Republic Of Mauritius

Second National Communication



under

the United Nations Framework Convention on Climate Change (UNFCCC)

November 2010

Second National Communication
of the
Republic of Mauritius
under the
United Nations Framework Convention on Climate Change (UNFCCC)

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Republic Of Mauritius

Minister of Environment and Sustainable Development

FOREWORD

Climate change is one of the crucial challenges confronting humankind in the twenty- first century and its adverse impacts are already being felt and will undoubtedly intensify over time if not addressed. There is overwhelming scientific evidence that climate change will threaten economic growth and long-term prosperity, as well as the very survival of the most vulnerable populations and fragile ecosystems. It is therefore imperative that we decisively deal with climate change in order to ensure sustainable development, poverty eradication and to safeguard economic growth.

In order to establish a safe environment and sustain the economy of the Republic, the Government has promulgated several Acts and Regulations, one of which is the Ambient Air Regulation which limits the emission of all obnoxious gases in the Republic.

Furthermore, this Ministry has recently established a Climate Change Division with the aim of devising and enforcing adaptation measures to mitigate the adverse impact of climate change and to ensure a safe environment for the welfare of the population.

This Ministry, as the focal point of the UN Framework Convention on Climate Change (UNFCCC), is actively participating in all activities be it at the local, regional or international levels which aim at finding ways of reducing, GHG emissions and at reaching an international accord to this effect.

I would like to seize this opportunity to thank the Global Environment Facility and its Implementing Agency, the United Nations Environment Programme for providing us with the necessary financial and technical support for the preparation of this Communication. A National Inventory Report containing detailed information on our emissions by sources and removals by sinks has also been prepared and is being presented as a separate document.

It gives me great pleasure in seeing the completion of this Communication which underscores not only our commitment to meet our reporting obligations under the UNFCCC but also our determination and tenacity to work with the international community in finding pragmatic solutions to addressing the challenges posed by climate change. It is therefore our pleasure to present the Communication to the UNFCCC Secretariat for onward transmission to the Conference of Parties.

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- Mauritius Sugar Industry Research Institute
- National Transport Authority
- University of Mauritius
- Wastewater Management Authority

Non Governmental Organisations

- Mauritian Wildlife Foundation
- Association pour le Development Durable

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LIST OF ABBREVIATIONS AND ACRONYMS USED IN THIS REPORT

A1B	Scenario assuming a world of very rapid economic growth, a global population that peaks in mid-century and rapid introduction of new and more efficient technologies (a balance across all sources)
A1F1	Scenario assuming a world of very rapid economic growth, a global population that peaks in mid-century and rapid introduction of new and more efficient technologies (fossil intensive)
A2	Scenario assuming a very heterogeneous world with high population growth, slow economic development and slow technological change.
AD	Activity Data
ADD	Association pour le Development Durable
amsl	above mean sea level
APSIM	Agricultural Productions Systems Simulator
AREU	Agricultural Research and Extension Unit
B2	Scenario assuming a world with intermediate population and economic growth, emphasising local solutions to economic, social, and environmental
BAU	Business as Usual
BIG-CC	Biomass Integrated Gasification – Combined Cycle
CC	Climate Change
CCAP	Climate Change Action Plan
CEB	Central Electricity Board
CH4	Methane
CNG	Compressed Natural gas
CO	Carbon monoxide
CO2	Carbon dioxide
CO2-eq	Carbon dioxide equivalent
COP	Conference of Parties
CSO	Central Statistics Office
CSR	Climate Reference Station
DM	Dry mass
DPV	Dual Purpose Vehicle
DSM	Demand Side Management
EEZ	Exclusive Economic Zone
EF	Emission Factors
EIA	Environmental Impact Assessment
EPA	Environment Protection Act
ESA	Environmentally Sensitive Area
EST	Environmentally Sound Technologies
ETPA	Education, Training and Public Awareness
EV	Electric vehicle
FLIS	Forest Land administration Information System

FM	Fresh mass
GCM	General Circulation Model
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagram
GHG	Greenhouse gas
GIS	Geographical Information System
GNI	Gross National Income
GSR	Global Solar Radiation
GWh	Giga Watt hour
H2O	Water
ha	hectare
HFC	Hydro Fluoro Carbon
HFO	Heavy Fuel Oil
ICE	Internal Combustion Engine
ICZM	Integrated Coastal Zone Management
IE	Included Elsewhere
INC	Initial National Communication
IOC	Indian Ocean Commission
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
SIPP	Small Independent Power Producer
km	kilometre
km2	kilometre square
kt	kilo tonne, 1 000 tonne
ktoe	kiloton of oil equivalent
kV	kilo Volt
kVA	kilo Volt Ampere
kW	kilo Watt
kWh	kilo Watt hour
l	litre
LAVIMS	Land Administration, Valuation and information Management System
LEAP	Long-range Energy Alternatives Planning System
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land use change and Forestry
M	Million
MAGICC -	Model for the Assessment of Greenhouse Gas Induced Climate Change
MCA	Multi-criteria Analysis
MEA	Multilateral Environmental Agreement
MMS	Mauritius Meteorological Services
MoA	Ministry of Agro-Industry and Food Security
MoE & SD	Ministry of Environment and Sustainable Development

MPA	Mauritius Ports Authority
MPU	Ministry of Energy and Public Utilities
MSIRI	Mauritius Sugar Industry Research Institute
MUR	Mauritian Rupee
MW	Mega Watt
N	Nitrogen
N2O	Nitrous oxide
NA	Not available or Not Applicable
NCC	National Climate Committee
NE	Not Estimated
NGO	Non-Governmental Organization
NMVOC	Non-methane volatile organic compound
NO	Not Occurring
NOx	Oxides of nitrogen
NTA	National Transport Authority
O2	Oxygen
oC	Degree Celsius
PFC	Per-Fluoro Carbon
PPG	Planning Policy Guidance
PPM	Parts per million
QA	Quality assurance
QC	Quality Control
rpm	revolutions per minute
SCENGEN	A Regional Climate SCENarioGENarator
SIDS	Small Island Developing States
SLR	Sea level rise
SO2	Sulphur dioxide
SRES	Special Report on Emissions Scenarios
SST	Sea surface temperature
STC	State Trading Corporation
SWIO	South West Indian Ocean
Tmax	Maximum temperature
t	tonne
Tmin	Minimum temperature
TNA	Technology Needs Assessment
ULP	Unleaded Petrol
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UoM	University of Mauritius
W	Watt
WMA	Waste Water Management Authority
WMO	World Meteorological Organisation

EXECUTIVE SUMMARY

INTRODUCTION

The Government of the Republic of Mauritius has diligently been crafting measures to mitigate the impacts of climate change which are already felt through stronger cyclone events, heavier rainfall episodes, warmer temperatures and reduced rainfall. It is therefore, undeniably in the interest of this Republic to contribute to the reduction of GHGs, be it in an infinitely small amount. The gesture is more than symbolical. Several measures have been put in place to address the issue of climate change.

It is in this context that Mauritius is presenting its Second National Communication.

GEOGRAPHY AND CLIMATE

The Republic of Mauritius comprises the main island, Mauritius and the Outer Islands namely, Rodrigues, Cargados Carajos Archipelago (known as St Brandon) and Agalega Islands. The Republic also claims sovereignty over Tromelin and the Chagos Archipelago which includes the Diego Garcia atoll. The total land area of the Republic is 2 040 km^2; the Exclusive Economic Zone (EEZ) covers an area of about 1.9 million km^2 but this is most likely to increase with submissions to United Nations Convention on the Law of the Sea.

The main island, Mauritius, located just north of the Tropic of Capricorn enjoys a mild tropical maritime climate throughout the year. It has two seasons: a warm humid summer extending from November to April and a relatively cool dry winter from June to September. The months of October and May are commonly known as the transition months.

The mean maximum temperature reaches 29.2°C during the summer months when tropical cyclones occur. The coolest months are July and August when average minimum temperatures drop to 16.4 °C. Rainfall ranges from about 4 000mm on the Central Plateau to about 800mm along the coast. The Outer Islands enjoy more or less a similar climate, the main difference being in the rainfall amount which has a high degree of variability.

SOCIO-ECONOMIC FACTORS

Despite numerous challenges linked to distant world markets, few natural resources, its heavy dependence on sugar industry, a small domestic market and rapid population growth, Mauritius launched a wide-ranging reform strategy in 2005 that is bearing positive results. The structure of Mauritius' economy is changing rapidly as shown in **Figure ES 1**, and the sugar and textile industries have had to adapt to new realities. The sugar industry, a pillar of development since colonial times, is consolidating and restructuring. The area under cane cultivation is being reduced, with land converted for tourism and

other agricultural purposes. Sugar producers are expanding into related activities, such as power generation from sugar cane residue (bagasse) and ethanol production, and are moving up the supply chain into refined sugar.

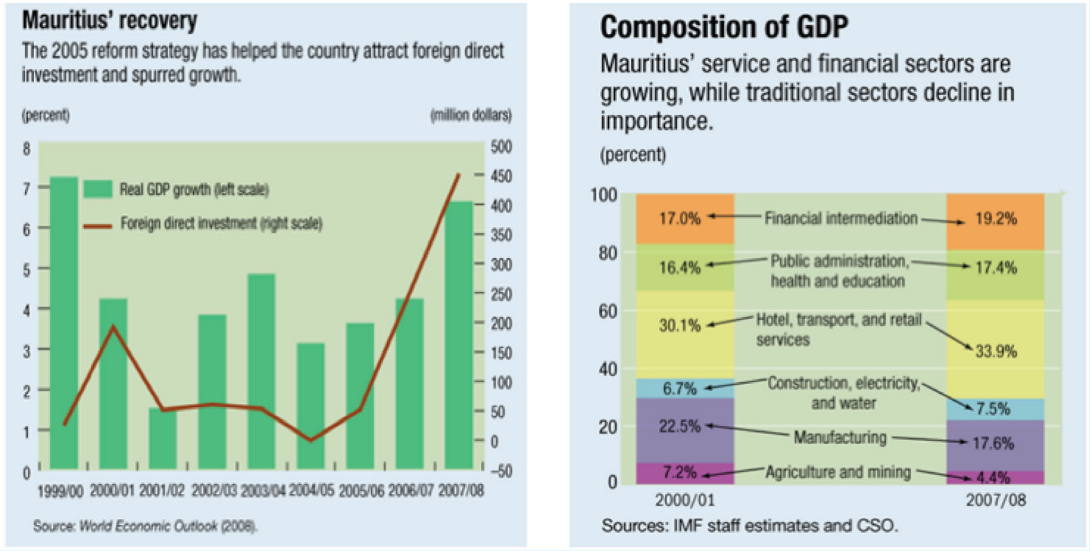


Figure ES 1 (a) and (b) - Economic development of Mauritius

Mauritius has an average real growth rate of 5.1%, and is now classified as a middle income country with a per capita income of US $7 000. The Human Development Index (HDI) is 0.83 – ranking 81st out of 182 countries. The tourism and fisheries sectors together with the financial services have seen significant growth recently.

Free education and health care have contributed significantly to this growth. Life expectancy has increased from 63.5 years in the early seventies to 72.4 in 2007.

COMPUTATION OF GHG EMISSIONS BY SECTOR

For computations of GHG emissions it must be underlined that sources and sinks are not numerous in Mauritius. In order to meet the main objective of the Convention all categories were treated with equal consideration with the exception of Solvent and Other Product Use category due to limited AD availability and quality.

A Tier 2 level was predominantly adopted for the present inventory. Furthermore, the scope of this inventory has been widened with additional sub-sectors (Wastewater handling) and processes (Agricultural Soils). The LULUCF sector has been exhaustively addressed in the SNC as opposed to INC.

Mauritius has to import most (above 80%) of its fuels for electricity generation and for the transport sector. Local renewable source of energy is hydroelectricity, wind, bagasse and fuel wood. Computations indicate that the during the period 2000 to 2006, net GHG

emissions rose by 16.8% from 3 914 Gg CO_2-eq to 4 572 Gg CO_2-eq with an annual average increase of 2.7%. Per capita emissions remained nearly constant in the range 3.3 to 3.6 t CO_2-eq during that period while the GHG emission intensity index decreased from 100 in 2000 to 90.7 in 2006.

The three main sources of GHG emissions within the Energy sector are Energy industries (electricity generation) followed by Transport and Manufacturing Industries & Construction. Fuel combustion in the energy sector resulted in 2 315 Gg CO_2-eq of GHG emissions in the year 2000. It increased to 3 154 Gg CO_2-eq in 2006.

Of the direct GHGs, CO_2 was the main contributor to the national emissions. CO_2 and CH_4 emissions increased while that of N_2O, HFCs and PFCs decreased over the period 2000 to 2006. Methane emissions increased by 157 Gg CO_2-eq from 1 234 Gg CO_2-eq. The Waste sector followed by the Agriculture sector contributed most of these emissions.

Over the period 2000 to 2006, the combined emissions of HFCs and PFCs decreased by 107 Gg CO_2-eq from 170 Gg CO_2-eq. As for SF6, no estimation was made due to unavailability of adequate records. Emissions occurred as leakages only.

In the Agriculture sector emissions are from Enteric Fermentation, Manure Management, Agricultural Soils and Field Burning of agricultural residues. In 2006, the share of emissions from agriculture amounted to 4.2% of total national emissions. It declined by 12.3% from 235 Gg CO_2-eq in 2000 to 206 Gg CO_2-eq in 2006. Of these emissions, Agricultural Soils contributed the highest amount (59.6%) followed by the Livestock sector with 40.4%.

The LULUCF sector represented a net removal of CO_2 from the atmosphere during the period 2000-2006. This net removal was much lower in the year 2000, due to the conversion of some 300 ha of forest land for the commissioning of a dam. Emissions are estimated at 117.6 Gg CO_2 and the removals at 303.7 Gg CO_2 in the year 2006. The removals represented 7% of total national emissions in the year 2000 and 6% in 2006.

The Waste sector was the second largest emitter of GHGs during the period 2000 to 2006 and accounted for 1 170 Gg CO_2-eq (27.7%) of total emissions in the year 2000. Emissions increased by 13.9% (2.3% annually) to reach 1 333 Gg CO_2-eq in 2006. Emissions from Solid Waste Disposal on land increased by 58.2% (8.2% annual average), from 447 Gg CO_2-eq in 2000 to 708 Gg CO_2-eq in 2006. This change is attributed to the increase in population as well as to the shift in consumption pattern associated with GDP growth. In contrast, emissions from Wastewater handling regressed by 13.5% (2.1% annually) from 722 Gg CO_2-eq to 625 Gg CO_2-eq during the inventory period.

CH_4 was the major GHG emitted from the Waste sector. It increased by 2.4% annually on average over the inventory period from 54.28 Gg in the year 2000 to 62.27 Gg in 2006. CO_2 emissions remained more or less constant while that of N_2O regressed slightly.

CONVENTION IMPLEMENTATION AND ADAPTATION

The first action aimed at implementing the Convention was the drawing up of a Climate Change Action Plan in 1998 which highlighted the high vulnerability of the country to climate change as a SIDS. The Action Plan highlighted the importance to reduce GHG emissions and increase the sink capacity.

Presently, there is an ongoing initiative for integrating climate change into the sectoral plans and strategies under the African Adaptation Programme (AAP), funded by the Government of Japan and implemented by the Ministry of Environment and Sustainable Development. This Ministry has also recently created a Climate Change Division to spearhead all activities associated with adaptation to climate change.

Some of the concrete Adaptation measures put in place are:

The ***Long Term Energy Strategy 2009 - 2025*** was adopted in October 2009 with the target of meeting 35% of the energy demand through renewable energy sources by the year 2025.

An array of 18 measures has been identified for implementation during the ***Mauritius Transport Consensus Forum of 2006.*** Most of these aim at reducing traffic congestion which is one of the main causes of high level of CO_2 emissions in this sector.

With regards to solid waste, the present system of land filling will be upgraded to reduce emissions with the possibility of direct conversion to electricity or through methane produced during composting or gasification.

Within the agriculture sector, the objectives of programmes are to reduce burning of agricultural residues and to promote their conversion to composts which can be used in lieu of inorganic fertilizers.

The ***National Forest Policy, 2006*** includes measures to enhance sink capacity through better management of existing forests while reducing timber exploitation.

The ***Hotel Development Strategy*** aims at developing guidelines for adherence to Planning Policy Guidance and for giving due consideration to eco-friendly and energy-saving practices by hotels..

The ***Environment Protection Act 2002*** has been amended to provide, inter alia, for the setting up of a Multilateral Environmental Agreement (MEAs) Coordinating Committee to ensure better mainstreaming of all MEAs into sectoral and national policies.

Through the ***National Environment Policy, 2007***, Government plans to enhance the resilience of the country to extreme weather events, climate change and sea level rise and other environmental disasters. The national targets are to improve national and regional coordination for early warning systems.

A Blueprint for a Sustainable Diversified Agri-food Strategy for Mauritius, 2008-2015 addresses the food security through improving self-sufficiency status of a number of strategic crops in the short to medium term.

A ***Master Plan Study*** for the development of water resources is being drawn up. This will take into consideration impact studies of climate change on the sector.

A study for the Development of an ***Integrated Coastal Zone Management*** (ICZM) Framework has been completed with the objectives of developing an ICZM Strategy for Mauritius and for preparing a National Policy and Comprehensive Legislative Framework.

The ***Fisheries Development Plan, 1998*** highlighted the precarious status of artisanal fishery as a result of direct and indirect adverse effects of climate change on the marine ecosystems of the lagoon.

The ***National Biodiversity Strategy and Action Plan, 2006-2016*** recommends the development of an ICZM plan and the study of Environment Sensitive Areas towards protecting biodiversity.

The ***Country Paper on the Health sector, 2006*** does not specifically address the issue of climate change with regard to the health sector. However, some of the identified measures will help to cope with these issues such as further strengthening the on-going surveillance system for the control of communicable diseases.

MITIGATION MEASURES ADOPTED

Mitigation and adaptation to climate change are gradually becoming a priority for the Republic. Since the year 2000, various measures have been adopted at country level. The main mitigation measures that have been implemented include:

- Shift to energy-efficient appliances and buildings;
- Promotion of solar water heaters through financial incentives;
- Installation of four wind turbines in Rodrigues;
- Flaring of landfill gas;
- Partial replacement of sodium vapour lamps for street lighting with energy saving lamps;
- Setting-up of endemic gardens in schools to enhance sink capacity and promote awareness;
- Planting of mangroves as sink to CO_2 and initiation of an afforestation and tree planting campaign;
- Phasing out of HFCs and PFCs;
- Replacement of household incandescent bulbs with energy saving lamps; and
- Increasing the energy conversion efficiency of bagasse.

MODEL PROJECTION OF EMISSIONS BY SECTOR AND MITIGATION OPTIONS

After having assessed the GHG mitigation potential of a range of selected options within each subsector, a multi-criteria analysis was performed in order to assess the suitability

and feasibility of adoption within the local context for each option. The multi-criteria analysis took on board such specificities and ranks the option most feasible to be adopted first.

Energy sector

In a Business-As-Usual (BAU) Scenario, on the consumption trends of the period 2000 to 2008, the bottom-up approach has been used for forecasting the energy demand. The LEAP Model using year 2000 to 2006 activity data and EFs adopted in the GHG inventory compilation was used to generate emissions under the BAU and mitigation scenarios of the Energy Industries sub-sector for the 2020, 2030 and 2040 horizons.

Energy demand forecasts were based on criteria such as current level of electricity sales, peak demand, end-users consumption behaviour, level of economic development, demographic rates and technological advances amongst others. The energy forecasts were then adjusted to take into account the network (transmission and distribution) losses, and the internal consumption of the different power plants to match the generation capacity to the demand.

Five mitigation options were assessed:

- *Wind Energy* is projected to substitute coal and HFO to occupy a share of 6%, 12% and 18% of the fuel mix by the 2020, 2030 and 2040 time horizons, respectively.
- *Solar Energy* has been projected to substitute fossil fuels coal and HFO to the level of 1%, 5% and 10% of the national fuel mix as from the year 2020 over periods of a decade.
- *Solid Waste-to-Energy* from landfills is projected contribute about 4% over the timeframe 2040.
- *Geothermal Energy* has been identified in the longer term as one of the potential sources of renewable energy and is expected to contribute 8% in 2030 and 15 % in 2040. *Improvement in TheTransmission and Distribution System* can potentially reduce losses of electricity and eventually reduce emissions. Upfront major investments have been made to upgrade the network to 132 kV in the future from the present 66 kV.

Transport sector

The measure with the highest mitigation potential in the Transport Sector is in the improvement in system efficiency area with 137 Gg CO_2–eq in 2020. This amount is projected to increase to 295 Gg CO_2–eq by the year 2040. The total reduction in emissions through the successful implementation of all the measures is projected at 252 400 and 534 Gg CO_2–eq at the 2020, 2030 and 2040 time horizons respectively. This represents

36%, 58% and 77% of the road transport emissions of the baseline emissions of the year 2000 in the year 2020, 2030 and 2040 respectively.

Agriculture Sector

The projected emissions in the Agriculture Sector under BAU increased from 235 for the base year 2000 to 250 Gg CO_2-eq in 2020, 259 Gg CO_2-eq in 2030 and 262 Gg CO_2-eq in 2040. The magnitude of increase from the BAU is projected to be only 12 Gg CO_2-eq by the 2040 horizon and is explained by the fact that reductions in emissions stemming from decrease in sugarcane area is nearly balanced by the increased emissions from development in other agricultural sectors to guarantee food security.

LULUCF sector

In the LULUCF Sector the following mitigation options have been implemented during period 2000-2006:

- Reforestation of about 770 hectares of state forest lands including some 20 hectares of degraded mountain slopes, which represent more than 1 million new trees.
- Some 100 000 trees and ornamental seedlings have been planted under the National Tree Planting Campaign.
- Reduction in the volume of timber exploited.

Under the Business-as-Usual scenario, net CO_2 removal decreased from 218 Gg CO_2-eq in the base year 2001 to 179 Gg CO_2-eq in 2020, 156 Gg CO_2-eq in 2030 and 114.88 Gg CO_2-eq in 2040. However with Mitigation Scenarios the afforestation of 5 000 ha of abandoned sugarcane lands will result in an increase in net removals of 8.3%, 27.6% and 52.2% in 2020, 2030 and 2040 respectively compared to the business as usual scenario.

Waste Disposal Sector

In Solid Waste Disposal Sector emissions under the BAU scenario will increase from 447 Gg CO_2-eq in 2000 to 766.8 Gg CO_2-eq in 2020, 834.9 Gg CO_2-eq in 2030 and 1 006.8 Gg CO_2-eq in 2040. The compiled emissions show that on a stand-alone basis, incineration would result in maximum GHG reductions.

In the Wastewater Sector emission reductions resulting from the mitigation options for the Industrial (sugar sector) and Domestic and Commercial Sectors amount to 324 Gg CO_2-eq in 2020, 347 Gg CO_2-eq in 2030 and 334 Gg CO_2-eq in 2040. This represents mitigation of some 45% of the base year emissions. The decrease between the 2030 and 2040 time horizons are attributed to a reduction in activity in the sugarcane sector.

Monitoring climate change

Assessing climate change is a priority for the Government of the Republic of Mauritius in view of the consequences of its impacts on the hard won socio-economic development. The key sectors already impacted upon are: infrastructures that support the livelihood of communities, water resources, coastal areas, coral reefs, fisheries and other marine-based resources, agriculture, tourism, human health and biodiversity.

Long-term series of data **(Figure ES 2)** collected by the Mauritius Meteorological Services were used to derive climate trends and develop climate projections. These were then used to assess current and future vulnerability as well as adaptation options to climate. Regression analysis has revealed that the mean temperature has been increasing by 0.18oC per decade at national level while the magnitude of increase of the minimum temperature has been higher than for maximum temperature. Furthermore, summer temperatures have been observed to be increasing more rapidly than winter ones and the number of days with maximum temperatures above the threshold value of 30oC is on the rise.

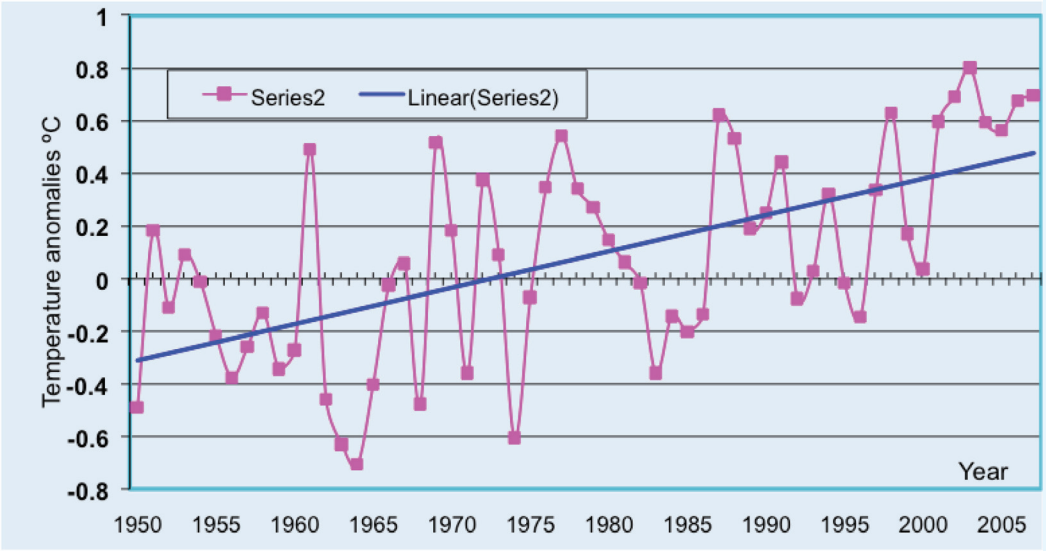


Figure ES 2- Mean Temperature variation at Vacoas (1950 - 2007) *(Courtesy : MMS)*

On the other hand, rainfall amount over the period has decreased by at least 400mm between the periods 1931-1960 and 1971-2000. Thus, the main recharge zone has witnessed a decrease from 4400mm per year to 4000mm per year. In addition, rainfall variability has risen together with an increased occurrence of high-intensity rainfall events. This condition favours flash-floods and consequently run-off to the detriment of recharge of aquifers.

Downscaling climate change projections for Mauritius

In order to ensure that vulnerability is adequately assessed and adaptation measures defined at sectoral level, projections were downscaled for Mauritius Island using the

MAGICC-SCENGEN v5.3 model. Using the 1980 to 1999 observed data, the baseline temperature and rainfall were derived. The 1990 to 2008 data were then used to identify a set of General Circulation Models (GCM) that best reflect the locally-observed trends.

The selected set of nine GCMs was then used to project mean temperature and rainfall changes for four SRES, namely, A1B, A1F1, A2 and B2, for different time horizons up to 2100 for Mauritius. Changes in minimum and maximum temperatures were then computed based on the observed relationship of the latter parameters and the mean temperature. Associated increase in atmospheric CO2 and sea level were then abstracted.

Projected impact and mitigation measures by sector

Agriculture sector

Statistical analysis of long-term data (1947 to 2008) revealed that both cane productivity and sugar extraction rate are reduced by extreme weather events like cyclones and drought. The magnitude of the impact varies according to the timing, severity and duration of the extreme event and may have carry-over effects on the productivity of subsequent years.

Assessment was made using the Agricultural Productions Systems Simulator (APSIM) biophysical model for a range of climate change scenarios. It showed that for a decrease in rainfall of 10% to 20% and an increase in temperature of 2oC, reductions in cane yield is expected to range from 34% and 48% while reductions in sugar yield is expected to range from 47% to 65%. Under the projected increase in mean temperature and the narrowing of the temperature amplitude between day and night temperatures, it is expected that vegetative growth will be favoured at the expense of sugar accumulation.

Vegetables and other crops will suffer similarly. With increased temperatures and lower temperature amplitude the vulnerability is expected to worsen. As an example, such a change in temperatures will result in a change in phenology and a decrease in flowering intensity. Expected decrease in rainfall will exacerbate the stress intensity while temperature increase will result in higher demand from evapo-transpiration. Increase in temperature will also have adverse impacts on yield and productivity.

A rising temperature will fasten the reproductive cycle of insect pests and vectors, increase disease transmission rate and lead to expansion of the geographical ranges of agricultural pests and diseases as well as increase the duration that they are prevalent. Intense rainfall events may cause inundation of cultivated areas and the complete loss in vegetable production.

Climate is thus expected to directly impact on profitability and may lead to abandonment of cultivable areas. Such cases would lead to soil erosion and leaching of nutrients.

Some of the key adaptation strategies/ measures for land use, agriculture and agro-biodiversity include:

- The need for introducing new varieties of cultivars;
- The shifting of regions where actual crops are grown to higher elevations with cooler

temperatures. However, a limit will be reached beyond which the normally cultivable areas will not suffice to contain all varieties required to feed the nation; and

- The substantial increase in irrigation water requirement to compensate for increase in evapo-transpiration, shift in the rainy season and longer drier periods. In the model run, this requirement was quantified to range from 302 million m3 to 327 million m3 on an industry extending over 60 000 ha.

Water sector

The water resources are well documented with a fair degree of details on the aquifers and catchment areas **(Figure 3)**. Projections made using the MAGICC_SCENGEN model indicates that by 2050, the utilizable water resources will decrease by up to 13%. Despite the fact that the difference in project values under the two scenarios is only less than 1% for 2020, around 1% for 2030 and 4% for 2050, the changes in pattern of rainfall with more episodes of heavy rainfall and more extreme weather events will allow only a definite amount to go into the storage system. Adaptation additionally requires the following measures to be put in place:

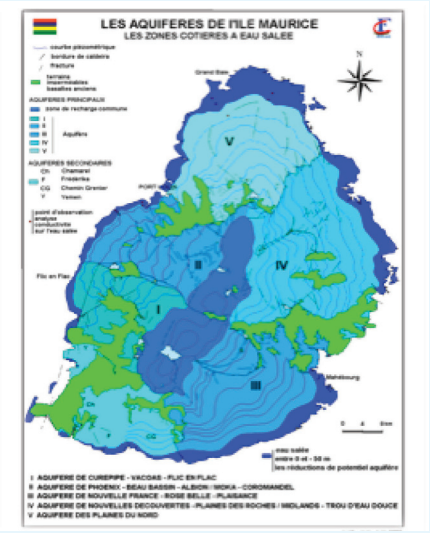


Figure ES 3 - Aquifers of Mauritius *(Courtesy : WRU)*

- Increase in surface water storage capacity through the construction of two new dams and increase in the storage capacity of existing ones;
- Incorporation of climate variability into water management; Quantitative projections of changes in rainfall, river flows and groundwater levels and systematic monitoring of water resources systems and coastal aquifers;
- Protection of common recharge zones of aquifers and rivers as a priority through appropriate land use management strategies including legal aspect; and
- Water recycling rationalization of gray water.

