/ technical and capacity needs
Green House Gas) Inventory	• Lack of Emission Factors to better represent national circumstances and provide for more accurate estimates even if this has started to be addressed for some key categories • No institution has yet been endorsed with the responsibility for collection of specific Activity Data needed for the estimation of emissions according to the IPCC on an annual basis • Some of the Activity Data archived are still not yet in the required format for feeding in the software to make the emission estimates • National experts are not yet ready to take over the full inventory compilation process which dictated the collaboration of consultants;	• Enhance capacity of researchers and relevant stakeholders as well as provide better laboratory facilities or collaborate with regional institutions and labs on determination of country specific emission factors • There is a need to institutionalize the GHG Inventory process
Measurement, Reporting and Verification (MRV)	• Inadequacy of the present institutional arrangements for the components of the MRV system • No formal agreement between institutions and coordinating body to ensure a regular and smooth data transfer • There is no completed formal recording system for tracking mitigation actions within the institutions to report conveniently about the status and progress of activities implemented • There is no centralized database for data archiving by relevant institutions	• Existing institutional arrangements will have to be constantly reviewed, strengthened and/or even initiated, where still inexistent • Institutional arrangement also needs to be formalised to ensure ongoing and sustainable domestic MRV • The development and implementation of the proposed MRV system will demand for additional staff or a review of work structure within the Department of Climate Change • Data structuring should be aligned with a QA/QC system • There is a need to build technical capacity of the national team to establish the technical bases and transfer of knowledge required for the design and implementation of the MRV system
Energy	• Inadequate energy audit exercises. However, to note that mandatory energy audits in private sector has been launched in January 2021.	• Additional training of Energy Auditors and on EE enforcement • Create enabling environment for IPP to move gradually to more renewable sources of energy, as per the Energy Outlook policy

	• Limited capacity for Grid Storage System as well as to accommodate more small power producers • The intermittency of Renewable Energy (RE) electricity poses a challenge in terms of controlling and stabilising the frequency of the electricity grid, particularly to cater for any sudden fall in power output. This may impose a limit on the extent of intermittent RE absorption in the grid, even if batteries are being deployed to mitigate the problem • Although Mauritius is endowed with sunshine and wind, there is a limitation in terms of availability of land for implementation of large-scale PV and wind farms. An offshore wind farm may be contemplated; however, there is lack of technology transfer. Financial resources are also a major constraint for the implementation and management of RE projects	• Develop policies and incentives for waste to energy projects. • Technology transfer on development of clean energy required
Transport	• Lack of EE data in relation to mass transport system, hybrid technologies, electric cars, compared to traditional transportation system	• Conduct EE studies in relation to green transportation system.
Industrial Processes and Product Use (IPPU)	• Non availability of a supply chain for certain type of natural refrigerants • Difficulty to certify local experienced technicians on new natural refrigerant technology	• Need to give a legal status to the Mauritian ISO standard on safety of refrigerants • Regulation on control of import of HFCs required • Technology transfer on ammonia, carbon dioxide and hydrocarbon as refrigerants
Forestry Sector	• No updated land use maps, soil maps and climate maps available to support the GHG inventory	• Refine inventory system through the development of updated land use maps using IPCC categories

	• No data on age distribution for natural forest including mountain reserves • No data for private forests	• Acquire high resolution satellite imagery with near infrared band for Mauritius to undertake survey of private forests and accurate calculation of carbon sinks;
Agriculture	• Lack of trained staff on techniques for mitigation analysis and quantification of GHG emission reduction • No updated land cover maps and land acreage data under food crops, tea and fruits • The potential of GHG sequestration in tea plantation and orchards have not been adequately accounted for in the GHG inventory. No data available on fruit trees not bearing fruits and non-fruit trees as well as on age and species • No data on amount of fertilizer application in golf courses • Lack of country specific emission factors • Limited policies on climate smart agriculture	• Capacity building on mitigation analysis and quantification of GHG emission • Update land cover maps and develop data collection strategy where there are data gaps • Capacity building on the development of country specific emission factors. • Develop and promote climate-smart agriculture (CSA) for crops and livestock in Mauritius, Rodrigues and Agalega based on policies and programmes for greater efficiency and coverage. • Further encourage the use of locally-produced organic compost, bio-fertilizers and organic fertilizers. • Enforcement of regulations to control the practice of burning agricultural residues to reduce CO2 emissions and to promote their conversion into composts. • Need to reactivate a National Remote Sensing Centre to generate plans, maps and tools inter alia for climate change analysis.
Solid Wastes	• Lack of data on industrial wastes • Lack of awareness on the suitability/viability of waste-to-energy technologies for Mauritius	• Setting-up of an industrial waste databank using the data collected from Industrial Waste Audit Reports under the Industrial Waste Audit Regulations 2008 • In-depth feasibility study concerning the appropriateness of waste-to-energy in Mauritius including the technical and financial viability, siting and design

Liquid Wastes	• Insufficient emissions data on treatment plants and extent of use, hence it is difficult to develop EFs • Absence of a real time flow monitoring system for sewers to obtain real time data and take remedial measures upfront • Limited areas connected to the sewage system • Use of renewable sources of energy has not been explored for the operation of wastewater treatment plants and pumping stations;	• Build human and institutional capacity to gather primary data and develop EFs; • Use renewable sources of energy to operate wastewater treatment plants and pumping stations; • Establish more sewage water treatment plants; • Develop and implement policies and legislation (e.g., all large industries and hotels should have a liquid treatment plant with approved disposal mechanism(s), followed by proper monitoring and inspection by local authorities).

Table 5.2a: Funds Allocated for Adaptation and Mitigation Projects under National Environment Fund (2019/2020)

	Implementing Agency	2018/19 Estimates	2019/20 Estimates
Adaptation Projects			
Rehabilitation, Protection and Management of Beaches, Lagoons and Coral Reefs Programme		**160**	**279**
Rehabilitation of Beaches	M/Environment and SD	80	110
Beach Management Plans at Flic en Flac, Mon Choisy, La Prairie and Belle Mare	Beach Authority	10	50
Replacement of Casuarina Trees on Beaches	M/Environment and SD	10	10
Reprofiling of Beaches	M/Environment and SD	10	8
Coastal Rehabilitation - Climate Change Adaptation	M/Environment and SD	50	80
(i) Refuge Centre at Quatre Soeurs		*2*	*18*
(ii) Coastal Adaptation Works at Mon Choisy		*30*	*62*
(iii) Coastal Adaptation Works at Riviere des Galets		*18*	-
Implementation of Control Measures for Population Outbreaks of Crown of Thorns Starfish in Mauritius	M/Tourism and Leisure	-	3
Restoration of Coral Reefs - Adaptation Fund	M/Ocean Economy, MR Fisheries and Shipping	-	18
Flood Management Programme		**965**	**923**
Construction of Drains	M/Local Govt and Outer Islands	100	100
Digital Elevation Model	Land Drainage Authority	40	18
nd Drainage Programme *of which Rodrigues*	National Development Unit	750	550
Machinery & Equipment for Cleaning of Drains			
Construction and Upgrading of Roads and Drains Affected by Extreme Weather Conditions	*Rodrigues Regional Assembly*	-	*50*
Audit of Rivers and Watercourses causing Recurrent Flooding	M/Local Govt and Outer Islands	75	75
Storm Water Drain at New ENT Hospital	National Development Unit	-	150
Clean-Up Mauritius and Embellishment Programme - "Moris Nou Zoli Pei"	M/Environment and SD	-	10
Cleaning, Desilting, Rehabilitation and Upgrading of Drains, Bridges & Rivers	M/Health and Quality of Life	-	20
Cleaning of Lagoons	M/Environment and SD & M/Local Govt and Outer Islands	**165**	**270**
Acquisition of Compactor / Tipper Lorries and Others			
Cleaning & Embellishment of Public Sites including Places of Worship	Beach Authority	30	35
	M/Local Govt and Outer Islands	-	5
	M/Local Govt and Outer Islands / CCC	65	130
	Committee/ PMO	70	100

Table 5.2b: Funds Allocated for Adaptation and Mitigation Projects Under National Environment Fund (2020/2021)

Rs Million

	Implementing Agency	2019/20 Estimates	2020/21 Estimates
Adaptation Projects			
Details of Payments			
Rehabilitation, Protection and Management of Beaches, Lagoons and Coral Reefs Programme		**279**	**215**
Rehabilitation of Beaches	M/Environment	110	125
Beach Management Plans at Flic en Flac, Mon Choisy, La Prairie and Belle Mare	Beach Authority	50	50
Replacement of Casuarina Trees on Beaches	M/Environment	10	10
Reprofiling of Beaches	M/Environment	8	9
Coastal Rehabilitation - Climate Change Adaptation Programme	M/Environment	80	9
Implementation of Control Measures for Population Outbreaks of Crown of Thorns Starfish in Mauritius	M/Tourism	3	3
Restoration of Coral Reefs - Adaptation Fund	M/Blue Economy	18	9
Flood Management Programme		**923**	**1,272**
Land Drainage Programme	NDU	550	1,100
o/w Rodrigues	RRA	*50*	-
Construction of Drains	M/Local Government	100	100
Machinery & Equipment for Cleaning of Drains	M/Local Government	75	45
Construction and Upgrading of Roads and Drains Affected by Extreme Weather Conditions	NDU	150	-
Digital Elevation Model	Land Drainage Authority	18	15
Audit of Rivers and Watercourses causing Recurrent Flooding	M/Environment	10	12
Storm Water Drain at New ENT Hospital	M/Health & Wellness	20	-
Clean-Up Mauritius and Embellishment Programme		**270**	**207**
Cleaning, Desilting, Rehabilitation and Upgrading of Drains, Bridges & Rivers	M/Environment/ M/Local Government	35	35
Cleaning & Embellishment of Public Sites including Places of Worship	M/Environment/ M/Local Government	100	65
Cleaning of Lagoons	Beach Authority	5	5
Control of Stray Dogs	M/Agro Industry	-	5
Mainstreaming IAS Prevention, Control and Management	M/Agro Industry	-	7
Embellishment of M1 and M2 Motorways	M/Environment	-	10
Acquisition of Compactor / Tipper Lorries and Others	M/Local Government	130	80
Solid Waste Management Programme		**136**	**153**

Construction of Solid Waste Disposal Facilities at Mare Chicose Landfill	M/Environment	50	114
Asbestos Treatment Programme in ex-CHA Houses	M/Environment	10	5
Expenses icw Houses Containing Asbestos	M/Housing & Land Use	20	5
Setting up of Civic Amenity Centres / *Dechetteries*	M/Environment	4	10
Setting up of Scrapyard Facility for end-of-life Vehicles	M/Environment	1	7
Sorting Units at Forbach and La Chaumiere *(Study)*	M/Environment	1	4
Waste Recycling Programme (including collection of PET Bottles)	M/Environment/ M/Local Government	50	8
Landslide Management Programme		**156**	**314**
Landslide Management at Morcellement Hermitage, Coromandel and Ruisseau des Creoles, Baie du Cap	M/Local Government	18	10
Landslide Treatment at Chamarel	M/N. Infrastructure	33	153
Landslide Works on Terre Rouge-Verdun	M/N. Infrastructure	86	-
Countermeasure Works to Slope Failure at Montagne Ory	M/N. Infrastructure	6	40
Countermeasure Works to Slope Failure at Batelage Souillac	M/N. Infrastructure	9	59
Countermeasure Works to Slope Failure at Souillac Bridge	M/N. Infrastructure	4	45
Royal Bridge, Quay D, Port Louis	M/N. Infrastructure	-	5
Baramie Bridge, Grand Port	M/N. Infrastructure	-	2
Disaster Risk Reduction Operations		**42**	**40**
National Multi-Hazard Emergency Alert System	M/Local Government	25	22
High Resolution Area Model for Mauritius	M. Meteorological Serv.	5	5
Synopsis Workstation	M. Meteorological Serv.	12	12
Vulnerability Assessment of Agricultural Sector	M/Environment	-	1
Mitigation Projects			
Green Economy		**36**	**48**
Mauritius Readiness and Preparatory Support Programme	M/Finance, EP & D	-	5
Solar Water Heater Scheme	M/Environment	25	20
Air Quality Indexing (AQI) System for Mauritius	M/Environment	-	10
Greening of the Public Sector	M/Environment	-	1
Mauritius Resilience Strategy	M/Environment	-	1
Portable Smoke Metres to Monitor Vehicle Exhaust Emission	M/Environment	-	5
Pelletizing of Raw Cattle Manure	M/Agro Industry	2	2
Electricity Production from Pig Manure *(Study)*	M/Agro Industry	5	2
Solar PV cells on Public Buildings *(Study)*	M/Health/ M/Local Govt	4	2

Table 5.3: An estimate of private sector funding for key sectors as from 2016

Implementing Organisation	Name of project	Key Objectives	Status of project	Cost of project	Implementation period
Terragen	Sweet Power: Using cane straw as a source of energy for power production	i) Decrease of coal consumption ii) Reduction of burning of sugarcane before harvesting iii) Social and economic benefits in the country iv) Sustainability of cane industry v) Creation of jobs	Completed	MUR100 M	2015 - 2020
Terragen	Recyclable paper (shredded) as source for power production	i) Decrease of coal consumption ii) Enhance recycling of paper	Feasibility study completed		Stand-by - Waiting for economically viable kWh biomass pricing
Terragen	Hybridation Project with eucalyptus as source of power production	i) Decrease of coal consumption ii) Social and economic benefits in the country iii) Creation of jobs	Feasibility study completed	MUR 20 M	Stand-by - Waiting for economically viable kWh biomass pricing
Terragen	Hybridation Project with bagasse dryer for improving efficiency of power production with bagasse	i) Decrease of coal consumption ii) Sustainability of cane industry iii) Increase bagasse production of 10 Gwh, coal saving of 5000 T per year	Feasibility study completed	MUR 250 M	Stand-by - Waiting for economically viable kWh biomass pricing

Terragen	Hybridation Project with local wood chips as source of power production	i) Decrease of coal consumption ii) Social and economic benefits in the country iii) Creation of jobs iv) Production of 12 GWh from local biomass, coal saving of 7000 T per year	Feasibility study on-going		
Terragen	Hybridation Project with a solar farm of a production capacity of 10 MW	i) Decrease coal consumption ii) Increasing the production through renewable sources iii) Creation of jobs	Feasibility study completed	MUR 700 M	Stand-by - Waiting for economically viable renewable kWh pricing
Terragen	Hybridation Project with sweet Power - phase 2: Using additional cane straw as a source of energy for power production	i) Decrease of coal consumption ii) Reduction of burning of sugarcane before harvesting iii) Social and economic benefits in the country iv) Sustainability of cane industry v) Creation of jobs	Feasibility study completed	MUR 70 M	Stand-by - Waiting for economically viable kWh biomass pricing