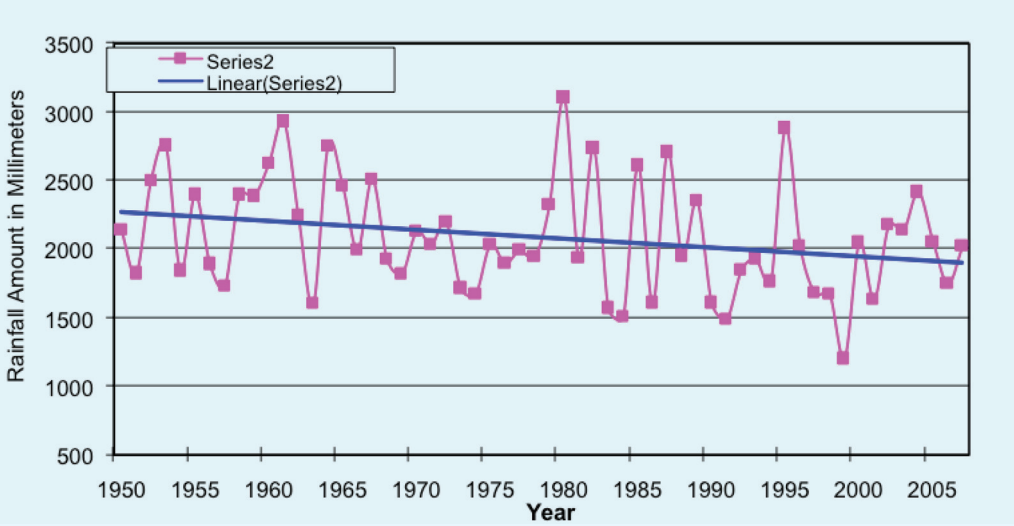


Figure ES 4 - Annual Rainfall variation at VACOAS, 1950-2007 *(Courtesy : MMS)*

Health sector

The health sector is likely to become more vulnerable to climate change through the propagation of vector-borne and infectious diseases, the lengthening of the transmission period of important vector-borne diseases and an increase in the frequency of gastroenteritis and respiratory problems.

Adaptation measures for the health sector include:

- Adoption of preventive measures to further reduce the load of air-pollutant;
- Strengthening of the existing disease surveillance system; and
- Organisation of regular training programmes for health personnel to deal with emerging diseases and natural disasters

Coastal zone sector

One of the most visible impacts of climate change will be on the coastal zone. Over the last two decades, beach erosion has become significant along several coasts in Mauritius as well as in the outer islands where it has led to the loss of beach space and caused damage to infrastructure. The lost in beach area last decade amounts to some 18 500 m^2.

Figure ES 5(a) - Beach eroded (left) and 5(b) being rehabilitated (right). *(Courtesy photo: ADD)*

The Financial Strategies Report prepared under the ICZM Framework Study (MOE & SD, 2010) estimates the revenue directly generated from the coastal zone as just under Rs74 billion, equivalent to 36% of GDP, 99 percent of which is generated by tourism. The total economic value of the coast, in present value terms, is of the order of Rs1 trillion (including property values attributable to the coast).

It is anticipated that the coastal zone will be seriously impacted as a result of climate change and sea level rise. The impacts are likely to cause:

- Gradual destruction of the reef system as a result of coral bleaching. The destruction of the reef will additionally result in lesser attenuation of the wave energies and therefore greater impacts on our beaches;
- Increased flood risks in certain low lying areas. Twenty-four significant sub-zero zones

covering an estimated 22.3 km^2 area were identified along the coast of Mauritius;

- Damage to coastal infrastructure such as roads, houses and recreational amenities. Most of the coastal hotels sites are located within an elevation between 1 to 5 m amsl; and
- Disturbance of port activities. Part of the ports infrastructure which is 2.6 m amsl is flooded during adverse weather and sea conditions. The number of days where operations could not be carried out has increased from 3 days in 1999, 11 days in 2004 to 15 days in 2010.

Adaptation strategies include:

- Management of ESAs and implementation of Integrated Coastal Zone Management Plan;
- Coastal protection and rehabilitation works – consolidation of existing reefs and or building of artificial ones;
- Policy review in the Environment sector; and
- Adaptation of public infrastructure on the coastal zone and the Ports Area.

Fisheries sector

In the fisheries sector, significant losses have been noted as a result of fish mortalities around Mauritius due to abnormal SST over the last decade. Any further rise will highly jeopardise the livelihood of many and endanger food security.

One of the important adaptation measures pertaining to the fisheries sector is the implementation of an aquaculture master plan. Other measures are:

- The creation of marine protected areas and marine parks and the introduction of closed seasons for certain fisheries and for commercial fishing will help in protecting and conserving the marine biodiversity; and
- The sensitisation of fishers on climate change and its effects on marine ecosystem.

Marine life has also suffered as a result of warmer seas. Coral bleaching as well as loss of scores of fish species have been noted to occur. Some adaptation measures are envisaged:

- Intensification of coral farming and transplantation;
- Strengthening of management of coral reef ecosystem including setting up of monitoring programme; and
- Strengthening of ongoing mangrove propagation programme .

Forestry sector

Adaptation in the forest sector includes:

- Re-afforestation through the introduction of species that are more adapted to the new climatic conditions and its accompanying effects; and

- Cutting down and removal of all trees affected by disease.

Natural disasters

Tropical storms are increasing in strength. Events of floods are becoming more frequent and with structural developments and changes have more severe impacts. On the other hand the intermediated season from winter to summer, which is relatively dry, is increasing in duration and now lasts between three and four months, against two months some decades ago. Adaptation to natural disasters therefore as a result of climate change as well as the resulting greater impacts on infrastructure requires considerable investments. There is a need to redesign houses and buildings, the electric grid and other vital infrastructures.

Looking forward : Preparedness and resilience-building to climate change through sustainable development

Within this line of action, and in conformity with the Convention, Government is enforcing several steps to address global warming in a coordinated way to ensure enhanced preparedness of the population to cope with and build resilience to climate change as it manifests itself more frequently and strongly in the short, medium and longer term.

Climate change is being mainstreamed slowly but more systematically within national plans and strategies. Thus in 2008, and following the worldwide energy crisis, the "Maurice Ile Durable (MID)" - Sustainable Mauritius vision - which laid emphasis on the sustainable development for the country, was adopted to reduce dependence on fossil fuels. Measures taken under the MID concept included:

- The setting up of a dedicated Fund under the aegis of the Ministry of Energy and Public Utilities;
- Conduct of a study to chart out a new grid code for IPPs to supply renewable energy and to allow Small Independent Power Producers to feed into the grid of the regulating institution;
- Proclamation of a Utility Regulatory Authority Act in September 2008;
- Introduction of an Energy Efficiency Bill shortly for the setting up of the Energy Efficiency Unit which will be mandated to develop guidelines and recommend strategies and policies for energy efficiency improvements; and
- The review of the building codes and regulations under the planned GEF/UNDP-funded *"Energy Efficiency and Energy Conservation in Buildings in Mauritius"*. The *New Building Control Act* will also incorporate components for sustainable buildings.

Concurrently, climate change concerns are gradually finding their way in other sectoral development policies, plans and strategies such as agriculture and food security, water resources, tourism, land use, transport, health, forest, infrastructure and coastal zone management among others to ensure sustainable development while aiming at poverty reduction.

CHAPTER ONE

NATIONAL CIRCUMSTANCES

1.1 INTRODUCTION

The Republic of Mauritius comprises the main island, Mauritius and several Outer Islands: Rodrigues, Cargados Carajos Archipelago (known as St Brandon), Agalega, Tromelin and the Chagos Archipelago which includes the Diego Garcia atoll. Mainland Mauritius occupies about 1 865 km^2, out of a total land area of about 2 040 km^2 for the Republic. The Exclusive Economic Zone (EEZ) covers an area of about 1.9 million km^2.

The Republic of Mauritius and the Republic of Seychelles have made a joint submission to the United Nations Convention on the Law of the Sea for an extended continental shelf of an area of about 400 000 km^2 in the region of the Mascarene Plateau (Figure 1.1). Furthermore, Mauritius has also made a submission for an extended continental shelf of an area of about 123 000 km^2 in the region of Rodrigues Island and intends to make a submission for an extended continental shelf of about 180 000 km^2 in respect of the Chagos Archipelago region.

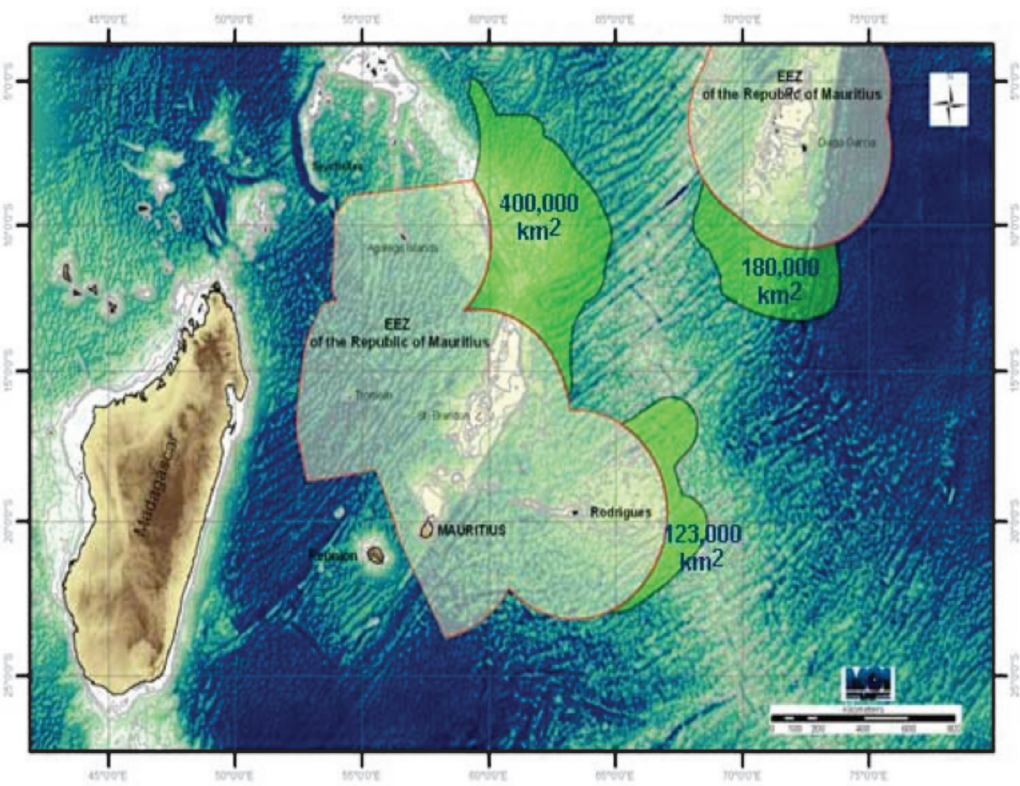


Figure 1.1 - Geographical location of Mauritius and Outer Islands with the EEZ (light green) and areas of continental shelves submitted for extension as EEZ (bright green)

1.2 GEOGRAPHY

1.2.1 Mauritius (Mainland)

Mainland Mauritius is situated close to the Tropic of Capricorn between latitudes 19°50' and 20°30' South and longitudes 57°18' and 57°46' East in the South West Indian Ocean (SWIO) and forms part of the Mascarene group of islands including Rodrigues and Réunion. Mauritius was formed by volcanic activity some 12 million years ago and consists of basaltic rocks, except for the sandy beaches and fringing coral reefs which surround most of the 322 km of coastline. Three soil types have been identified : the zonal, intra-zonal and azonal which are generally found in eroded mountain slopes and gorges. The topography is characterized by undulating plains in the North, East and West parts of the island and an irregular Central Plateau with a mean elevation of 300-400 m with the highest peak rising to 828 m.

1.2.2 The Outer Islands - Rodrigues, St Brandon and Agalega

Rodrigues, a 109 km^2 island, of volcanic origin, lies at about 650 km East of Mauritius near latitude 19°45'S and longitude 63°21'E. The lavas are basaltic with olivine. The island is surrounded by coral reefs and has a coastline of about 67 km. A relatively shallow lagoon extends several km to the South and the West and covers almost twice the land area. Due to its mountainous topography with steep slopes, marked soil degradation has resulted from deforestation and overgrazing.

Cargados Carajos Shoals is made up of a group of about 40 small islands and islets over an extended reef located at about 350 km to the North East of Mauritius. Saint Brandon, one of the main islands, is situated near latitude 16°35'S and longitude 59°37'E. St Raphael Island culminates at about 4 m above mean sea level (amsl) whereas the highest point on Albatros Island is about 6 m amsl. The shorelines of the shoals constantly undergo morphological changes under the effects of extreme weather. The islands have a total land area of 1.3 km^2.

Agalega, comprises two islands, with a total area of about 70 km^2 and lies at about 1 100 km almost to the North of Mauritius between latitudes 10°20'S and 10°28'S and longitude 56°34'E and 56°42'E. The islands are separated by a strip of shallow water about 1 km wide. North Island is 12.5 km long and 1.5 km wide while South Island is 7 km long and 4.5 km wide. The soil is coralline and the highest point is the Emmer Hill, some 3 m amsl.

1.3 HISTORY

The main island of the Republic was visited by the Polynesians, followed by Arabs as from the 10th century and the Portuguese in 1507. The Dutch were the first to settle

on the island in 1638 but left in 1658. They were followed by the French as from 1715 until 1810 when they lost its control to the British during a naval battle. The British ruled Mauritius until its independence on March 1968. Twenty-four years later Mauritius became a Republic.

The clearing of the original dense tropical forests was started in the 18th century to make way for sugarcane plantations and a permanent presence on the island. Gradually, the population grew in number to about 1.2 million and today it consists of a mosaic of people originating from Europe, Africa and Asia.

1.4 CLIMATE

The country enjoys a mild tropical maritime climate throughout the year, characterized by a warm humid summer extending between November and April and a relatively cool dry winter between June and September. October and May are the transition months.

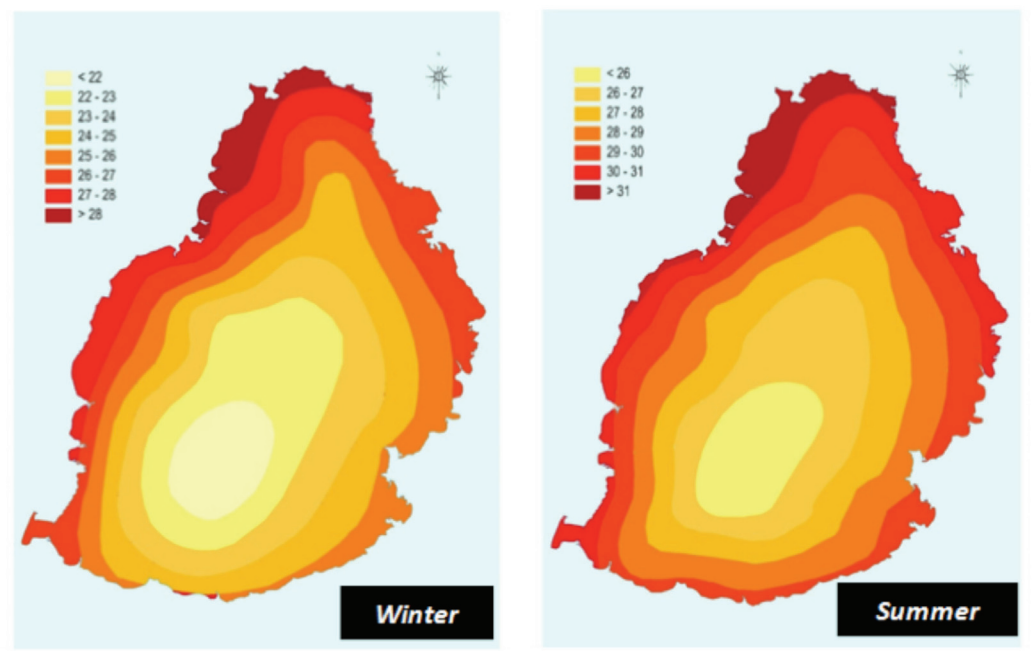
1.4.1 Weather systems affecting Mauritius

During winter, South-East trade winds, emanating from subtropical anticyclones that travel Eastward over the South of the Indian Ocean, blow most of the time over the Mascarene Islands. These anticyclones, often preceded by cold fronts, inject relatively cold air and give light rain over the country, mainly over the East, South and Central Plateau. In between the anticyclones, the weather is generally pleasant with a gentle breeze.

During summer, the subtropical anticyclones become weaker and migrate pole ward. The weather in Mauritius is then influenced mainly by weather systems of tropical origin. The most significant ones are the tropical depressions that may evolve into cyclones. Around nine of these develop into named cyclones each year in the SWIO and are associated with very strong winds and heavy rains leading to local flash floods during their passage over or near the islands.

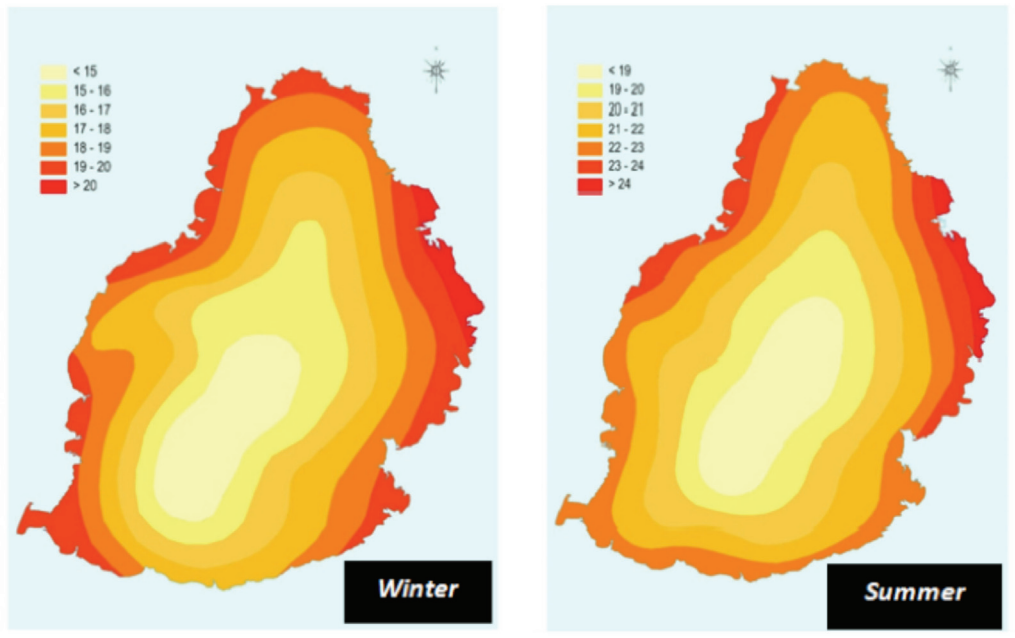
1.4.2 Temperature

Mean maximum temperature ranges from 26°C to around 30°C in summer and from 22°C to 27°C in winter when moving from the Centre to the coastal areas. Average minimum temperature varies from 19°C to around 22°C in summer and from 15°C to 19°C in winter when moving from the Central Plateau to the coastal areas. The warmest months are January and February and the coolest July and August. The spatial distributions of mean maximum and average temperatures for summer and winter months for the period 1971-2000 are given in **Figure 1.2** and **Figure 1.3**, respectively.



(Source: Mauritius Meteorological Services)

Figure 1.2 - Distribution of mean maximum temperature (°C) over Mauritius



(Source: Mauritius Meteorological Services)

Figure 1.3 - Distribution of mean minimum temperature (°C) over Mauritius

1.4.3 Rainfall

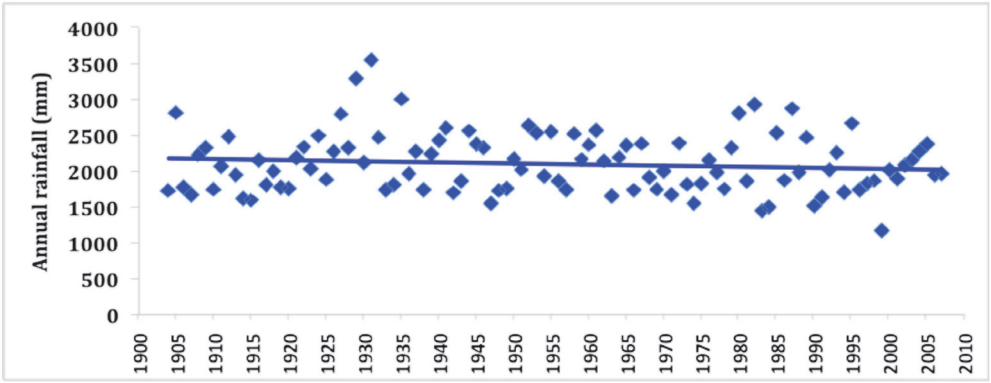
Average annual rainfall for the period 1971-2000 over Mauritius amounts to 2 010 mm, of which about two thirds (1 344 mm) are recorded during summer. The summer rains are very often associated with tropical systems and contribute significantly to replenish the country's reservoirs and aquifers. The wettest month is February and the driest October **(Table 1.1)**.

Table 1.1 - Mean monthly rainfall (mm) for the period 1971 – 2000 over mainland Mauritius

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ANNUAL
261	336	242	226	159	115	120	122	81	70	80	199	**2 010**

(Source: Mauritius Meteorological Services)

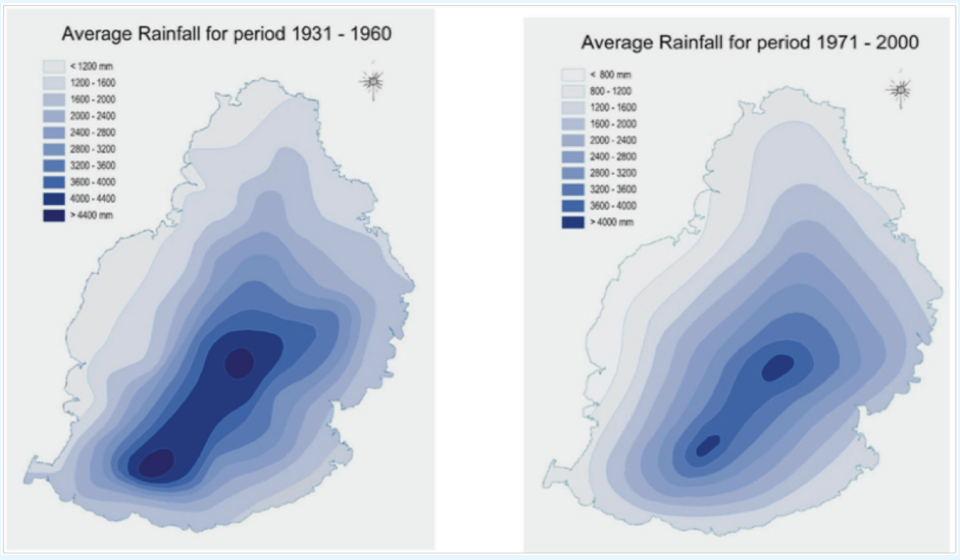
The rainfall regime varies widely over the island, the Central Plateau receiving up to around 4 000 mm compared to the Western region where an average of 800 mm is recorded annually. Year to year variability is high, with annual rainfall ranging from 1 171 mm to 3 539 mm **(Figure 1.4)**. The straight line shows a slight but steady decreasing trend.



(Source: Mauritius Meteorological Services)

Figure 1.4 - Long-term annual rainfall over Mauritius

The average annual rainfall distribution over mainland Mauritius for the period 1971-2000 is presented in **Figure 1.5**. A comparison of the normal rainfall distribution for the periods 1931-1960 and 1971-2000 clearly shows a decline in the amount of rainfall. The highest isohyet in the central part of the island reached only 4 000 mm over the 1971-2000 periods compared to 4 400 mm in the earlier period. Additionally, an 800 mm isohyet has appeared in the latter period, instead of the 1 200 mm one, along the West coast.



(Source: Mauritius Meteorological Services)

Figure 1.5 - Rainfall distribution over Mauritius for periods 1931-1960 and 1971-2000

1.4.4 Solar radiation

The number of hours of bright sunshine ranges from 6.5 to above 8 hours daily representing an incoming global solar radiation (GSR) of 17 MJ m^{-2} to 20 MJ m^{-2}. The mean daily GSR received at some sites representative of the Centre, South, West, East, North, and of the Island is given in **Table 1.2.**

Table 1.2 - Mean Global Solar Radiation (MJ m^{-2}) received at representative sites in Mauritius

	CENTRE	SOUTH	WEST	EAST	NORTH	ISLAND
Summer	21.86	21.57	20.62	18.48	25.29	21.57
Winter	18.61	16.52	16.90	13.63	21.27	17.39
Annual	20.24	19.05	18.76	16.06	23.28	19.48

(Source: Mauritius Meteorological Services)

1.4.5 Climate of the Outer Islands

1.4.5.1 *Rodrigues*

Rodrigues enjoys a mild tropical maritime climate. The average monthly minimum temperature for the period 1971-2000 varied between 19.1°C and 23.8°C while the maximum was in the range 25.0°C to 29.4°C. Long-term mean annual rainfall for the period 1971-2000 cumulated at 1 104 mm with mean rainfall totaling 724 mm (65%) for summer and the remaining 380 mm for winter. The monthly mean temperatures and rainfall totals are given in **Table 1.3**. The island receives about 8.9 hours of bright sunshine daily. The daily wind speed averages 18.1 km h^{-1}.

Table 1.3 - Average monthly rainfall (mm) and temperature (°C) in Rodrigues (1971 - 2000)

Elements	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	mm	135	169	155	129	85	73	85	61	46	42	56	80
Maximum Temperature	°C	29.2	29.3	29.4	28.7	27.5	26.0	25.0	24.8	25.4	26.3	27.4	28.7
Minimum Temperature	°C	23.6	23.8	23.7	23.0	21.6	20.1	19.1	18.8	19.3	20.1	21.3	22.8

(Source: Mauritius Meteorological Services)

1.4.5.2 St Brandon

St Brandon experiences a rather windy tropical maritime climate throughout the year. The mean daily wind speed is 24 km h^{-1} peaking at 30 km h^{-1} in winter months. The average summer temperature is 27.4°C and the average winter temperature is 23.6°C. The rainfall regime is similar to that of Rodrigues with an annual average of 934 mm for the period 1971-2000. The monthly mean temperatures and rainfall totals are given in **Table 1.4.**

Table 1.4 - Average monthly rainfall (mm) and temperatures (°C) in St Brandon (1971 – 2000)

Elements	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	mm	162	179	116	100	79	54	48	46	28	29	29	67
Maximum Temperature	°C	30.2	30.5	30.4	29.5	7.9	26.2	25.1	25.0	25.5	26.7	28.2	29.7
Minimum Temperature	°C	25.3	25.5	25.7	25.2	24.1	22.7	21.6	21.3	21.6	22.4	23.5	24.8

(Source: Mauritius Meteorological Services)

1.4.5.3 Agalega

Agalega Island has a hot and humid tropical climate. Mean summer and winter temperature are 27.4 °C and 25.6 °C respectively. Long-term mean annual rainfall amounts to 1 710 mm with 1 170 mm recorded during the summer months and 540 mm during the winter ones. The monthly mean temperatures and rainfall totals are given in **Table 1.5**.

Table 1.5 - Average monthly rainfall (mm) and temperatures (°C) in Agalega (1971 – 2000)

Elements	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall	mm	272	251	179	152	102	79	85	61	46	69	110	181
Maximum Temperature	°C	30.7	30.7	31.0	31.0	30.0	28.8	28.1	28.1	28.7	29.4	30.3	30.7
Minimum Temperature	°C	23.9	24.1	24.2	24.4	24.3	23.3	22.6	22.4	22.8	23.3	23.7	23.9

(Source: Mauritius Meteorological Services)

1.4.6 Climate analysis for mainland Mauritius and the Outer Islands

Analysis of temperature data over the period 1950-2007 for several stations in Mauritius and over the Outer Islands shows that the mean temperature is rising by about 0.16 °C per decade. On the average, temperatures have increased over the region by 0.74 °C to 1.2 °C since 1950. The warming effect has not been uniform. The minimum temperature has increased by a larger magnitude. Similar tendencies have been observed over the entire Republic.

Annual rainfall over mainland Mauritius has decreased by about 63 mm per decade over the past century (1905-2007). In the Outer Islands there is a significant yearly variation but the decreasing pattern is apparent when long-term analysis is performed. However, the magnitude is lower than over the main island of Mauritius. Moreover, a change in the rainfall pattern is noticeable with a delay in the onset of summer rains resulting in a lengthening of the dry season. Over the last 50 years, rainfall variability has increased significantly over the western and northern districts thus exacerbating the situation in these already water-stressed regions.

1.4.7 Extreme weather events

Tropical cyclone: Though no change has been observed over the last 30 years in the number of tropical storm formations in the SWIO, the frequency of intense tropical cyclones (wind gusts between 234 and 299 km/h) has increased.

Torrential rain: The number of rainy days and the amount of precipitation has decreased but the number of heavy rainfall events has increased in recent years. Consequently, flash floods and temporary disruption of various socio-economic activities have become more frequent.

In order to cope with, and improve the preparedness of the population to, the threat of potentially devastating climate extremes, the Republic has developed a robust Early Warning System for tropical cyclones and torrential rains. A Tropical Cyclone and Other Natural Disaster Scheme operates under the aegis of the Prime Minister's Office.

1.4.8 Sea level rise

On the basis of reconstructed tide gauge data for the period 1950-2001 and complementary Topex/Poseidon altimeter data, the cumulative sea level in the SWIO has risen on average by 7.8 cm at Port Louis and 6.7 cm at Rodrigues. Analysis of datasets from the tide gauge sited at Port Louis indicates an average rise of 3.2 cm over the 1988-2007 period. Thus, the rate of rise of the past 20 years since 1988 exceeds that observed since 1950.

1.5. POPULATION AND WELFARE

1.5.1. Demography

As at 31st December 2007, the population of the Republic of Mauritius stood at 1.265 million of whom 49.4% were males and 50.6% females. The average life expectancy of the population has increased consistently over the years to reach 72.4 years in 2007. Life expectancy of females was 76.1 years and that of males 69.2 years.

Population is unevenly distributed over the main island with a higher percentage living in urban areas. Thus, in 2006 the population density in towns was 2 065 persons km^{-2} compared to 437 persons km^{-2} in rural areas. However, recently there has been a noticeable migration towards the coastal areas.

1.5.2. Education

Education is free in Mauritius and is compulsory up to the age of 16 years. It is a four-tiered system and comprises of pre-primary, primary, secondary and tertiary levels. A pre-vocational stream caters for those who exit the system before tertiary level. The literacy rate in the population group of 15 to 24 years is 94.5 %, which is among the highest in

the world. As at March 2007, there were 289 primary schools (291 in 2000) in the Republic with a student population of 119 310 and a teaching staff of 4 201. At secondary level there were 186 schools (134 in 2000) with a student population of 116 706 and a teaching staff of 7 423. In addition there were 153 institutions offering pre-vocational education to some 9 573 students and with a teaching staff of 701.