Table 5.4: Resources Mobilised from International Funding Agencies as from 2016 to 2021

No	Funding Agency	Project Title/Objective	Date Approved	Funding Amount (USD)	Funding in MUR[7]
1.	Green Climate Fund (GCF)	Accelerating the Transformational Shift to a low carbon Economy in the Republic of Mauritius (through UNDP)	Project approved on December 2016	28,210,000	1,128,400
2		Climate Change Vulnerability & Adaptation Study for the Port of Port Louis (CTCN)	Project approved on 30 March 2017	324,764	12,990,560
3		Readiness and Preparatory Support Programme	Project approved on 15 February 2019	300,000	12,000,000
4		HYDROMET Project - Building Regional Resilience through Strengthened Meteorological, Hydrological and Climate Services in the Indian Ocean Commission Member Countries	Funding proposal approved by GCF Board on 19 March 2021	71400000 – Rs 2,856,000,000 (total for IOC) However, Mauritius component is assumed at Rs 500 million only (**USD 12,500,000)**	500,000,000
5		Climate Change and Health Readiness project in Mauritius	Project Concept note under consideration by GCF	300,000	12,000,000
6	Global Environment Facility (GEF)	Mainstreaming Biodiversity into the Management of the Coastal Zone in the Republic of Mauritius	Project approved on 31 March 2016	4,664,600	186,584,000
7		Nationally Appropriate Mitigation Actions for Low Carbon Island Development Strategy (NAMA)	Project approved on 12 July 2016	1,452,000	58,080,000
8		Strengthening the national greenhouse gas inventory of the Republic of Mauritius to improve climate reporting and transparency (CBIT)	Project approved on 03 June 2021	1,269,850	50,794,000
9		Mainstreaming Invasive Alien Species (IAS) Prevention, Control and Management	Project concept approved on 03 October 2016; Full project proposal not yet approved	3,912,265	156,490,600
10		Realising energy savings and climate benefits of implementing mandatory energy auditing in coordination with HCFC phase-out and HFC avoidance	Project concept approved on 01 May 2017, Full project proposal not yet approved.	4,532,164	181,286,560
11		Mainstreaming Sustainable Land Management and Biodiversity Conservation in the Republic of Mauritius	Project concept approved on 26 June 2018, Full	1,699,204	67,968,160

[7] Exchange rates assumed are as follows: 1 USD = MUR 40 and 1 EUR = 1.18 USD

No	Funding Agency	Project Title/Objective	Date Approved	Funding Amount (USD)	Funding in MUR[7]
			project proposal not yet approved		
12		Promoting Low-carbon Electric Public Bus Transport in Mauritius	Project Identification Form approved in December 2019	3,229,998	129,199,920
13		Preparation of the Biennial Update Report **(BUR)** under UN Framework Convention on Climate Change (UNFCCC)	Project Cooperation Agreement was signed between UNEP and this Ministry on 24 December 2015	352,000	14,080,000
14		Preparation of the Fourth National Communication (NC4) for the Republic of Mauritius under UN Framework Convention on Climate Change (UNFCCC)	Project Cooperation Agreement signed between this ministry and UNEP on 23 July 2020.	500,000	20,000,000
15	Adaptation Fund	Rehabilitating coral reefs to meet a changing climate future in Mauritius	Project approved on 15 December 2018	5,000,000	200,000,000
16	Agence Française de Développement-Facilité Adapt'Action	AFD intends to support Mauritius to mainstream climate change in public policies and prepare transformational climate projects for financing by AFD / international climate finance like the Green climate fund (GCF) in the areas of Flood management, Disaster Risk Reduction (DRR) and coastal tourism, given importance of climate change related issues.	Project approved on 12 December 2017	2, 342, 857 (2,000,000 Euros)	93,714,280
17		Assistance from AFD for a consultancy study to be funded under the envelope of Fonds D'Expertise et de Renforcement des Capacité (FERC) No 3 CMU 1072 01 Envelope for "Establishing End-Points" for the cleaning operation following the MV Wakashio Oil Spill	Approval of the AFD obtained on 23 November 2020.	38007.80 (EUR 32,210)	1,520,312
18		Agence Francaise de Developpement (AFD) Financing agreement signed on 29th July 2021 with regards to Facilité d'Amorçage, de Préparation et de Suivi de projets (FAPS) to the tune of which will contribute to the financing of expertise and studies relating	Financing agreement signed on 29th July 2021	247800 (EUR 210,000)	9,912,000

No	Funding Agency	Project Title/Objective	Date Approved	Funding Amount (USD)	Funding in MUR[7]
		to the grounding of MV Wakashio.			
19		AFD (FERC 3) – Financing of a consultancy study to develop the Terms of Reference for the design and setting up an "Observatoire de L'Environnement". The main objectives of this observatory are, inter-alia, to: (i) determine, prioritise and monitor environmental indicators, (ii) collect environmental data (iii) generate periodic environmental reports (iv) Serve as an advisory body for environmental governance.	Approval of the AFD obtained on 23 November 2020.	14750 (EUR 12,500)	590,000
20		Facilité Adapt'Action (Technical Assistance to the Ministry of Environment, and LDA for the Elaboration of a Land Drainage Master Plan and Review of the NDC)	Agreement signed on 12 December 2017	2,360,000 (EUR 2,000,000.00)	94,400,000
21		Support to the water sector in Mauritius and Rodrigues	Project is currently ongoing. The contract for the Land Drainage Masterplan has been awared and assignment is on-going.	590,000 (EUR 500,000.00)	23,600,000
22	European Union	Mauritius from Ridge to Reef – Restoration of the native forest cover (including mangroves) as part of an integrated sustainable landscape management initiative to enhance the climate resilience of natural ecosystem, augment carbon sequestration	Awaiting the signature of Financing Agreement	4,720,000 (EUR 4 million)	188,800,000
23	European Union - Climate Smart Agriculture	The objective is to increase the capacity of vulnerable non-sugar planters and key stakeholders in developing climate smart agriculture in Mauritius and Rodrigues.	Financing Agreement signed on 10 March 2017	3, 514, 286 (3,000,000 Euros)	140,571,440

No	Funding Agency	Project Title/Objective	Date Approved	Funding Amount (USD)	Funding in MUR[7]
24	European Union-Switch Africa	Improving Sustainable Tourism In Mauritius Through Greening The Value Chain Of Tour Operators (SUS-ISLAND)	Project approved on May 2018	1,405,714 (EUR 1,200,000)	56,228,560
25	European Union-Global Monitoring for Environment and Security (GMES) and Africa Support Programme	The objective is to focus on monitoring and forecasting of Physical and Biological oceanography variables, fishing zones monitoring and protection, aquaculture site monitoring and protection, coastal Ecosystem Mapping, Coastal vulnerability, Three day's Marine Weather forecast.	Project approved on 12 July 2018	1,640,000 (EUR 1,400,000)	65,600,000
26	European Union - DeSIRA initiative	The Overall Objective of the project is to foster innovation in agriculture to raise national food security and safety in the context of sustainable development and to contribute to reducing poverty and vulnerability	Project Concept Note approved on 21 Dec 2018. Full Application form to be submitted by 31 March 2019.	3,514,286 (EUR 3,000,000)	140,571,440
27	Global Climate Change Alliance (GCCA+) - European Union	Improving the resilience of small holders in the agricultural sector to climate change		671,267.07 (EUR 568,870.40)	26,850,682.88
28		Setting up of an integrated organic chilli farm at Montagne du Sable and a lime and Honey farm at Anse Ali		1,180,000 (EUR 1,000,000.00)	47,200,000
29		Transformation of Belle Mare into a Climate Smart Agriculture Village for Climate Resilience, Food Security and Poverty Alleviation of its Farmers		356,000.40 (EUR 301,695.25)	14,240,015.80
30		Supporting Climate Smart Agriculture for smallholders in the Republic of Mauritius • Technical assistance for studies and feasibility studies		330,400 (EUR 280,000.00)	13,216,000
Estimated Total Climate Finance Secured				**91,172,213**	**3,646,888,531**


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Chapter 6
Level of Support Received to Enable Preparation and Submission of BUR

6.0 Level of Support Received to Enable Preparation and Submission of BUR

Financial support for the preparation of the BUR was received from the Global Environment Facility (GEF) through UNEP as the implementing agency. In June 2015, GEF/UNEP approved USD 352,000 for Mauritius to start the preparation of its first BUR. The Project Cooperation Agreement was signed between UNEP and this Ministry in December 2015 and the Project Implementation Plan was finalised and signed on 28 March 2017. The support was received in a timely and effectively manner which enabled the country to meet its reporting obligation. However, additional assistances were also received for the preparation of the BUR as listed in ***Table 6.1.***

Table 6.1: Assistance received in the context of the BUR 1 preparation

Project Component	Support Received	Description	Source of support
MRV	Capacity building of 2 participants from Mauritius	The Southern Africa Regional MRV Network Training and Peer Review Workshop was held during 3rd to 6th September 2019 in Mbabane, Eswatini (Swaziland). **Main objective of the workshop** 1) Capacity building on enhanced reporting framework of Paris Agreement, Modalities, Procedures and Guidelines 2) Peer review of national reports such as Biennial Update Report 3) Sharing of lessons learned and challenged on MRV institutional arrangements at country level 4) Identification of priority areas for future capacity building in southern African region and agreement on a training plan.	Southern Africa Regional MRV Network
GHG Inventory	Waiving of Consultancy fee to the tune of USD 6 000 by the Regional Centre for Mapping Resource for Development (RCMRD) for a follow up Capacity Building Workshop on GIS,	The RCMRD was contracted to design and impart a one-week Capacity Building workshop which was held during 12th-16th November 2018, to empower stakeholders from the relevant Ministries and Institutions to acquire enhanced knowledge and capacity for carrying mapping efforts and activities including:	Regional Centre of Mapping of Resources for Development

	specifically on Geospatial Technique to assess Land Use, Land Use Change & Forestry. To note that the request for waiving of consultancy fee was made by the Ministry of Housing and Lands, the focal point for RCMRD.	• Developing the Land use map of one region of Mauritius; • Image classification; and • Accuracy Assessment and ground truthing. This workshop was a follow up of the 1st Capacity Building Workshop on GIS, specifically on Geospatial Technique to assess Land Use, Land Use Change & Forestry imparted in 2016 under the Third National Communications (TNC).	
Development of Country Specific Emission Factors for the crop sector	In-kind contribution by Food and Agricultural Research and Extension Institute (FAREI) for sampling across several regions of Mauritius. The samples were then oven-dried, packed, labelled and sent for required analyses. Financial support for the analysis of plant samples for the determination of Emission Factor obtained under GEF.	The development of Country Specific Emission Factors (CSEFs) has as main objective to improve the accuracy of the inventory of greenhouse gases. Seven emission factors for the crop sector have been developed by the FAREI. The University of Mauritius (UOM) has been hired for the analysis of plant samples. 10 annual crops and 3 perennial crops were earmarked for the project. A maximum of 150 samples were analysed.	Food and Agricultural Research and Extension Institute (FAREI)
Development of Country Specific Emission Factors for the solid waste sector	The Solid Waste Management Division of the Ministry provided cash contribution to the tune of Rs. 75, 600 for the payment of Consultancy services	A Consultant was hired to conduct the national solid waste characterisation study in collaboration with the Solid Waste Management Division. The aim of the study is to determine the carbon contents of the organic components of the solid waste stream in Mauritius which is a pre-requisite to determination of the degradable organic carbon (DOC) of solid wastes. It also aims at updating the waste composition and characteristics in	Solid Waste Management Division

		Mauritius so that these data can be efficiently used for determination of the DOC of solid wastes in Mauritius which will then allow the accurate quantification of GHG emissions from solid wastes in Mauritius. Under the study, sampling of municipal solid wastes (MSW) generated at the 5 transfer stations and at Mare Chicose Sanitary landfill will be performed over 12 months including both summer and winter seasons.	

Chapter 7
National Measurement, Reporting and Verification

7 National Measurement, Reporting and Verification 116

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7. National Measurement, Reporting and Verification (MRV) Framework

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) laid the foundation for the current system of reporting climate information. Article 12, paragraph 4 of the Convention mandates all Parties to communicate actions they have taken or envisage to take to implement the Convention to the Conference of the Parties (COP), through the Secretariat. This includes information on greenhouse gas (GHG) emissions by sources, removals by sinks, as well as on the actions that Parties are taking to mitigate and adapt to climate change.

The arrangements for national reporting under the Convention have since evolved over the subsequent COP meetings. The Kyoto Protocol, which implements the framework Convention, helped to put in place a comprehensive MRV framework which remains up to now the most detailed and comprehensive set of rules and also the reflection of best practices regarding MRV and setting up national systems under the Convention. The set of rules for reporting information under the Convention were further detailed to include guidance on the content and frequency of National Communications (NC), provisions for Biennial Update Reports (BUR) and Biennial Reports along with the process of international consultation and analysis (ICA) and respectively International Assessment of these reports.

The term MRV originally came from the Bali Action Plan, the negotiating text of the UNFCCC in Bali, Indonesia at the end of 2007. The basic understanding of the Bali Action Plan is that climate change mitigation actions – mainly Greenhouse Gas (GHG) emissions reduction – shall be implemented in a "measurable, reportable and verifiable" manner, and this idea has brought significant implications for international negotiations since then.

The key function of MRV is enhancing transparency through the tracking of national GHG emission levels, the tracking of climate finance flows received or the impact of mitigation actions. MRV facilitates sharing information and lessons learnt and allows assessing whether set targets have been achieved. This creates transparency and shows the continuity of a country's actions, which internationally strengthens trust of climate finance donors and other investors. Transparent MRV approaches can improve comparability at national and international level thus supporting coherence between domestic and international MRV systems where detailed reporting on MRV approaches takes place, as in National Inventory Reports under the UNFCCC, this enhances the identification of best practice examples.

For developing country Parties, the current MRV framework under the Convention includes submitting NCs every four years and BURs every two years, undergoing ICA, and setting up domestic MRV. Moreover, it includes undertaking MRV of the Reducing Emissions from Deforestation and Forest Degradation (REDD+) activities for the purpose of obtaining and receiving results-based incentives.

Measurement, reporting, and verification (MRV) is given a central place under the Paris Agreement, thus enhancing the requirements existing already under the UNFCCC. The Paris Agreement makes it clear that all developing countries must be provided with support in order to be able to put in place the institutional structures needed to support compliance with the transparency obligations.