1.5.3. Health

Health services are run on a regional basis and are provided free of charge to the population. At the end of 2001, Mauritius had 1 107 doctors and 149 dentists, i.e. one doctor for every 1 089 inhabitants and one dentist for every 8 000 inhabitants. The health status of the population is considered to be good but the health sector also faces several challenges towards achieving the United Nations Millennium Development Goals. These include HIV/AIDS, cardiovascular-related diseases, diabetes and other non-communicable diseases.

Ambient air quality lies within acceptable norms. However, monitoring of ambient air at one urban site indicated a diurnal variation in relation to the traffic density. Data from a mobile unit revealed a few cases whereby SO2 and particulate matter exceeded the standards in the vicinity of industrial zones. This is explained by the fact that some industries use mainly heavy fuel oil and coal as fuel in their boilers. It is to be noted here that in an endeavour to protect the health of the population through maintaining good air quality, only unleaded fuel is used since 2002. Low-sulphur diesel will be introduced in the near future.

1.6. THE ECONOMY

When Mauritius became independent in 1968, the country faced numerous challenges such as its isolation from world markets, very limited natural resources, heavy dependence on sugar, a small domestic market and rapid demographic growth. Mauritius overcame these challenges successfully. Steps were taken to diversify the economy and along with the traditional sugar sector, a manufacturing sector and a tourism sector emerged. The change in the various sectors of the economy over the period 2000 to 2006 is given in **Figure 1.6**.

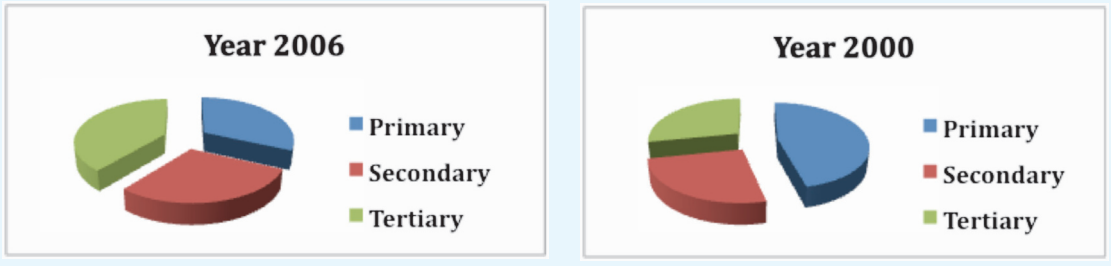


Figure 1.6 Contribution of primary, secondary and tertiary sectors in the economy in 2000 and 2006
(Source: CSO)

This transformation contributed to increase the per capita income from US$ 200 in the late 1960s to US$ 3700 in 1997. Strong democratic institutions and political stability were, among other factors, key to the country's success. But after two decades of sustained growth, Mauritius suffered at the turn of the millennium as longstanding trade preferences phased out. More recently, the energy and food crises undermined the economy and average growth declined from 5% level of the 1990s to 4% for the present decade. Successful economic diversification continued such that the agriculture sector, the previously major contributor to GDP, is now superseded by secondary and tertiary economic engines. This permitted a further increase in the per capita income that reached some US$ 6400 in 2007.

Table 1.6 - Selected Economic Indicators for Mauritius *(Source: CSO)*

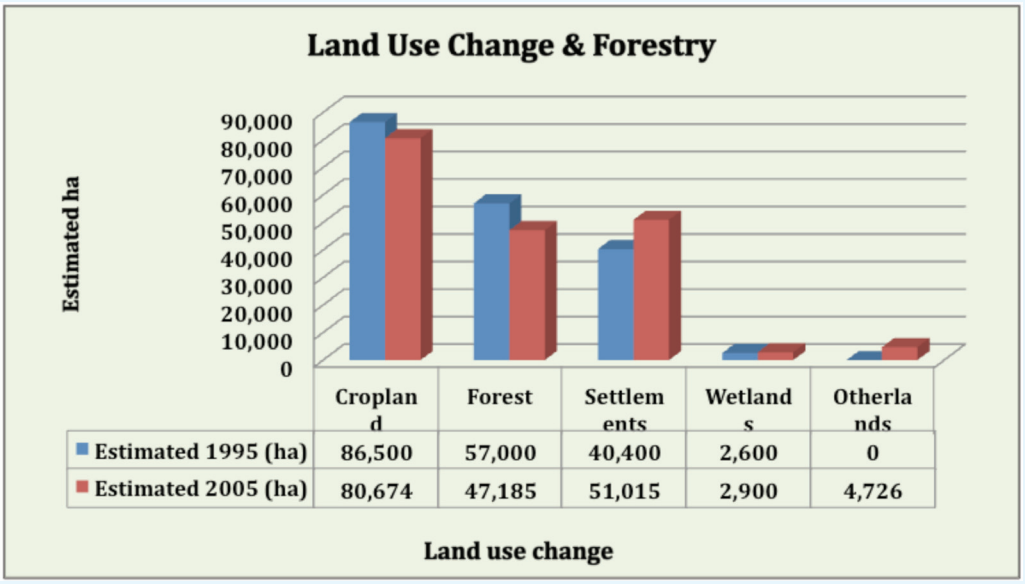
Item	Unit	1995	2000	2005	2006	2007
1. Population (Mid - year)	000	1 122.5	1 187	1 243.3	1 252.7	1 260.4
2. Per capita GNI	MUR	62 573	100 667	148 857	165 972	192 389
3. GDP at current market prices	MUR (M)	70 246	120 291	185 348	206 327	235 520
4. GDP at current basic prices	MUR (M)	62 259	105 206	162 172	182 009	206 971
- Breakdown (as a % of total)						
Agriciculture, hunting, forestry, fishing	%	10.3	7	6	5.5	4.9
- Sugar	%	1.6	0.8	0.9	0.9	0.7
Manufacturing	%	22.9	23.5	19.8	20.1	19.8
- EPZ	%	11.4	12	6.7	6.6	6.5
Construction	%	6.4	5.6	5.6	5.6	6.4
Wholesale, Retail trade, Restaurants & Hotels	%	12.7	12.2	12.0	12.4	12.4
- Restaurants & Hotels	%	5.1	6.5	7.6	8.5	9.4
5. GDP annual growth rate	%	+5.3	+9.7	+2.3	+5.1	+5.5
6. Gross National Savings	MUR (M)	17 697	31 648	32 189	35 384	49 892
7. Savings Rate	%	25.2	26.3	17.4	17.1	21.2
8. Investment (GDFCF)	MUR (M)	16 499	27 595	39 731	50 048	59 170
9. Investment Rate	%	23.5	22.9	21.4	24.3	25.1
10. Exports (f.o.b) (Includes re-exports)	MUR (M)	26 756	39 072	59 095	68 966	64 265
- Sugar (as a % total)	%	24.5	14.2	17.8	16.2	14.9
- EPZ (as a % total) EPZ/EOE	%	68.3	79.2	49.0	48.7	58.9
11. Imports (c.i.f)	MUR (M)	34 363	54 928	93 282	115 502	121 037
12. Balance of payments	MUR (M)	-3.0	2.1	-3.1	-3.0	6.6
13. Total Labour Force	000	484.4	519.8	559.1	565.1	570.5
14. Employment (March)	000	460.5	484.9	507.2	515.3	523.7
- Agriculture (as a % of total)	%	11.5	12.1	9.6	9.3	
- Manufacturing (as a % of total)	%	29.4	28.6	23.7	23.4	17.6
15. Unemployment	000	24.3	45.0	51.9	49.8	46.8
16. Unemployment rate	%	5.1	6.7	9.6	9.1	8.5
17. Inflation rate	%	6.1	5.3	5.6	5.1	10.7
18. Overall budget balance	MUR (M)	...	-25 86.1	-10 344.5	-9 439.2	-8 321.1
19. Tourism						
- Tourism arrivals	000	422.5	656.4	761.1	788.3	906.9
- Gross tourism earnings	MUR (M)	7 472	14 234	25 704	31 942	40 687
20. Nominal Exchange rate (Annual average)	US $	17.8	26.26	29.23	31.15	31.37

However, it is of paramount importance to underline the precariousness of the situation with regard to climate change and variability and weather extremes. A drastic fall (43.9%) in the contribution from the sugar cane sector occurred in 1999 when a severe drought was experienced and in 2002 a significant fall (25%) occurred when the country was hit by an intense tropical cyclone.

The Human Development Index (HDI) is 0.804* and Mauritius ranks 81st out of 182 countries worldwide. The Human Poverty Index is 9.5%* and the country ranks 45th among 135 developing countries. Through sustained efforts, the country has made significant progress towards meeting the Millennium Development Goals (MDGs), namely, with respect to education, health, environment management, Information and Communication Technology (ICT) development and economic management.

1.7. LAND USE

The Republic of Mauritius has limited natural resources, primarily land, to meet the increasing demand for various development purposes. Consequently, there is high pressure on land and fierce competition amongst the different user groups for this scarce resource. Over a period of 10 years from 1995 to 2005, about 10 000 ha of forest have been converted to settlements and some 6 000 ha of agricultural land converted to other uses **(Figure 1.7).** Decreasing profitability of the agriculture is favouring further conversion of cropland. Most of the coastal zone, namely the beach areas, is occupied by tourist resorts. Development is undertaken in a sustainable manner with well-defined norms.



(Source: Central Statistics Office)

Figure 1.7 - Land occupancy in 1995 and 2005 in Mauritius

** UNDP Human Development Report 2009, http://hdrstats.undp.org/en/countries/country_fact_sheets/cty_fs_MUS.html*

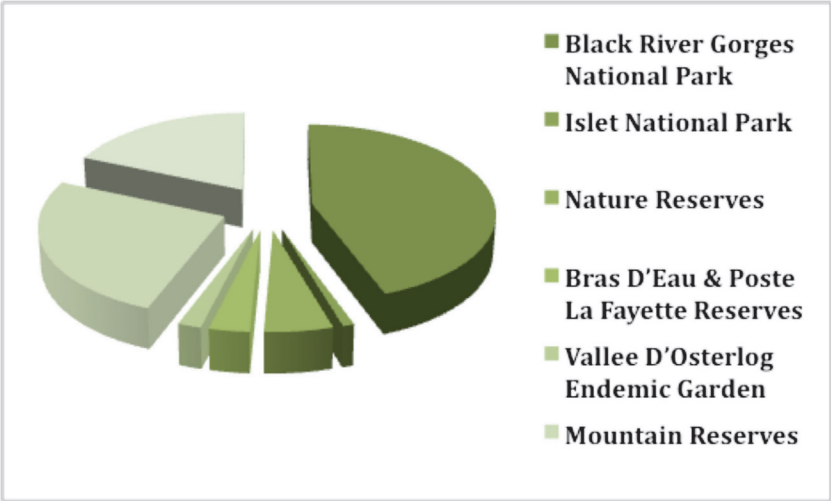
1.8. AGRICULTURE AND FOOD SECURITY

Agriculture occupied 46% of the land area in the year 2000 and the percentage has gradually decreased to 43% in 2006. The sector is dominated by sugarcane production (about 90% of cultivated land) with about 70% of the sugarcane sector (43 000 ha) under corporate management (31 units) and the remaining 23 000 ha owned by some 23 500 individuals. Food crops, tea, tobacco, palm, fruit and flowers are produced on the remaining 10% of the cultivated land area and the production is dominated by some 12 000 small growers. Livestock is practiced by 6 000 producers at a relatively low level on mainland Mauritius.

Rodrigues has an important agricultural culture with the production of basic food commodities (maize, beans, onion, chilli, lime, honey and meat). Adverse climatic conditions and water stress have severely constrained agricultural development with a regression in agricultural activities over the recent decades.

1.9. FOREST

About 25% of the total land area of the Republic of Mauritius is still under forest cover. This forest land is mostly devoted to silviculture along with deer ranching. Special efforts have been made to promote conservation and protection with the creation of National Parks and Nature Reserves. Details on the forest cover are depicted in **Figure 1.8.**



(Source: Forestry Service)

Figure 1.8 - Forest cover in Mauritius

1.10. WATER RESOURCES

The country has a very good network of water sources comprising rivers, boreholes in the aquifers and surface water reservoirs. Most of the rivers spring from the Central Plateau and flow radially to the sea. The Island receives an average annual rainfall of about 3 700 Mm^3 out of which about 60% is run-off, 30% lost through evapo-transpiration and 10% recharges the aquifers. The utilizable water resources are estimated at about

1 233 Mm^3. The total storage capacity of reservoirs is about 91 Mm^3 and the average annual regulated yield is about 271 Mm^3. The annual volume of water utilized from boreholes is about 112 Mm^3 out of which about 99 Mm^3 is drawn for domestic (including tourism), 6 Mm^3 for industrial and 7 Mm^3 for agricultural purposes.

The agricultural sector is the biggest water consumer with about 48% of all available fresh water. Hydropower uses 28% whereas the domestic, industrial and tourism sectors utilize about 23% of available fresh water. The daily per capita consumption of water has risen by 7 l since the year 2000 to reach 162 l in 2007. Piped water, filtered and treated as per World Health Organization (WHO) norms, is accessible to almost all households.

1.11. FISHERIES

The Fisheries sector has an important socio-economic bearing and it is part of the culture of islanders. It contributes to about 1% of the GDP and provides employment to some 11 000 people. Local fish production has dwindled over the years. Catches have regressed due to various factors including climate change through its impacts on the coral cover and the marine ecosystem. This sector is called upon to play a more important role in the economy, with further development. A Sea Food Hub has been established to provide a "One Stop Shop" service in the free-port area.

1.12. ENERGY

Mauritius is highly dependent on imported fossil fuels (>80%) for its energy requirement. The energy demands of the country grew steadily at around 5% annually during the last decade to reach 1384 ktoe in 2007 **(Figure 1.9)**. The existing renewable resources, such as hydro and bagasse, are being almost fully tapped. Only minimal amounts of fuel wood are used for energy purposes. Renewable energy production has levelled off despite the adoption of more recent technologies to raise the conversion efficiency of bagasse. There is a strong political will to exploit other renewables such as wind, solar and biomass.

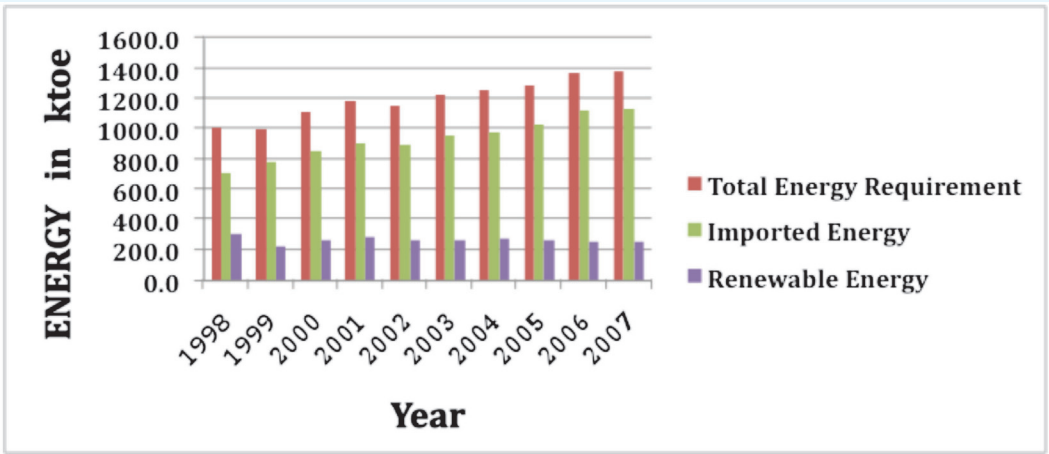


Figure 1.9 - Evolution of the energy requirement over the decade 1998-2007

1.13. TRANSPORT

Road transport is the only mode of internal transport in the Republic. At the end of 2007, the number of vehicles registered was 334 145 compared to 190 867 in 1995, an increase of 75% over the 12-year period. The fleet has been growing at an annual average rate of about 4.5%, corresponding to some 15 000 registrations. Public passenger transport is confined to buses and taxis, the former being the main means of mass transit, catering for over 800 000 passengers daily.

It is to be noted that thanks to the application of new technologies, the increase in the fleet size has not led to a corresponding increase in fuel consumption. The use of LPG is gaining momentum through the conversion of petrol-propelled cars into bio-fuel ones and a twelve-fold increase has been recorded from 2000 to 2007. Hybrid vehicles have recently made their appearance on the market but the prices are still prohibitive despite fiscal incentives.

1.14. WASTE MANAGEMENT

Adequate waste management and sanitation are major factors responsible for a healthy population. Legislations promote the treatment and reuse of wastewater and all liquid wastes receive some treatment before their discharge in the environment. Aerobic biological treatment processes, mainly of the activated sludge, are used for public wastewater treatment. Sewerage cover increased from 22% to 26% of households during the period 2000 to 2006. The remaining households mainly used on-site wastewater disposal systems consisting of septic tanks, absorption pits and cesspits. Most industries are connected to the sewerage system while the most important industrial sector, the sugar industry, discharges treated wastewater into the environment. The large tourist resorts operate on-site wastewater treatment plants. The remaining smaller units use septic tanks and absorption pit systems.

Solid waste management progressed from open dumps to a unique landfill in 2002. The latter has absorbed all the solid wastes after their compaction at transfer stations around the country. Available data show that the average amount of wastes generated per capita has increased from 0.7 kg daily in 1982 to 1 kg in 2000. But over the five year period since 2000, the amount of wastes has increased by 43%. Part of the methane emitted from the landfill is flared and it is planned to use the methane to generate electricity.

1.15. BIODIVERSITY

1.15.1 Terrestrial biodiversity

Due to its volcanic origin, age and isolation, Mauritius developed a diversity of flora and fauna not usually found in such a small area. The arrival of man saw the introduction of invasive alien species and the rapid destruction of habitat and the loss of much of the endemic flora and fauna. There are 671 species of indigenous flowering plants recorded in

Mauritius; of which 311 are endemic (Mauritius has eight endemic plant genera). Seventy seven of these indigenous species are classified as extinct. Of the existing flowering species, about 35% are already classified as threatened as per IUCN criteria.

Twenty four of the 52 native species of forest vertebrate that were known to have occurred in Mauritius and adjacent islets are now extinct, including the Dodo *(Raphus cucullatus)*, the giant parrot *(Lophopsittacus mauritianus)* and two species of giant tortoise *(Cylindrapsis spp.)*. Many of the existing species are threatened.

1.15.2 Freshwater, coastal and marine biodiversity

The island has a coastal zone comprising of wetlands, mangroves, lagoon coral and fringing coral reefs and some 49 offshore islets. The freshwater biodiversity of Mauritius is contained within some 90 rivers and streams, several man-made reservoirs, natural lakes and marshy areas.

The country has a diverse marine environment with five reef types: *fringing reefs, patch reefs, atolls, reef flats and barrier reefs*. A total of 159 species of corals have so far been recorded. Out of 340 species of fish that have been identified, 42 found within the lagoon area are of economic importance. Five species of Penaeid shrimps as well as two species found in deeper waters have been identified. Other invertebrates include octopus, mussels, oysters, barnacles and clams. Over 160 genera of marine algae have so far been identified from the coastal waters. Records on the marine flora date back to 1875 and the Mauritius Herbarium has a collection of more than three hundred marine algae. This rich biodiversity is now under threat as a result of global warming with its resulting sea level rise, coral bleaching and damage to ecosystems.

CHAPTER TWO

GREENHOUSE GAS INVENTORY

2.1 INTRODUCTION

Under Article 4.1 (a) of the UN Framework Convention on Climate Change (UNFCCC), each Party has to develop, periodically update, publish and make available to the Conference of the Parties, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties.

Mauritius has complied with the Convention with regards to national inventories of greenhouse gases (GHGs). This has been done taking into account its common but differentiated responsibilities and its specific national and regional development priorities, objectives and circumstances, After the publication of a first inventory in the *National Climate Change Action Plan* in 1998 for the year 1990, the Republic officially reported its inventory for the base year 1995 in its *Initial National Communication* (INC) submitted to the UNFCCC in April 1999. As from the year 2000, the *National Inventory of GHGs* has been compiled annually by the Central Statistics Office (CSO) and published in the Digest of Environment Statistics. GHG inventories for the period 1996-1999 have also been compiled and archived to enable the analysis of the evolution of GHG emissions. The inventories for the period 1990-1999 have all been compiled using the sectoral bottom-up approach, Tier level 1, and the GHG Inventory software. The Reference Approach has also been used for the energy sector to enable comparison of the two methods.

The GHG in this inventory report covers the period 2000 to 2006 and has been compiled and reported in a separate document to the SNC. Only a summary is reported here. The gases addressed were CO_2, CH_4, N_2O, NO_x, SO_2, SF_6, HFCs, PFCs, NMVOCs and CO.

2.2 THE INVENTORY PROCESS AND METHODOLOGICAL ISSUES

2.2.1 Institutional arrangement

Relevant institutions which contributed to the GHG inventory compilation are given in **Figure 2.1.**

The steps adopted for the preparation of the inventory were: drawing up of a work plan with timeline and deliverables; allocation of tasks to sectoral experts; collection, quality control and validation of activity data; selection of Tier level within each category and sub-category; selection of emission factors (EFs) and derivation of local EFs wherever necessary; designing of appropriate MS Excel worksheets for detailed calculations; computation of GHG emissions; uncertainty analysis; implementing QA/QC activities; assessment of completeness; recalculations; trend analysis; gaps, constraints and needs

analysis, planned improvements; and reporting.

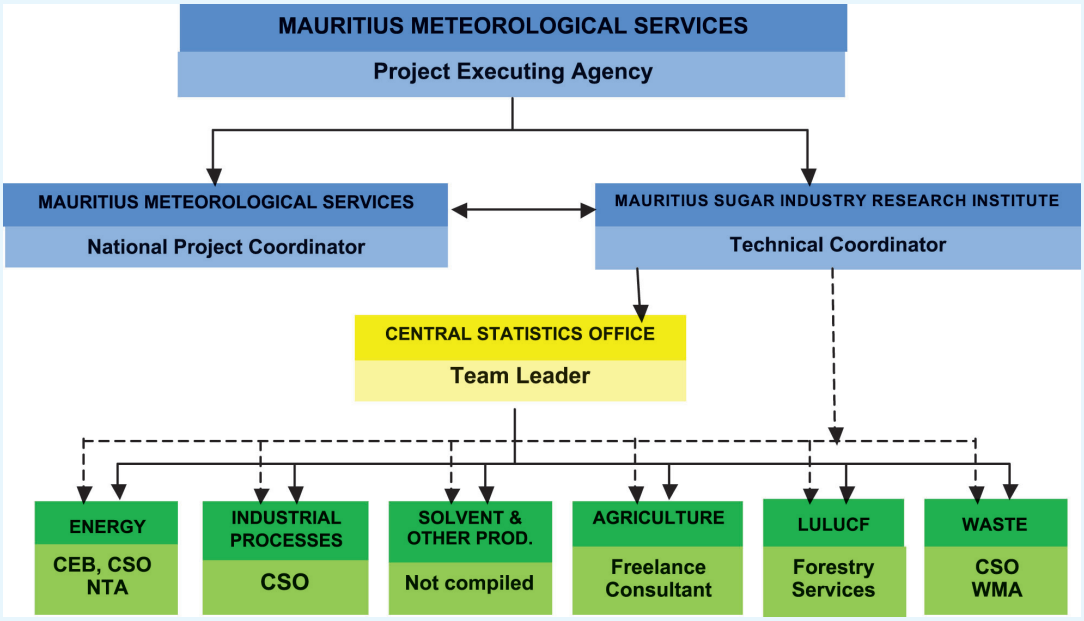


Figure 2.1 – Institutional arrangements and responsibilities

2.2.2 Key Source Category Analysis

Key Source Category Analysis gives the characteristics of emission sources and sinks. Since the source and sink categories are not numerous in Mauritius and with a view to providing maximum possibilities for meeting the main objective of the Convention and the sustainable development agenda of the country, all categories were treated with equal consideration with the exception of Solvent and Other Product Use category due to limited Activity Data (AD) availability and quality.

2.2.3 Methodological issues

A Tier 2 level was predominantly adopted for the present inventory. The scope of this inventory has been widened with additional sub-sectors (Wastewater handling) and processes (Agricultural soils). The LULUCF sector has been exhaustively addressed in the SNC as opposed to INC where only the forestry was addressed.

The inventory was prepared in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1997) and supplemented by the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000) and the *IPCC Good Practice Guidance on Land Use Land Use Change and Forestry* (IPCC, 2003). The IPCC Guidelines (IPCC, 2007) has been used to some extent for reporting in the LULUCF sector. Emissions have been calculated using different worksheets, either separately or within the UNFCCC Software version 1.3.2, according to the Tier level adopted for each source category.

The gases that play a key role in contributing to the intensification of the greenhouse effect have been assessed. Based on the global warming potential of these GHGs **(Table 2.1)** reported in IPCC (2001), emissions were converted to the common unit of carbon dioxide equivalent (CO_2-eq). Additional gases that indirectly affect global warming, namely oxides of nitrogen (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2), have also been computed and reported in this inventory.

Table 2.1 - Global warming potential used in aggregated emissions

GHG		Global Warming Potential
Carbon dioxide	CO_2	1.0
Methane	CH_4	21.0
Nitrous oxide	N_2O	310.0
Hydro-fluorocarbons	HFCs (R134a) (R404a) (R407c) (R12)	 1 300 3 780 1 653 1 990
Per-fluorocarbons	PFCs (Perfluoropropane)	7 000

2.2.4 Activity data and emission factors

Activity data were collected from the different operational entities for the respective source categories to supplement the National Database of the CSO. The methodologies and EFs were adopted from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1997) and the *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000). EFs were amended and/or derived to better reflect national circumstances wherever possible.

2.2.5 Assessment of completeness

All source and sink categories assessed were treated with equal consideration with the compilation exercise as complete as possible with respect to the key source category and in terms of the different GHGs emitted **(Tables 2.2** and **2.3)**. With the exception of the Solvent and Other Products category, where AD was not complete, all other sectors were included in the compilation.

2.2.6 Quality Assurance and Quality Control (QA/QC)

QC and QA procedures, as defined in the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000) were adopted throughout the inventory process. When the compilation of the inventory was nearing

completion, a two-day workshop was held under the guidance of a UNFCCC GHG Inventory Expert, to identify any shortcoming and to ascertain that all IPCC procedures have been strictly adhered to.

2.2.7 Time series consistency

AD for all source categories were abstracted from the same sources and the same EFs were used for all years. QA/QC procedures were kept constant for the whole inventory period. This enabled a consistent time series to be built, with a good level of confidence in the trends of the emissions.

Table 2.2- Completeness of the inventory for the Energy and Industrial Processes sectors

	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
• ENERGY							
1.A.1 Energy Industries	X	X	X	X	X	X	X
1.A.2 Manufacturing Industry and Construction	X	X	X	X	X	X	X
1.A.3 Transport							
1.A.3a **Civil Aviation**	X	X	X	X	X	X	X
1.A.3b **Road transportation**	X	X	X	X	X	X	X
1.A.3c **Navigation**	X	X	X	X	X	X	X
1.A.4 Other Sectors							
1.A.4a **Commercial/Institutional**	X	X	X	X	X	X	X
1.A.4b **Residential**	X	X	X	X	X	X	X
1.A.4c **Agriculture**	X	X	X	X	X	X	X
1.A.5 Other (Other Works and Needs in Energy and para-Military Transport)	NE	NE	NE	NE	NE	NE	NE
Memo Items : International Bunkers	X	X	X	X	X	X	X
Memo Items : Emissions from Biomass	X	IE	IE	IE	IE	IE	IE
• INDUSTRIAL PROCESSES							
2. A. Mineral products							
2.A.1. **Cement Production**	NO	NO	NO	NO	NO	NO	NO
2.A.2. **Lime Production**	X	NA	NA	NA	NA	NA	NA
2.A.3. **Limestone and Dolomite Use**	NO	NO	NO	NO	NO	NO	NO
2.A.4. **Soda Ash Production and Use**	NO	NO	NO	NO	NO	NO	NO
2.A.5. **Asphalt Roofing**	NA	NA	NA	NA	NA	NE	NA
2.A.6. **Road Paving with Asphalt**	NA	NA	NA	NA	NA	X	NA
2.A.7. **Other**	NO	NO	NO	NO	NO	NO	NO
2.A.7.1. **Glass production**	NO	NO	NO	NO	NO	NO	NO
2. B. Chemical Industry							
2.B.1. **Ammonia Production**	NO	NO	NO	NO	NO	NO	NO
2.B.2. **Nitric Acid Production**	NA	NA	X	X	NA	NA	NA
2.B.3. **Adipic Acid Production**	NO	NO	NO	NO	NO	NO	NO
2.B.4. **Carbides Production**	NO	NO	NO	NO	NO	NO	NO
2.B.5. **Other Production**	NO	NO	NO	NO	NO	NO	NO
2.C. Metal Production							
2.C.1. **Iron and Steel Production**	NO	NO	NO	NO	NO	NO	NO
2.C.2. **Ferroalloys Production**	NO	NO	NO	NO	NO	NO	NO
2.C.3. **Aluminium Production**	NO	NO	NO	NO	NO	NO	NO
2.C.4. **SF_6 Used in Aluminium and Magnesium Foundries**	NO	NO	NO	NO	NO	NO	NO
2.C.5. **Other (please specify)**	NO	NO	NO	NO	NO	NO	NO
2.D. Other Production							
2.D.1. **Pulp and Paper**	NO	NO	NO	NO	NO	NO	NO
2.D.2. **Food and Drink**	NO	NO	NO	NO	NO	X	NO
G. Other (please specify)	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
F-gases	NA	NA	NA	NA	NA	NA	NA
• SOLVENT AND OTHER PRODUCTS	NE	NE	NE	NE	NE	NE	

X = Estimated, NA = Not Applicable, NO = Not Occurring, NE = Not Estimated, IE = Included Elsewhere

Table 2.3 - Completeness of the inventory for the Agriculture, LULUCF and Waste sectors

	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
• AGRICULTURE							
4.A. Enteric Fermentation	NA	X	NO	NA	NA	NA	NA
4.B. Manure Management	NA	X	X	NA	NA	NA	NA
4.C. Rice Cultivation	NA	NO	NA	NA	NA	NA	NA
4.D. Agricultural soils							
4.D.1. **Direct Soil Emissions**	NA	NA	X	NA	NA	NA	NA
4.D.1.1. **Synthetic Fertilizers**	NA	NA	X	NA	NA	NA	NA
4.D.1.2. **Animal Manure Applied to Soils**	NA	NO	NO	NA	NA	NA	NA
4.D.1.3. **N-fixing Crops**	NA	NA	X	NO	NO	NA	NA
4.D.1.4. **Crop Residue**	NA	NA	X	NO	NO	NA	NA
4.D.1.5. **Cultivation of Histosols**	NO	NO	NO	NO	NO	NA	NA
4.D.1.6. **Other emissions (Sludge to agricultural soils)**	NO	NO	NO	NO	NO	NA	NA
4.D.2. **Pasture, Range and Paddock Manure**	NA	NA	X	NA	NA	NA	NA
4.D.3. **Indirect Emissions**	NA	NA	X	NA	NA	NA	NA
4.D.3.1. **Atmospheric Deposition**	NA	NA	NE	NA	NA	NA	NA
4.D.3.2. **Nitrogen Leaching and Run-off**	NA	NA	X	NA	NA	NA	NA
4.D.4. **Other**	NO	NO	NO	NO	NO	NA	NA
4.E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NA	NA
4.F. Field Burning of Agricultural Residues	X	X	X	X	X	NA	NA
• LULUCF							
5.A. Forest Land							
5.A.1. Forest Land remaining Forest Land							
Carbon stock change	X	X	X	X	X	NO	NO
5(I) **Direct N_2O emissions from N fertilization**	NA	NA	NO	NA	NA	NO	NO
5(II) **Non-CO_2 emissions from drainage of soils /wetlands**	NA	NO	NO	NO	NO	NO	NO
5(V) **Biomass burning (Forest Fires)**	IE	X	X	X	X	NO	NO
5.A.2. Land converted to Forest Land	NO	NO	NO	NO	NO	NO	NO
5.B. Cropland							
5.B.1. **Cropland remaining Cropland**	X	NE	NE	NE	NE	NO	NO
Carbon Stock Change	X	NE	NE	NE	NE	NO	NO
Biomass Burning	NE	NE	NE	NE	NE	NO	NO
5.B.2. Land converted to Cropland	NO	NO	NO	NO	NO	NO	NO
5.C. Grassland	NA	NA	NA	NA	NA	NO	NO
5.D. Wetlands							
5.D.2.1. **Forest Land Converted to Wetlands**	X	NE	NE	NE	NE	NO	NO
5.E. Settlements							
5.E.1. **Settlements remaining Settlements**	X	NE	NE	NE	NE	NO	NO
5.E.2. **Land converted to Settlements**	X	NE	NE	NE	NE	NO	NO
5.E.2.1. **Forest Land Converted to Settlements**	X	NE	NE	NE	NE	NO	NO
5.F. Other Land **(Not to be reported as per IPCC, 2003)**							
5.F.2. **Cropland converted to Other Land**	X	NE	NE	NE	NE	NO	NO
• WASTE							
6.A Solid Waste Disposal on Land							
6.A.1 **Managed Waste Disposal on Land**	NO	NO	NO	NO	NO	NO	NO
6.A.2 **Unmanaged Waste Disposal Sites**	NO	NO	NO	NO	NO	NO	NO
6.A.2.1 **Deep greater than 5m**	NO	NO	NO	NO	NO	NO	NO
6.A.2.2 **Shallow less than 5m**	NO	NO	NO	NO	NO	NO	NO
6.A.3 **Other**	NO	NO	NO	NO	NO	NO	NO
6.B Wastewater Handling							
6.B.1 **Industrial Wastewater**	NO	X	NO	NO	NO	NO	NO
6.B.2 **Domestic and Commercial wastewater**	NO	X	X	NO	NO	NO	NO
6.B.3 **Others (Hotels)**	NO	X	NO	NO	NO	NO	NO
6.C Waste incineration							
6.C.1 **Biogenic**	X	NE	NE	NO	NO	NO	NO
6.C.2 **Other (Biological treatment)**	X	X	X	NO	NO	NO	NO
6.D **Other**	NO	NO	NO	NO	NO	NO	NO

X = Estimated, NA = Not Applicable, NO = Not Occurring, NE = Not Estimated, IE = Included Elsewhere

2.2.8 Recalculations

Previous inventories compiled and published by the CSO using mostly the Tier 1 level did not include many sub-categories or even sectors. Recalculations have been made where necessary and the results of the two compilations are presented.

2.2.9 Uncertainty assessment

The uncertainties, associated with annual estimates of emissions, are reported according to the *Tier 1 Method for Uncertainty Assessment of the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000) supported by the Revised 1996 *IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC, 1997) for the uncertainty levels associated with the AD and EFs which were adopted after thorough discussions with the respective sectoral experts. The spreadsheet was adopted for calculations and reporting. The combined uncertainty expressed as a percentage of the national emissions ranged from 5.05 to 5.68, thus giving an average of 5.4 for the period 2000 to 2006 **(Table 2.4)**.

Table 2.4 - Uncertainties associated with the national inventory (2000 – 2006)

	NATIONAL EMISSIONS (Gg CO_2-eq)	COMBINED UNCERTAINTY AS % OF NATIONAL EMISSIONS
2000	37 842	5.60
2001	3 912	5.68
2002	3 930	5.51
2003	4 104	5.67
2004	4 111	5.14
2005	4 192	5.20
2006	4 646	5.05

2.2.10 Planned improvements

In order to reduce uncertainties and to enable computations at higher Tier levels for future inventories, more disaggregated data for the various sectors as well as country-specific EFs would have to be adopted. The evaluation of the completed inventory has highlighted areas that will have to be reviewed and improved in terms of data collection and research needs assessment for refining EFs. The development of specific sectoral databases for GHG inventory purposes will prove useful.

Adoption of Tier 2 level, which is even more demanding with regards to time and the in-depth knowledge of the processes within each sector, further complicated the process. Future inventory preparations should take into account the lessons learnt. Concurrently, local EFs will have to be developed. The development should take into account the

intricate nature of the processes that require not only the basic scientific knowledge of the GHG emitting activity but also the impact of the latest technologies being adopted and their contribution within the process for more precision.

2.3 TRENDS OF NATIONAL EMISSIONS

National emissions were computed for the period 1990 to 1999, based predominantly on a Tier 1 level. The period 2000 to 2006 was treated at a higher level of details, with at least Tier 2 level being adopted partly or fully in all source categories reported (see sections 2.1 and 2.2.3).

2.3.1 The 1990 to 1999 period

Total net GHG emissions increased by 74% from 1 600 Gg CO_2-eq in 1990 to 2 788 Gg CO_2-eq in 1999 with the energy sector contributing around 90% of the emissions during that period **(Table 2.5)**. Energy and Waste are the two sectors that exhibited the highest annual rate of increase of 6.8% and 6.9% respectively. The rate of increase in GHG emissions per capita rose by 60% (5.3% annually) during the same period, from 1.5 t CO_2-eq in 1990 to 2.4 t CO_2-eq in 1999. Concurrently, the GHG intensity index, an indicator of emissions per unit of GDP produced, increased by 6.2% per year from 100.0 in 1990 to 169.8 in 1999.

Table 2.5 - GHG emissions (CO2-eq) for the period 1990 to 1999

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Annual Average Change (%)
Energy	Gg	1 416	1 493	1 631	1 713	1 827	1 779	2 018	2 064	2 258	2 533	6.8
Industrial Processes	Gg	79	82	82	85	85	88	95	99	105	102	2.9
Agriculture	Gg	253	255	254	252	253	231	251	292	270	293	1.9
LULUCF	Gg	(195)	(204)	(209)	(211)	(216)	(221)	(223)	(223)	(224)	(224)	1.6
Waste	Gg	47	62	65	68	70	72	77	79	81	84*	6.9
NET EMISSIONS	Gg	**1 600**	**1 689**	**1 824**	**1 906**	**2 019**	**1 948**	**2 219**	**2 312**	**2 490**	**2 788**	**6.5**
PER CAPITA EMISSION	t	1.5	1.6	1.7	1.7	1.8	1.7	1.9	2.0	2.1	2.4	5.3
PER GDP EMISSION	t / MUR M	40.6	41.0	43.4	46.0	49.2	45.4	53.3	55.5	59.5	68.9	6.2
GHG EMISSION INTENSITY INDEX (Base yr=1990)		100.0	101.1	107.0	113.4	121.2	116.7	131.3	136.7	146.7	169.8	6.2

Note: Figures in brackets are removals.

** This period excluded the waste-water handling sector as data was unavailable. The solid waste sector used different emission factors as dumping sites were the most current disposal method.*

2.3.2 The 2000 to 2006 period

2.3.2.1 National Emissions

During the period 2000 to 2006, net GHG emissions rose by 22.8% from 3784 Gg CO_2-eq to 4 646 Gg CO_2-eq with an annual average increase of 3.5% (Table 2.6). Per capita emissions remained nearly constant in the range 3.3 to 3.6 t CO_2-eq during that period while the GHG emission intensity index decreased from 100 in 2000 to 90.7 in 2006.

Table 2.6 - GHG emissions (CO2-eq) for the period 2000 to 2006

SOURCE		2000	2001	2002	2003	2004	2005	2006	Average annual change (%)
Energy		2 315	2 503	2 521	2 692	2 692	2 855	3 154	5.4
Industrial Processes		146	104	149	126	133	35	142	0.7
Agriculture		235	243	219	224	217	212	206	-2.1
LULUCF	**Emission**	234	100	106	124	105	129	118	4.3*
	Removal	*-316*	*-318*	*-289*	*-323*	*-302*	*-306*	*-304*	*-0.4*
Waste		1 170+	1 281	1 226	1 261	1 265	1 266	1 333	2.3
TOTAL		**4 100**	**4 230**	**4 219**	**4 427**	**4 413**	**4 498**	**4 950**	**3.2**
NET		**3 784**	**3 912**	**3 930**	**4 104**	**4 111**	**4 192**	**4 646**	**3.5**
PER CAPITA EMISSION (t)		3.3	3.3	3.3	3.4	3.3	3.3	3.6	1.8
PER GDP EMISSION (t/MUR M)		51.6	51.6	50.0	50.0	47.1	47.1	49.7	-0.6
GHG EMISSION INTENSITY INDEX (Base yr = 1990)		100.0	100.0	96.9	96.8	91.3	91.2	96.3	-0.6

* *Excludes the year 2000 because of abnormally high emissions due to construction of a dam*

** *Excludes the years 2005 and 2006*

\+ *This period included the wastewater handling sector for the first time. The solid waste sector used different emission factors as landfills became current disposal methods*

The energy sector remained the largest source of emissions throughout the inventory period, contributing 65% of total emissions in 2006. Fuel combustion resulted in 2 315 Gg CO_2-eq of GHG emissions in the year 2000. It increased by 839 Gg CO_2-eq to 3 154 Gg CO_2-eq in 2006, i.e., a cumulative increase of 36%. The Waste sector was the second largest contributor with emissions of 1 170 Gg CO_2-eq in 2000 increasing to 1 333 Gg CO_2-eq in 2006, a cumulative increase of 14% over the 2000-2006 period.

2.3.2.2 Emissions by gas

Of the direct GHGs, the main contributor to the national emissions was CO_2 **(Table 2.7)**. CO_2 and CH_4 emissions increased while that of N_2O, HFCs and PFCs decreased over the period. CO_2 emissions increased by 711 Gg from 2 524 Gg in the year 2000 to 3 235 Gg

in 2006. Most of the emissions emanated from the Energy sector from combustion of fossil fuels.

Methane emissions increased by 157 Gg CO_2-eq from 1 234 Gg CO_2-eq to 1 391 Gg CO_2-eq , waste sector contributing most of these emissions followed by agriculture sector.

Nitrous oxide contributed 186 Gg CO_2-eq (3.8%) of total emissions in 2006. Emissions decreased by 117 Gg CO_2-eq from the 303 Gg CO_2-eq of the year 2000. Agriculture was the highest emitter of N_2O.

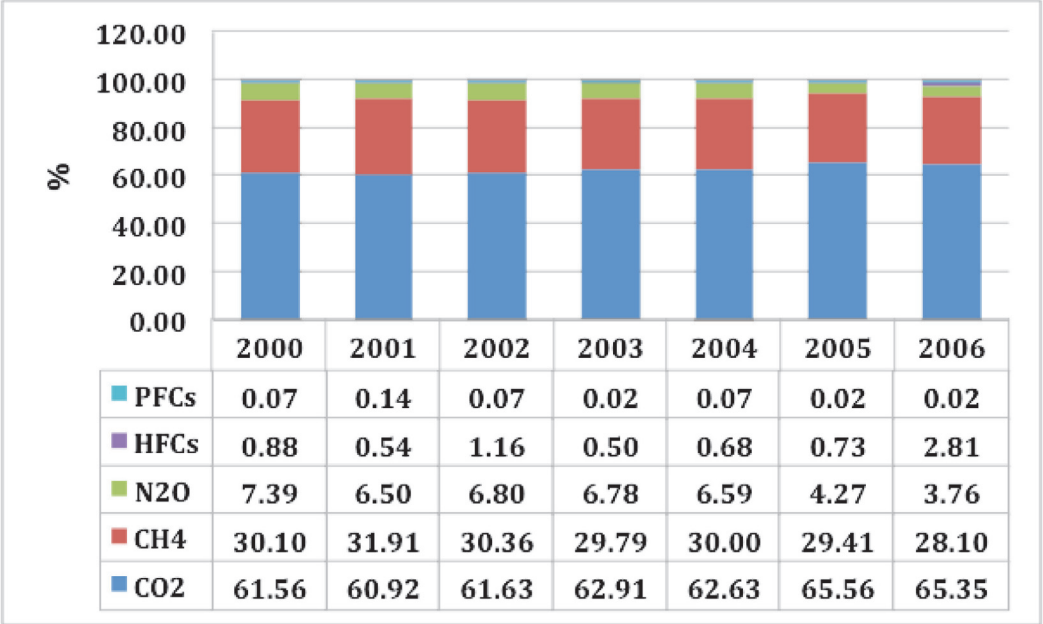
The combined emissions of HFCs and PFCs increased by 101 Gg CO_2-eq from 39 Gg CO_2-eq in the year 2000 to 140 Gg CO_2-eq in 2006. As for SF_6, no estimation was made due to unavailability of adequate records. Emissions occurred as leakages only.

Table 2.7 - Aggregated emissions by sources and removals by sinks of GHGs by gas (2000 – 2006)

	2000	2001	2002	2003	2004	2005	2006	Average annual change (%)
CO_2 (Gg)	2 524	2 577	2 600	2 785	2 764	2 949	3 235	**4.3**
CH_4 (CO_2-eq)	1 234	1 350	1 281	1 319	1 324	1 323	1 391	**2.1**
N_2O (CO_2-eq)	303	275	287	300	291	192	186	**-6.7**
HFCs (CO_2-eq)	36	23	49	22	30	33	139	**66.2**
PFCs (CO_2-eq)	3	6	3	1	3	1	1	**6.1**
SF6 (CO_2-eq)	NE	NE	NE	NE	NE	NE	NE	-
Total GHG emissions (CO_2-eq)	**4 100**	**4 230**	**4 219**	**4 427**	**4 413**	**4 498**	**4 950**	**3.2**
Removals (CO_2)	*-316*	*-318*	*-289*	*-323*	*-302*	*-306*	*-304*	***-0.4***
NET EMISSIONS (CO_2-eq)	**3 784**	**3 912**	**3 930**	**4 104**	**4 111**	**4 192**	**4 646**	**3.5**

Note: There have been substantial increases in HFCs and PFCs in 2006 due to the phasing out of CFC in 2005

The share of CO_2 in the net national emissions gradually increased from 64.5% in the year 2000 to 70.8% in 2006 (Figure 2.2). CH_4 exhibited a slight decrease from 33.6% in 2000 to 30.4% in 2006. A decreasing trend was also observed for the remaining GHGs with N_2O down by 4.07%. HFC increased by 2.8% and PFCs by 0.02% during the period 2000 to 2006. SF_6 was not estimated.



	2000	2001	2002	2003	2004	2005	2006
PFCs	0.07	0.14	0.07	0.02	0.07	0.02	0.02
HFCs	0.88	0.54	1.16	0.50	0.68	0.73	2.81
N2O	7.39	6.50	6.80	6.78	6.59	4.27	3.76
CH4	30.10	31.91	30.36	29.79	30.00	29.41	28.10
CO2	61.56	60.92	61.63	62.91	62.63	65.56	65.35

Figure 2.2 - Share by gas of GHG emissions

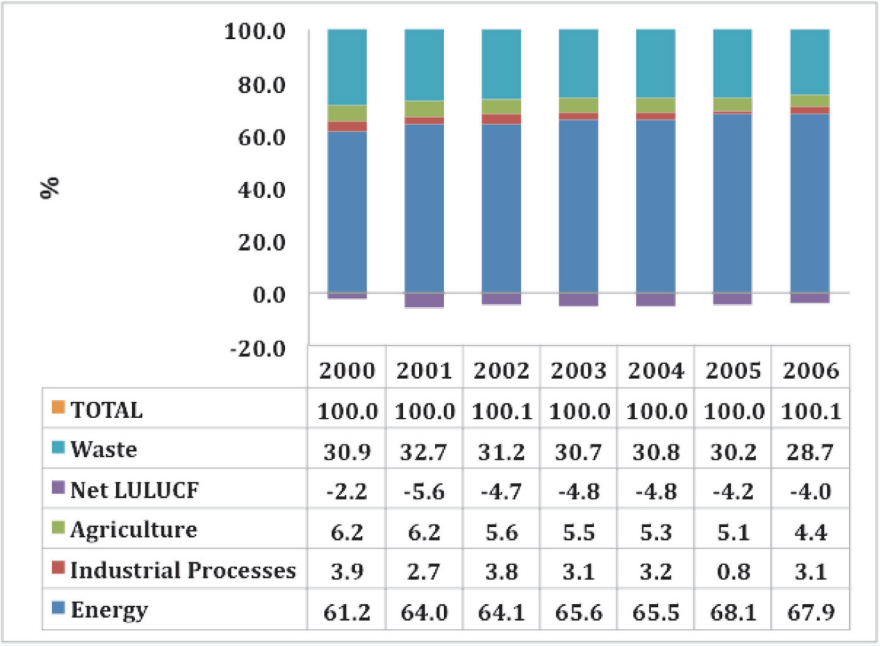
Emissions of indirect GHGs **(Table 2.8)** such as SO_2, CO, NO_x and NMVOCs have also been estimated and reported in the inventory but have not been included in the compilation of total aggregated emissions. Emissions of NO_x increased slightly from 13.6 Gg in the year 2000 to 15.1 Gg in 2006. CO emissions dropped by 21% from 62.4 Gg in the year 2000 to 49.0 Gg in 2006 while that of NMVOCs and SO_2 did not differ much during the reported period 2000 and 2006.

Table 2.8 – Emissions (Gg) of indirect GHGs and SO2 (2000 – 2006)

	2000	2001	2002	2003	2004	2005	2006	Average annual change (%)
NO_x	13.6	13.5	13.8	14.3	14.0	13.7	15.1	2.0
CO	62.4	63.4	58.5	54.8	51.6	49.7	49.0	-3.9
NMVOC	22.2	22.2	23.3	21.6	20.0	21.8	21.2	-0.6
SO_2	8.8	9.5	9.2	12.5	9.7	9.6	11.4	6.1

2.3.2.3 Sectoral emissions

The Energy and Waste sectors remained the largest contributors of GHG emissions with the share from energy increasing from 59% in the year 2000 to 69% in 2006 while that of the Waste sector remained stable at some 30 % **(Figure 2.3)**. The share of Agriculture decreased from 6.0% to 4.5 % while that of the Industrial Processes sector regressed from 7.1% to 1.4%.



	2000	2001	2002	2003	2004	2005	2006
TOTAL	100.0	100.0	100.1	100.0	100.0	100.0	100.1
Waste	30.9	32.7	31.2	30.7	30.8	30.2	28.7
Net LULUCF	-2.2	-5.6	-4.7	-4.8	-4.8	-4.2	-4.0
Agriculture	6.2	6.2	5.6	5.5	5.3	5.1	4.4
Industrial Processes	3.9	2.7	3.8	3.1	3.2	0.8	3.1
Energy	61.2	64.0	64.1	65.6	65.5	68.1	67.9

Figure 2.3 - Share of GHG emissions by sector

2.4 ENERGY

This source category comprised both stationary and mobile fuel combustion activities only as fuel extraction does not occur. The energy sector relied primarily on fossil fuels. During the inventory period, the share of liquid fossil fuels fell from 84% in the year 2000 to 82% in 2006. That of LPG rose from 12% to 15% while that of coal, the major source of solid fossil fuel, dropped from 4% to 3%.

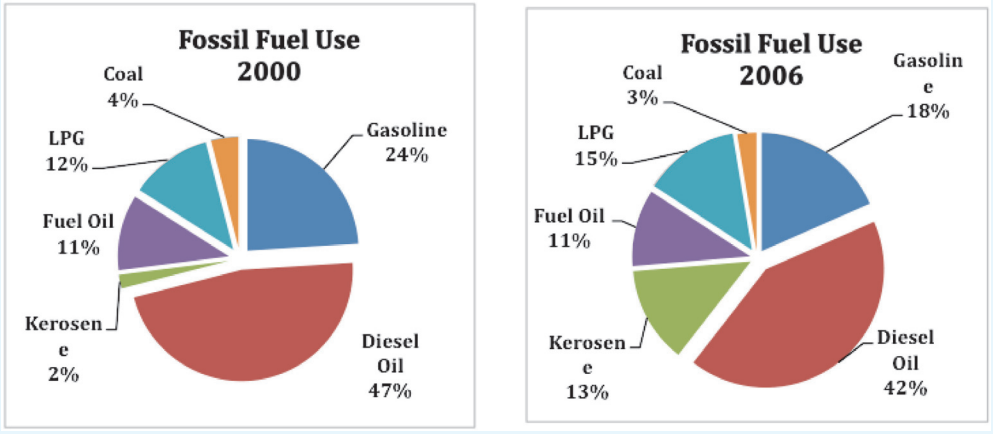


Figure 2.4 – Pie chart illustrating GHG emissions by sector

The three main GHG emitters of the energy sector are Energy industries followed by Transport and Manufacturing Industries & Construction. In 2000, the Energy Industries contributed 44.2% of emissions followed by the Transport sub-sector with 31.7% and Manufacturing Industries with 15.5%. The Residential sub-sector came next with 6.2% while the contribution of the Commercial/Institutional and Agriculture/Forestry/Fishing sub-sectors made up for the remainder.

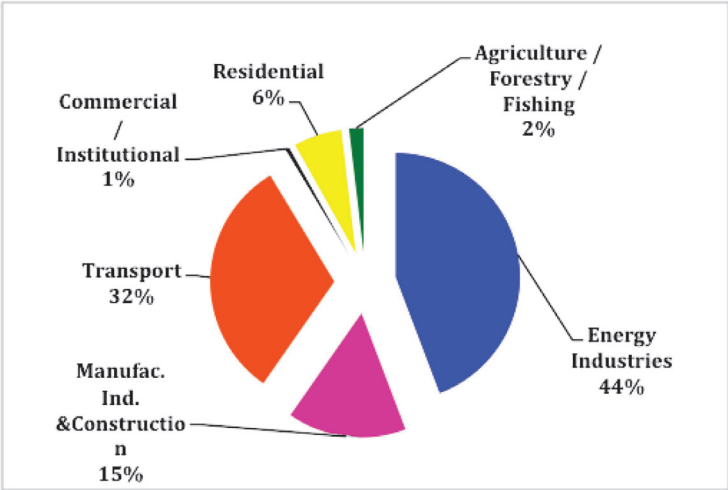
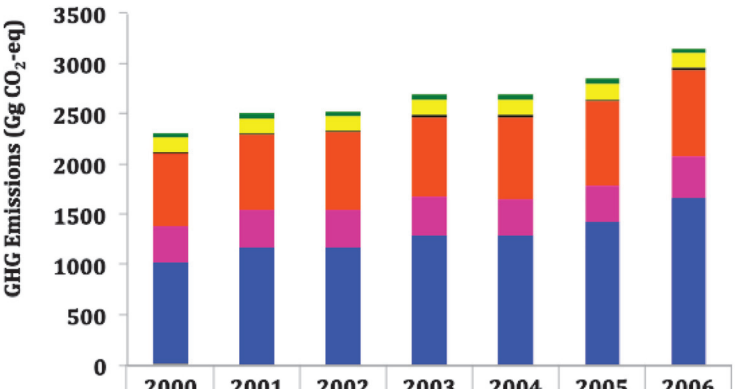


Figure 2.5 - Share of emissions of the Energy sub-sectors (2000)

Fuel combustion in the energy sector resulted in 2315 Gg CO_2-eq of GHG emissions in the year 2000. It increased to 3154 Gg CO_2-eq in 2006, which represented a cumulative increase of 36.2% and an annual average increase of 5.4% **(Table 2.9)**.

Emissions from the Energy Industries recorded a net 63.1% increase from 1024 Gg in 2000 to 1670 Gg CO_2 -eq in 2006, mainly attributed to the increase in fossil fuels burnt to meet the electricity demand. For the Transport sub-sector, emissions rose from 733 Gg CO_2-eq in 2000 to 857 Gg CO_2-eq in 2006 (16.9%). The Manufacturing sub-sector witnessed an increase from 358 Gg CO_2-eq in 2000 to 410 Gg CO_2-eq in 2006 (14.5%). The Commercial/Institutional sub-sector recorded the highest increase with an annual average of 16.4% during the period 2000 – 2006, i.e., a cumulative increase of 150%.



	2000	2001	2002	2003	2004	2005	2006
Agriculture/Forestry/Fishing	43	45	44	54	46	46	48
Residential	145	145	145	149	157	162	140
Commercial/Institutional	12	13	14	17	19	21	30
Transport	733	749	771	797	815	845	857
Manufac. Ind. & Construction	358	385	384	385	363	352	410
Energy Industries	1024	1166	1165	1291	1294	1430	1670

Figure 2.6 - Emissions (Gg CO2-eq) from the Energy Sector (2000 to 2006)

Among the GHGs, CO_2 represented more than 98% of the total aggregated emissions within the energy sector **(Table 2.9)**. Its emissions rose from 2286.71 Gg in 2000 to peak at 3114.96 Gg in 2006. This represented a cumulative increase of 36.2%.

Table 2.9 - Emissions (Gg) by gas for the Energy Sector (2000 – 2006)

	2000	2001	2002	2003	2004	2005	2006
CO_2-eq	**2 314.50**	**2 502.64**	**2 520.68**	**2 692.10**	**2 692.13**	**2 855.01**	**3 153.58**
CO_2	2 286.71	2 473.92	2 491.69	2 658.65	2 657.24	2 817.92	3 114.96
CH_4	0.47	0.47	0.43	0.44	0.44	0.44	0.44
N_2O	0.06	0.06	0.06	0.08	0.08	0.09	0.09
NMVOC	12.70	12.71	13.03	13.57	13.31	13.50	14.97
CO	53.70	53.95	51.71	48.81	46.74	45.66	45.13
NOx	13.46	13.70	13.24	13.08	12.17	12.58	12.47
SO_2	8.76	9.55	9.20	12.47	9.72	9.60	11.44

2.5 INDUSTRIAL PROCESSES

GHGs from the Industrial Processes sector were emitted from various activities. Emissions from this source declined significantly from 146 Gg CO_2-eq in 2000 to 142 Gg CO_2-eq in 2006 following the gradual phasing out of nitric acid production and the cessation of its production in 2005 (Table 2.10). The contribution of Industrial Processes in the total emissions decreased from 3.5% in 2000 to 2.9% in 2006.

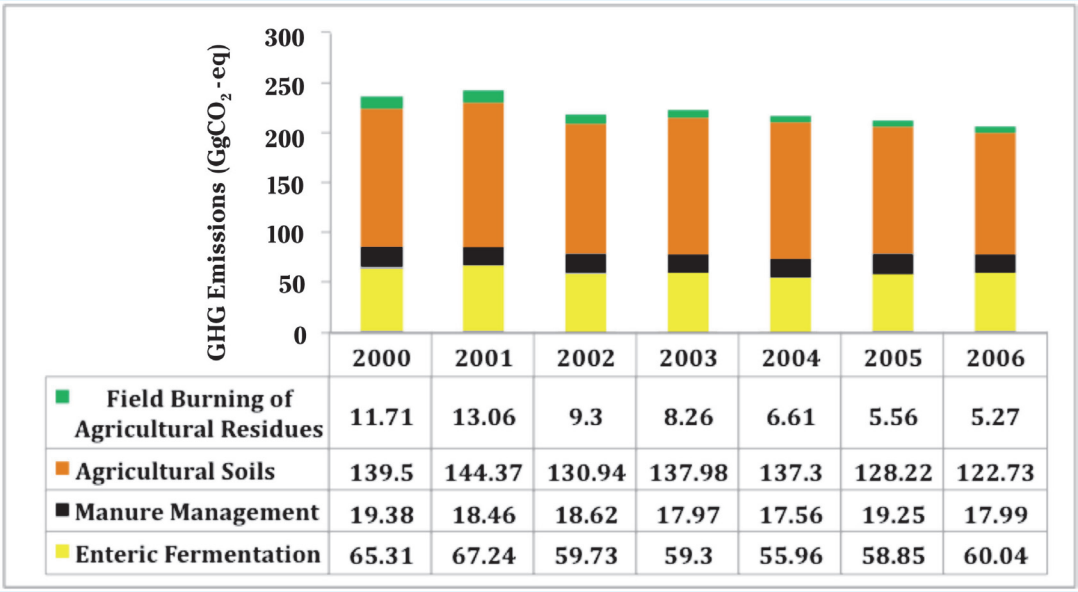
Table 2.10 - GHG emissions (Gg) from the Industrial Processes Sector (2000 – 2006)

SOURCE CATEGORY	GHG	2000	2001	2002	2003	2004	2005	2006
TOTAL	**CO_2-eq**	**145.8**	**103.8**	**149.0**	**126.5**	**133.0**	**35.5**	**141.8**
A. 2 Mineral Products (Lime Production)	**CO_2**	2.57	2.51	2.3	2.19	1.79	1.84	1.9
A.6 Mineral Products (Road paving with asphalt)	**NMVOC**	6.14	5.86	7.38	5.87	5.17	6.5	6.11
B.2 Chemical Industry (Nitric Acid Production)	**N_2O**	0.34	0.23	0.31	0.33	0.32	0	0
	NO_x	0.45	0.31	0.41	0.44	0.42	0	0
D.2 Other Production (Food & Drink)	**NMVOC**	2.64	2.69	2.68	2.64	2.64	2.74	2.63
F.1 Consumption of Halocarbons and SF6	**HFC**							
	HFC 134a	0.0157	0.0082	0.0224	0.0068	0.0068	0.0102	0.0244
	HFC BlendR404a	0.0019	0.0018	0.0047	0.0033	0.0049	0.0031	0.0088
	HFC Blend R407c	0.0053	0.0010	0.0005	0.0002	0.0012	0.0039	0.0476
	HFC Blend R408a	0.0002	0.0019	0.0012	0.0009	0.0005	0.0010	0.0020
	HFC Blend R410a	0	0	0	0	0.0003	0.0003	0.0005
	HFC Blend R507	0.0002	0	0.0002	0	0.0006	0.0002	0
G. Other (Consumption of PFCs)	**PFC : PFC 218**	0.0004	0.0009	0.0004	0.0002	0.0004	0.0002	0.0001

Within the Industrial Processes sector, the relative importance of the different sub-sectors has drastically changed over the inventory period. Thus, Chemical Industry that contributed to the level of 37.6% in 2000 was non-existent in 2006. The consumption of HFCs and PFCs, which are used as substitutes for Ozone Depleting Substances (ODS), increased in 2006 due to the phasing out of Chloro fluoro carbons (CFCs) in 2005.