A model structure of Institutional Arrangements

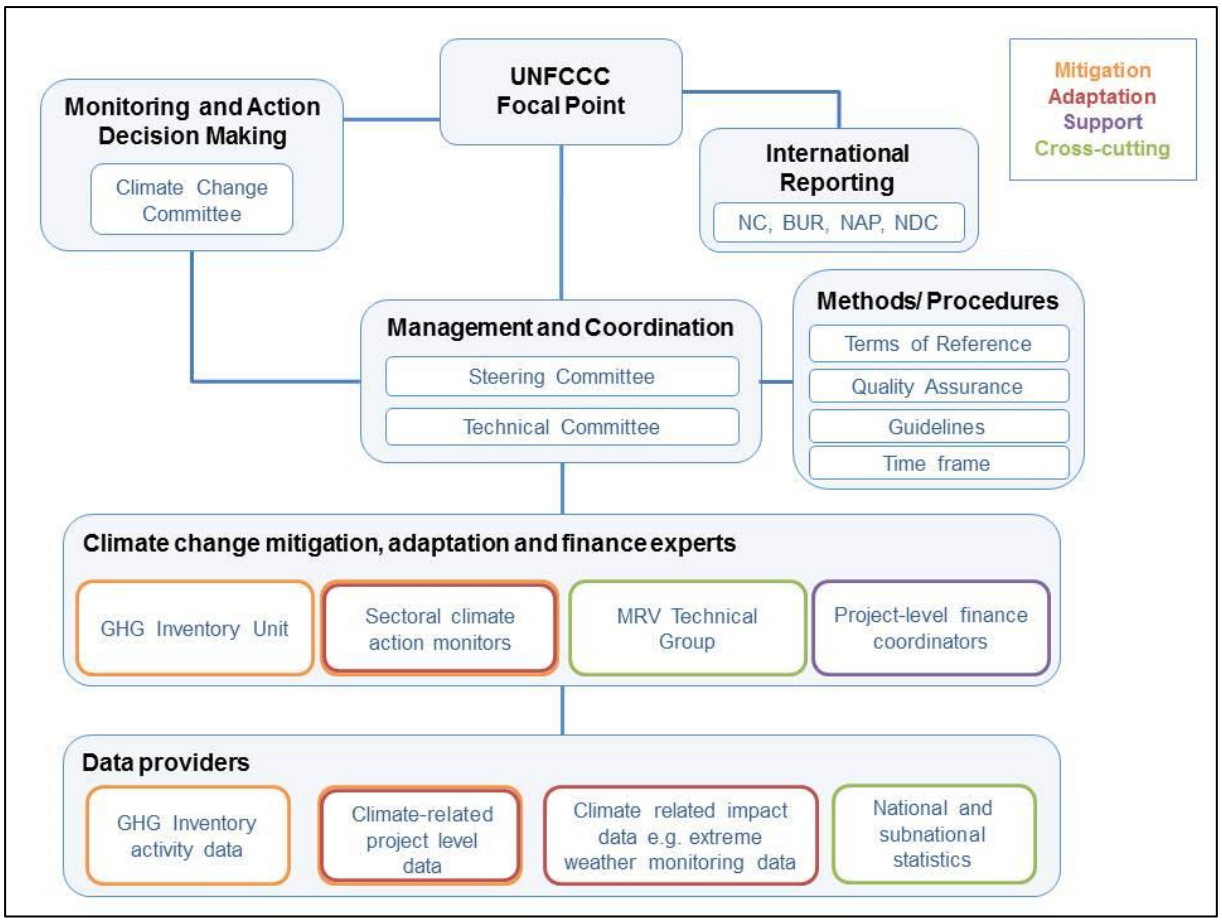

Figure 7.1: A model structure of Institutional Arrangements

Source: Adapted from UNFCCC Handbook on Institutional Arrangements to support MRV/transparency of Climate Action and Support

7.1 Domestic MRV system in RoM

7.1.1 Government structure relevant to MRV

In order to integrate the MRV system in the organizational structure of Mauritius 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 IPCC categories for reporting emissions and removals.

The Department of Climate Change leads the process of institutional reorganization and, depending on the sector to which the GHG relates, involves 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 Department
- 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 will be involved in the whole process of institutional arrangement to provide technical resources to shape the sectoral technical working groups.

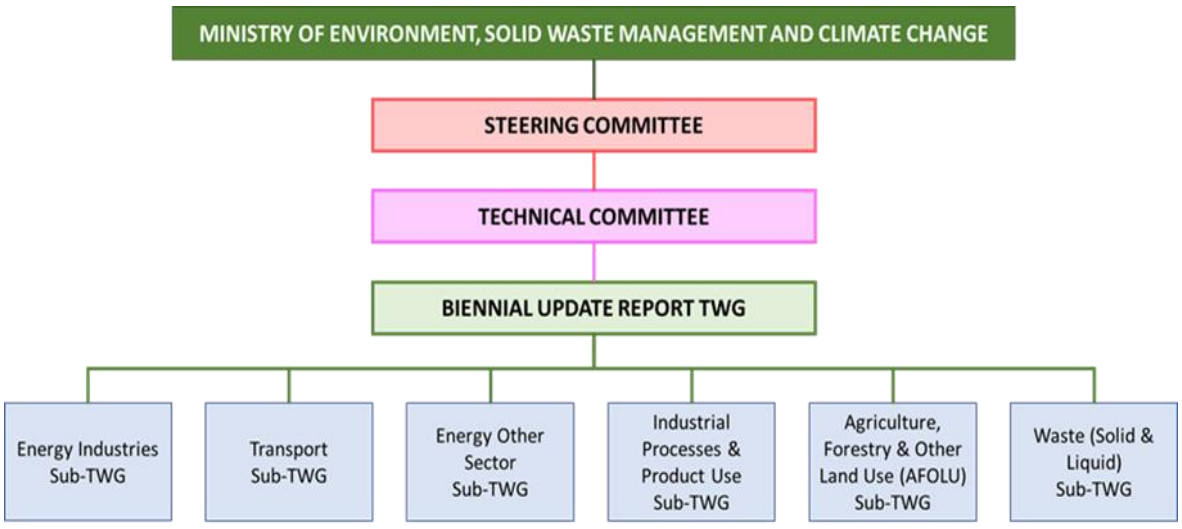

Figure 7.2: Sustained institutional arrangement for Biennial Update Report

7.1.2 How the system is presently functioning

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.

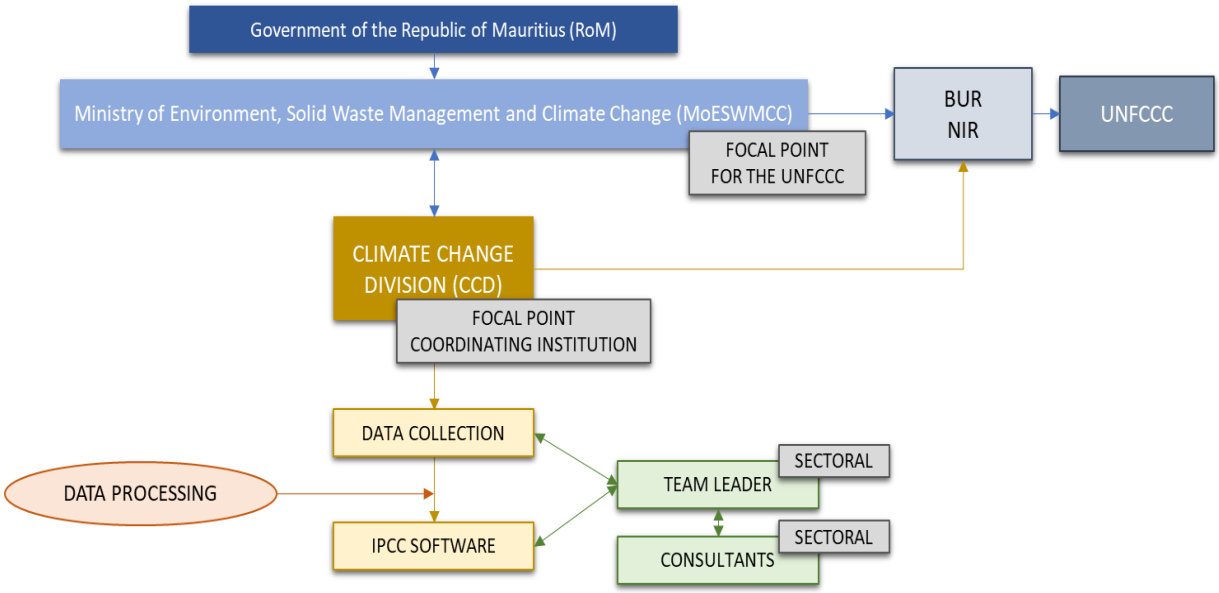

Figure 7.3: Presently adopted structure relevant to MRV

7.1.3 MRV for GHG Inventory System

RoM has an obligation to submit BUR as well as NC on a regular basis, including GHG emissions inventory. 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 Republic's 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.

DCC together with the support of 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. 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.

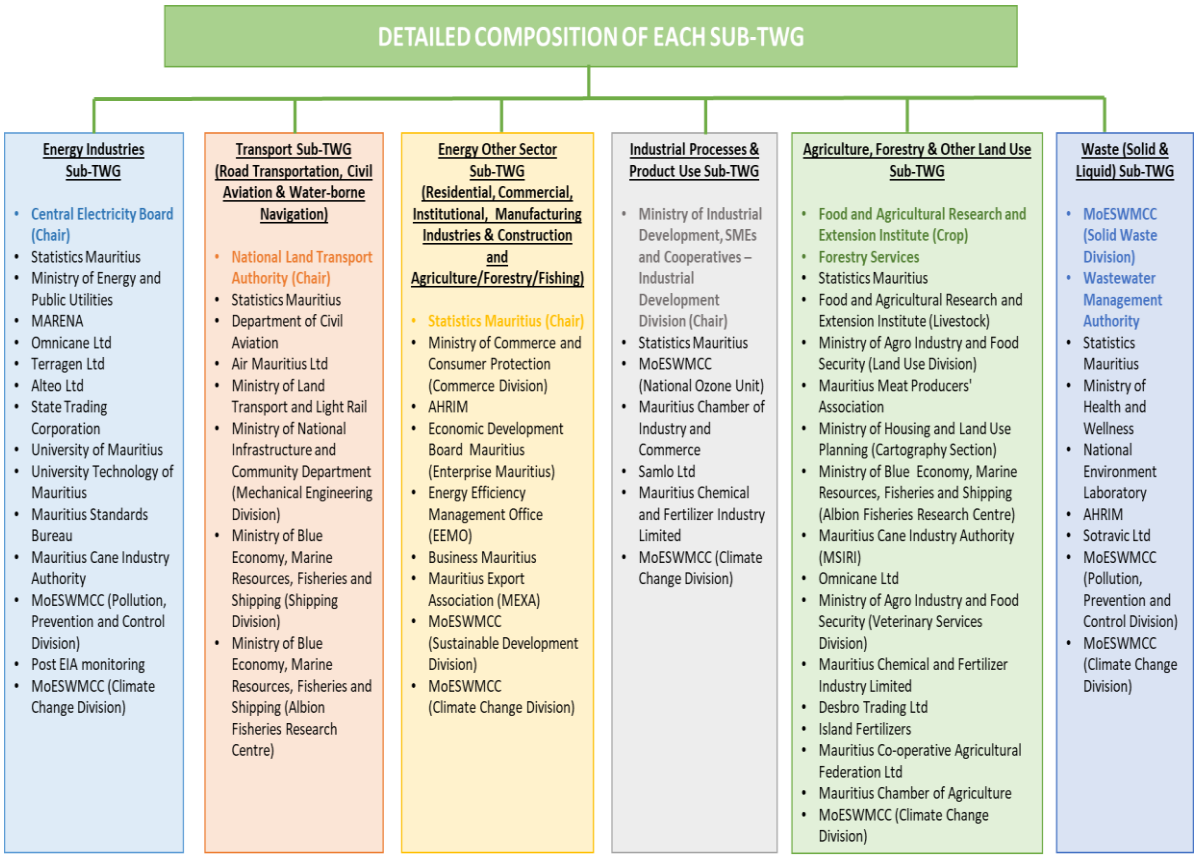

Figure7.4: Institutions involved in the preparation of GHG Inventory

Proper institutional arrangements need to consider the aspects as described in US EPA templates.
For the data request it is necessary to sign a Memorandum of Understanding and Confidentiality Agreement with the data provider. A template for the CA and MoU is reported in US EPA templates.
Before and during the input of the data collected in the Inventory software, it is necessary to gather and report as much information as possible on the data collected, such as contact of the data provider, methodology used, data processing (if applicable), calculations, assumptions (if any), recalculations (if any), etc. All this information should be collected as described in US EPA templates.

It is also important at this stage to consider the **QA/QC procedures** during the data collection, for that end, QA/QC procedure proposal is reported in US EPA templates.

Proposed archiving system

One of the most important procedures to be considered in the Inventory System is the data archiving. An Archiving System helps make a national inventory transparent and reproducible and facilitates development of subsequent inventories by future inventory staff and category leads. Some preliminary work will be initiated under the Capacity Building Initiative project.

All information used to create the inventory should be archived in a single location in both electronic and/or hard copy (paper) storage so that future inventory managers can reference all relevant files to respond to reviewer feedback including questions about methodologies.

Main features:

- Information should be stored in a single location: DCC seems the more appropriate location. Other options could be the cloud or the IT department.
- Both electronic and paper storage
- Include all emission factors, activity data, and documentation of how these factors and data have been generated and used
- Documentation of QA/QC procedures, reviews, key categories, and planned inventory improvements (e.g. use QA/QC template)
- Multiple copies, including frequent backups.

Content:

- List and Copies of References
- Expert Judgment (Documentation, Contact Information)
- Key Category Analysis
- Uncertainty Analysis
- QA/QC Measures
- Changes and Recalculations
- Improvement Plan
- Archiving Plan
- Review Findings and Responses
- Templates for Future Work
- Results, Analyses, Plans, Measures

Instructions for archiving relevant information:

- Books, Databases or Large Reports:
    1. Print and scan cover/title page
    2. Print and scan relevant pages of the book/report or screenshots of the database showing the actual source data
- Small Reports, Websites, Spreadsheets:
    1. Print and scan entire report, full website, or spreadsheet ensuring all source data is included
- Personal Communications/Interviews with Experts:

1. Create a log listing the expert, interview date, mode of communication (email, in person interview, phone), and the experts contact information
2. Include as much detail as possible from the expert source, including all source data
3. Print and scan the log

A proposal for the archiving system can be consulted in the US EPA templates.