2.6 AGRICULTURE

The agriculture source category comprised emissions from Enteric Fermentation, Manure Management, Agricultural Soils and Field Burning of Agricultural Residues. In 2006, the share of emissions from agriculture amounted to 4.2% of total national emissions. It declined from 235 Gg CO_2-eq in 2000 to 206 Gg CO_2-eq in 2006, a cumulative decrease of 12.3% over that period. Of these emissions, Agricultural Soils contributed the highest amount (59.6%) followed by the Livestock sector with 40.4%.



	2000	2001	2002	2003	2004	2005	2006
Field Burning of Agricultural Residues	11.71	13.06	9.3	8.26	6.61	5.56	5.27
Agricultural Soils	139.5	144.37	130.94	137.98	137.3	128.22	122.73
Manure Management	19.38	18.46	18.62	17.97	17.56	19.25	17.99
Enteric Fermentation	65.31	67.24	59.73	59.3	55.96	58.85	60.04

Figure 2.7 - Emissions (Gg CO_2-eq) from Agriculture (2000 to 2006)

Among the GHGs, CH_4 remained the direct GHG produced in largest amount while for the indirect GHGs, CO was the gas of major importance **(Table 2.11)**.

Table 2.11 - Emissions by gas (Gg) from Agriculture Sector (2000 – 2006)

GHG	2000	2001	2002	2003	2004	2005	2006
CH_4	3.989	4.101	3.611	3.545	3.364	3.511	3.514
N_2O	0.488	0.507	0.461	0.481	0.474	0.446	0.427
NO_x	0.404	0.440	0.313	0.278	0.222	0.187	0.178
CO	8.525	9.278	6.602	5.871	4.689	3.952	3.753

2.7 LAND USE, LAND USE CHANGE AND FORESTRY (LULUCF)

The LULUCF sector comprised the sub-categories Forest Land, Cropland, Wetlands, Settlement and Other land. Land occupancy data, abstracted from the Initial National Communication (INC, 1999) and used for computing the inventory, are presented in **Figure 2.8.**

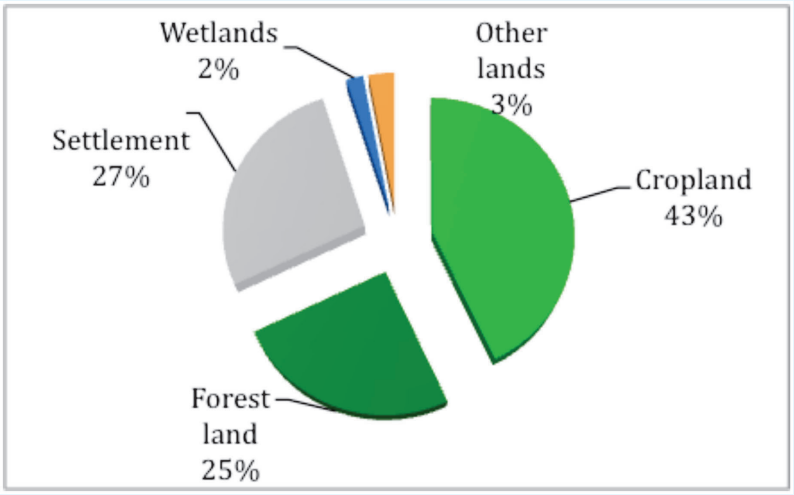


Figure 2.8 - Land Use in Mauritius in 2005 (Adapted from INC, 1999)

The LULUCF sector represented a net removal of CO_2 from the atmosphere during the period 2000-2006. The net removal was much lower in the year 2000, due to the conversion of some 300 ha of forest land to Wetland for the commissioning of a dam. Emissions are estimated at 117.6 Gg CO_2 and the removals at 303.7 Gg CO_2 in the year 2006. The removals represented 7% of total national emissions in the year 2000 and 6% in 2006. Emissions and removals by sub-category **(Table 2.12)** are illustrated in **Figure 2.9**.

Table 2.12 - Emissions and removals by gas (Gg) in the LULUCF sector (2000-2006)

	2000	2001	2002	2003	2004	2005	2006	% Annual change
CO_2 emissions	*233.96*	*100.05*	*105.53*	*123.65*	*104.65*	*128.84*	*117.63*	*4.3**
CO_2 removals	*-315.98*	*-317.96*	*-289.37*	*-323.39*	*-302.33*	*-305.53*	*-303.70*	*-0.4*
Net CO_2 removals	**-82.02**	**-217.91**	**-183.84**	**-199.74**	**-197.68**	**-176.69**	**-186.07**	**25.4**
CH_4	0.0077	0.0109	0.0109	0.0101	0.0114	0.0027	0.0042	4.4
N_2O	0.0001	0.0002	0.0002	0.0002	0.0002	0.0000	0.0001	-16.7
NOx	0.0008	0.0011	0.0011	0.0010	0.0011	0.0003	0.0004	-0.2
CO	0.1214	0.1722	0.1723	0.1591	0.1800	0.0420	0.0657	4.5

* Excludes the year 2000 because of abnormally high emissions due to construction of a dam

CO_2 removal from Cropland and Settlement remained more or less constant. Emissions from conversion of cropland to other land fluctuated over the years. Forest Land remaining Forest Land represented a net sink of CO_2 from living biomass, the annual average being about 273 Gg during the period 2000-2006.

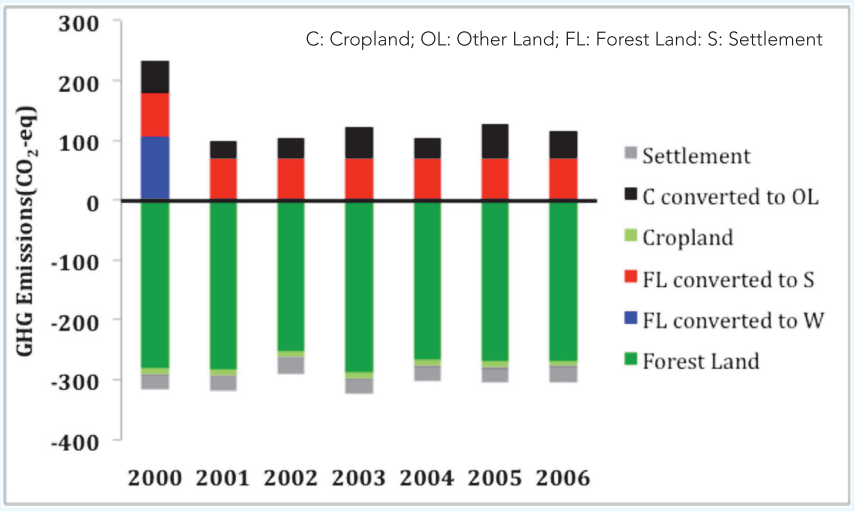
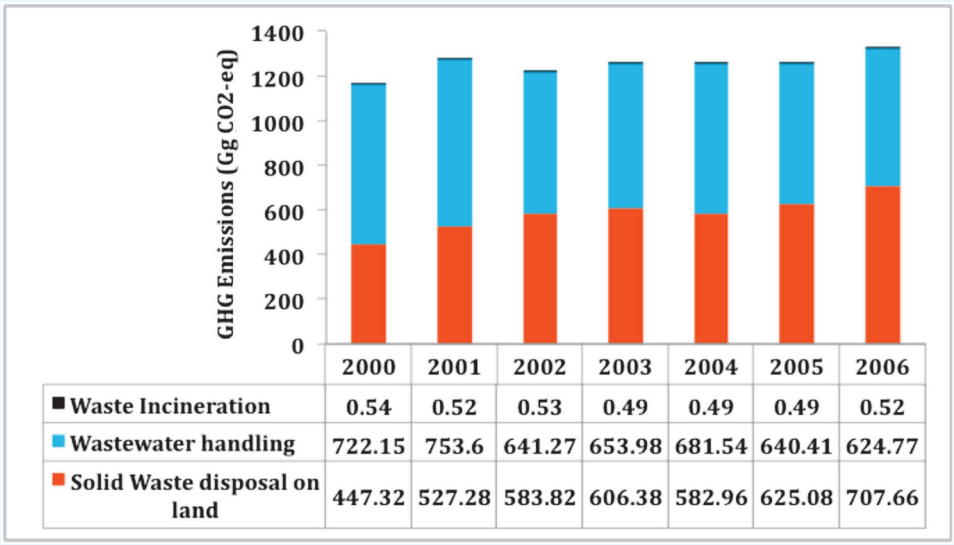


Figure 2.9 - Emissions and removals (CO_2-eq) in the LULUCF sector (2000 - 2006)

2.8 WASTE

The Waste sector was the second largest emitter of GHGs during the period 2000 to 2006 and accounted for 1 170 Gg CO_2-eq (27.7%) of total emissions in the year 2000. Emissions increased by 13.9% (2.3% annually) to reach 1 333 Gg CO_2-eq in 2006. Emissions from Solid Waste Disposal on land increased by 58.2% (8.2% annual average), from 447 Gg CO_2-eq in 2000 to 708 Gg CO_2-eq in 2006. This change is attributed to the increase in population as well as to the shift in consumption pattern associated with GDP growth. In contrast, emissions from Wastewater Handling regressed by 13.5% (2.1% annually) from 722 Gg CO_2-eq to 625 Gg CO_2-eq during the inventory period.



	2000	2001	2002	2003	2004	2005	2006
Waste Incineration	0.54	0.52	0.53	0.49	0.49	0.49	0.52
Wastewater handling	722.15	753.6	641.27	653.98	681.54	640.41	624.77
Solid Waste disposal on land	447.32	527.28	583.82	606.38	582.96	625.08	707.66

Figure 2.10 - GHG Emissions (CO_2-eq) from the Waste sector (2000 to 2006)

CH_4 was the major GHG emitted from the Waste sector. It increased by 2.4% annually on average over the inventory period from 54.28 Gg in the year 2000 to 62.27 Gg in 2006. CO_2 emissions remained more or less constant while that of N_2O regressed slightly.

Table 2.13 - Emissions by gas (Gg) from the Waste sector (2000 - 2006)

	2000	2001	2002	2003	2004	2005	2006	Annual Change (%)
CO_2	0.536	0.524	0.531	0.493	0.493	0.493	0.518	-0.5
CH_4	54.285	59.719	56.954	58.804	59.240	59.026	62.268	2.4
N_2O	0.095	0.086	0.094	0.082	0.066	0.084	0.084	-1.0

2.9 OVERVIEW TABLES

The Short summary tables from the overview worksheet are given below.

Country	The Republic of Mauritius
Inventory Year	2000

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2523.7737**	**-315.9800**	**58.7491**	**0.9770**	**13.5565**	**62.3505**	**22.2478**	**8.7557**
1. Energy	**2286.7098**	**0.0000**	**0.4672**	**0.0580**	**12.7033**	**53.7044**	**13.4623**	**8.7557**
A. Fuel combustion (sectoral approach)	2286.7098		0.4672	0.0580	12.7033	53.7044	13.4623	8.7557
1. Energy Industries	1020.5868		0.0259	0.0082	3.3233	0.2376	0.0694	4.7135
2. Manufacturing industries and construction	349.2725		0.1353	0.0194	1.7813	4.1640	0.2365	2.0362
3. Transport	720.7697		0.2044	0.0245	6.6522	48.6383	12.8889	1.6072
4. Other sectors	196.0808		0.1016	0.0059	0.9465	0.6645	0.2675	0.3988
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**2.5680**	**0.0000**	**0.0000**	**0.3361**	**0.4481**	**0.0000**	**8.7855**	**0.0000**
A. Mineral products	2.5680				0.0000	0.0000	6.1430	0.0000
B. Chemical industry	0.0000		0.0000	0.3361	0.4481	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6425	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.9894**	**0.4877**	**0.4043**	**8.5247**	**0.0000**	**0.0000**
A. Enteric fermentation			3.1084					
B. Manure management			0.4751	0.0275			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4490			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural residues			0.4059	0.0112	0.4043	8.5247	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**233.9600**	**-315.9800**	**0.0077**	**0.0001**	**0.0008**	**0.1214**	**0.0000**	**0.0000**
A. Changes in forest and other woody biomass stocks	0.0000	-315.9800	0.0077	0.0001	0.0008	0.1214		
B. Forest and grassland conversion	178.9700	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
E. Other (Cropland converted to Other	54.9900	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.5359**		**54.2848**	**0.0951**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			21.3008		0.0000		0.0000	
B. Waste-water handling			32.9840	0.0951	0.0000	0.0000	0.0000	
C. Waste incineration	0.5400				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**1302.9893**		**0.0506**	**0.0230**	**16.4872**	**10.1193**	**2.2855**	**0.0000**
Aviation	617.3697		0.0044	0.0174	2.6165	0.8722	0.4361	0.0000
Marine	685.6196		0.0462	0.0055	13.8707	9.2471	1.8494	0.0000
CO_2 emissions from biomass	**1023.0677**							

Country	The Republic of Mauritius
Inventory Year	2000

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0157**	**0.0019**	**0.0002**	**0.0053**	**0.0002**	**0.0000**	**0.0004**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0157**	**0.0019**	**0.0002**	**0.0053**	**0.0002**	**0.0000**	**0.0004**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0157	0.0019	0.0002	0.0053	0.0002	0.0000	0.0004	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	GWP
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2001

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2577.0074**	**-317.9600**	**64.2980**	**0.8870**	**13.4640**	**63.3959**	**22.2429**	**9.5494**
1. Energy	**2473.9184**	**0.0000**	**0.4672**	**0.0610**	**12.7124**	**53.9454**	**13.6991**	**9.5494**
A. Fuel combustion (sectoral	2473.9184		0.4672	0.0610	12.7124	53.9454	13.6991	9.5494
1. Energy Industries	1162.6970		0.0271	0.0100	3.5422	0.2521	0.0755	5.3421
2. Manufacturing industries and construction	376.1598		0.1353	0.0195	1.4564	4.1467	0.2373	2.2714
3. Transport	736.6324		0.2032	0.0252	6.7426	48.8656	13.1162	1.5383
4. Other sectors	198.4292		0.1016	0.0063	0.9712	0.6810	0.2701	0.3976
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**2.5148**	**0.0000**	**0.0000**	**0.2329**	**0.3105**	**0.0000**	**8.5438**	**0.0000**
A. Mineral products	2.5148				0.0000	0.0000	5.8573	0.0000
B. Chemical industry	0.0000		0.0000	0.2329	0.3105	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6865	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**4.1009**	**0.5065**	**0.4400**	**9.2783**	**0.0000**	**0.0000**
A. Enteric fermentation			3.2021					
B. Manure management			0.4570	0.0286			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4657			0.0000	
E. Prescribed burning of			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural			0.4418	0.0122	0.4400	9.2783	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**100.0500**	**-317.9600**	**0.0109**	**0.0002**	**0.0011**	**0.1722**	**0.0000**	**0.0000**
A. Changes in forest and other woody	0.0000	-317.9600	0.0109	0.0002	0.0011	0.1722		
B. Forest and grassland	71.4900	0.0000						
C. Abandonment of managed		0.0000						
D. CO_2 emissions and removals	0.0000	0.0000						
E. Other (Cropland converted to	28.5600	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.5242**		**59.7190**	**0.0864**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			25.1085		0.0000		0.0000	
B. Waste-water handling			34.6105	0.0864	0.0000	0.0000	0.0000	
C. Waste incineration	0.5200				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**872.9723**		**0.0445**	**0.0119**	**13.8521**	**8.8961**	**1.8808**	**0.0000**
Aviation	239.7212		0.0017	0.0068	1.0160	0.3387	0.1693	0.0000
Marine	633.2511		0.0428	0.0051	12.8361	8.5574	1.7115	0.0000
CO_2 emissions from biomass	**1108.6613**							

Country	The Republic of Mauritius
Inventory Year	2001

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0082**	**0.0018**	**0.0019**	**0.0010**	**0.0000**	**0.0000**	**0.0009**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0082**	**0.0018**	**0.0019**	**0.0010**	**0.0000**	**0.0000**	**0.0009**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0082	0.0018	0.0019	0.0010	0.0000	0.0000	0.0009	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	GWP
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2002

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2600.0604**	**-289.3700**	**61.0015**	**0.9244**	**13.7522**	**58.4843**	**23.2976**	**9.1978**
1. Energy	**2491.6947**	**0.0000**	**0.4250**	**0.0647**	**13.0309**	**51.7102**	**13.2358**	**9.1978**
A. Fuel combustion (sectoral approach)	2491.6947		0.4250	0.0647	13.0309	51.7102	13.2358	9.1978
1. Energy Industries	1159.3008		0.0302	0.0149	3.7424	0.2622	0.0750	5.4493
2. Manufacturing industries and construction	376.5119		0.1157	0.0169	1.3917	3.4942	0.2043	1.6912
3. Transport	757.8299		0.1789	0.0266	6.9314	47.2818	12.6902	1.6656
4. Other sectors	198.0521		0.1002	0.0063	0.9654	0.6720	0.2663	0.3917
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**2.3048**	**0.0000**	**0.0000**	**0.3053**	**0.4071**	**0.0000**	**10.0618**	**0.0000**
A. Mineral products	2.3048				0.0000	0.0000	7.3805	0.0000
B. Chemical industry	0.0000		0.0000	0.3053	0.4071	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6813	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.6112**	**0.4605**	**0.3131**	**6.6018**	**0.0000**	**0.0000**
A. Enteric fermentation			2.8441					
B. Manure management			0.4527	0.0294			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4224			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural			0.3144	0.0087	0.3131	6.6018	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**105.5300**	**-289.3700**	**0.0109**	**0.0002**	**0.0011**	**0.1723**	**0.0000**	**0.0000**
A. Changes in forest and other woody	0.0000	-289.3700	0.0109	0.0002	0.0011	0.1723		
B. Forest and grassland conversion	71.4900	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
Other Land)	34.0400	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.5309**		**56.9544**	**0.0937**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			27.8009		0.0000		0.0000	
B. Waste-water handling			29.1535	0.0937	0.0000	0.0000	0.0000	
C. Waste incineration	0.5300				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**816.2531**		**0.0375**	**0.0125**	**11.8741**	**7.5022**	**1.6246**	**0.0000**
Aviation	292.9491		0.0021	0.0083	1.2416	0.4139	0.2069	0.0000
Marine	523.3040		0.0354	0.0043	10.6325	7.0883	1.4177	0.0000
CO_2 emissions from biomass	**1024.4512**							

Country	The Republic of Mauritius
Inventory Year	2002

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0224**	**0.0047**	**0.0012**	**0.0005**	**0.0002**	**0.0000**	**0.0004**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0224**	**0.0047**	**0.0012**	**0.0005**	**0.0002**	**0.0000**	**0.0004**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0224	0.0047	0.0012	0.0005	0.0002	0.0000	0.0004	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	GWP
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2003

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2784.9820**	**-323.3900**	**62.8000**	**0.9681**	**14.2863**	**54.8360**	**21.5874**	**12.4703**
1. Energy	**2658.6495**	**0.0000**	**0.4415**	**0.0780**	**13.5712**	**48.8058**	**13.0831**	**12.4703**
A. Fuel combustion (sectoral	2658.6495		0.4415	0.0780	13.5712	48.8058	13.0831	12.4703
1. Energy Industries	1285.0662		0.0341	0.0160	4.0483	0.2846	0.0822	6.0008
2. Manufacturing industries and construction	376.6096		0.1307	0.0189	1.4491	4.0012	0.2295	4.3638
3. Transport	781.6268		0.1738	0.0364	6.9388	43.7193	12.4768	1.6979
4. Other sectors	215.3469		0.1029	0.0067	1.1350	0.8007	0.2946	0.4078
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**2.1893**	**0.0000**	**0.0000**	**0.3268**	**0.4357**	**0.0000**	**8.5043**	**0.0000**
A. Mineral products	2.1893				0.0000	0.0000	5.8688	0.0000
B. Chemical industry	0.0000		0.0000	0.3268	0.4357	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6355	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.5446**	**0.4809**	**0.2784**	**5.8711**	**0.0000**	**0.0000**
A. Enteric fermentation			2.8241					
B. Manure management			0.4409	0.0281			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4451			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural			0.2796	0.0077	0.2784	5.8711	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**123.6500**	**-323.3900**	**0.0101**	**0.0002**	**0.0010**	**0.1591**	**0.0000**	**0.0000**
A. Changes in forest and other woody	0.0000	-323.3900	0.0101	0.0002	0.0010	0.1591		
B. Forest and grassland conversion	71.4900	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
E. Other (Cropland converted to	52.1600	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.4932**		**58.8038**	**0.0822**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			28.8752		0.0000		0.0000	
B. Waste-water handling			29.9286	0.0822	0.0000	0.0000	0.0000	
C. Waste incineration	0.4900				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**1087.5880**		**0.0328**	**0.0223**	**11.2846**	**6.5762**	**1.5993**	**0.0000**
Aviation	670.2473		0.0047	0.0189	2.8406	0.9469	0.4734	0.0000
Marine	417.3407		0.0281	0.0034	8.4440	5.6293	1.1259	0.0000
CO_2 emissions from biomass	**1017.5487**							

Country	The Republic of Mauritius
Inventory Year	2003

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0068**	**0.0033**	**0.0009**	**0.0002**	**0.0000**	**0.0000**	**0.0002**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0068**	**0.0033**	**0.0009**	**0.0002**	**0.0000**	**0.0000**	**0.0002**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0068	0.0033	0.0009	0.0002	0.0000	0.0000	0.0002	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	GWP
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2004

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2764.1733**	**-302.3300**	**63.0513**	**0.9379**	**13.9508**	**51.6100**	**19.9760**	**9.7153**
1. Energy	**2657.2428**	**0.0000**	**0.4362**	**0.0830**	**13.3070**	**46.7414**	**12.1711**	**9.7153**
A. Fuel combustion (sectoral approach)	2657.2428		0.4362	0.0830	13.3070	46.7414	12.1711	9.7153
1. Energy Industries	1287.9726		0.0361	0.0154	3.9902	0.2823	0.0828	5.8396
2. Manufacturing industries and construction	353.8948		0.1320	0.0190	1.3866	4.0572	0.2309	1.7540
3. Transport	797.7084		0.1634	0.0416	6.9047	41.7082	11.5817	1.7206
4. Other sectors	217.6670		0.1047	0.0070	1.0255	0.6937	0.2757	0.4011
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**1.7873**	**0.0000**	**0.0000**	**0.3152**	**0.4203**	**0.0000**	**7.8049**	**0.0000**
A. Mineral products	1.7873				0.0000	0.0000	5.1680	0.0000
B. Chemical industry	0.0000		0.0000	0.3152	0.4203	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6369	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.3637**	**0.4735**	**0.2224**	**4.6886**	**0.0000**	**0.0000**
A. Enteric fermentation			2.6646					
B. Manure management			0.4758	0.0244			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4429			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural residues			0.2233	0.0062	0.2224	4.6886	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**104.6500**	**-302.3300**	**0.0114**	**0.0002**	**0.0011**	**0.1800**	**0.0000**	**0.0000**
A. Changes in forest and other woody biomass stocks	0.0000	-302.3300	0.0114	0.0002	0.0011	0.1800		
B. Forest and grassland conversion	71.4900	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
E. Other (Cropland converted to Other	33.1600	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.4932**		**59.2400**	**0.0660**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			27.7600		0.0000		0.0000	
B. Waste-water handling			31.4800	0.0660	0.0000	0.0000	0.0000	
C. Waste incineration	0.4900				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**1169.0221**		**0.0358**	**0.0238**	**12.2689**	**7.1743**	**1.7354**	**0.0000**
Aviation	711.3897		0.0050	0.0201	3.0150	1.0050	0.5025	0.0000
Marine	457.6324		0.0308	0.0037	9.2539	6.1693	1.2329	0.0000
CO_2 emissions from biomass	**1054.0674**							

Country	The Republic of Mauritius
Inventory Year	2004

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0068**	**0.0049**	**0.0005**	**0.0012**	**0.0006**	**0.0003**	**0.0004**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0068**	**0.0049**	**0.0005**	**0.0012**	**0.0006**	**0.0003**	**0.0004**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0068	0.0049	0.0005	0.0012	0.0006	0.0003	0.0004	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	**GWP**
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2005

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**2949.0900**	**-305.5300**	**62.9770**	**0.6193**	**13.6891**	**49.6544**	**21.8137**	**9.5991**
1. Energy	**2817.9200**	**0.0000**	**0.4374**	**0.0900**	**13.5014**	**45.6601**	**12.5792**	**9.5991**
A. Fuel combustion (sectoral	2817.9200		0.4374	0.0900	13.5014	45.6601	12.5792	9.5991
1. Energy Industries	1424.2718		0.0316	0.0167	4.1137	0.2872	0.0814	6.2406
2. Manufacturing industries and construction	343.8148		0.1222	0.0186	1.3268	3.7372	0.2143	1.2036
3. Transport	826.0896		0.1751	0.0480	7.1160	40.9244	12.0005	1.7390
4. Other sectors	223.7438		0.1085	0.0067	0.9449	0.7113	0.2830	0.4159
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**1.8368**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**9.2345**	**0.0000**
A. Mineral products	1.8368				0.0000	0.0000	6.4986	0.0000
B. Chemical industry	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.7359	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.5114**	**0.4456**	**0.1874**	**3.9523**	**0.0000**	**0.0000**
A. Enteric fermentation			2.8022					
B. Manure management			0.5210	0.0268			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.4136			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural			0.1882	0.0052	0.1874	3.9523	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**128.8400**	**-305.5300**	**0.0027**	**0.0000**	**0.0003**	**0.0420**	**0.0000**	**0.0000**
A. Changes in forest and other woody biomass stocks	0.0000	-305.5300	0.0027	0.0000	0.0003	0.0420		
B. Forest and grassland conversion	71.4900	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
E. Other (Cropland converted to Other	57.3500	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.4932**		**59.0255**	**0.0837**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			29.7655		0.0000		0.0000	
B. Waste-water handling			29.2600	0.0837	0.0000	0.0000	0.0000	
C. Waste incineration	0.4932				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**1244.9825**		**0.0447**	**0.0231**	**14.7902**	**8.9428**	**2.0638**	**0.0000**
Aviation	649.3147		0.0046	0.0183	2.7519	0.9173	0.4587	0.0000
Marine	595.6678		0.0401	0.0048	12.0383	8.0255	1.6051	0.0000
CO_2 emissions from biomass	**1026.4537**							

Country	The Republic of Mauritius
Inventory Year	2005

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0102**	**0.0031**	**0.001**	**0.0039**	**0.0002**	**0.0003**	**0.0002**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0102**	**0.0031**	**0.001**	**0.0039**	**0.0002**	**0.0003**	**0.0002**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0102	0.0031	0.0010	0.0039	0.0002	0.0003	0.0002	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	GWP
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

Country	The Republic of Mauritius
Inventory Year	2006

National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors

Greenhouse gas source and sink categories	CO_2 emissions (Gg)	CO_2 removals (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOCs (Gg)	SO_x (Gg)
Total national emissions and removals	**3235.0106**	**-303.7000**	**66.2287**	**0.6013**	**15.1466**	**48.9507**	**21.2094**	**11.4422**
1. Energy	**3114.9648**	**0.0000**	**0.4424**	**0.0946**	**14.9682**	**45.1318**	**12.4686**	**11.4422**
A. Fuel combustion (sectoral	3114.9648		0.4424	0.0946	14.9682	45.1318	12.4686	11.4422
1. Energy Industries	1662.7241		0.0396	0.0221	5.3939	0.3791	0.1053	7.9049
2. Manufacturing industries and construction	401.6403		0.1211	0.0173	1.4738	3.6518	0.2138	1.3471
3. Transport	838.1172		0.1705	0.0482	7.1473	40.3706	11.8543	1.7581
4. Other sectors	212.4832		0.1112	0.0070	0.9532	0.7303	0.2952	0.4321
B. Fugitive emissions from fuels	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000
1. Solid fuels			0.0000		0.0000	0.0000	0.0000	0.0000
2. Oil and natural gas			0.0000		0.0000	0.0000	0.0000	0.0000
2. Industrial processes	**1.8975**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**8.7408**	**0.0000**
A. Mineral products	1.8975				0.0000	0.0000	6.1117	0.0000
B. Chemical industry	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C. Metal production	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
D. Other production	0.0000		0.0000	0.0000	0.0000	0.0000	2.6291	0.0000
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride								
G. Other (please specify)	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3. Solvent and other product use	**0.0000**			**0.0000**			**0.0000**	
4. Agriculture			**3.5138**	**0.4266**	**0.1780**	**3.7532**	**0.0000**	**0.0000**
A. Enteric fermentation			2.8590					
B. Manure management			0.4761	0.0258			0.0000	
C. Rice cultivation			0.0000				0.0000	
D. Agricultural soils				0.3959			0.0000	
E. Prescribed burning of savannahs			0.0000	0.0000	0.0000	0.0000	0.0000	
F. Field burning of agricultural			0.1787	0.0049	0.1780	3.7532	0.0000	
G. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	
5. Land-use change and forestry [1]	**117.6300**	**-303.7000**	**0.0042**	**0.0001**	**0.0004**	**0.0657**	**0.0000**	**0.0000**
A. Changes in forest and other woody	0.0000	-303.7000	0.0042	0.0001	0.0004	0.0657		
B. Forest and grassland conversion	71.4900	0.0000						
C. Abandonment of managed lands		0.0000						
D. CO_2 emissions and removals from	0.0000	0.0000						
E. Other (Cropland converted to	46.1400	0.0000	0.0000	0.0000	0.0000	0.0000		
6. Waste	**0.5183**		**62.2683**	**0.0800**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
A. Solid waste disposal on land			33.6983		0.0000		0.0000	
B. Waste-water handling			28.5700	0.0800	0.0000	0.0000	0.0000	
C. Waste incineration	0.5183				0.0000	0.0000	0.0000	0.0000
D. Other (please specify)			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7. Other (please specify)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Memo items								
International bunkers	**1267.5321**		**0.0415**	**0.0250**	**13.9941**	**8.3013**	**1.9687**	**0.0000**
Aviation	727.7741		0.0051	0.0206	3.0844	1.0281	0.5141	0.0000
Marine	539.7580		0.0364	0.0044	10.9097	7.2732	1.4546	0.0000
CO_2 emissions from biomass	**990.9360**							

Country	The Republic of Mauritius
Inventory Year	2006

National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6

Greenhouse gas source and sink categories	HFCs[a,b] (Gg)							SF_6[a] (Gg)
	HFC-R134a	HFC-R404a	HFC-R408a	HFC-R407c	R507	HFC-R410a	Insert PFC	
Total national emissions and removals	**0.0244**	**0.0088**	**0.002**	**0.0476**	**0.0000**	**0.0005**	**0.0001**	**0**
1. Energy								
A. Fuel combustion (sectoral approach)								
1. Energy Industries								
2. Manufacturing industries and construction								
3. Transport								
4. Other sectors								
5. Other (please specify)								
B. Fugitive emissions from fuels								
1. Solid fuels								
2. Oil and natural gas								
2. Industrial processes	**0.0244**	**0.0088**	**0.0020**	**0.0476**	**0.0000**	**0.0005**	**0.0001**	**0**
A. Mineral products								
B. Chemical industry								
C. Metal production								
D. Other production								
E. Production of halocarbons and sulphur hexafluoride								
F. Consumption of halocarbons and sulphur hexafluoride	0.0244	0.0088	0.0020	0.0476	0.0000	0.0005	0.0001	
G. Other (please specify)								
3. Solvent and other product use								
4. Agriculture								
A. Enteric fermentation								
B. Manure management								
C. Rice cultivation								
D. Agricultural soils								
E. Prescribed burning of savannahs								
F. Field burning of agricultural residues								
G. Other (please specify)								
5. Land-use change and forestry								
A. Changes in forest and other woody biomass stocks								
B. Forest and grassland conversion								
C. Abandonment of managed lands								
D. CO_2 emissions and removals from soil								
E. Other (please specify)								
6. Waste								
A. Solid waste disposal on land								
B. Waste-water handling								
C. Waste incineration								
D. Other (please specify)								
7. Other (please specify)								
Memo items								
International bunkers								
Aviation								
Marine								
CO_2 emissions from biomass								

Note :

HFC	**GWP**
R134a	1300
R404a(44%HFC32+52%HFC125+4%HFC134a)	3260
R408a(7%HFC132+46%HFC125+47%HFC134a)	2650
R407c(23%HFC32+25%HFC125+52%HFC134a)	1530
R507(50%HFC143a+50%HFC125)	3300
R410a(50%HFC32+50%HFC125)	1730

CHAPTER THREE

GENERAL STEPS TAKEN TO IMPLEMENT THE CLIMATE CHANGE CONVENTION

3.1 INTRODUCTION

During the last decade, the Mauritian economy has witnessed major challenges such as the dismantling of the Multi-Fibre Agreement, the phasing out of the Preferential Sugar Agreement with cuts in the guaranteed price, volatile energy prices and increasing food prices. Alternative development engines, such as the financial and tourism sectors, have a direct bearing on the implementation of the Convention as they are highly energy intensive and vulnerable to climate change and variability. Additionally, the country has experienced the impacts of climate change on different sectors of the economy with serious setbacks on the GDP growth and the welfare of the population. Recurrent climate change experienced at the local level include more intense cyclones, more frequent flash floods, prolonged and severe droughts and a more variable climate with consistent rainfall patterns coupled with higher temperatures. The impacts of climate change at the regional and international levels are being felt locally, namely, in terms of food security as about 70% of our food requirements are imported. As a result the development approach has changed in the last few years with emphasis on an urgent need to reduce dependence on imported food and to increase food security.