The archiving template will assist:

- Assess past archiving System
- Guidance to develop an archiving system (e.g., procedures)
- Establish roles/responsibilities /procedures consistent with inventory schedule
- Future improvements

Applying and completing the template will help the inventory team:

- Access previous records
- Easily reproduce and review estimates
- Ensure credibility
- Respond to inquiries
- Safeguard against loss of data/information

As Mauritius moves towards more frequent reporting, in the form of BURs and the upcoming Fourth National Communication (FNC), there is a greater need for institutional continuity and systematic procedures, including deeper engagement with civil society and the private sector. There is a pressing need to build internal capacities for data collection and GHG estimation to improve data supply and quality in the national GHG Inventory.

Several improvements required for the GHG Inventory that have been identified, are provided in the table below.

Table 7.1: Improvements required for the GHG Inventory

Sector	Adopted GHG Estimation Approach	Improvements Required
Energy	Tier 1 approaches were adopted for all energy sub-sectors, using IPCC default emission factors. Fugitive emissions from fuels were not estimated.	The adopted approach is the simplest Tier 1 but with country-specific net calorific values.
Energy Industries	Tier 1 approach but with country-specific net calorific values (NCVs), which were derived from the energy statistics maintained by Statistics Mauritius. Mass and volume data on fuel imports were provided by the State Trading Corporation (STC). Consumption data was obtained from CEB, IPPs and Statistics Mauritius. Default emission factors from the 2006 IPCC guidelines were used.	The activity data used for Energy Industries are quite detailed and obtained at plant level. However, this is not the case for EFs. It would be useful for the carbon content of fuels to be tested, so that country-specific carbon emission factors could be used rather than default ones from the 2006 IPCC guidelines.
Manufacturing Industry and Construction	The activity data comprised the fuel used for the Manufacturing Sector in the Energy Statistics produced by Statistics Mauritius. The split among the manufacturing sub-categories required the estimations of fuels used in boilers based on the proportions of boilers available in each of the sub-categories.	The approach adopted was Tier 1 since not enough country specific EFs were available.

Transport	Tier 1 approach has been used. The NTA maintains a vehicle database containing information on types of vehicles (including light-duty and heavy-duty split into fuel-types), age of vehicle, and use of catalyst and fuel-injection technology. Fuel consumption and vehicle km travelled estimated from sample surveys of large vehicle fleet operators.	The lack of country specific EFs prevented use of Tier 2 or Tier 3 for CO_2 emissions. Need for data related to vehicle kilometres (surveys), vehicle emissions (tests) and country specific emission factors.
Energy Other Sectors	Tier 1 approach has been adopted. Activity data, primarily use of LPG by households and the commercial sector, was obtained from the national energy statistics.	The activity data used for this category was sufficiently detailed. Improved development of sub-sector EFs will ensure more accuracy.
Industrial Processes and Product Use (IPPU)	Source categories covered by the inventory are Mineral Products (primarily Metal Production – Iron and Steel) and ODS substitutes. A Tier 1 approach was used.	Although Iron and Steel Production is a key category within IPPU, its contribution to GHG emissions is only minor. Following 2006 IPCC guidelines, since IPPU is not a key category, not much time and effort were put to develop higher-tier methods for this category.
Agriculture, Forestry and Other Land Use (AFOLU)	GHG sources include enteric fermentation, manure management, agricultural soils and field burning.	It is recognised that this sector needs improvement and data gap analysis activity need to be performed.
Agriculture	Most agricultural activity data was obtained locally, but EFs used were Tier 1 default factors drawn from the IPCC 2006 Guidelines.	Some activity data and EFs had to be estimated by using expert knowledge. It is proposed to empower FAREI to improve collection of livestock population data and develop local EFs to reduce the uncertainty level. Change in the agriculture
Forestry	Removals in the forestry sector were estimated using local activity data, data from statistics Mauritius and default Tier 1 removal factors (gain-loss method). Above-ground biomass and the soil carbon pools were considered.	Most of the country-specific factors were not available (basic wood density, biomass expansion factors, root-to-shoot ratio, amongst others). The removal factors utilised were mostly default values. The major data gaps identified were lack of data and maps for general land cover changes and land uses for the past 10 years and lack of data on private forest lands. Limited data on privately-owned forests, trees along rivers and roadsides; and on natural forests (types of trees, age distribution, annual increment). Land use pattern and its GIS map need to be developed to assess the changes in land use and cropping pattern.
Waste	GHG emissions for waste sector were generally calculated using the measurement and monitoring records from the waste management plant and records from site office. Other statistical methods used were (e.g., amount of waste landfilled, population connected to the sewer network and per capita generation rate etc.) and emissions were calculated using Tier 1 approach	The Waste Sector measurement, reporting and verification is dependent upon accurate and regularly updated data on solid waste composition. The calculation will be more transparent if there are country specific Emission factors. The activity data for liquid wastes needs to be studied with a view

		to develop country specific EFs and hence it is deemed to use EF's from IPCC.
Solid Waste	The IPCC waste model was used to estimate CH_4 emissions from the Mare Chicose sanitary landfill. A fraction of the biogas is captured and used to generate electricity, for which reasonable source of data exists; the inventory quantifies the CH_4 emissions that are vented without capture and without oxidation in the cover of the landfill. Composting and waste incineration (clinical waste only) are minor emissions sources, for which default IPCC EFs are used.	Mauritius has country-specific and accurate [municipal solid waste] data. Insufficient work on EF development for emissions from waste and previous data record is from the year 2000 does not meet the standard QA/QC. UNFCCC Model correction factor is applied
Liquid Waste	Activity data were provided and sourced from treatment plants metered water statistics supplied and coordinated by from Wastewater Management Authority, Mauritius. Wastewater characteristics were determined using laboratory analyses as provided by WWMA, Mauritius. Default CH_4 emission factors were used.	There is lack of effective and verifiable data on the quantity of wastewater generated its source types. Comprehensive survey on number of households, commercial establishment and other wastewater generation source shall be identified and measured for Integrated Wastewater Management Framework for the purpose of MRV. The WWMA needs to identify and improve the monitoring of the types of storm water and sewage network, including wastewater from residential, commercial and Industrial sector for accurate calculations. Also, WWMA may need to conduct the survey of catchment area for Waste characterisation and chemical analysis need to be carried out to have more accurate data for percentage of waste (paper, garden and others). Lack of actual measured data on different sources of wastewater emissions at treatment plants and records of population connected. More country specific

7.1.4 MRV of mitigation actions

A Measuring, Reporting and Verification (MRV) System is required for GHG mitigation/sequestration actions to support NAMAs and the regular submission of BURs.

There is no completed formal recording system for tracking mitigation actions within the RoM institutions, which would be used to report conveniently about the status and progress of activities implemented. Nevertheless, RoM is in the process of developing a framework which ensures MRV approaches for individual mitigation actions. These should be developed using:

a) A uniform process; and
b) A common sectoral assumption to provide comparability with existing projections.

The framework should be aligned with data and emission factors in the national GHG inventory where feasible to avoid double counting. All activities should be reported using standardized reports on implementation and impacts. The reported data will provide quality information for political decision-making and reporting on implementation of mitigation action at the national level as well as input for next Biennial Update Reports (BUR) compilation.

RoM continues to build and improve its system for measuring, reporting and verifying mitigation actions and their effects while tracking support received in implementing these. The institutional arrangements follow closely those described above for the GHG inventory, involving many of the same institutions collaborating for the MRV of emissions but with somewhat different responsibilities for the MRV mitigation and support systems. The Mitigation Working Groups (MWG), with representatives responsible for collecting and reporting data, should have well-developed procedures and these arrangements must be reviewed and upgraded to be fully operational and to deliver for meeting reporting standards.

For making the appropriate linkages on funding, the Ministry of Finance, Economic Planning and Development may be a full-fledged member of the MRV mitigation and support systems. Ministries/Institution/Agencies implementing mitigation actions will automatically join the mitigation working group to provide data collected.

First step for developing an MRV of the mitigation actions proposed is reported in **Annex 4** Parameters needed for the MRV mitigations actions.

7.1.5 MRV of support needed and support received

To ensure effective MRV of support needed and support received, the measurement dimension is important so that finance for project components that are not climate-relevant is not counted, while avoiding double counting.

Mauritius has some experience in measuring and reporting climate finance. In 2015, the Ministry of Finance implemented the Public Environment Expenditure Review (PEER) project which consisted of a preliminary estimate of Environment and climate change related expenditures from 2011 to 2014. Building on this report, in 2018, the Ministry of Finance, commissioned the report on “Tracking Public Sector Environment Expenditure” which focused on the tracking of public sector expenditure relating to environment, climate change, mitigation and adaptation for financial year 2017/18.

The templates produced during the above-mentioned studies may be used to further track climate finance. It is important to consider not only public but also private finance, at both domestic and international levels. The reporting should also include contributions to technology development and transfer and capacity building.

Avoiding double counting in reporting can be challenging and it is important to rely on strong accounting rules but also consider transparency as a means to enable a better understanding of the domestic MRV.

The main ministries and institutions identified to be part of the MRV of support are:

- Ministry of Finance, Economic Planning and Development
- Ministry of Energy and Public Utility (MEPU)
- Ministry of Agro Industry and Food Security
- Ministry of Land Transport and Light Rail

- Central Electricity Board (CEB)

7.2 Prioritised Actions to Develop an MRV System

This section includes the priority actions to further develop the MRV systems. Links are presented in table below to the key activities as described above and the templates included in the annex in this report.

Table 7.2: Prioritised actions

Prioritised action	KA1	KA2	KA3	KA4	KA5	KA6	Template
Update / Review / Establish / Officialize the coordinating body and technical working groups		✓					Annex 3
Identification of necessary/required data and information for the appropriate (accurate, transparent, consistent, comparable, complete) development of the inventory of emissions, mitigation actions and other required parameters for the national MRV system. Identification of all relevant stakeholders required to achieve all this information			✓	✓			Annex 3 Annex 4
Define and sign institutional agreements with identified stakeholders		✓					Annex 1 Annex 2
Design and agreement between working groups and stakeholders of the templates and contents of the required information			✓	✓			Annex 5
Design and registration of the archiving system				✓			Annex 6
Analysis of gaps and constraints and needs identification to request the appropriate international support from a financial and capacity building point of view					✓		

7.3 Prioritised Actions for MRV System in RoM

This section includes the prioritized actions to further develop the MRV system in ROM. Based on the current situation of the MRV system in RoM, there are some activities/tasks which require attention and improvements. Depending on the activity/task, the resources required (in terms of time, staff or capacity) to finally achieve the complete implementation will vary. The implementation of the MRV system is an iterative process: it will evolve in different steps and will need to adapt the changes in, for example, institutions or reporting needs. Table shows, by using the colour coding system described below, the current status of the different activities/tasks of the MRV system in RoM.

- **Green**: Implemented
- **Orange**: In progress
- **Red**: Not implemented

Table 7.3: Prioritised actions*

Key activities/tasks	Status
Key activity 1: Review current MRV activities	
Key activity 2: Establish institutional arrangements	
Establishing National Legal or Formal Arrangements	
Choosing an appropriate Coordinating Body	
Engaging Stakeholders	
Building In-Country Institutional and Technical Capacity	
Maintaining a Motivated and Stable Coordinating Body	
Reporting on Institutional Arrangements within BURs	
Key activity 3: Assess data gaps and needs	
Assess and prioritise data gaps	
Identify how existing MRV systems can be extended to address data gaps	
Key activity 4: Establish data management processes	
Develop systems to improve data quality	
Develop data management systems	
Address data gaps	
Develop data improvement plans	
Key activity 5: Build MRV capacity	
Key activity 6: Improve the MRV system over time	
Ensure MRV reports are relevant	
Consider options for continuous improvement	

*Key activities and tasks follow the scheme in section 2. National (domestic) MRV system

Based on the current status, and also considering the resources required to continue improving each of these activities/tasks of the MRV system, RoM will identify which activities/tasks need to be prioritised in the short, medium and long term.

As it has previously mentioned, some of these prioritized actions can be developed in parallel, even some have a strong relation between them so the simultaneous implementation, developing them organically, will use their synergists and enhance cost-effectiveness.


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Chapter 8
Any Other Information Relevant to the BUR Process

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8 - Any Other Information Relevant to the BUR Process

This chapter presents a collection of additional detail (over and above that reported in Chapters 1 – 7) of work and/or decisions that has been undertaken to address climate change in Mauritius. The information presented below gives a general overview of the initiatives to follow on from information presented in BUR-1.

8.1 Renewable Energy Programmes

In view of shaping a new economic architecture, the Government of Mauritius aims to develop a new economic growth pole, the Green Energy Industry, which will have a significant impact on the economy, boost our GDP growth and create new job opportunities.
Presently, there is already a guaranteed local demand of some Rs 20 billion for energy in our economy– most of which are imported as fossil fuel. Along this line, the Government has announced the following key measures in the budget 2021/2022:

- the production of 60 percent of our country's energy needs from green sources by 2030; and
- the total phase out of coal before 2030. In line with this strategy, there will be the following strategic investment over the next 3 years:
    - A tenfold rise in the absorption capacity of intermittent renewable energy through increased battery capacity to some 40 MW from the current 4 MW;
    - Setting up of 10 Gas Insulated Switchgear (GIS) substations to improve reliability and increase the share of renewable energy; and
    - Development of integrated green energy projects, combining the use of biomass, wind and solar energy. A biomass framework is currently under preparation.

8.2 Capacity Building Initiative for Transparency

Mauritius has embarked on the Capacity Building Initiative for Transparency to improve the quality of the national GHG inventory and the data collection, storage and dissemination processes associated, thereby improving reporting and transparency and providing a firmer basis for evidence-based-policy-making.
The project will also enable Mauritius to track progress of its Nationally Determined Contribution (NDC) compared to its observed emissions (i.e. national GHG emissions inventory), prospective emissions (mitigation) and support needed to implement climate action (support). Furthermore, a Measurement, Reporting and Verification (MRV) architecture will allow the regular elaboration of national reports, including the future Biennial Transparency Report (BTR).

On 04 October 2019, the Global Environment Facility Council has approved the CBIT Project Identification Form with a grant funding to the tune of USD 1,269,850. Project duration is 48 months, from May 2021 to May 2025.

8.3 Nationally Appropriate Mitigation Actions for Low Carbon Island Development Strategy for Mauritius (NAMA)

Mauritius sought technical and financial assistance from United Nations Environment Programme (UNEP) and Global Environment Facility (GEF) respectively, to formulate the first National Climate Change Mitigation Strategy and Action Plan**.** The aim is to ensure a low carbon path for Mauritius. This project is in line with the *Government Programme 2020-2024* in pursuing efforts to make Mauritius a cleaner and greener country in the context of meaningful ecological transition. It will play a pivotal role in mitigation achievements of the Nationally Determined Contributions (NDC). It will also meet the requirement for the implementation of the Climate Change Act 2020.

The project has started in February 2017 and is expected to be completed by June 2022. Grant funding from GEF is to the tune of USD 1.6 million.

8.4 Development of Country Specific Emission factors (CSEFs)

Funding was provided under the BUR-1 to develop country specific emission factors to improve the accuracy of our GHG Inventory. Proposals were received from 5 stakeholders of different sectors, namely Energy Industries, Transport, AFOLU (crop and livestock) and Waste sectors.

Proposals for the determination of CSEFs for the crop and solid waste sectors were selected during the first meeting of the Technical Committee held on 29 March 2018. Eventually, the Terms of Reference and the modality for recruitment of Consultancy Services for a solid waste characterisation study and the laboratory analysis of crop samples through a Request for Proposal approach were approved by the Project Steering Committee at its second meeting.

The outcome of both studies is given at Annex 5 and Annex 6.

Technical Annexes to the BUR: GHG Inventory

Annex 1: Methodology Applied in 2000 – 2016 series

Table A.1.1: Methodology applied for the GHG emission inventory 2000-2016

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
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 Water-borne Navigation	T1	D/T1	D	International Energy Agency
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	-
2.A – Mineral Industry				
2.A.2 – Lime production	T2	D (CO_2)	-	Statistics Unit of the ESDD[8] facilitated by the institutional authority via mail
2.B – Chemical Industry				
2.B – Chemical Industry	NO	NO	-	-
2.C – Metal Industry				

[8] Environmental and Sustainable Development Division

2.C.1 – Iron and Steel production	T1	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	T1	D (CO_2)	-	International Energy Agency
2.E – Electronics Industry				
2.E – Electronics Industry	NO	NO	-	
2.F – Product Uses as Substitutes for Ozone Depleting Substances (ODS)				
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	-	-
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	-	Central Statistical Office
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	-	Central Statistical Office
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
3.B.1.b – Land converted to Forest land	T1	D, CS	-	Forestry Service, Ministry of Agro-Industry & Food Security
3.B.1.b.i – Cropland converted to Forest land	T1	D	-	Forestry Service, Ministry of Agro-Industry & Food Security
3.B.2 – Cropland				
3.B.2.a – Cropland remaining cropland	T1	D	-	Digest of Agricultural Statistics Mauritius and MCIA
3.B.2.b – Land converted to Cropland	T1	D, CS	-	Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.2.b.i – Forest land converted to Cropland	T1	D, CS	-	Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.3 – Grassland				
3.B.3.a – Grassland remaining grassland	T1	D		Forestry Service

3.B.3.b – Land converted to grassland	T1	NO		TNC data
3.B.4 – Wetland				
3.B.4.a – Wetlands remaining wetlands	T1	NO, NA		TNC data
3.B.4.a.i – Peatlands remaining peatlands	T1	NO		NO
3.B.4.a.ii – Flooded land remaining flooded land	T1	NA		-
3.B.4.a – Wetlands remaining wetlands	NO, NA	D, CS		Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.5 – Settlements				
3.B.5.a – Settlements remaining settlements	T1	D		TNC data
3.B.5.b – Land converted to settlements	T1	D, CS		Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.5.b.i – Forest land converted to settlements	T1	D, CS		Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.6 – Other land				
3.B.6.a – Other land remaining other land	T1	NA		TNC data
3.B.6.b – Land converted to other land	T1	D, CS		Forestry Service, Ministry of Agro-Industry & Food Security.
3.B.6.b.i – Forest land converted to other land	T1	D, CS		Forestry Service, Ministry of Agro-Industry & Food Security
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		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 – Other				
3.D.1 – Harvested wood products	T1	D		FAOSTAT
3.D.2 – Other	NO	NO		
4 - Waste				
4.A – Solid Waste Disposal	T2	D, CS	-	Solid Waste Management Division, Statistics Mauritius
4.B – Biological Treatment of Solid Waste	T2	D	-	Solid Waste Management Division, Statistics Mauritius
4.C – Incineration and Open Burning of Waste	T2	D	-	Solid Waste Management Division, Statistics Mauritius
4.D – Wastewater Treatment and Discharge	T2	D, CS	-	Wastewater Management Authority, Statistics Mauritius
4.E – Other	NO	NO	-	-

Annex 2: Summary Report for GHG Emissions Inventory

Table A.2.1: 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				

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
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			

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
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				

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
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 A.2.2: Summary Report for GHG Emissions Inventory. Year 2005

	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					

	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
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		

	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
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						

	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
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 A.2.3: 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					

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
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		

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
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						

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
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 A.2.4: 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					

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
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		

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
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						

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
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 A.2.5: 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					

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
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		

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
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						

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
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 A.2.6: 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					

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
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		

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
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						

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
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

Annex 3: Key Category Analysis

Table A.3.1: Key Category Analysis, Approach 1 – Level Assessment

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

IPCC Category code	IPCC Category	GHG	2016 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
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

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 - 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

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.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

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.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

IPCC Category code	IPCC Category	GHG	2016 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
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**	

Table A.3.2: Key Category Analysis, Approach 1 – Trend Assessment

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

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
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

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 - 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

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.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

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.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

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
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	

Annex 4: Parameters needed for the MRV mitigation actions

Background

Below the main mitigation policies proposed in the country for GHG emission mitigation, including the parameters needed for the MRV of the mitigation actions.

Table A.4.1: Parameters needed for mitigation scenarios MRV for the energy industries

Parameter	Units	Remarks
Grid Emission Factor		
Share of Low Cost Must Run (LCMR) power plants/units in the electricity system in the past 5 years	% of total generation	All the parameters are as defined in the CDM Methodological Tool 07, version 5 - "Tool to calculate the emission factor of an electricity system"(UNFCCC, CDM, PA Methodologies, 2016)
Annual data from each power plant/unit on power generation	MWh	Data should be measured using calibrated meters and collected using the Quality Assurance System (QAS) established by the CEB.
Annual data from each power plant/unit on fuel type		The fuel type determines the fuels for which emission factors and net calorific values (NCV) are needed (see NCV below).
Annual data from each power plant on fuel/unit consumption	t	Data are recorded using the QAS established by the CEB.
Net calorific value (NCV) of each type of fuel used in power plants/units	GJ/(tonne fuel)	Uses laboratory data from CEB for fuel oil and kerosene, and IPPs for coal.
Emission factor of each type of fuel used in power plants/units	tCO_2/GJ	Uses IPCC default values.
Annual electricity generated from renewable energy sources	MWh	Data should be measured using calibrated metres and collected using the Quality Assurance System (QAS) established by the CEB.
Avoided electricity through demand side management	MWh	• Reduction in electricity use against historical baseline • Surveys carried out by EEMO • Data collected during energy audits • At the project level, the parameters defined in CDM Approved Small-Scale methodologies, such as AMS-II.C; II.D; II.E; II.J; II.L; II.N; II.O; II.Q; II.R; II.S need to be measured (UNFCCC, CDM, SSC Methodologies, 2016)

Source: Third National Communication

Table A.4.2: Parameters needed for land transport mitigation scenarios MRV

Parameter	Units	Remarks
Passenger Mobility		
Average annual distance travelled by different types of passenger vehicles (e.g. two-wheelers, car, bus, DPV) and broken down by fuel type (e.g. LPG, gasoline, diesel, hybrid, electric)	km per year	This has to be carried out through sampling, and is a parameter that may be collected by the road worthiness test centres.
Average occupancy of different types of passenger vehicles and broken down by fuel type	Number of passengers	Data should be measured through surveys.
Average fuel consumption of different types of passenger vehicles and broken down by fuel type	L fuel per 100km travelled	Data should be measured through surveys using methodology adopted by the Global Fuel Economy Initiative (GFEI) project.
Number of registered passenger vehicles and broken down by fuel type	Number of passenger vehicles	Although these data are not used in the model, they can nevertheless be used to carry out cross verification of the model output.
Net calorific value (NCV) of each type of fuel used in vehicles	GJ/(tonne fuel)	Uses IPCC default values or can use laboratory data from national authorities (preferred).
Emission factor of each type of fuel used in passenger vehicles	tCO_2/GJ	Uses IPCC default values or can use Tier II factors when available.
Freight Mobility		
Average annual distance travelled by freight vehicles (diesel or gasoline)	km per year	This has to be carried out through sampling, and is a parameter that may be collected by the road worthiness test centres. Although not used in the model, it will be useful to collect data by categorising freight vehicles by tare or maximum load.
Average load of freight carried by vehicles	t	Data should be measured through surveys.
Average fuel consumption of freight vehicles	L fuel per 100km travelled	Data should be measured through surveys using methodology adopted by the Global Fuel Economy Initiative (GFEI) project. Data can also be collected for different types of freight vehicles classified by tare.
Number of registered freight vehicles by fuel type and size of vehicles (e.g. tare or maximum load)	Number of freight vehicles	Although these data are not used in the model, they can nevertheless be used to carry out cross verification of the model output.
Net calorific value (NCV) of each type of fuel used in vehicles	GJ/(tonne fuel)	Uses IPCC default values or can use laboratory data from national authorities (preferred).
Emission factor of each type of fuel used in passenger vehicles	tCO_2/GJ	Uses IPCC default values or can use Tier II factors when available.
Aggregate fuel statistics		
Quantity of total annual fuel consumed in land transport by fuel type	t per year	This data are already available at Statistics Mauritius. It is used in the model for carrying out the energy balance and for tracking overall national GHG emissions.

Source: Third National Communication

Table A.4.3: Parameters needed for solid state mitigation scenarios MRV

Parameter	Units	Remarks
Population (annual)	Number of persons	Annual population is provided by SM.
Per capita waste generated	kg/person/yr	This value is calculated by dividing the total quantity of MSW generated (tonne) in a year by the population in that year. The quantity of total waste generated/collected is compiled by the Solid Waste Management Division, MoESDDBM.
Composition of waste	%	The total waste is disaggregated into its various components such as food, garden, paper, wood, inert, etc. These values can be obtained from waste characterisation at transfer stations. It should be measured periodically by the Solid Waste Management Division, MoESDDBM
Quantity of sludge	kg (or equivalent)	The quantity of sludge (e.g. from wastewater treatment) landfilled is recorded and available at the Solid Waste Management Division, MoESDDBM.
Quantity of industrial waste	kg (or equivalent)	The quantity of industrial waste landfilled is recorded and is available at the Solid Waste Management Division, MoESDDBM
Quantity of waste diverted from landfill for alternative uses (e.g. recycling, composting and waste-to-energy)	kg (or equivalent)	These quantities are recorded and are available at the Solid Waste Management Division, MoESDDBM.
LFG capture (either for flaring or electricity generation)	kg CH_4 (or equivalent units)	Data are recorded and available at the Solid Waste Division, MoESDDBM
Degradable Organic Carbon (DOC) in various types of solid waste	dimensionless	Uses IPCC default values.
Fraction of DOC (DOCf) dissimilated	dimensionless	Uses IPCC default values.

Source: Third National Communication

Table A.4.4: Parameters needed for agricultural crops mitigation scenarios MRV

Parameter	Units	Remarks
Crop burn		
Area of sugar cane on which agricultural residue is burnt	ha/year	This area is usually captured as a percentage of total area cultivated, and data are recorded and are available at the MCIA.
Mass of fuel available for combustion	t/ha	Uses IPCC default value for sugar cane post-harvest field burning (6.5 t/ha).
Emission factor	kg CH_4/(kg dm burnt)	Uses IPCC default value for agricultural residues (2.7 kg CH_4/(kg dm burnt))
Direct N_2O emissions from managed soils		
N input in the form of chemical fertiliser	kg N/yr	This data are obtained from chemical fertilisers used in sugar and non-sugar crop cultivation. They are estimated by MCIA and FAREI, respectively. Parameter is also used to calculate indirect N_2O emissions.
N input in the form of manure	kg N/yr	This data corresponds to livestock manure and is recorded by FAREI. Parameter is also used to calculate indirect N_2O emissions.
N input in the form of agricultural residues	kg N/yr	Data are recorded by MCIA (sugar cane residues) and FAREI (food crop residues), respectively. Parameter is also used to calculate indirect N_2O emissions.
Emission factor	kg N_2O-N/kg N	Uses IPCC default value (0.01 kg N_2O-N/kg N).
Direct N_2O emissions from managed soils–urine and dung inputs		
N input from pig, cattle and poultry excrement	kg N/yr	Data available from FAREI.
N input from sheep and other animals' excrement	kg N/yr	Data available from FAREI.
Emission factors	kg N_2O-N/kg N	Uses IPCC default values (0.02 kg N_2O-N/kg N for pig, poultry and cattle; 0.01 kg N_2O-N/kg N for sheep and other animals).
Indirect N_2O emissions from managed soils		
Fraction of synthetic fertiliser that volatilises	(kg NH3-N+NOx-N)/kg N	Uses IPCC default value [0.1 (kg NH3-N+NOx-N)/kg N].
Fraction of organic or dung inputs that volatilises	(kg NH3-N+NOx-N)/kg N	Uses IPCC default value [0.2 (kg NH3-N+NOx-N)/kg N].
Fraction N lost through leaching and/or runoff	kg N/kg of N additions	Uses IPCC default value [0.3 kg N/kg of N additions].
Emission factor for N_2O from leaching/runoff	kg N_2O-N/kg N leached	Uses IPCC default value [0.0075 kg N_2O-N/kg N leached].

Source: Third National Communication

Table A.4.5: Parameters needed for livestock management mitigation scenarios MRV

Parameter	Units	Remarks
Enteric fermentation		
Number of animal heads per year by livestock type	Number of heads	The livestock types covered in the analyses are: dairy cow, other cattle (calves, heifers, local and imported bulls), sheep, goats, horses, swine, poultry and deer). The data are recorded and are available from FAREI. Data are also used for the calculation of direct CH_4 and indirect N_2O emissions from livestock manure management.
Livestock type specific CH_4 emission factors for enteric fermentation	kg CH_4/(head yr)	Use IPCC default values. Each type of livestock has a specific emission factor as per details in Annex 17(f) of the e-version of TNC.
Direct CH_4 emissions from livestock manure management		
Number of animal heads per year by livestock type	Number of heads	Same as above.
Livestock type specific CH_4 emission factors for manure	kg CH_4/(head yr)	Use IPCC default values. Each type of livestock has a specific emission factor as per details in Annex 17(f) of the e-version of TNC.
Direct N_2O emissions from livestock manure management		
Number of animal heads per year by livestock type	Number of heads	Same as above.
Excretion rate for each livestock type	kg N/(1000 kg head/day)	Each type of livestock has a specific emission factor as per details in Annex 17(f) of the e-version of TNC. Data are available at FAREI.
Typical mass of each type of livestock and sub-category (e.g., heifer vs calf vs bull or piglet vs swine vs fattener)	kg	Each type of livestock has a specific emission factor as per details in Annex 17(f) of the e-version of TNC. Data are available at FAREI.
Fraction of N managed in Manure Management System (MMS) for each livestock type	dimensionless	FAREI has an inventory of the Manure Management System (MMS) categorisation for each livestock type.
Emission factors for direct N2O-N from MMS	kg N_2O-N/kg N in MMS	Uses IPCC default values.