3.2 STEPS TAKEN OR ENVISAGED TO IMPLEMENT THE CONVENTION

Mauritius, as the first country to ratify the Convention, has upheld its commitments through the various steps that have been taken to implement the Convention to-date and the numerous actions envisaged for its further implementation in the short- and longer-terms within the country's development agenda.

The first action aimed at implementing the Convention was the drawing up of a *Climate Change Action Plan* in 1998 which highlighted the high vulnerability of the country to climate change as a SIDS. The Action Plan highlighted the importance of reducing GHG emissions and increasing the sink capacity towards achieving the major objective of the Convention, even if the country had no obligations to do so as a Non-Annex I Party.

A *National Climate Change Committee* was established under the chairmanship of the Prime Minister's Office to oversee the implementation of this Plan. However, the implementation of the Action Plan was undermined by various factors. The main ones were limited awareness and knowledge of the various key stakeholder groups on climate change, lack of studies quantifying the impacts on different sectors of the economy, limited financial means and human resources, and inadequate incorporation of climate change in the national development and planning processes. Nevertheless, the Plan paved the way for the mainstreaming of climate change issues in sectoral policies,

strategies and action plans. Further work such as the publication of the INC in 1999, the *Technology Needs Assessment in 2004* and the *National Capacity Self-Assessment* exercise in 2005 paved the way in promoting the climate change issues.

Presently, there is an ongoing initiative to integrate climate change into the sectoral plans and strategies under the *African Adaptation Programme (AAP)*, funded by the Government of Japan and implemented by the Ministry of Environment and Sustainable Development. This Ministry has also recently created a Climate Change Division to spearhead all activities associated with adaptation to climate change.

3.3 PROGRAMMES AND MEASURES TO MITIGATE CLIMATE CHANGE

3.3.1 Energy

The ***Long Term Energy Strategy 2009 - 2025*** was adopted in October 2009 with the target of meeting 35% of the energy demand through renewable energy sources by the year 2025. Concurrently, multitude options have been identified to improve energy efficiency at both the demand and supply side ends and the adoption of cleaner technologies with lower emission standards for fossil fuels that will still be utilised.

3.3.2 Transport

An array of 18 measures has been identified for implementation during the ***Mauritius Transport Consensus Forum of 2006***. Most of these aim at reducing traffic congestion which is one of the main causes of high level of CO2 emissions in this sector. The implementation of a bus modernisation programme for enhancing the quality of transport services is also being considered to encourage a shift from private to public transport.

3.3.3 Waste

Programmes addressing waste management concern both solid and liquid wastes. With regards to solid waste, the present system of landfilling will be upgraded to reduce emissions with the possibility of direct conversion to electricity or through methane produced during composting or gasification. Programmes concerning wastewater handling aim at increasing the sewered population to 50% of the households by the year 2020 while adopting more advanced treatment technologies. It is also anticipated to tap the methane and convert it to electricity to further displace fossil fuel.

3.3.4 Agriculture

Within the agriculture sector, the objectives of programmes are to reduce burning of agricultural residues and to promote their conversion to composts which can be used in lieu of inorganic fertilizers. Concurrently, manure management will be enhanced to reduce emissions.

3.3.5 LULUCF

The ***National Forest Policy, 2006*** spells out key activities to counter the major cause of climate change. The strategy includes measures to enhance sink capacity through better management of existing forests while reducing timber exploitation.

The Forest Land Information System (FLIS) was developed under the GEF Sustainable Land Management Project.

In addition, Mauritius is currently implementing the Land Administration, Valuation and Information Management System (LAVIMS) to address a number of disciplines, ranging from law, valuation, surveying, land registration and land planning.

3.3.6 Tourism

The ***Hotel Development Strategy*** aims at developing guidelines for adherence to Planning Policy Guidance (PPG) and for giving due consideration to eco-friendly and energy-saving practices by hotel promoters. The ***Tourism Development Plan, 2000*** sets as objective the establishment of Mauritius as a "Green Destination" by 2020.

3.3.7 Regulatory Framework

The ***Environment Protection Act 2002*** has been amended to provide, inter alia, for the setting up of a *Multilateral Environmental Agreement (MEAs) Coordinating Committee* to ensure better mainstreaming of all MEAs into sectoral and national policies. A review of all existing legislations within the framework of the preparation of the SNC revealed that several of these dating far back need to be updated to cater for the new challenges posed by climate change. In some cases, the legislations do provide for the necessary framework to deal with climate change but they are very often not enforced due to inadequate means. Government has planned to amend these to better address climate change and its impacts.

3.4 PROGRAMMES AND MEASURES TO FACILITATE ADAPTATION TO CLIMATE CHANGE

3.4.1 Risk Reduction and Preparedness

The ***National Environment Policy, 2007*** highlighted the importance of climate change to Mauritius. The objective of Government is to enhance preparedness of the country so as to address the impacts of extreme weather events, climate change and sea level rise and other environmental disasters. The national targets are to improve national and regional coordination for early warning systems, enhance the preparedness of the local population, prepare an integrated action plan to better respond and adapt to disasters and to set up a panel of experts for disaster management. Presently there exists a Disaster Management Committee under the chairmanship of the Prime Minister's Office which meets as and when necessary for pre- and post-event actions.

3.4.2 Agriculture

A Blueprint for a Sustainable Diversified Agri-food Strategy for Mauritius, 2008-2015 – addresses the food security through improving self-sufficiency status of a number of strategic crops in the short to medium term.

A Food Security Fund has been set up to increase the resilience of Mauritius towards food self-sufficiency and to face subsequent global food and feed crunches by increasing production of foodstuff locally and at the regional level by partnering with neighbouring countries. This will help to curtail the adverse effects of climate change. The Fund also provides funds for adaptation such as the *Food Crop Insurance Scheme and Sheltered Farming.*

In Rodrigues, it is planned to rehabilitate some 100 ha of abandoned agricultural lands and to set up irrigation facilities.

3.4.3 Water resources

An assessment of the impacts of climate change on the water sector has been conducted and measures for a more efficient use of this finite resource have been drawn up. Cost–benefit analyses will be made for appropriate adaptation measures by the end of 2011 under AAP. A ***Master Plan Study*** for the development of water resources is being drawn up. This will take into consideration impact studies of climate change on the sector.

3.4.4 Coastal zone and tourism

A study for the Development of an ***Integrated Coastal Zone Management*** (ICZM) Framework has been completed with the objectives of:

- Developing an ICZM Strategy for Mauritius;
- Reviewing and Preparing a National Policy and Comprehensive Legislative Framework; and
- Preparing ICZM Area Plans for Pressure Zones in Mauritius.

3.4.5 Fisheries

The ***Fisheries Development Plan, 1998*** highlighted the precarious status of artisanal fishery as a result of direct and indirect adverse effects of climate change on the marine ecosystems of the lagoon. An ***Aquaculture Master Plan*** has been prepared in addition to encouraging bank fishing as` well as promoting exploitation of pelagic fishes as alternatives.

3.4.6 Biodiversity

The ***National Biodiversity Strategy and Action Plan, 2006-2016*** recommends the development of an ICZM plan and the study of Environment Sensitive Areas towards

protecting biodiversity. Additional measures include increasing the area of coastal wetlands and mangroves, and to include 10% of Mauritian terrestrial area within the Protected Area Project.

The Ministry of Environment and Sustainable Development has developed a framework for the *Environment Sensitive Areas which has been adopted by Government.*

3.4.7 Health

The ***Country Paper and the Health sector, 2006*** does not specifically address the issue of climate change with regard to the health sector. However, some of the identified measures will help to cope with these issues such as further strengthening the on-going surveillance system for the control of communicable diseases. The on-going intensive island-wide vector control programme will be maintained and strengthened. Surveillance programmes at the port and airport will be consolidated.

3.5 REPORTING INVENTORY AND NATIONAL COMMUNICATIONS

The SNC is being completed 10 years after the submission of the INC to the UNFCCC in 1999. Almost all the experts who were involved in the preparation of the INC were no longer available to contribute in the SNC. Thus the preparation of the SNC suffered from a severe lack of capacity for meeting the reporting requirements of the Convention. Additionally, the country has not undertaken studies and assessments relating to mitigation and adaption to climate change for inclusion in the SNC. On the other hand, the framework for the preparation of the inventory on an annual basis has been developed and since the year 2000, an inventory has been compiled and published in the Digest of Environmental Statistics. These inventories have been prepared using the sectoral approach at the Tier 1 level. Thus, it was a fresh start for most of the sectoral experts being exposed to climate change considerations with regards to their activities for the first time.

Taking into consideration the present and future importance of climate change in the socio-economic development agenda, the institutional set-up comprised a wide group of stakeholders from the public and private sectors, including civil society organizations. The Mauritius Meteorological Services led the process with the support of nominees from the various Ministries and parastatal bodies, from the academia, NGOs and CBOs whose activities have a direct bearing on climate change, members.

Expert teams each with a Leader covered the following thematic areas.

- National Circumstances
- GHG Inventory
- Steps taken to implement the Convention
- Vulnerability and Adaptation
- Mitigation
- Education, Training and Public awareness
- Research and Systematic Observation; and

- Others steps, namely Integration of Climate Change within Development, Technology Transfer, Capacity Building, Information and Networking, and Gaps, Constraints and Needs.

A mix of the top-down and bottom-up approaches was adopted. The former approach enabled national policies, strategies and plans to be analysed in an appropriate manner while the bottom-up approach allowed for basic information pertaining to the impacts of climate change on the various segments of the population to be obtained as well as evaluation of their degree of awareness and preparedness to cope with climate change within their daily activities.

With regard to the GHG inventory which covered the period 2000 to 2006, a similar arrangement was adopted with the expert groups dealing with the different source categories and sub-categories. Compilations were done using IPCC Guidelines at Tier 2 level fully or partially. An accompanying report to be submitted with the SNC, the *National Inventory Report*, has been prepared to enable presentation of the extensive exercises undertaken.

Some of the lessons learned and to be taken into consideration in the future preparation of GHG inventories and National Communications are:

- Constitute a pool of National experts to work on NC preparation;
- Maintain climate change activities between submissions of NCs to ensure continuity; and
- Ensure a wide participation of stakeholders in the process.

CHAPTER FOUR

MITIGATION

4.1 INTRODUCTION

The Republic of Mauritius, a SIDS and developing country, forming part of the Non-Annex I group of Parties, has no obligation as a signatory to the Convention to reduce its greenhouse gas emissions. However, within its sustainable development agenda and the goodwill to contribute towards meeting Article 2, the ultimate objective of the Convention, namely the *stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*, Mauritius has embarked on mitigation for more than a decade now. This chapter presents the main measures adopted as well as additional options that have been evaluated within the different emitting source categories.

On the basis of the NIR, the energy sector came out as the sector emitting most of the GHGs with 64% of total national emissions, shared mainly by the electricity generation (44.2%) and transport (31.7%) sub-sectors in the year 2000. The waste sector came next with 27.7% of national emissions. The assessment addressed these sectors because of their strong abatement potential as well as the agriculture and LULUCF sectors, in-line with the Government's sustainable development agenda to preserve a healthy and natural environment.

4.2 IMPLEMENTED MITIGATION MEASURES

Since the year 2000, various measures have been adopted at country level with a view to fostering sustainable development. The main mitigation measures that have been implemented include:

- Shift to energy-efficient appliances;
- Energy efficiency in buildings, electrical domestic appliances;
- Promotion of solar water heaters through financial incentives;
- Installation of four wind turbines in Rodrigues;
- Flaring of Landfill gas;
- Partial replacement of sodium vapour lamps for street lighting with energy saving lamps;
- Setting-up of endemic gardens in schools to enhance sink capacity and promote awareness;
- Planting of mangroves as sink to CO2;
- Initiation of an afforestation and tree planting campaign;
- Phasing out of HFCs and PFCs;
- Replacement of household incandescent bulbs with energy saving lamps; and
- Increasing the energy conversion efficiency of bagasse

Other measures that have been identified and that will be implemented shortly include:

- Encouraging the use of Hydrocarbon refrigerators and domestic air conditioners;
- Energy auditing in the industrial activities;
- Implementation of measures to alleviate road decongestion;
- Introduction of the ECO-Village concept;
- Partial solid waste recycling and composting;
- Taxation on car emissions and promotion of the use of ethanol as fuel;
- Increasing the energy efficiency in hotels and restaurants; and
- Introduction of energy-efficient buses.

4.3. THE ASSESSMENT

4.3.1 Base year and Baseline scenarios

The year 2000 has been adopted as the base year for the assessment in all sectors except the LULUCF sector. In the latter case, year 2001 was adopted because year 2000 was characterized by abnormally high emissions generated through the conversion of 300 ha of forest land into a dam. A set of options was then evaluated for their emission reduction potential when compared to the baseline or business-as-usual (BAU) scenario with no mitigation measure adopted within that sector. The assessment was made up to the 2040 time horizon with emissions calculated for decadal periods in, 2020, 2030 and 2040. When working out the emissions up to the 2040 time horizon, projections for demographic growth, GDP growth and other factors such as standard of living, welfare and wealth were taken into consideration in the projections in the various socio-economic sectors and the resulting emissions. The development plans and strategies of Government were also taken into account in the workings within each sector.

4.3.2 Multi-criteria analysis

After having assessed the GHG mitigation potential of a range of selected options within each subsector, a multi-criteria analysis was performed in order to assess the suitability and feasibility of adoption within the local context for each option. This was an important component of the assessment since an option may have the highest emission reduction potential but yet has no chance of being adopted because of specificities within the local context. The multi-criteria analysis took on board such specificities and ranks the option most feasible to be adopted first. Each criterion was subdivided into a set of sub-criteria and the weight allocated was based on their pertinence for adoption for mitigation **(Table 4.1)** in the Republic. The scale of assessment ranged from one to five with five being the most probable level of adoption. The assessment was performed by a group of persons with different backgrounds.

Table 4.1 – Mitigation assessment criteria with their respective weight (on a scale 1 to 10 in brackets)

Climate Change and Environmental Impacts (3.5)	Socio-Economic Factors (3.0)	Financial Factors (2.0)	Other Factors (1.5)
Mitigation potential	Social acceptability	Costs implications	Land requirement
Sustainable resource use	Cultural acceptability	Commercial availability	Legislation needs and/or enforcement
Environmental benefits	Employment benefits	Affordability	Capacity-building needs
	GDP growth potential	Investment sustainability	Durability/ Scale of utilization
	Market penetration		Incentives

4.4 MITIGATION ANALYSIS

4.4.1 Energy (Electricity Generation)

Electricity generation is the major contributor of GHG emissions and accounted for 21.0% of total national emissions and 44.2 % of the energy sector in the year 2000.

Electricity is the form of energy that sustains the safe and continuous socio-economic development of the country. With no source of fossil fuels, Mauritius has relied on imported fossil fuels to secure its energy requirements but has always explored renewable resources. In fact, the country has used bagasse, a biomass feedstock, for electricity generation as from the 1960s and all sites amenable to hydro-power generation have been exploited.

Power generating plants are owned by the public utility company, the Central Electricity Board (CEB), and private companies, the Independent Power Producers (IPPs). The plants of the CEB run mainly on Heavy Fuel Oil (HFO) with a few hydro plants and a gas turbine plant running on Jet A1 Kerosene to meet the peak demands. Those of the IPPs are mostly cogeneration plants burning bagasse during the sugarcane harvest season and coal during the intercrop.

4.4.1.1 Business-As-Usual scenario in the Electricity sector

The bottom-up approach has been used for forecasting the energy demand and entailed the use of population forecasts and sectoral outlooks to project "stock" in the form of household formation, commercial and industrial infrastructure & entities, which generates the need for electricity. The **Box-Jenkins ARIMA model** was used to determine both the number of customers and the specific consumption.

Energy demand forecasts were based on criteria such as current level of electricity sales, peak demand (MW), end-users consumption behaviour, level of economic development, demographic rates and technological advances amongst others. The energy forecasts (GWh) were then adjusted to take into account the network (transmission and distribution) losses, and the internal consumption of the different power plants to match the generation capacity (MW) to the demand.

The yearly peak demand forecast was derived from the energy sent-out while assuming a network loss of 9.0% as from 2020. In order to decide on the generation plan for the different forecast horizons, the technology to be adopted and the capacity to be installed have to be identified. These were derived from an analysis of the load duration curves (the number of hours over a year whereby the demand was above a certain specific value) for the period 2002 to 2008. The resulting base load, semi-base load and peak load were about 150 MW, 180 MW and 50 MW respectively. Based on the load forecast data the technology that will be required for the short-, medium- and long-term was identified. The other essential aspect considered in the generation plan is the timing to ensure that the new generator will be available on time to meet the forecasted demand. Therefore, planning to erect a power plant should be done years in advance so that demand can be met in future. These rules were adopted to select the best generation technology.

The forecasts for the BAU scenario were based on the consumption trends of the period 2000 to 2008 and considered the present Government policy, the above technical criteria and the least cost option. The Spreader Stoker technology has been replaced by the Pulverised Coal one for the replacement of the old plants. The forecast fuel mix up to the 2040 horizon is given in **Table 4.2.**

Table 4.2 - Projected fuel mix under BAU scenario

		2000	2020	2030	2040
Energy Demand	**GWh**	**1 778**	**3 132**	**3 926**	**4 675**
Energy Peak Demand	**MW**	**283**	**577**	**751**	**925**
Renewable (Hydro + Bagasse)	**%**	**23.6**	14.4	11.2	3.0
Coal Spreader Stoker	**%**	**20.9**	30.4	13.3	0.0
Heavy Fuel Oil	**%**	**55.0**	29.4	30.7	28.8
Coal Pulverised	**%**	**0.00**	25.5	44.4	67.9
Kerosene (Gas Turbine for peaking)	**%**	**0.5**	0.3	0.4	0.3

The share of pulverized coal more than doubles in 2040 with the concurrent phasing out of the Spreader Stoker technology with that of HFO remaining constant. A gradual shrinking of the share of renewables from 14.4% in 2020 to 3% in 2040 is expected because of the reduction in bagasse production from reduced area under sugarcane. Emissions are thus projected to increase from 1 024 Gg CO_2-eq for the base year 2000 to 2 750, 3 164 and 3 985 Gg CO_2-eq in the year 2020, 2030 and 2040 respectively.

4.4.1.2 Mitigation scenarios in the Electricity sector

Mitigation can be achieved in two ways within the electricity sector, namely by improving energy efficiency and switching to less carbon-intensive fuels. Improving energy efficiency reduces the energy used without reducing the level of service. Energy efficiency improvements include improving equipment for power generation, phasing out of older power plants, shifting towards use of pulverized cleaner technologies, reducing transmission and distribution losses, and conversion of landfill gas to electricity. Renewable energy sources such as wind, solar and hydro have no direct carbon content

and offset fossil fuel with significant emission reductions. Five mitigation options were assessed.

a) *Wind Energy:* Electricity from wind farms is projected to substitute coal and HFO to occupy a share of 6%, 12% and 18% of the fuel mix by the 2020, 2030 and 2040 time horizons, respectively.

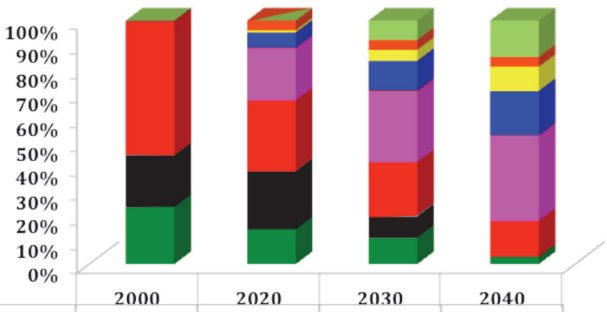
b) *Solar Energy:* Solar energy also has been projected to substitute fossil fuels coal and HFO to the level of 1%, 5% and 10% of the national fuel mix as from the year 2020 over periods of a decade.

c) *Solid Waste-to-Energy:* Mauritius caters for its solid waste by disposing them in a single landfill which is rapidly nearing its full capacity. Waste incineration represents an alternative but is linked with environmental problems since there is no segregation at source. It is projected that this option will contribute a share of about 4% over the timeframe 2040.

d) *Adoption of Geothermal Energy:* Geothermal energy has been identified in the longer term as one of the potential sources of renewable energy to replace fossil fuels. The preliminary estimates are made on the basis of a share of 8% in 2030 and 15 % in 2040.

e) *Improvement in the Transmission and Distribution system:* Improvement in the Transmission and Distribution system can potentially reduce losses of electricity and eventually reduce emissions. The network is presently being operated at 66 kV. Upfront major investments have been made to upgrade the network to 132 kV in the future. For the assessment period, the line losses have been reduced from the present 9.7 % to 9 % as from the year 2020.

The projections for energy mix were associated with a reduction in the share of HFO and the replacement of Stoker Coal by the more efficient pulverized coal technology **(Figure 4.1)**. The penetration of renewables into the electricity mix is expected to increase to reach 50% by 2040 from the 23.6 % in the year 2000.



	2000	2020	2030	2040
Geothermal	0	0	8	15
Solid waste	0	4	4	4
Solar	0	1	4.6	10
Wind	0	6	12	18
Kerosene (Gas Turbine)	0.5	0.3	0.4	0.3
Coal Pulverised	0	21.5	29.2	35
Heavy Fuel Oil	55	29.3	22.6	14.7
Coal Spreader Stoker	20.9	23.5	8.2	0
Renewable (Hydro + Bagasse)	23.6	14.4	11	3

Figure 4.1 - Projected fuel mix under mitigation scenarios

4.4.1.3 Emissions with Mitigation scenarios in Electricity Generation sector

The offsetting of fossil fuels by wind energy will result in emission reductions of the order of 221 Gg CO_2-eq in 2020, 415 Gg CO_2-eq in 2030 and 765 Gg CO_2-eq in 2040 while emission reductions from the adoption of solar energy will range from 18 Gg CO_2-eq in 2020 to 405 Gg CO_2-eq in 2040 **(Table 4.3** and **Figure 4.2)**. Waste-to-Energy can potentially reduce GHG emissions by 118 Gg CO_2-eq in 2020, 153 Gg CO_2-eq in 2030 and 161 Gg CO_2-eq 2040. Geothermal would contribute to a reduction of 282 Gg CO_2-eq and 593 Gg CO_2-eq by the year 2030 and 2040 respectively. A 1% reduction in transmission would reduce GHG emissions by the order of 0.02%. The estimated reduction in 2040 is 47 Gg CO_2-eq.

All the measures within the electricity generation sector when added up have the potential of reducing national emissions by 1971 Gg CO_2-eq by the year 2040. This will represent nearly 50% emission reductions compared to the BAU scenario. It will also correspond to the BAU level of the year 2010.

Table 4.3 - Projected emissions and reductions (Gg CO2-eq) for mitigation options in the Electricity Generation sector

OPTION	DESCRIPTION	EMISSIONS (Gg CO_2-eq)			Emission Reductions (Gg CO_2-eq)		
		2020	2030	2040	2020	2030	2040
BAU	BUSINESS-AS-USUAL	2 750	3 164	3 985			
1	Wind	2 529	2 749	3 220	221	415	765
2	Solar	2 732	2 992	3 580	18	172	405
3	Waste-to-Energy	2 632	3 011	3 824	118	153	161
4	Geothermal	2 750	2 882	3 392	0	282	593
5	Transmission losses	2 739	3 131	3 938	22	33	47
	TOTAL	2 371	2 109	2 014	379	1 055	1 971

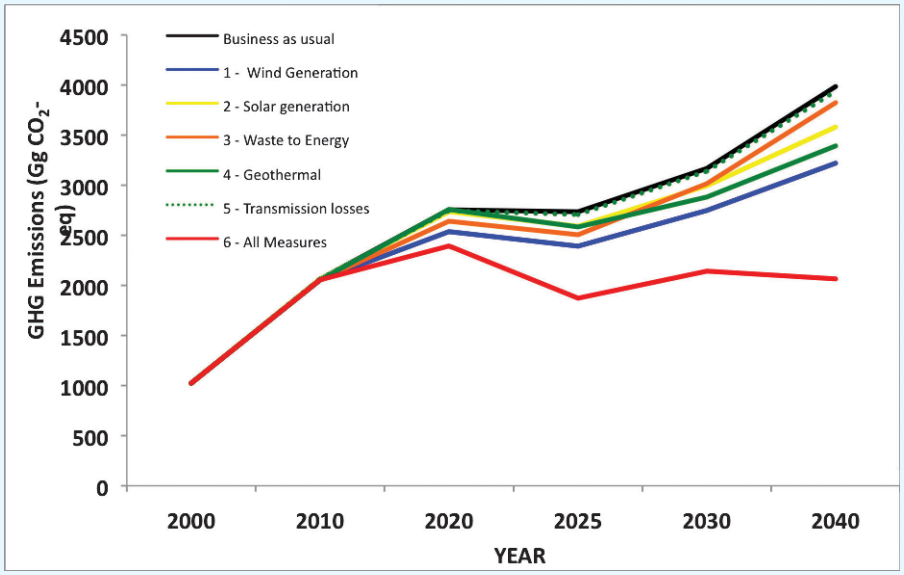


Figure 4.2 - Emission under different mitigation options in the Electricity Generation sector
(The numbers in the legend refer to the Options in Table 4.3)

4.4.1.4 Multi-Criteria Analysis in Electricity Sector

The different options presented, while having their own merits and disadvantages, are promising. The timeframe identified for adoption is believed to be realistic and have taken into consideration further development of the technologies and their availability on the market at competitive prices. In the case of Mauritius, it is believed that there is a need to resort to the diverse promising measures for ensuring energy security and sustainable development.

The results of the MCA are given in **Table 4.4.** When taking into consideration other factors in addition to the emissions reduction potential, the future very clean geothermal tops the list. It is closely followed by both solar and wind with the same rating. Waste to energy comes last as the population is risk aversive and not prone to the adoption of a technology that may pose risks for the health.

Table 4.4 - MCA score for mitigation options in Electricity Generation category sector

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	Improvement in transmission efficiency	1.00	4.05	2.74	3.48	3.17	**3.04**
2	Waste-to-Energy	2.00	2.80	2.38	2.65	2.77	**2.55**
3	Solar	3.00	4.75	3.32	3.13	2.85	**3.39**
4	Geothermal	4.00	4.45	3.86	2.95	3.57	**3.74**
5	Wind	5.00	4.55	2.96	3.20	2.77	**3.39**

4.4.2 Transport

The transport sector contributed 23% of energy-related CO_2 emissions in the year 2000 and is the activity area with the fastest growing GHG emissions.

4.4.2.1 Business-As-Usual scenario in Transport sector

In the baseline scenario, it is assumed that transport activities will evolve in the same pattern as that of the base year in terms of fleet mix, modal share, age and engine cohorts, fuel type, fuel intensity and after treatment emission technologies. Passenger and freight mobility has been worked out using historical data to derive the relationship between GDP and population growths for up to the 2040 horizon. The mobility forecast was then used to obtain the fleet vehicle evolution using the parameters of 2006 as constants.

Up to the year 2040, a 3-fold increase is projected for the vehicle fleet. Emissions are projected to rise from 692 Gg CO_2-eq for the base year 2000 to 899 Gg CO_2-eq in 2020, 1 615 Gg CO_2-eq in 2030 and 2 137 Gg CO_2-eq in 2040 for the Business-As-Usual scenario, i.e. an average annual growth of 3.9%.

4.4.2.2 Mitigation scenarios

The mitigation options considered are those which are most likely to be implemented in the short and medium term and which will have direct impacts on GHG emissions. These options are:

(i) ***Improved Vehicle Technical Efficiency:*** Under this option, two improvements are foreseen, namely,

- *Improved Energy Intensity:* Improvements in energy intensity for developing countries have been found to be from 1.5 – 2.5% per year. Within our context and taking into account the fact that a significant portion of the fleet will be old ones due to the absence of a scrapping policy. The fleet-average fuel intensity improvement of 1.0% has thus been adopted up to 2020 and 1.5% onwards.
- *Improved Emission after Treatment Control Technologies:* With regard to after treatment emission technologies, the same types used in the computation of the inventory has been applied for vehicles to be registered up to the year 2020. Thereafter all gasoline vehicles have been assumed to have efficient 3-way catalytic system. The same assumption has been made for diesel driven vehicles and all those registered after 2020 have been considered to be fitted with advance emission control technologies.