Source: Third National Communication

Table A.4.6: Parameters needed for sequestration scenarios MRV

Parameter	Units	Remarks
Area of land planted/forested with trees by type (e.g., native vs exotic), and where necessary (such as pine) by age group	ha/yr	The areas are the effective areas – i.e., net of clear-felled areas and gaps. If demarcated forest areas are used, then replanting in clear-felled areas and gaps does not add to carbon stock. Forest areas are categorised as: Dry Lowland (DLL); Moist Forest; and Wet Upland (WUL). All native tree species are placed in one category – i.e., Natives, whereas exotic plants are categorised per species. The data are recorded and are available at the Forestry Services, Ministry of Agro-Industry and Food Security (MoAIFS).
Average annual above-ground biomass growth	tonne dm/ha/yr	The annual increase in biomass is needed for each tree species by forest type. The data are recorded and are available at the Forestry Services (MoAIFS)
Ratio of below-ground biomass to above-ground biomass	tonne dm below-ground/tonne dm above-ground (<1)	Data are needed for each tree species and by forest type. The data are recorded and are available at the Forestry Services (MoAIFS)
Wood removal	m^3/ yr	Volume of pine (WUL forest) and eucalyptus (DLL forest) removed annually for timber. The data are recorded and are available at the Forestry Services, (MoAIFS).
Fuelwood removal	m^3/ yr	Volume of pine (WUL forest) and eucalyptus (DLL forest) removed annually for thermal energy use. The data are recorded and are available at the Forestry Services, (MoAIFS)
Area affected by disturbance	ha / yr	Area of forest type and by type of tree species that is affected by disturbance. The data are recorded and are available at the Forestry Services, (MoAIFS)
Fraction of biomass lost in disturbance	number (<1)	The data are recorded and are available at the Forestry Services, (MoAIFS)
Average above-ground biomass of areas affected	tonne dm / ha	The data for above-ground biomass for each tree species by forest type are recorded and are available at the Forestry Services, (MoAIFS)
Carbon fraction of dry matter	(tonne C)/(tonne dm)	Constant at 0.47 (tonne C)/(tonne dm) for all tree species and forest type.

Source: Third National Communication

Annex 5: Determination of selected Emission Factors for an enhanced GHG inventory in the agricultural sector in Mauritius

The Republic of Mauritius has submitted in December 2016 to the UNFCCC Secretariat its Third National Communication (TNC) on Climate Change in fulfilment of the reporting requirement under the United Nations Framework Convention on Climate Change (UNFCCC). Mauritius has the obligation under the UNFCCC to make, as accurately as possible, an inventory on GHG emissions for National Inventory Reports from different sectors of which agriculture is a major component.

The IPCC strongly recommends developing local Emission Factors (EFs) to assess GHG emissions in the preparation of National Inventory reports, which is equivalent to a Tier 2 methodology. However, for the Third National Communication a Tier 1 methodology was used for the agricultural sector, which used default EFs that may not be appropriate for local conditions and that carries large uncertainties. In addition, the C sequestration potential in tree-based systems, such as orchards, agroforestry and tea plantations have not been adequately considered in the inventory. To enhance Greenhouse Gas Inventory in the agricultural sector selected Emission Factors in the food crop, fruit and tea cultivation systems are being determined under this project.

The IPCC Inventory Software requires a range of EFs to determine GHG emission in the agricultural sector, based on the 2006 IPCC Guidelines. In this project the following EF's have been targeted in the Foodcrops and Fruit sector.

Category	Activity data	Unit
Annual crops	Above ground biomass	t d.m/ha
	Carbon fraction of dry matter	t C/t d. m
	Harvest/maturity cycle	yr.
	Biomass carbon loss	t C/ha/yr.
Perennial crops	Biomass accumulation rate	t C/ha/yr.
	Carbon fraction of dry matter	t C/t d. m
	Annual carbon stock in biomass removed (removed or harvested)	t C/yr.

For this project, ten species of annual crops and three species of perennial crops were selected across the main vegetable, fruit and tea growing areas and plant samples collected, processed and sent for analysis as described below:

Methodology and Laboratory procedures

1. Site Selection

Sites chosen were representative of the vegetable, fruit and tea grown in different agro- climatic zones. The main localities where samples were taken were La Marie, La Laura, Camp Fouquereaux, Curepipe, Seneville, La Ferme, Réduit, Belle Mare, Palmar, Rose Belle, Midlands and Nouvelle France.

2. Sample preparation for analysis

A total number of 154 representative plant samples of different major cultivated crops were collected from the different localities. Sample preparation was carried out at the Soil and Water Management Research Facility at Wooton CRS of the Food and Agricultural Research and Extension Institute. The plant samples were washed to remove any loose soil, air-dried and whole weight recorded. As appropriate and depending on the species the plants were then separated into parts (leaves, stems, fruit, roots, tubers, bulbs, head, curds and crown) and labelled as appropriate. The initial fresh weight was recorded, and then oven dried at 70 ºC till constant weight. Final dry weight value was recorded and dry matter % content determined. The oven-dried samples were ground into powdered form to pass through a 2 mm sieve. The ground samples parts were hermetically packed and sealed in plastic bags with proper labelling using a coding system.

3. Determination of Nitrogen, Phosphorus, Potassium and Carbon content

The sealed and labelled plant samples were sent to the Faculty of Agriculture for analysis of nitrogen, phosphorus, potassium and carbon content. Potassium and phosphorous content were analysed using the acid digestion method (MAFF, 1986 and Page, 1982). Potassium content were determined using Flame Photometer and Phosphate content was determined by Spectrophotometer read at 400nm. The Carbon content was determined by colorimetric method with a Spectrophotometer read at 600 nm (Baker, 1976). Nitrogen content was determined using distillation and titration method of Rowell (1994). Phosphorus and Potassium were conveniently determined for use to optimise fertiliser application in crop production.

Calculation of Crop Emission Factors

The raw and averaged data for nitrogen, phosphorus, potassium and carbon contents in the plant samples was submitted by the University of Mauritius to the Food and Agricultural Research and Extension Institute for calculation of emission factors.

4. Results of Analysis

The results of analysis for organic carbon (%), phosphorous (g/kg), potassium (g/kg), and nitrogen (%) content of the samples submitted are given below:

Table 1: % N and % C, P (g/kg) and (g/kg) K content in annual crops

Crop	Plant Parts	N (%)	P (g/kg)	K (g/kg)	Carbon (%)
Carrot	**Tubers**	1.97	4.05	42.51	35.15
	Leaves	3.21	5.61	46.18	33.78
Onion	**Leaves**	1.78	3.12	29.17	35.47
	Bulbs	1.61	3.71	15.94	36.27
Cauliflower	**Curd**	3.91	6.09	48.14	35.40
	Leaves	3.73	5.71	50.52	35.53
Cabbage	**Curd**	3.50	10.35	53.72	33.50
	Leaves	1.86	5.08	25.90	38.90
Chayote	**Leaves**	3.64	8.77	32.95	34.83
	Stems	2.19	7.84	51.98	35.47
	Fruit	1.99	5.64	28.58	35.38
Pumpkin	**Leaves**	3.49	5.89	32.66	33.80
	Stems	2.35	6.73	47.87	34.75
	Fruit	1.39	3.39	27.67	37.25
Eggplant	**Leaves**	2.22	3.90	12.97	36.95
	Stems	0.85	2.02	16.21	34.15
	Fruit	1.83	3.75	29.21	37.45
Tomato	**Leaves**	3.10	4.40	22.94	34.65
	Stems	1.59	3.94	28.83	35.40
	Fruits	2.26	3.73	32.09	35.57
	Roots	2.05	3.33	20.49	31.85
Chilli	**Leaves**	4.39	5.30	30.10	35.10
	Stems	2.04	3.03	23.74	34.40
	Fruits	2.58	4.54	28.79	37.55
	Roots	2.23	2.85	13.96	36.30
Banana	**Leaves**	1.74	2.95	24.42	36.00
	Stems	0.91	2.53	41.58	35.32
	Fruits	0.64	2.26	24.48	37.99
Pineapple	**Crown**	1.31	3.93	23.40	36.50
	Leaves	0.88	2.87	26.40	37.57
	Fruits	1.23	3.31	36.39	36.50
	Roots	0.60	2.17	5.89	35.83
Potato	**Leaves**	2.81	3.52	65.37	34.95
	Stems	0.82	2.34	66.89	36.72
	Tubers	1.49	3.34	22.25	36.20
	Roots	1.31	2.50	20.80	35.40

Table 2: Total N, P and K and Carbon content in Perennial crops

Crop	Plant Parts	N (%)	P (g/Kg)	K (g/Kg)	Carbon (%)
Tea	**Leaves**	7.16	4.35	17.16	43.38
	Branch/Twigs	0.87	2.12	5.76	35.03
Mango	**Branch/Twigs**	0.553	2.758	7.975	35.23
	Leaves	1.23	3.13	13.23	35.50
Litchi	**Branch/Twigs**	0.61	3.39	10.87	34.87
	Leaves	1.28	1.75	10.99	35.18

5.0 Targeted Emission Factors

The above primary data obtained through analysis of plant materials were used to calculate the Emission Factors targeted as per the methodologies and equations described in the IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Volume 4: AFOLU, Chapter 5: Cropland. Theas are reproduced below:

General Equation to determine targeted Activity Data (Annex 2: Summary of Equations)

i. **Above ground Biomass (t d.m/ha)**
   - Above-ground biomass growth, tonnes d.m. ha^{-1} yr^{-1} = % Dry Matter content X Total tonnes of fresh above ground biomass per hectare.

i. **Carbon fraction of dry matter (t C/t d. m)**
   - Carbon fraction of dry matter, tonnes C (tonne d.m.)$^{-1}$ = % Carbon content per tonnes dry biomass.

ii. **Biomass accumulation rate (t C/ha/yr)**
   - Biomass accumulated in perennial crops per hectare per year =% Carbon content X sum of tonnes dry biomass accumulated per year.

The default coefficient for biomass stock for annual cropland is 5 tonne C/ha/yr under a Tier 1 approach IPCC 2006 Guidelines for National Greenhouse Gas Inventories, Chapter 5: table 5.9, pp.28 "Default biomass stock present land to converted to cropland in year following conversion."

<u>Annual Crops:</u>

a. Above ground Biomass (td.m/ha)

Table 3: Above ground biomass for the targeted crops (td.m/ha)

Crop	Plant parts	Above ground Biomass td.m/ha
Carrot	Leaves	2.67
Onion	Leaves	0.09
	Curd	2.20
Cauliflower	Leaves	1.02
	Curd	6.11
Cabbage	Leaves	0.64
	leaves	1.37
	Stems	1.37
Chayote	Fruit	1.21
	Leaves	2.59
	Stems	4.76
Pumpkin	Fruit	1.51
Beetroot	whole	1.86
	Leaves	0.57
	Stems	3.43
Eggplant	Fruit	2.17
	Leaves	0.92
	Stems	0.56
Tomato	Fruits	1.08
	Leaves	1.81
	Stems	4.04
Chilli	Fruits	1.48
	Leaves	1.07
	Stems	1.14
Banana	Fruits	4.12
	Crown	1.20
	Leaves	1.97
Pineapple	Fruits	8.13
	Leaves	1.16
Potato	Stems	1.36

b. Carbon fraction of dry matter (t C/t d. m)

Table 4: Carbon fraction of dry matter (t C/t d.m)

Annual crops	Plant parts	Carbon fraction of dry matter t C/t d.m
Carrot	**Tubers**	0.352
	Leaves	0.338
Onion	**Leaves**	0.355
	Bulbs	0.363
Cauliflower	**Curd**	0.354
	Leaves	0.355
Cabbage	**Curd**	0.335
	Leaves	0.389
Chayote	**leaves**	0.348
	Stems	0.355
	Fruit	0.354
Pumpkin	**Leaves**	0.338
	Stems	0.348
	Fruit	0.373
Beetroot	**whole**	0.363
Eggplant	**Leaves**	0.370
	Stems	0.342
	Fruit	0.375
Tomato	**Leaves**	0.347
	Stems	0.354
	Fruits	0.356
	Roots	0.319
Chilli	**Leaves**	0.351
	Stems	0.344
	Fruits	0.376
	Roots	0.363
Banana	**Leaves**	0.360
	Stems	0.353
	Fruits	0.380
Pineapple	**Crown**	0.365
	Leaves	0.376
	Fruits	0.365
	Roots	0.358
Potato	**Leaves**	0.350
	Stems	0.367
	Tubers	0.362
	Roots	0.354

c. Harvest/maturity cycle/yr

Table 5: Harvest/maturity cycle/yr

Annual crop	Crop cycle/ month	Harvest/cycle/yr
Carrot	3-3 1/2	3
Onion	4-4 1/2	1
Cauliflower	2-3'	2
Cabbage	1 1/2-3	2
Chayote*	7	Multiple harvests
Pumpkin	3-4'	1
Beetroot	3	2
Eggplant*	5-6	2
Tomato*	6'	2
Potato	90-105	2
Chilli*	6-12'	2

*Note: 2 harvest per week

Perennial Crops

Default Above ground biomass for various types of perennial cropland tonnes ha^{-1} (Volume 4: AFOLU Chapter 5: table 5.3, pp.9), indicated a default factor for 0.5 C/tonne for carbon density biomass. The Above-ground biomass carbon stock at harvest was 21 (tonnes C ha^{-1}). The estimate for tropical moist country for perennial species for a harvest cycle 8 years was 2.6 tonnes C/ha/yr for the above ground biomass accumulated and the Biomass Carbon loss for tropical moist country was 21 tonnes C/ha/yr.

Mauritius context

a. Tea

Mean aboveground fresh biomass determined in tea plantation is 55 tonnes/ha, and a mean dry matter biomass of 26.18 t d.m/ha was obtained. The mean carbon content by analysis is 43.38 %. The mean annual carbon stock in biomass calculated is 11.36 tonnes C/ha. The mean carbon stock in biomass removed or harvested is 0.54 tonne C/ha/yr, which consists of leaves harvested for black tea production.

b. Mango and Litchi

For mango and litchi, the carbon content by analysis is 35.2 % and 34.87 % respectively in wood and twigs. In the leaves the carbon content is 35.5 % and 35.18 respectively. The carbon stock in biomass removed is considered negligible for these two trees. However, further study needs to be carried in the local context for estimating above ground biomass, as this could not be undertaken within the time frame of the project. Determination of EFs for other tree crops need also to be determined, especially those included in agroforestry systems.

Conclusions

The Emission Factors targeted in this study to improve the determination of GHG emission from managed land has been successfully completed for the foodcrop and tea sectors. Further studies need to be undertaken to calculate emission factors for tree crops, namely those included in fruit orchards and agroforestry. Considerable primary data have been generated in this project, which will be used to improve the GHG emission for subsequent inventories. The data generated can be used in aggregated form or as a system-based approach to refine further the GHG inventory in Mauritius. However, there are still other Emission Factors that need to be developed to further enhance the GHG inventory in the agricultural sector, such as Nitrous oxide emissions from managed and crop land.

Annex 6: National Solid Waste Characterisation Study in Mauritius

1. Introduction

The Republic of Mauritius, a small island developing state, has a total land area of 2,040 km^2, comprising the mainland Mauritius, Rodrigues, Agalega, Tromelin, Cargados Carajos and the Chagos Archipelago, and has a total population of approximately 1.27 million (TNC, 2016). Rapid economic growth via industrialization, urbanization, higher standards of living along with an increasing number of tourists' arrivals have led to a serious challenge with respect to management of solid wastes in the immediate future since the island comprises of a sole landfill situated at Mare Chicose and the latter is already packed to capacity.

Currently, solid waste management (SWM) is a crucial challenge confronted by both emerging and industrialized nations. According to the Solid Waste Management Division (SWMD), 1200 tonnes of solid wastes was generated on a daily basis and approximately 509,085 tonnes of wastes was disposed of in the sanitary landfill in 2020. Moreover, roughly Rs1 billion is being spent on solid waste management particularly with regard to collection of solid wastes in diverse areas, proper operation as well as maintenance of the 5 transfer stations namely La Brasserie, Roche Bois, La Chaumiere, Poudre D'or and La Laura as well as waste conveyance to Mare Chicose landfill and operation along with maintenance of the landfill. Besides, an additional of Rs 500 million is used by the Local Authorities to cater for waste collection services (Ministry of Social Security, National Solidarity, and Environment and Sustainable Development, 2019).

For a developing country like Mauritius, solid waste management is a policy issue owing to competition between land utilization, high population density and elevated quantity of tourist arrivals as well as restricted national markets. The insufficient surface area renders landfilling as a non-viable disposal possibility in the long run. To confront the continually soaring pile of solid wastes, appropriate solid waste management approaches are imperative. Nonetheless, credible data and figures are instrumental with an eye towards realizing proper solid waste management measures as emphasized by Metin et al. (2003). Accordingly, waste characterization studies in Mauritius are mandatory for the sake of establishing adequate waste management measures compliant with the local situation.

The objectives of this study are to assess the quantity of waste generated, to obtain accurate statistics on waste composition with respect to their chemical, physical and thermal attributes, to identify the quantity of biodegradable and organic materials present in the disposed waste. Subsequently, policymakers can seize the opportunity to opt for the most suitable technology to operate, control as well as valorise waste components in Mauritius.

2. Waste characterization methodology

2.1 Sampling Protocol

The technique of random sampling was adopted for the characterisation study conducted whereby trucks were assigned randomly for municipal solid waste collection and sorting purposes from waste streams as per ASTM D 5231-5292. With the aim of acquiring accurate and reliable statistics on the waste components and attributes, features such as the desired sample size and the number of samples required had to be determined (Rhyner et al., 1995).

2.2 Determination of sample number and sample size

2 to 3 trucks were considered where a representative sample size of 90 to 110 kg was pre-determined for the waste characterization analysis at each transfer stations and landfill for the purpose of obtaining an indicative composition of the waste components in different regions. The trucks were selected at random at the sanitary landfill and transfer stations whereby the manual sorting was carried out on spot.

2.3 Sample size reduction: Coning and quartering

Coning and quartering were performed on the waste streams to reduce the size of the waste whereby the waste was mixed mechanically into a waste heap measuring 0.8m in height. The heap was then split into 4 uniform quarters in straight lines perpendicular with respect to one another. Wastes from diagonal side pairs were then removed and solely half of the waste sample was used for sorting while the other half was kept for the determination of moisture content and bulk density in the representative sample. This particular technique was replicated till a desired sample size of 90 to 100 kg was achieved.

2.4 Classification of waste streams

Before the classification process of the waste components, bulky equipment and materials having substantially large sizes notably mattresses, glasses and branches were isolated and grouped according to their waste categories. The staff of the waste characterisation team was allocated a specific waste component to be sorted into bins bearing capacity of 7 L and the classified waste materials were weighed and the load recorded by the head of the characterisation team.

3. Results of waste characterization for the period 2019-2020

3.1 Composition of Municipal Solid waste

It was observed from the study that the composition of food waste, yard waste, paper and textile were in the range of 10.5 – 24.3%, 23.6 – 40.6%, 12.9 – 22.2% and 3 – 9.7% respectively as shown in Figure 1.

As for the inorganic waste fraction, it consisted mainly of plastic, metals, glass and others. LDPE was the major constituent of plastic waste which ranged from 5.1 - 9.8% over the period of study as shown in Figure 2. Metal waste varied from 1.8 to 6.0 %, glass from 2.4 - 7.5 % and the other waste category varied from 2.7 - 8.5 as shown in Figure 3.

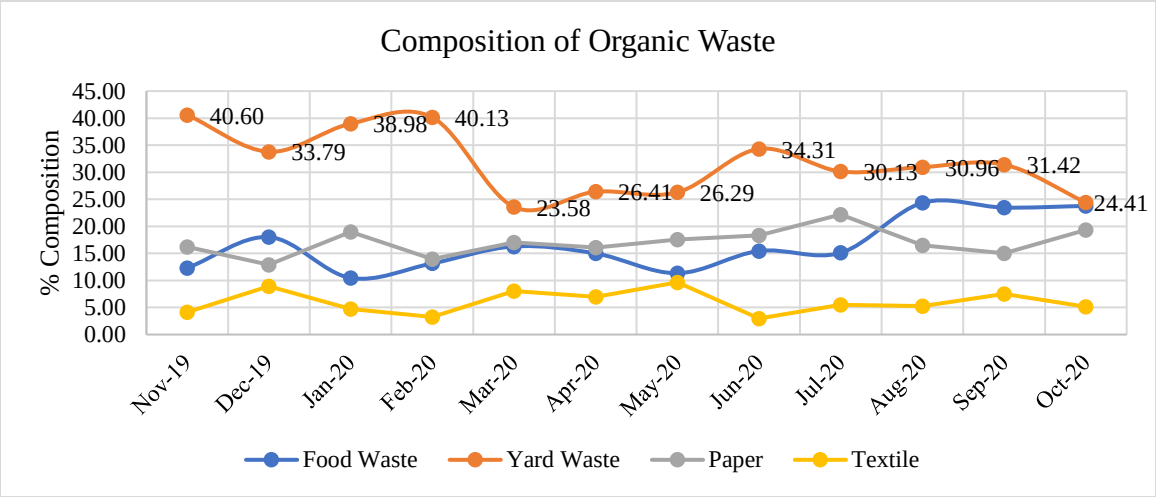

Figure 1: Organic fraction of MSW

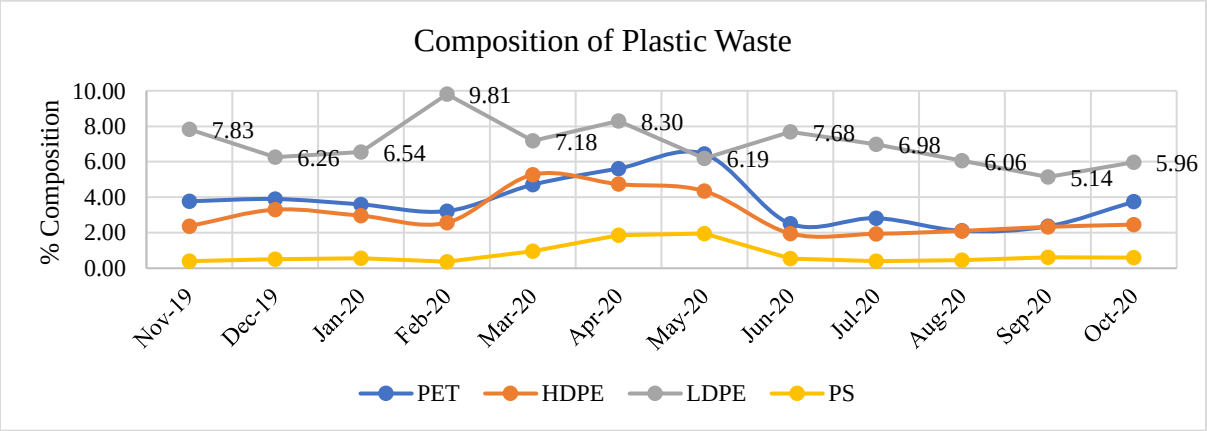

Figure 2: Composition of plastic waste

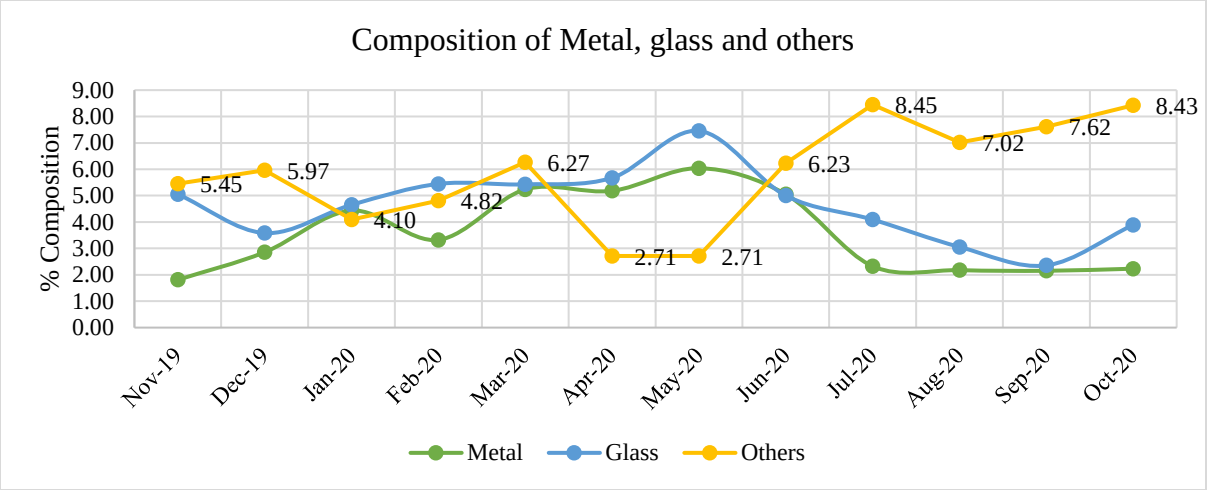

Figure 3: Composition of Metal, glass and other waste

3.2 Moisture Content

The moisture can affect the weight of municipal solid wastes by increasing their mass and resulting in a high cost of collection and transportation of these wastes. Moisture content is a critical determinant in the economic feasibility of waste treatment especially by incineration, because wet waste consumes energy for evaporation of water and in raising the temperature of water vapor. It was observed that the moisture content of food and yard waste that constitute the major fraction of the organic waste component ranged from 29.7 - 69.5% and 40.4 - 71.7 % respectively as shown in Figure 4.

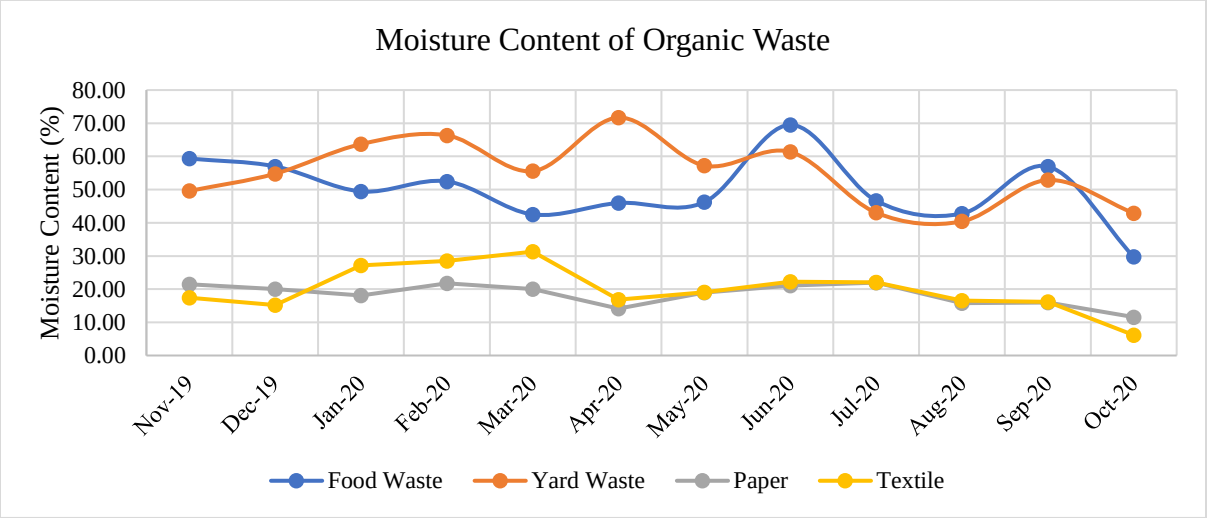

Figure 4: Variation in moisture content of the organic fraction of MSW

3.3 Ash content of various fractions

The possibility of producing energy from waste on a dry weight basis is highly dependent upon the ash content of the waste components. The higher the ash content, the greater the problems associated with its disposal. The ash content of the organic fraction varied between 0.8 to 18.8% and that of plastic varied between 0.1 to 3.8 % as shown in Figure 5 and 6 respectively.