(ii) ***Switch to Fuel with Lower Emissions***

- *Use of Ethanol:* Ethanol has been successfully tested on a few gasoline cars. Mauritius has a potential to produce about 20 M litres of ethanol leading to 200 M litres of E10 mixture. It is assumed that by 2020 ethanol blended gasoline in the form of EI0 will be commercialized and that up to the 2030 horizon, market penetration of EI0 would be around 10% and increase to 20% after 2030. The use of EI0 has the potential to reduce CO2 emissions by 4%, hydrocarbon emissions by 5% and carbon monoxide by 17%.
- *Liquefied Petroleum Gas:* During the last 10 years, the LPG fleet grew by about 0.3%. Because engine corrosion problems and the rise in the price of LPG to almost the same as that of gasoline, the same growth rate has been assumed up to the 2040 time horizon.
- *Hybrid Vehicles:* The market penetration of these vehicles has been insignificant to -date in spite of given incentives. Thus, the progress in number of hybrid vehicles has

been assumed at 2.0% annually after 2020.

(iii) *Improvement in System Efficiency*

This option consists of improvement in road infrastructure to ease up acute traffic congestions. A significant investment programme has been launched and new roads to improve North/South and East/West traffic as well as a bus lane are under construction to render public transport more attractive. A bus modernization programme is also envisaged with the same objective. Completion of these projects by the year 2020 will lead to a 40% improvement in the traffic flow. The consequent reduction in fuel consumption is estimated to be around 10% as from 2020.

(iv) *Improvement in Vehicle Inspection and Maintenance*

The present plan is to privatise vehicle inspection and centres are expected to be fully equipped to ensure inter alia that vehicles are properly maintained and prescribed emission standards are fully complied with. This measure will result in lower emissions. Full implementation is projected to bring a 5% reduction in GHG emissions from both diesel and gasoline driven vehicles as from 2015.

(v) Increase In Vehicle Load Factor

The load factor of cars and buses is presently 0.4 and 1.2. That of freight vehicles is 0.5 on account of their empty back hauling. With the policies and projects in the pipeline, it is assumed that as from 2020, 15% of those attending work in the capital city will shift to public transport and that this share will increase to 20% as from 2030. Consequently, the load factor of buses will increase and some 7500 and 10,000 private vehicles will not operate daily within the latter time horizons. The load factor of private cars is also assumed to rise to 0.5 by 2020 and to 0.6 as from 2030. These changes will bring commensurate reduction in fuel consumption.

With regards to freight vehicles, the load factor is assumed to increase to 0.6 as from 2020 and to 0.7 as from 2030 through better planning. Relevant changes in fuel consumption foreseeable on account of changes in the activity level in the sugar sector, namely a reduction in the area under cultivation shrinking by about 27% by 2020, 32% by 2030 and 36% by 2040 from the year 2000 level.

(vi) *Light Rail Transit System*

The introduction of a light rail transit system on the main traffic corridor has been on the agenda for more than a decade. Emissions of CO_2 from that mode can only be meaningfully worked out on the basis of a complete fuel cycle analysis. The latter will

be calculated in the next reporting exercise when all required data are expected to be available.

4.4.2.3 Emissions with Mitigation scenarios in Transport sector

The reduction of emissions (Gg CO_2–eq) of the different options assessed in the road transportation sector up to the 2040 horizon is given in **Table 4.5**. The measure with the highest mitigation potential is in the Improvement in system efficiency area with 137 Gg CO_2–eq in 2020. This amount is projected to increase to 222 Gg CO_2–eq and eventually 295 Gg CO_2–eq by the year 2040. The total reduction in emissions through the successful implementation of all the measures is projected at 252, 400 and 534 Gg CO_2–eq at the 2020, 2030 and 2040 time horizons respectively. This represents 36%, 58% and 77% of the road transport emissions of the baseline emissions of the year 2000 in the year 2020, 2030 and 2040 respectively.

Table 4.5 - Projected GHG emissions (Gg CO2-eq) from mitigation options in Transport sector

OPTION	DESCRIPTION	GHG EMISSIONS (Gg CO_2-eq)			GHG Emissions reduction (Gg CO_2-eq)		
		2020	2030	2040	2020	2030	2040
B-a-U	**BUSINESS-AS-USUAL**	1 213	1 614	2 136			
1	**Switch to fuel systems with lower emissions**	1 210	1 605	2 126	3	9	10
2	**Increase vehicle load factor**	1 211	1 586	2 096	2	28	40
3	**Improve vehicle inspection & maintenance**	1 162	1 549	2 050	51	65	86
4	**Improvement in technical efficiency**	1 154	1 538	2 033	59	76	103
5	**Improve system efficiency**	1 075	1 392	1 841	137	222	295
	Total				252	400	534

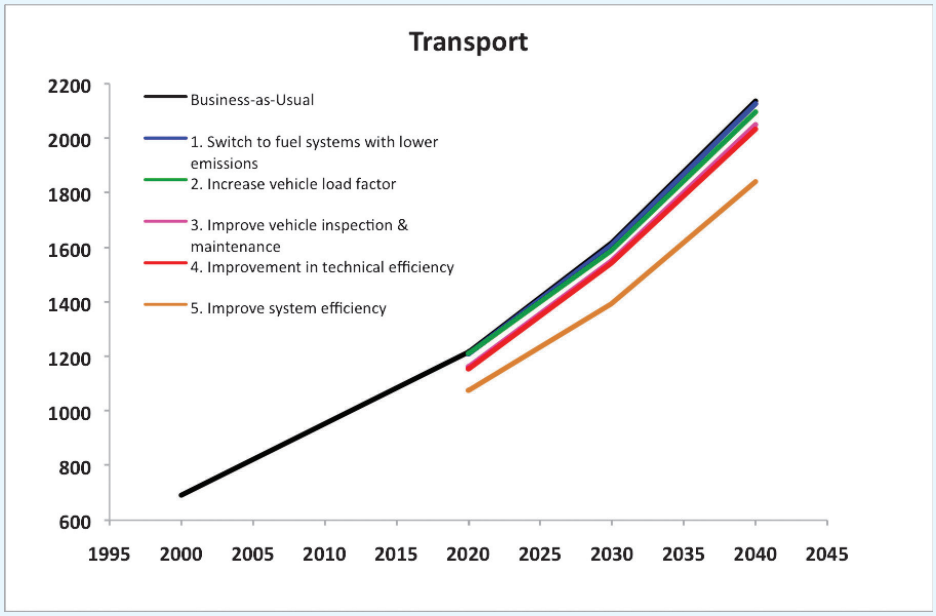


Figure 4.3 - Emission reduction with different options in the transport sector

(The numbers in the legend refer to the Options in Table 4.5)

4.4.2.4 Multi-Criteria Analysis of Mitigation Scenarios in Transport Sector

The measures embedded within the renewal of the fleet, namely technological improvement, leads the series of measures. It's penetration on the market is guaranteed compared to measures where the population will have to directly bear the cost such as improvement in vehicle maintenance or switching to lower emission fuels and change its cultural habits such as increasing the load factor of vehicles. This situation is expected to evolve rapidly as market prices and other economic and financial factors come into play in the near future.

Table 4.6 - MCA score for mitigation options in Transport sector

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	**Switch to fuel systems with lower emissions**	1.00	3.33	2.56	3.50	2.84	**2.81**
2	**Increase vehicle load factor**	2.00	3.56	1.97	4.26	3.89	**2.92**
3	**Improve vehicle inspection & maintenance**	3.00	4.00	2.78	3.23	3.40	**3.20**
4	**Improve technical efficiency**	4.00	4.00	3.28	4.14	3.67	**3.71**
5	**Improve system efficiency**	5.00	2.00	3.56	3.03	3.22	**3.34**

4.4.3 Agriculture

The share of agriculture in the total national emissions was 5.6% in 2000 and the importance of mitigation in this sector will be of minor significance. However, agriculture will be maintained for socio-economic and food security considerations. Accordingly, an intensification of the production system is expected and waste (predominantly from livestock production) disposal will have to be addressed. Emission reductions would result from the reduction in the volume of pre-harvest burning of agricultural residues, reduction in synthetic fertilizer use and generation of electricity from manure management.

4.4.3.1 Business-As-Usual scenario in Agriculture sector

The different policy documents of the Government were used to project cropping area, fertilizer use and livestock population. Emission factors and assumptions made in the computation of the Inventory were used to project the emissions for the 2020, 2030 and 2040 time horizons.

4.4.3.2 Mitigation scenarios in Agriculture sector

a. Reduction in Field-burning of Agricultural Residues

This option consisted of reducing the area over which field burning of agricultural residues is practiced from the present 10 % to 5%.

b. Abandonment of Cultivated Land

Sugarcane cultivation, being no longer economically profitable on substantial areas and with no immediate alternative as to their immediate occupation, it is projected that 5000 ha of sugarcane land will be abandoned. Emissions reductions will be associated with lower emissions from decrease in the use of synthetic N fertilizers, field burning of agricultural residues and use fuel for infield agronomic practices.

c. Electricity Production from Farm Manure

Presently, manure from the pig is disposed of as liquid slurry while manure from the remaining farm animals (cattle, sheep and goat) are stacked in piles and then disposed of as farmyard manure. This option consisted of anaerobic digestion of 100% of the slurry from pig production and 60% of the manure from the remaining animal production using a digester efficiency of 75%. The recovered CH4 is then used for electricity generation, thus displacing emissions from fossil fuel.

4.4.3.3 Emissions with Mitigation scenarios in Agriculture sector

The projected emissions under BAU increased from 235 for the base year 2000 to 250 Gg CO_2-eq in 2020, 259 Gg CO_2-eq in 2030 and 262 Gg CO_2-eq in 2040 **(Table 4.7)**. The magnitude of increase from the BAU is projected to be only 12 Gg CO_2-eq by the 2040 horizon and is explained by the fact that reductions in emissions stemming from decrease in sugarcane area is nearly balanced by the increased emissions from development in other agricultural sectors to guarantee food security.

OPTION	DESCRIPTION	GHG EMISSIONS (Gg CO_2-eq)			Emissions reduction (Gg CO_2-eq)		
		2020	**2030**	**2040**	**2020**	**2030**	**2040**
B-a-U	**BUSINESS-AS-USUAL**	**250**	**259**	**262**			
1	Reducing Field burning of Agricultural Residues	238	247	251	12	12	11
2	Abandonment of cultivated land	243	250	253	7	9	10
3	Electricity generation from farm manure	239	246	248	10	10	10
	Total	**221**	**228**	**231**	**29**	**31**	**31**

Table 4.7 - Projected emission reductions (Gg CO_2-eq) in the Agriculture sector

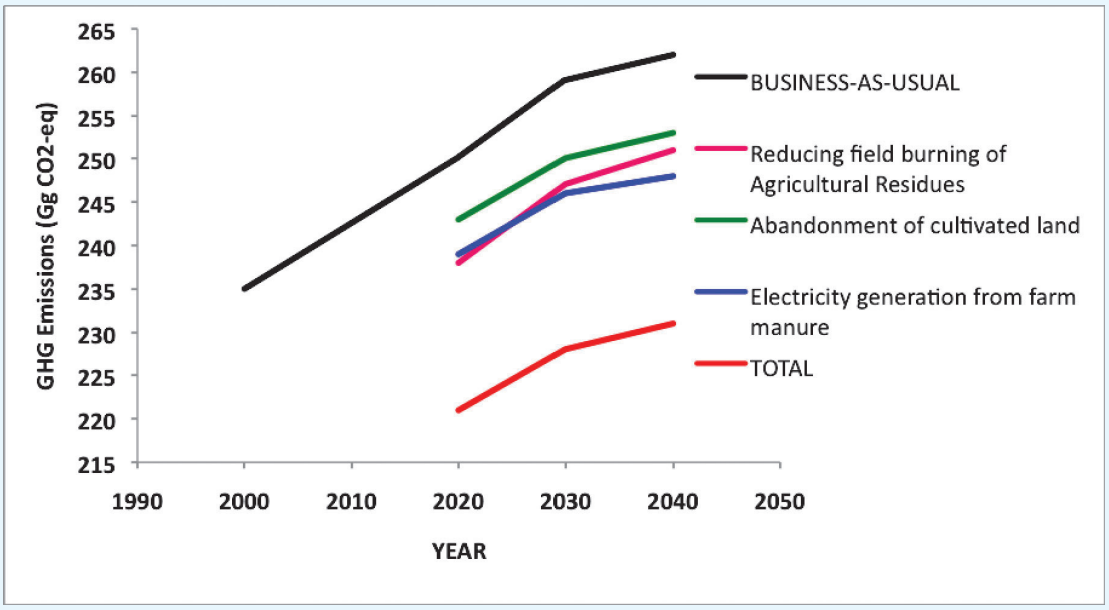


Figure 4.4 - Projected GHG emissions (Gg CO_2-eq) from BAU and mitigation options

4.4.3.4 Multi-Criteria Analysis of Mitigation scenarios in Agriculture sector

Based on the score from the MCA **(Table 4.8)**, the option consisting of reducing field burning of agricultural residues is the most attractive one. Anaerobic digestion of manure from farm animals obtained the least score since it is associated with high investment costs and logistics constraints.

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	Reduce field burning of Agricultural Residues	4.00	4.25	3.19	3.50	2.46	**3.45**
2	Abandonment of cultivated land	3.00	5.00	3.42	2.33	2.65	**3.14**
3	Electricity generation from farm manure	1.00	3.94	2.25	3.00	2.80	**2.75**

Table 4.8 - MCA score for mitigation options in Agriculture sector

4.5 LULUCF

During the period 2000-2006, forests accounted for the removal of about 4% of the national emissions. Further mitigation potential exists through measures to cease converting forests to other uses and increasing the sink capacity through afforestation

and reforestation.

The following mitigation options have been implemented during period 2000-2006:

- Reforestation of about 770 hectares of state forest lands including some 20 hectares of degraded mountain slopes, which represent more than 1 million new trees.
- Some 100,000 tree and ornamental seedlings have been planted under the National Tree Planting Campaign.
- Reduction in the volume of timber exploited.

4.5.1 Business-As-Usual scenario in LULUCF sector

The sink capacity of the LULUCF sector has been slowly decreasing over the years on account of forest degradation and the conversion of some forest lands to other uses. Projections were based on the recent 2000 to 2008 trend and policy documents as they have more reliable data.

Under the Business-as-Usual scenario, net CO_2 removal decreased from 218 Gg CO_2-eq in the base year 2001 to 179 Gg CO_2-eq in 2020, 156 Gg CO_2-eq in 2030 and 114.88 Gg CO_2-eq in 2040 **(Table 4.2).**

4.5.2 Mitigation options in LULUCF Sector

Mitigation strategies should on the one hand minimize GHG emissions and on the other increase removals. The largest short-term gains are always achieved through mitigation activities aimed at emission avoidance (e.g. reduced deforestation and degradation, fire protection). But once an emission has been avoided, carbon stocks will be merely maintained or increased slightly. In contrast, the benefits of afforestation accumulate over the years to decades. The options available are:

- Maintaining or increasing the forest area through combating deforestation and land degradation and through afforestation/reforestation; and
- Maintaining or increasing the stand level carbon density (t C per ha) through tree planting, tree improvement or other appropriate silvicultural techniques.

a. *Conversion of Cropland to Forest Land*

This mitigation option consists of the conversion of 5,000 ha of abandoned sugarcane land to Forest land, in successive stages; 1 000 ha by 2020, an additional 2 000 ha by 2030 and the remaining 2 000 ha by 2040.

b. *Combating deforestation and land degradation*

This scenario includes measures to prevent emissions caused by deforestation & land degradation, and to increase carbon stocks through rehabilitation of poorly-stocked forest lands and the use of suitable tree species that have greater sequestration potential.

4.5.3 Emissions with Mitigation scenarios in LULUCF sector

The afforestation of 5 000 ha of abandoned sugarcane lands will result in an increase in net removals of 8.3%, 27.6% and 52.2% in 2020, 2030 and 2040 respectively compared to the business-as-usual scenario.

The option of combating deforestation and land degradation will contribute to an increased estimate of 35.0 %, 57.0% and 106.9% in 2020, 2030 and 2040 respectively of the business-as-usual emissions.

The projected total increase in net removals are 78 Gg CO_2-eq (43.3%), 132 Gg CO_2-eq (84.6%) and 183 Gg CO_2-eq (159.1%) at the 2020, 2030 and 2040 time horizons respectively, compared to the BAU scenario.

Table 4.9 - Projected GHG emissions (Gg CO_2-eq) from mitigation options in LULUCF

OPTION	DESCRIPTION	GHG EMISSIONS (Gg CO_2-eq)			Change in GHG Emissions (Gg CO_2-eq)		
		2020	**2030**	**2040**	**2020**	**2030**	**2040**
B-a-U	**BUSINESS-AS-USUAL**	-180	-156	-115			
1	Conversion of Cropland to Forest Land	-195	-199	-175	-15	-43	-60
2	Combating deforestation and land degradation	-243	-245	-238	-63	-89	-123
	TOTAL				**-78**	**-132**	**-183**

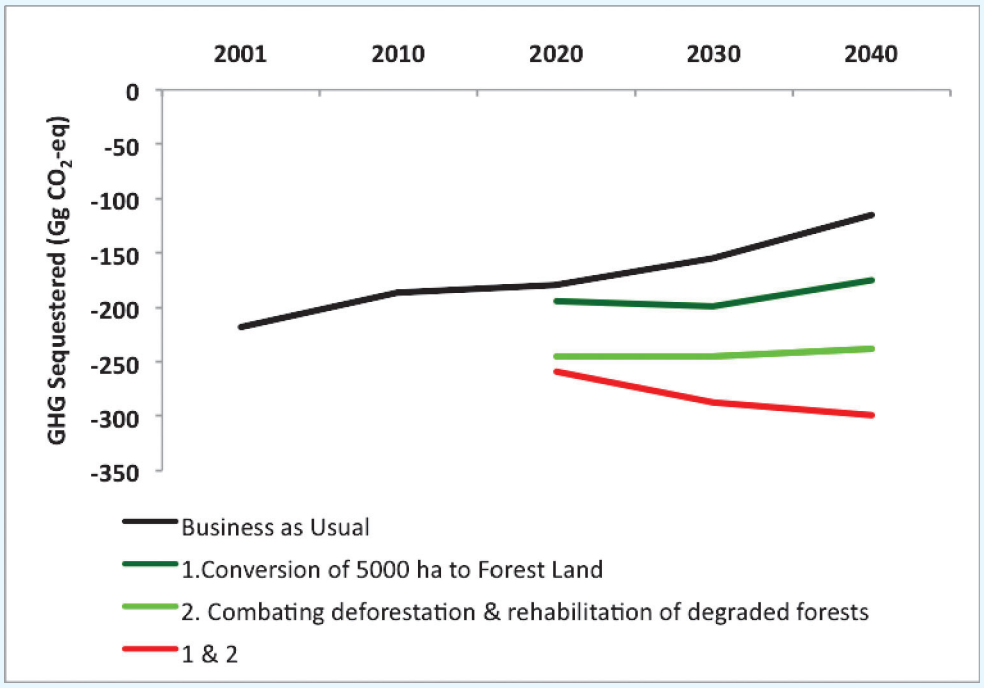


Figure 4.5 - Projected GHG sequestration with mitigation options in the LULUCF sector

(The numbers in the legend refer to the Options in Table 4.9)

4.5.4 Multi-Criteria Analysis of Mitigation Scenarios in LULUCF Sector

The MCA score of the two options are more or less equal **(Table 4.10)**. These options rank high in terms of environmental and socio-economic benefits. The financial implication is very high for option 1. The establishment and maintenance of 1 ha of forest plantation is around Rs 100,000.

Table 4.10 - MCA score for mitigation options in LULUCF sector

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	Conversion of Cropland to Forest Land	2.00	5.00	3.93	2.81	2.71	**3.47**
2	Combating deforestation and land degradation	1.00	5.00	3.50	2.13	3.16	**3.25**

Option 2 is a low-cost option. However, its implementation would require commitment at the highest level. Combating deforestation is a daunting challenge in the face of weak security of land tenure. Finally, intensive awareness campaigns on environmental and socio-economic benefits of forests are urgently required to educate and inform the population in order to enlist their full support.

4.5.5 Solid Waste Disposal

Currently, around 1 000 t of municipal solid waste (MSW) are generated daily. This mixture, comprising mainly domestic wastes and some industrial and commercial wastes are collected and sent to the sole landfill site. There is little recycling, recovery of waste or incineration. About 1.3% of the methane (CH_4) emitted is flared. Estimations/projections of emissions are made from BAU solid waste land filled using default methodology IPCC (1997).

4.5.5.1 Business-As-Usual scenario in the Solid Waste sector

Based on the observed trends for the period 2000 to 2006 and on projected population and GDP, the amount of Municipal waste was projected at 460 000 t in 2020, 500 000 t in 2030 and 605 000 t in 2040. It is assumed that 1.3% of the methane is flared.

4.5.5.2 Mitigation scenarios Solid Waste Disposal sector

The mitigation options deemed feasible and within policies are recycling, composting, Landfill gas (LFG) to energy, and Incineration (WTE).

a. *Recycling*: For this option, it has been assumed that only a small proportion of the solid wastes is recycled, namely part of paper, plastics and textiles.

b. *Composting*: As from 2011, about 30% of MSW, 110 tons daily, are expected to be composted with the coming into operation of an industrial compost plant. Thus, landfill emissions for this portion of MSW have been discounted on the assumption that the process used for composting will not generate CH_4.

c. *Landfill with LFG to Energy*: Exploiting LFG as an energy source has long been promoted as "good housekeeping". Presently, LFG is not used for electricity production and this mitigation option assumes that 50% of the CH_4 emissions from the landfill is recovered and used for electricity generation. In case this option is implemented, then the remaining waste will be less than the 300 t allocated for incineration.

d. *Incineration*: This option assumes that 300 t of the waste is incinerated daily. The process primarily emits CO_2 and is considered carbon-neutral but avoids the production of LFG. The displacement of fossil fuel through the use of the liberated energy for electricity generation has been reported as a mitigation option in the energy sector. Adoption of this option precludes that the LFG one will be at a lower level as the amount of waste going to the landfill will be drastically reduced.

4.5.5.3 Emissions with Mitigation scenarios in Solid Waste Disposal sector

Emissions under the BAU scenario will increase from 447 Gg CO_2-eq in 2000 to 766.8 Gg CO_2-eq in 2020, to 834.9 Gg CO_2-eq in 2030 and to 1 006.8 Gg CO_2-eq in 2040. The compiled emissions show that on a stand-alone basis, incineration would result in maximum GHG reductions **(Table 4.11)**. However, this option is not fully environment-friendly: The advantage of recycling biomass in the agricultural production system where it has the potential to displace synthetic fertilizer and to act as a soil conditioner is lost. Possible exposure hazards are fuelling public pressure against this option and some caution will have to be exercised. On the other hand, the option of combining the Recycling, Composting and Incineration would yield the best option. It is of note that throughout the whole period of study, it was assumed that only 110 000 t of waste is composted. Increasing the allocation of waste to composting will further improve the balance.

Table 4.11 - Projected GHG emissions (Gg CO_2-eq) from mitigation options in Solid Waste disposal

OPTION	DESCRIPTION	GHG EMISSIONS (Gg CO_2-eq)			Change in GHG Emissions (Gg CO_2-eq)		
		2020	2030	2040	2020	2030	2040
B-a-U	**BUSINESS-AS-USUAL**	766.8	834.9	1006.8			
1	**Recycling**	725.1	738.5	914.3	41.7	96.4	92.5
2	**Composting**	555.5	621.9	807.7	211.3	213.0	199.1
3	**Incineration**	186.8	253.2	439.1	580.0	581.7	567.7
4	**LFG to Energy**	383.4	417.4	503.4	383.4	417.5	503.4
	TOTAL (1,2,3)	200.7	213.0	391.0	621.9	615.8	621.9

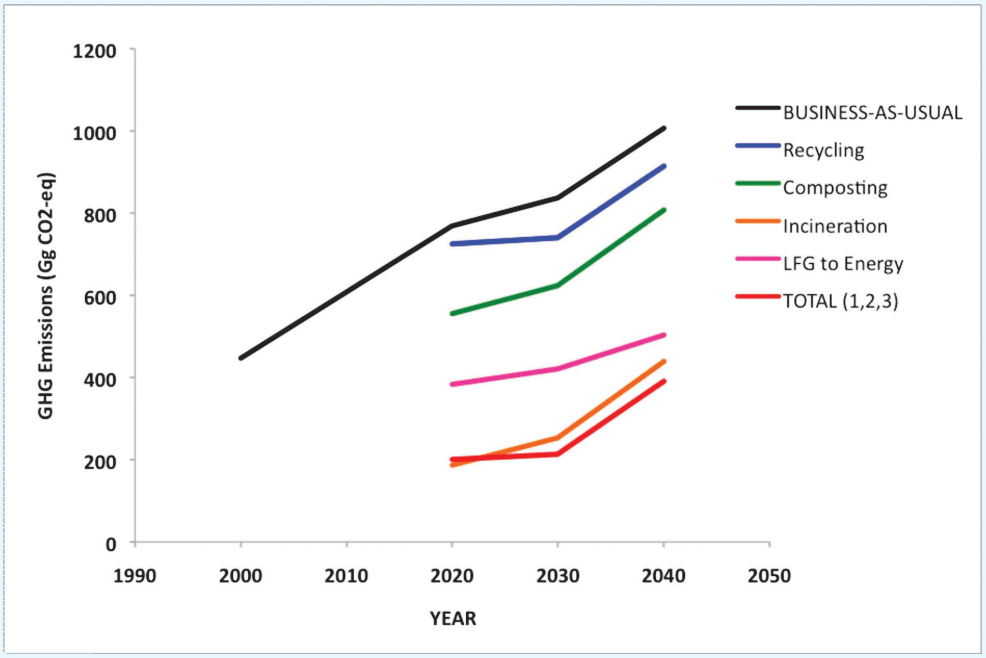


Figure 4.6 - GHG emissions under BAU and selected mitigation options in Solid Waste sector
(The number in the legend refer to the options in Table 4.11)

4.5.5.4 Multi-Criteria Analysis of Mitigation scenarios in Solid Waste disposal sector

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	**Recycling**	1.00	5.00	3.06	4.38	3.12	3.47
2	**Composting**	2.00	4.15	3.28	4.63	3.35	3.59
3	**LFG to Energy**	3.00	2.80	1.78	4.08	2.60	2.65
4	**Incineration (WTE)**	4.00	3.15	2.64	2.83	2.87	2.92

Table 4.12 - MCA score for mitigation options in Solid Waste disposal category

4.5.6 Wastewater handling

All wastewater generated, namely industrial (poultry and sugar industry), domestic and commercial wastewater and others (hotel wastewater) have been considered for the evaluation of mitigation options. In the base year 2000, the waste sector was responsible for 29% of total national emissions with the wastewater handling category contributing 61.7% of the total GHG emissions for the Waste sector i.e. 1 170 Gg CO_2-eq.

4.5.6.1 Business-as-Usual scenario in Wastewater handling sector

The trend of emissions for the period 2000 to 2006 and national plans were taken into consideration for working out the BAU scenario up to the year 2040. In the BAU, emissions from the industrial sector (sugar) and domestic and commercial sectors only were computed since emissions from the poultry industry and hotel sector were deemed negligible as well as the N_2O emissions also.

In the base year 2000, the waste sector was responsible for 30% of total net national emissions with the wastewater handling category contributing 61.7% of the total GHG emissions for the Waste Sector. Under the BAU scenario, emissions decreased from 747.2 Gg CO_2-eq in year 2000 to 582 Gg CO_2-eq in 2020, 570 Gg CO_2-eq in 2030 and 547 Gg CO_2-eq by 2040.

4.5.6.2 Mitigation scenarios in Wastewater sector

The mitigation options considered to curb down emissions are:

a. Extension of the sewerage network

The **National Sewerage Master Plan** makes provision for extending the connection of households to the public sewer network from the 13% in the base year 2000 to 62.9% in 2020 and to reach 80% in the years between 2030 and 2040.

b. Anaerobic treatment of Wastewater and sludge of the Sugar Industry

The sugar industry represents the major source of emissions within the industrial wastewater sub-category. The option proposed to mitigate the CH_4 emission from the sugar industry consists of applying anaerobic treatment to the wastewater and sludge to produce CH_4 gas. The CH_4 produced from the resulting treatment of the wastewater is then captured and flared for energy production.

4.5.6.3 Emissions with Mitigation scenarios in Wastewater handling sector

Emission reductions resulting from the mitigation options for the Industrial (sugar sector) and Domestic and Commercial Sector are given in **Table 4.13**. Adoption of these options concurrently, potentially reduces emissions by 324 Gg CO_2-eq in 2020, 347 Gg CO_2-eq in 2030 and 334 Gg CO_2-eq in 2040. This represents mitigation of some 45% of the base year emissions. The decrease between the 2030 and 2040 time horizons are attributed to a reduction in activity in the sugarcane sector; at the same time, no additional extension of the sewerage network is expected between this timeframe.

Table 4.13 - Projected GHG emissions (Gg CO_2-eq) from mitigation options in Wastewater handling

OPTION	DESCRIPTION	GHG EMISSIONS (Gg CO_2-eq)			Emission reductions (Gg CO_2-eq)		
		2020	**2030**	**2040**	**2020**	**2030**	**2040**
B-a-U	**BUSINESS-AS-USUAL**	582	570	547			
1	Extension of sewerage network	503	457	434	79	113	113
2	Anaerobic treatment of wastewater/sludge in the Sugar Industry	337	336	326	245	234	221
	Total				**324**	**347**	**334**

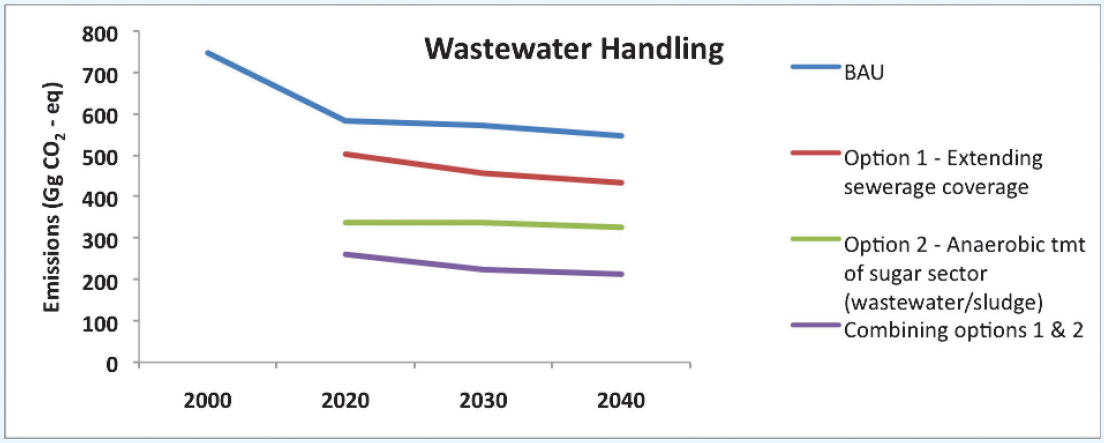


Figure 4.7 - Projected GHG emissions (Gg CO_2-eq) from mitigation options in Wastewater handling
(The Options in the legend refer to those in Table 4.13)

4.5.6.4 Multi-Criteria Analysis of Mitigation Scenarios in Wastewater Handling Sector

Results of the MCA are given in **Table 4.14**. Both options rank closely. Extension of the sewerage coverage will continue as a sine qua non component of the sustainable development of the country while maintenance of industrial activities in the sugarcane sector will be transformed to be more environment- friendly even if it will regress.