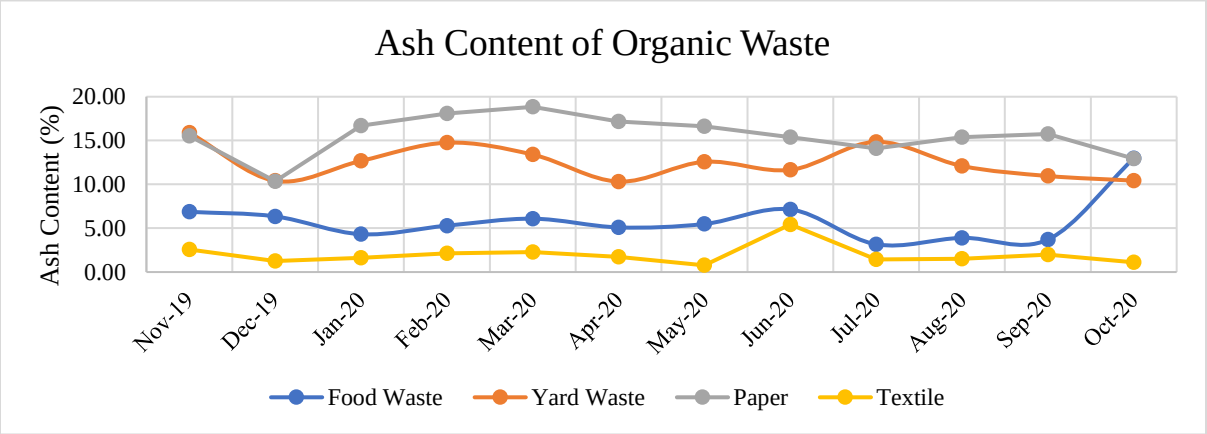

Figure 5: Ash content of organic fraction

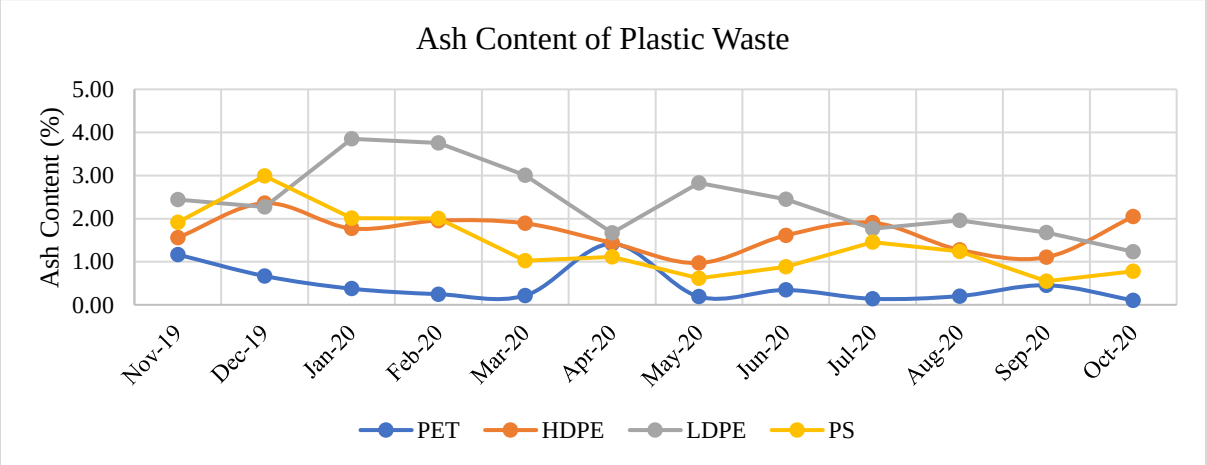

Figure 6: Ash content of Plastic Waste

3.4 Calorific Value

The calorific value of waste materials contributes to the evaluation of their energy recovery potential. Calorific values of wastes are crucial to determine the feasible technical solution of the waste fuel. If MSW has a high moisture content, then its high heating values will decrease. From the values obtained, it can be reported that plastics components have the highest NCV (27.1 - 37.9 MJ/kg when PET fraction is excluded), followed by textile wastes and paper from the organic fraction that varied from 9.9 - 16.1 MJ/kg and 9.4 - 11.4 MJ/kg respectively. It can be observed

that the calorific values of plastic fraction are far greater that the organic fractions. The NCV of MSW was found to be 8.89 MJ/kg.

3.5 DOC of MSW

Degradable organic carbon (DOC) is the organic carbon that is accessible to biochemical decomposition in anaerobic degradation of organic wastes such as paper, woods, textiles, food and yard waste to produce biogas. The amount of DOC in organic waste is the amount of carbon that is available for conversion during degradation. Figure 7 shows the DOC of the organic wastes on a monthly basis.

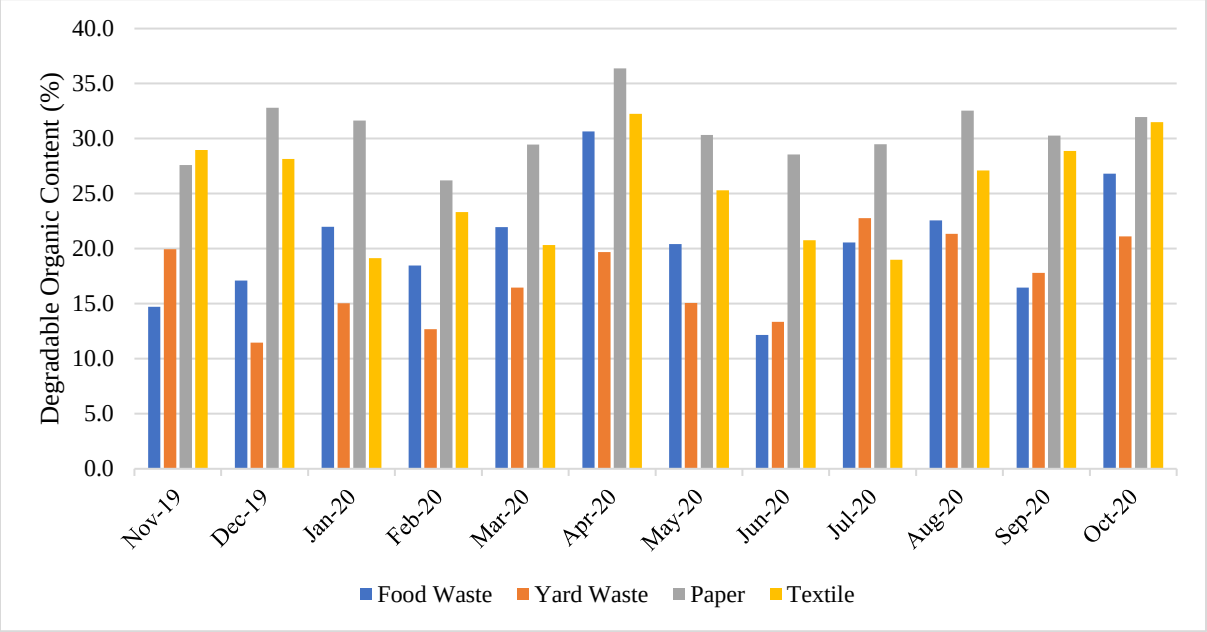

Figure 7: DOC of the organic wastes on a monthly basis

Table 1 shows the weighted average DOC of the different organic wastes.

Table 1: DOC of different components

Component	Degradable organic content (%), wet basis, DOC
Food Waste	20.4
Yard Waste	16.8
Paper	30.6
Textile	25.7

The DOC of the MSW was found to be in the range of 0.12 - 0.19 Gg C/Gg waste as shown in Figure 8 with a weighted average of 0.15 Gg C/Gg waste.

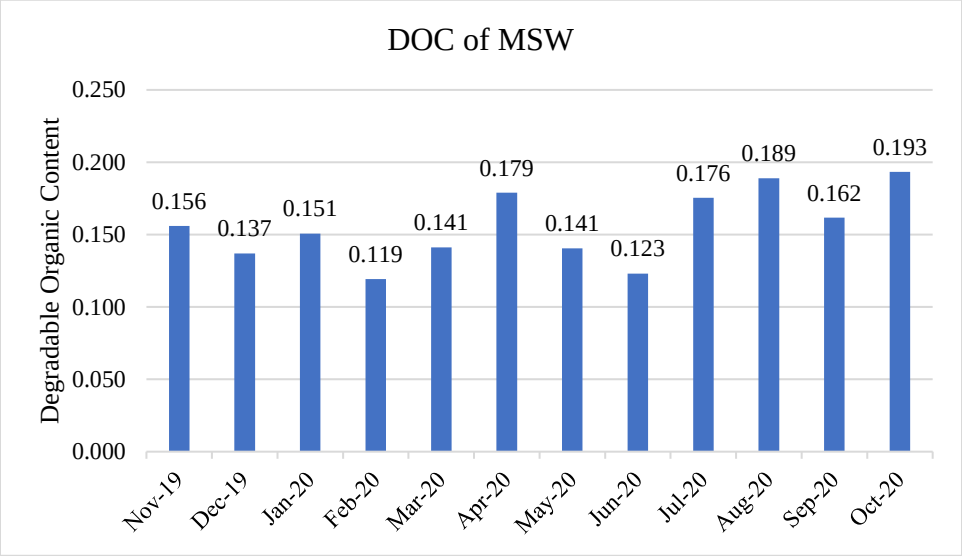

Figure 8: DOC

3.6 Composition of Municipal Solid Waste

The overall composition of municipal solid waste was obtained by determining the weighted average over the whole period as shown in Figure 9. Accordingly, the highest proportion of the total waste generated was discerned to be the organic fraction contributing to 71.5% comprising of 16.3% food waste, 32.2% yard waste, 17% paper and 6% textile waste. Moreover, plastic waste constituted mainly LDPE, HDPE, PET and PS occupied 14.5% of the total composition of the MSW sampled indicating that poor recycling approaches and implementation are being realized around the island.

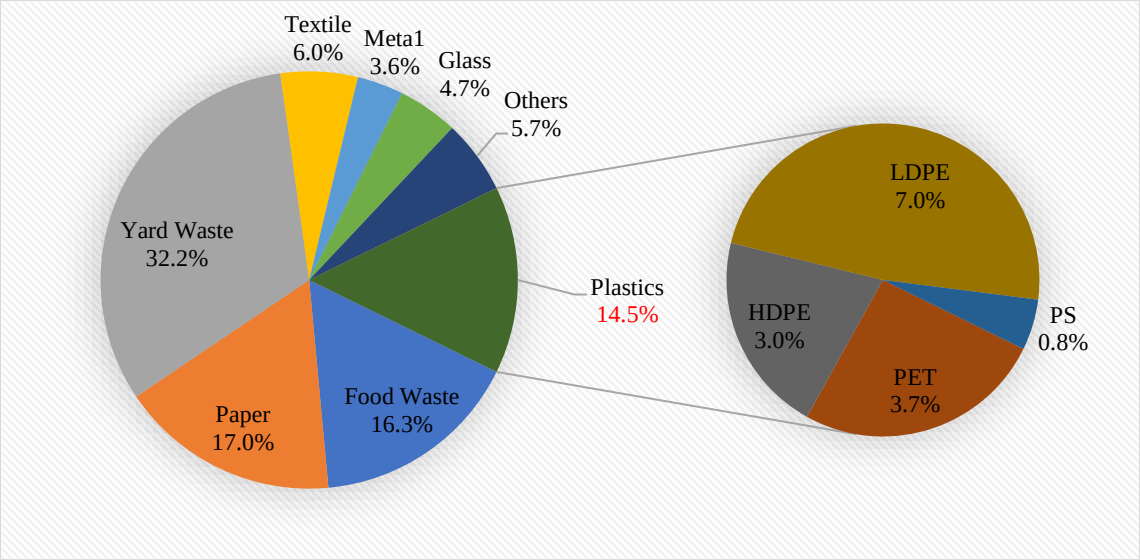

Figure 9: Composition of MSW

The 14.5% plastic waste was further categorized into high density polyethylene (HDPE), low density polyethylene (LDPE), polyethylene terephthalate (PET) and polystyrene (PS), representing 3%, 7%, 3.7% and 0.8% respectively. It can be inferred that LDPE which consists of mainly plastic bags and plastic containers, HDPE comprising chiefly of plastic bottles and crates as well as PET (packaging and consumer products) form part of the highest proportion of the total plastic waste generated. The high proportion of LDPE waste emanated may be explained by packaging and wrapping products that are utilized on a daily basis. It is to be noted that plastic waste has experienced a growth of 13 to 14% from 2002 to 2014 and from 14 to 14.5 % from 2014 to 2020.

The paper waste generated constituted of primarily newspaper, packaging material as well as tissue paper. Moreover, apart from small and medium enterprises practicing paper recycling and upcycling, recycling practices at household level is also at a low level. A slight increase was observed with respect to paper waste generation from 12% in 2002 to 16% in 2014 and 17% in 2020.

Components such as electronic equipment, leather as well as any obsolete waste components were classified as others which represented 5.7% of the total municipal solid waste stream. The low percentage of metals generated (3.6 %) might be due to the fact that specific types of metals such as iron bars, aluminium frames are picked up by scrap dealers which are eventually sold to the manufacturing industries. Also, the low percentage of glass waste observed, 4.7 %, might be

due to the deposit-refund scheme of glass bottles and institutions such as the Mauritius Glass Gallery (MGG) which collate and upcycle glass materials to produce decorative objects.

4. Conclusion and recommendations

Waste characterization studies are elementary to identify the waste components present in waste streams in Mauritius in an effort to formulate pertinent practical measures for waste management that are potentially conformable to the local situation. In addition, these studies allow the different stakeholders to analyse and evaluate the recovery potential of the diverse waste components, to identify the points of waste origin, to aid in structuring equipment to handle waste processing, to assess the properties of the waste components physically, chemically and thermally, to ensure conformity to the Mauritian regulations as well as to lengthen the lifetime of the sanitary landfill by changing the course of the waste components from being dumped to being sent to appropriate waste processing sites.

It was found that MSW has a moisture content of 33%, ash content of 8.04% and NCV of 8.89 MJ/kg. From the current study, it has been found that 71.5 % of the waste is organic in nature out of which 48.5 % are yard and food waste. The recyclable constituents from Municipal Solid Wastes (MSW) encompass paper, plastic, metal as well as glass. Recycling serves the interests of diminishing raw materials, resources such as energy and water as well as greenhouse gas emissions. After analysing the characteristics of MSW, it was concluded that a combination of composting, anaerobic digestion and recycling would be suitable for managing municipal solid waste in Mauritius in short and medium term.

Thus, the recommendations are as follows:

- Since the organic fraction notably yard and food wastes consist of a large percentage of organic matter, they can be treated biologically via treatments such as anaerobic digestion as well as composting.
- Waste components such as food and yard wastes having a small mean net calorific value as well as elevated moisture content, waste-to-energy (WtE) facilities are not the best technique for the treatment of these particular waste materials.
- Appropriate recycling possibilities should be envisaged in order to enable the utilization of the solid waste stream as a source of raw materials for the development of useful products as well as to gather pieces of information on the amount and group of materials that can be recycled and recovered in order to favour recovery potentials.
- The remaining waste materials constituting of high energy contents can thus be directed to thermochemical treatments such incineration

- In addition, since the waste components have a high moisture content, segregation of waste at the point of generation to separate the waste materials having a high energy content preceding the exploitation of the waste components for waste to energy purposes.

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