Table 4.14 - MCA score for mitigation options in Wastewater handling category

		MULTI-CRITERIA ANALYSYS SCORE					
OPTION	DESCRIPTION	Mitigation potential	Sustainability	Social considerations	Cost considerations	Other considerations	OVERALL
1	Extending sewerage coverage	1.00	4.50	2.92	3.13	3.52	**3.19**
2	Anaerobic treatment of wastewater/sludge in the sugar sector	2.00	3.90	2.46	2.78	3.25	**2.89**

4.6 GHG Mitigation Potential

The cumulative mitigation potential at national level for the range of sectors considered, namely, Electricity Generation, Road Transportation, Agriculture, LULUCF, Solid Waste and Wastewater Handling, show that the potential of emissions reductions ranges from 28% in 2020 to 42% in 2040 **(Table 4.15)**.

Table 4.15 – Projected GHG emissions (Gg CO_2-eq) under BAU and cumulative mitigation at national level

	BAU EMISSION (Gg CO_2-eq)			POTENTIAL MITIGATION (Gg CO_2-eq)			POTENTIAL MITIGATION (%)		
	2020	**2030**	**2040**	**2020**	**2030**	**2040**	**2020**	**2030**	**2040**
Energy Industries	2 750	3 164	3 985	379	1 055	1 971	14	33	49
Transport	1 213	1 614	2 136	252	400	534	21	25	25
Agriculture	250	259	262	29	31	31	12	12	12
LULUCF	-180	-156	-115	-78	-132	-183	43	85	159
Solid Waste	767	835	1 007	622	616	622	81	74	62
Wastewater Handling	582	570	547	324	347	334	56	61	61
TOTAL	5 382	6 286	7 822	1 528	2 317	3 309	28	37	42

4.6.1 Assessment of mitigation measures with the LEAP model

After complete calibration and validation of the LEAP Model using year 2000 to 2006 activity data and EFs adopted in the GHG inventory compilation (Re: Chapter 2), the model was used to generate emissions under the BAU and mitigation scenarios of the Energy Industries sub-sector for the 2020, 2030 and 2040 horizons. A sensitivity analysis was then conducted for replacement of coal with wind, solar and HFO.

4.6.2 BAU and Tested Mitigation Options

The fuel mix adopted for the BAU and mitigation option scenarios with the LEAP Model were as for the compilation using the IPCC software. The emissions using the LEAP Model were identical to those from the previous methodology **(Table 4.16)**. The emissions by fuel type as simulated by the LEAP Model are given in **Figure 4.8**.

Table 4.16 - GHG emissions (Gg CO_2-eq) under BAU scenario under two computation options

DESCRIPTION	BAU (Gg CO_2-eq)			
	2000	**2020**	**2030**	**2040**
LEAP Model	1 024	2 750	3 165	3 986
IPCC Methodology	1 024	2 750	3 165	3 986

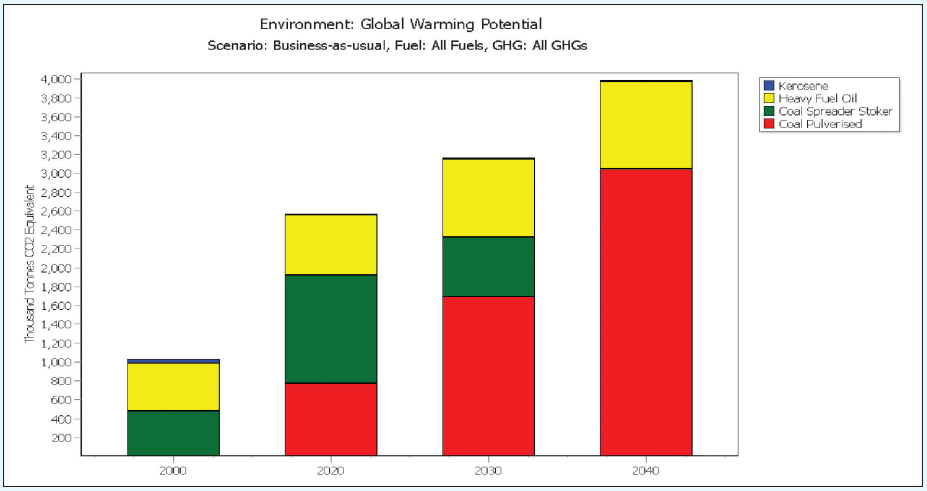


Figure 4.8 - Emissions (Gg CO_2-eq) by fuel from Electricity generation category under BAU scenario as estimated by the LEAP Model

4.6.3 Sensitivity analysis

The sensitivity analysis included the evaluation of replacing coal with wind, solar and HFO. The % share of the renewable in the total mix tested with the model (Option B) as compared to the adopted mitigation options (Option A) are given in **Table 4.17.**

Table 4.17 - Share of renewables under BAU and new mitigation scenarios

	WIND		SOLAR		HFO	
OPTION	A	B	A	B	A	B
2020	6	6	1	5	29	55
2030	12	15	5	15	31	75
2040	18	20	10	25	29	97

The output from the LEAP Model **(Table 4.18)** show that the increasing share of renewable in the fuel mix for electricity generation is translated by a decrease in GHG emissions. This confirms that the LEAP Model has been successfully validated for local conditions and that it can be reliably used for sensitivity analysis. The possibility of using the LEAP Model for assessment and sensitivity analyses in other source categories can be contemplated with confidence.

Table 4.18 - GHG emissions (Gg CO_2-eq) with different share of renewables under selected and new mitigation scenarios

	WIND		SOLAR		HFO	
	A	B	A	B	A	B
2020	2 338	2 338	2 587	2 408	2 564	2 338
2030	2 749	2 630	2 992	2 633	3 165	2 670
2040	3 220	3 183	3 609	3 986	3 986	3 119

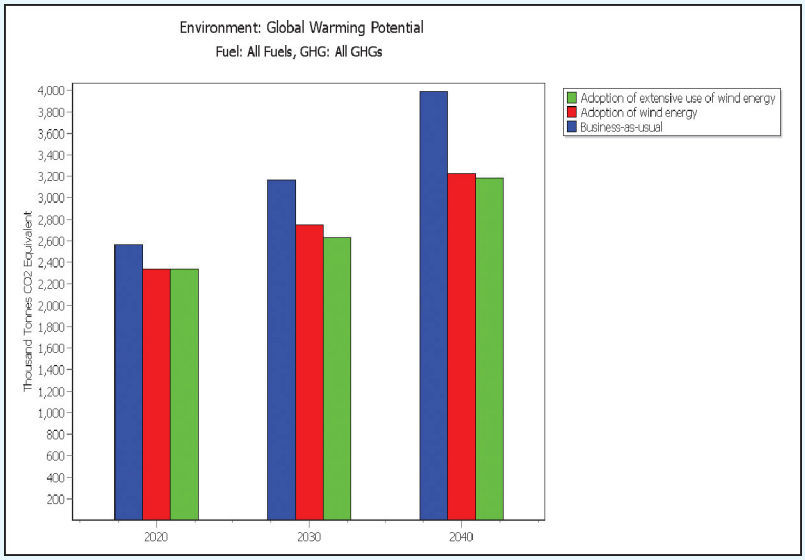


Figure 4.9 - Emissions (Gg CO_2-eq) by fuel from Electricity generation category under alternative share of wind energy as estimated by the LEAP Model

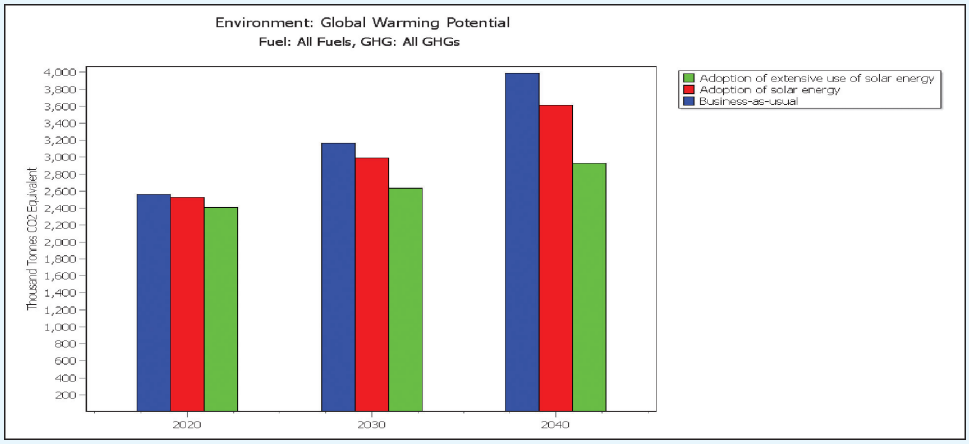


Figure 4.10 - Emissions (Gg CO_2-eq) by fuel from Electricity generation category under alternative share of solar energy as estimated by the LEAP Model

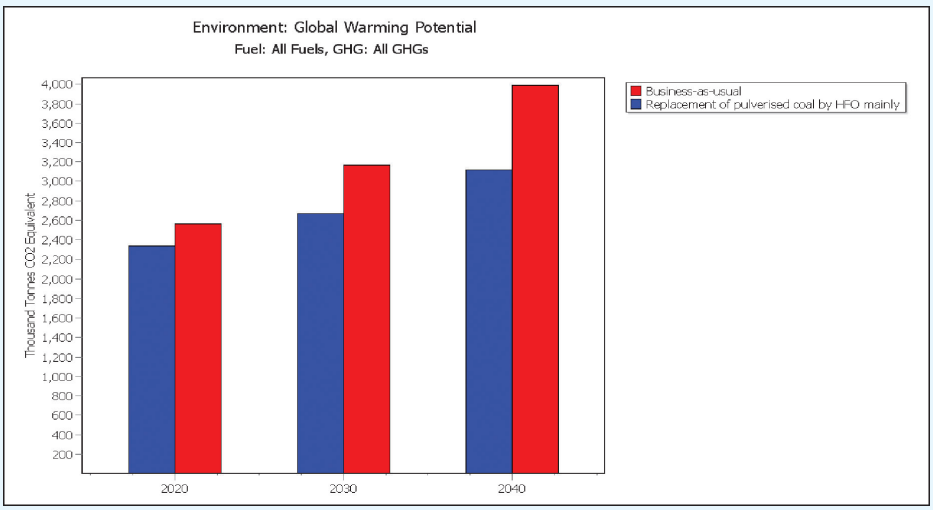


Figure 4.11 - Emissions (Gg CO_2-eq) by fuel from Electricity generation category with complete replacement of coal by HFO as estimated by the LEAP Model

CHAPTER FIVE

VULNERABILITY AND ADAPTATION

5.1 INTRODUCTION

The Government of Mauritius has taken due note of the consequences of the impacts of climate change on its hard won socio-economic development and initiated actions to address them. This chapter is in line with Article 12, paragraph 1(b) and (c), of the Convention which requires that, Non-Annex I Party, including the Republic of Mauritius, present general steps taken or envisaged towards formulating, implementing *programmes containing measures to facilitate adequate adaptation to climate change.* The key sectors already impacted upon are: infrastructures that support the livelihood of communities, water resources, coastal areas, coral reefs, fisheries and other marine-based resources, agriculture, tourism, human health and biodiversity.

5.2 CLIMATE IMPACTS AND CLIMATIC PROJECTIONS

Long-term series of data collected by the Mauritius Meteorological Services were used to derive climate trends and develop climate projections. These were then used to assess current and future vulnerability as well as adaptation options to climate.

5.2.1 Climate trends

5.2.1.1 Temperature

Figure 5.1 shows the trend of temperature at one of the stations. This trend reflects the general pattern in the Republic since 1950 when systematic data quality control and archiving started. Most significant of all is that the temperature patterns in the Outer Islands have not been influenced by any human, or even less by industrial activities.

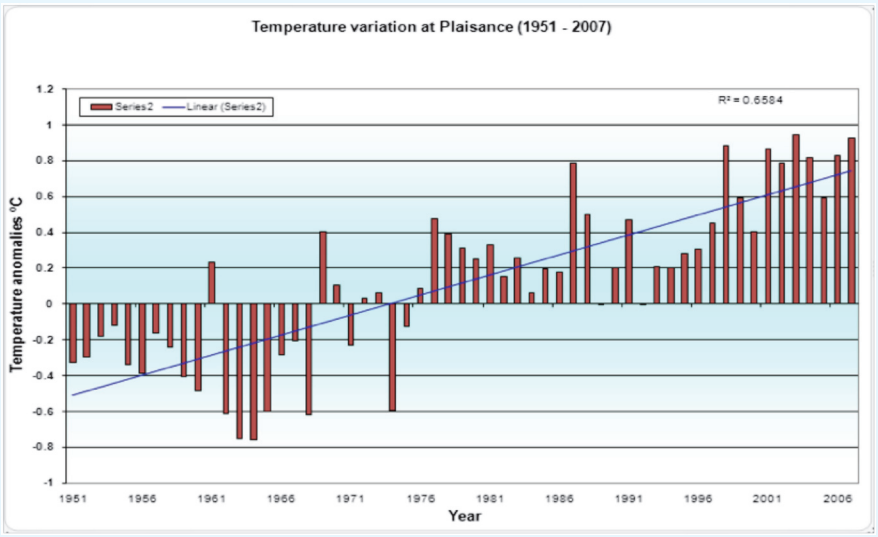


Figure 5.1 - Temperature Variation at Plaisance (1950-2007)
(Source: Mauritius Meteorological Services

Regression analysis has revealed that the mean temperature has increased by 0.18 oC per decade at national level while the magnitude of increase of the minimum temperature has been higher than for maximum temperature. Furthermore, summer temperatures have been observed to be increasing more rapidly than winter ones and the number of days with maximum temperatures above the threshold value of 30 oC is on the rise **(Figure 5.2).**

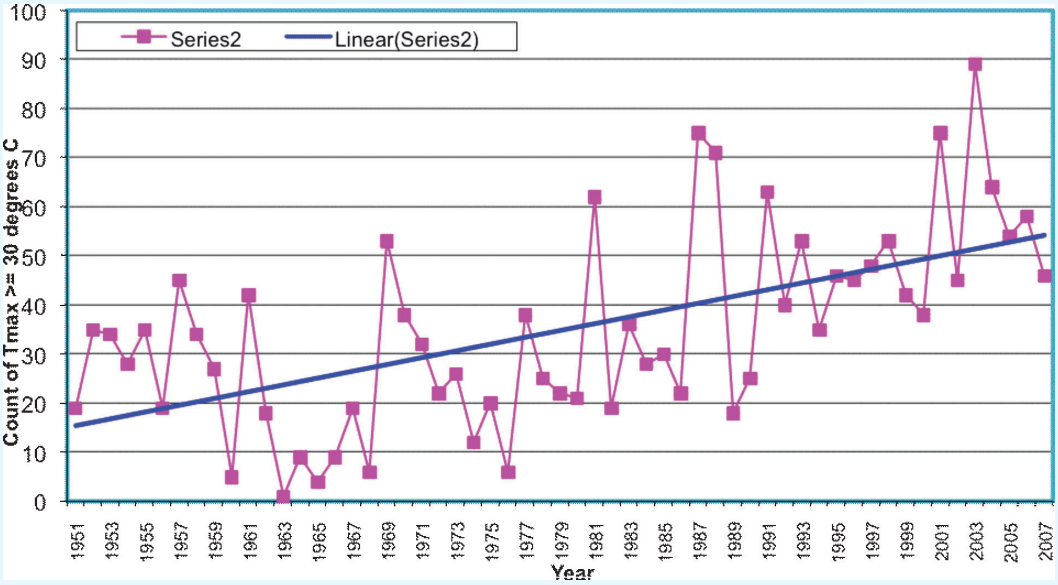


Figure 5.2 - Annual count with Tmax >= 30 oC at Plaisance

(Source: Mauritius Meteorological Services)

5.2.1.2 Rainfall

Rainfall amount over the period has decreased by at least 400 mm between the periods 1931-1960 and 1971-2000. Thus, the main recharge zone has witnessed a decrease from 4 400 mm per year to 4 000 mm per year and an area of less than 800 mm has appeared along the western coast. In addition, rainfall variability has risen together with an increased occurrence of high-intensity rainfall events. This condition favours the occurrence of flashflood and corresponding run-off to the detriment of recharge of aquifers.

5.2.2 Climate projections

Climate change projections at global level as reported by IPCC (2007) did not completely reflect the changes at local level. Thus, in order to ensure that vulnerability is adequately assessed and adaptation measures defined at sectoral level, projections were downscaled for Mauritius Island using the MAGICC-SCENGEN v5.3 model. Such information is essential to support the implementation of cost-effective sustainable development agenda. Using the 1980 to 1999 observed data, the baseline temperature and rainfall were derived. The 1990 to 2008 data were then used to identify a set of General Circulation Models (GCM) that best reflect the locally-observed trends.

The selected set of nine GCMs was then used to project mean temperature and rainfall changes for four SRES, namely, A1B, A1F1, A2 and B2, for different time horizons up to the year 2100 for Mauritius. Changes in minimum and maximum temperatures were then computed based on the observed relationship of the latter parameters and the mean temperature. Associated increase in atmospheric CO_2 and sea level were then abstracted. The projections are given in **Table 5.1.**

Table 5.1– Projected changes in temperature, rainfall, atmospheric CO_2 level and sea-level rise

SRES	HORIZON	Temperature (°C)			Rainfall	CO_2 level	Sea-level rise
		Mean	Minimum	Maximum	(%)	(ppm)	(cm)
A1F1	2020	0.47	0.64	0.41	-6.02	418	5.4
	2030	0.73	0.99	0.63	-7.88	456	8.2
	2050	1.40	1.91	1.21	-13.96	570	16.2
	2080	2.64	3.60	2.29	-22.22	811	34.6
	2100	3.28	4.48	2.85	-26.76	994	48.6
A2	2020	0.43	0.59	0.37	-5.41	416	5.3
	2030	0.64	0.87	0.56	-7.02	451	7.8
	2050	1.15	1.57	1.00	-11.09	533	14.6
	2080	2.06	2.80	1.78	-20.46	701	29.2
	2100				-22.44	867	41.7
A1B	2020	0.43	0.59	0.38	-5.67	421	5.3
	2030	0.64	0.87	0.55	-8.20	456	8.0
	2050	1.20	1.64	1.04	-9.19	533	15.1
	2080	1.76	2.39	1.52	-17.30	650	28.2
	2100	2.06	2.81	1.79	-19.77	717	37.1
B2	2020	0.43	0.58	0.37	-5.26	407	5.5
	2030	0.59	0.81	0.51	-6.90	428	7.9
	2050	0.94	1.28	0.82	-10.13	476	13.8
	2080	1.48	2.02	1.29	-14.75	557	24.5
	2100	1.86	2.54	1.61	-17.57	620	32.7

5. 2.3 Sectoral Vulnerability and Adaptation

5.2.3.1 Agriculture

Agriculture comprises mainly of sugarcane production on 66 000 ha by corporate estates and some 23 500 planters. Vegetable and other crops are produced on 7 200 ha by some 1 200 small planters and animal production is undertaken by some 6 000 breeders. Despite its decreasing share in GDP, agriculture still allows 30% food self-sufficiency. The vulnerability of this sector has been observed and climate change is expected to exacerbate the situation.

5.2.3.1.1 Vulnerability

Statistical analysis of long-term data (1947 to 2008) revealed that both cane productivity

and sugar extraction rate are reduced by extreme weather events like cyclones and drought. The magnitude of the impact varies according to the timing, severity and duration of the extreme event and may have carry-over effects on the productivity of subsequent years.

Assessment made using the Agricultural Productions Systems Simulator (APSIM) biophysical model for a range of climate change scenarios showed that for a decrease in rainfall of 10% to 20% and an increase in temperature of 2°C, reductions in cane yield is expected to range from 34% and 48% while reductions in sugar yield is expected to range from 47% to 65%. Under the projected increase in temperature and the narrowing of the temperature amplitude between day and night temperatures, it is expected that vegetative growth will be favoured at the expense of sugar accumulation.

Vegetables and other crops will suffer similarly. With increased temperature and lower temperature amplitude the vulnerability is expected to worsen. As an example, this temperature change will result in a change in phenology and a decrease in flowering intensity. Expected decrease in rainfall will exacerbate the stress intensity while temperature increase will result in higher demand from evapo-transpiration. Increase in temperature will have adverse impacts on yield and productivity such as:

- Pollination and seed set will be reduced, e.g., in tomato;
- Date of flowering, e.g., in litchi and mango, may be modified such that fruiting period may coincide with cyclonic season;
- Heat stress will impact on productivity in the poultry and livestock sector; and
- Bulking will be affected in root crops.

A rising temperature will fasten the reproductive cycle of insect pests and vectors, increase disease transmission rate and expansion of the geographical ranges of agricultural pests and diseases as well as the duration that they are prevalent. Intense rainfall events may cause inundation of cultivated areas and the complete loss in vegetable production.

Climate is thus expected to directly impact on the profitability and may lead to abandonment of cultivable areas. Such cases would lead to soil erosion and leaching of nutrients.

5.2.3.1.2 Adaptation

Some of the key adaptation strategies/ measures for land use, agriculture and agro-biodiversity include:

- The need for introducing new varieties of cultivars;
- The shifting of regions where actual crops are grown to higher elevations with cooler temperatures. However, a limit will be reached beyond which the normally cultivable areas will not suffice to contain all varieties required to feed the nation; and

- The substantial increase in irrigation water requirement to compensate for increase in evapo-transpiration, shift in the rainy season and longer drier periods. In the model run this requirement was quantified to range from 302 million m3 to 327 million m3 on an industry extending over 60 000 ha.

Together with the above measures there is need to:

a. Put in place sustainable management of land/soil, forests, arable croplands, fisheries, aquaculture, and livestock;
b. Design new housing structures for livestock and poultry;
c. Promote conservation and sustainable agricultural practices;
d. Combat land degradation;
e. Improve water-use efficiency of crops or plant more resistant crop varieties;
f. Provide farmers with Insurance and security for their investments;
g. Apply new and sustainable technologies, e.g. protected cultivation; and
h. Establish an early warning system for pest and disease management.

5.2.3.2 Water resources

The observed decrease in rainfall, increase in rainfall variability, increase in the occurrence of high-intensity rainfall and the shift in the onset of the summer rains have impacted negatively on the water resources. The Central Plateau with the largest catchments in the common recharge zones has seen a significant decrease in rainfall. This is reflected in changes in ground water and river-flow regimes. Moreover, groundwater-quality monitoring at 23 Interface Control Piezometers and in boreholes in use for industrial, agricultural and domestic purposes have shown deterioration in groundwater quality in coastal aquifers.

5.2.3.2.1 Projections and Vulnerability

Base line data for 1990, (average for period 1980-1989) and modeled projections by MAGICC-SCENGEN were used to estimate water availability and utilizable water resources up to a time horizon of 2050. Scenarios A1F1-M1 and B2-MES were selected for application to Mauritius **(Table 5.2)**. The projection indicates that by 2050, the utilizable water resources will be decreased by up to 13%. Despite the fact that the difference in project values under the two scenarios is only less than 1% for 2020, around 1% for 2030 and 4% for 2050, the changes in pattern of rainfall with more episodes of heavy rainfall and more extreme weather events will allow only a definite amount to go into the storage system. There is an immediate need to increase storage capacity to be able to meet demands in the short term.

Table 5.2 –Model projection of rainfall and water availability

	Scenario: A1F1-M1				Scenario:B2-MES			
Year	Annual Rainfall (mm)	%	Volume of rainfall (Mm^3/yr)	Utilizable water potential (Mm^3/yr)	Annual Rainfall mm	%	Volume of rainfall (Mm^3/year)	Utilizable water potential Mm^3/year
1990	1 887	100	3 519	1 161	1 887	100	3 519	1 161
2020	1 773	-6.018	3 307	1 091	1 788	-5.259	3 335	1 101
2030	1 738	-7.880	3 241	1 070	1 757	-6.897	3 277	1 081
2050	1 624	-13.959	3 029	1 000	1 696	-10.128	3 163	1 043

(Source: Water Resources Unit)

5.2.3.2.2 Adaptation

In order to adapt to impacts of climate change, the following measures/ strategies are ongoing and or planned:

a. Increase in surface water storage capacity through the construction of two new dams and increase in the storage capacity of existing ones;

b. Incorporation of climate variability into water management;

c. Quantitative projections of changes in rainfall, river flows and groundwater levels and systematic monitoring of water resources systems and coastal aquifers;

d. Protection of common recharge zones of aquifers and rivers as a priority through appropriate land use management strategies including legal aspect;

e. Water recycling rationalization of gray water;

f. Recharge of artificial groundwater;

g. Control of sea water intrusion through groundwater licensing; and

h. Desalination especially for Rodrigues which is water-scarce, despite the relatively high investment cost.

5.2.4 Human health

Analysis shows that higher temperature, precipitation and humidity facilitate the spread of diseases such as chikungunya and dengue. These are vector-borne viral infectious agents transmitted by mosquitoes which are known to increase their activities in warmer temperatures. Furthermore, although respiratory complications, cardiovascular diseases, food poisoning, diarrheal and skin diseases cannot be avoided, their occurrences can

increase and be aggravated during hot spells.

5.2.4.1 Vulnerability

Mauritius is likely to become more vulnerable to climate change through the following expected impacts on the health of its population:

- Propagation of vector-borne and infectious diseases as a result of higher temperature and recurrent floods;
- Lengthening of the transmission period of important vector-borne diseases due to rise in temperature; and
- Increase in the frequency of gastroenteritis and respiratory problems.

5.2.4.2 Adaptation

In order to reduce the vulnerability of the population from health hazards, a number of adaptation measures are proposed hereunder:

a. Adopt preventive measures to further reduce the load of air-pollutant;

b. Strengthen the existing disease surveillance system;

c. Reduce exposure to extreme heat of those afflicted by cardiovascular problems; and

d. Organise regular training programmes for health personnel to deal with emerging diseases and natural disasters. Simulation exercises to be carried for the evaluation of interventions in emergencies.

5.2.5 Coastal zone

Mauritius has a coastline of 322 km and a coral reef length of 150 km which encloses a lagoon area of 243 km^2. The area of coral reef is about 300 km^2. The shoreline has a varied geomorphology, dominated by sandy beaches and other sensitive ecosystems that include marine protected areas (7216 ha) and mangrove forests.

5.2.5.1 Vulnerability

Over the last two decades, beach erosion has become significant in the northwest, southwest and south of Mauritius where it has led to the loss of beach space and caused damage to infrastructure. Outer Islands such as Agalega and St Brandon where ground elevation range from few centimetres to a maximum of about 2 to 3 m amsl are highly vulnerable to increase in sea-level and storm surges.

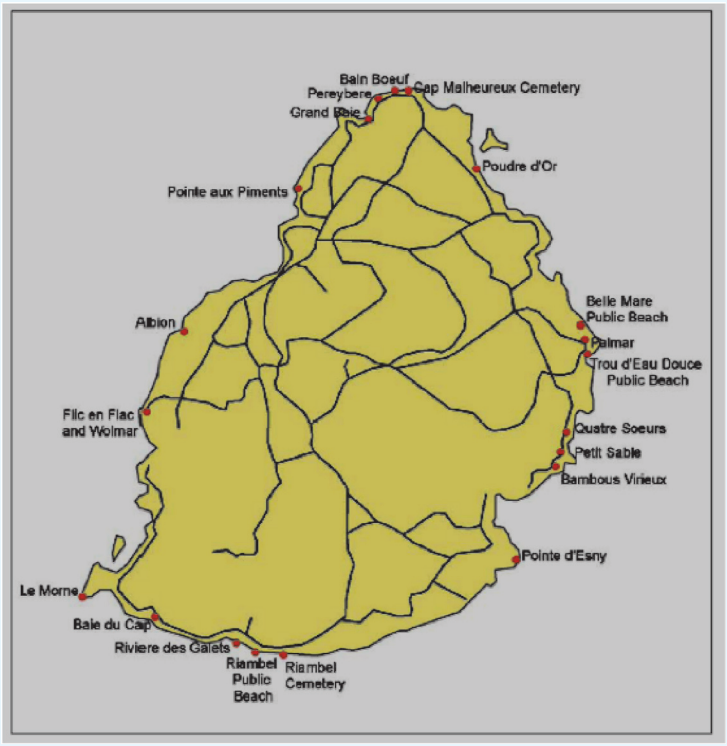


Figure 5.3 - Potential hotspots (beach erosion) identified around Mauritius following surveys under the Coastal Erosion Study, 2003 and follow up surveys by MOE & SD

(Source: MOE & SD)

Results from GIS analysis of the aerial photos:

- In the Flic en Flac and Wolmar area, the vegetation has retreated by 15 m between 1967 and 1997 (most of it occurring between 1979 and 1995). This retreat along approximately 500 m of shoreline and 4 m height (from the beach toe to the beach crest) amounts to approximately 30000 m^3 of sand lost from the beach;
- In the Le Morne area, there is evidence of a net northward longshore sand transport with serious beach retreat up to 10 m along 500 m beach stretch;
- Along the Trou aux Biches and Mon Choisy coasts, there is a beach retreat of 10 m between 1995 and 2009 along approximately 400 m of shoreline;
- The Grand Bay beach has retreated by 10 m along 100 m of the coast. The trees at the shoreline are being undermined and several have already been lost. Light poles have toppled over; and
- At Pointe aux Sables, the beach has retreated by 10 m along some 100 m of beach over the last decade.

Box 5.1 – Beach Losses at some surveyed sites

The lost in beach area at the above mentioned beaches (refer to Box above) over the last decade amounts to some 18 500 m^2 and the lost in terms of monetary values is estimated at Rs1.2 million rental value per year[1]. Albeit, this figure is a very conservative one and it does not capture the ecosystem and protection values, which could be of the order of millions of rupees.

[1]Monetary value estimation made on the basis of the Finance Act 2006 (Government Gazette of Mauritius No 71 of 7 August 2006)

The Financial Strategies Report prepared under the ICZM Framework Study (MOE & SD, 2010) estimates the revenue directly generated from the coastal zone as just under Rs 74 billion, equivalent to 36% of GDP, 99 percent of which is generated by tourism. The total economic value of the coast, in present value terms, is of the order of Rs 1 trillion (including property values attributable to the coast).

It is anticipated that the coastal zone will be seriously impacted as a result of the SLR. The impacts are likely to cause:

- *Gradual destruction of the reef system* as a result of coral bleaching due to increase in the temperature of sea water. The destruction of the reef will additionally result in lesser attenuation of the wave energies and therefore greater impacts on our beaches;
- *Increased flood risks* in certain low lying areas. Twenty-four significant sub-zero zones covering an estimated 22.3 km^2 area were identified along the coast of Mauritius, most notably at Port Louis, Surinam, Flic-en-Flac/Wolmar, Grand Baie (Pte aux Cannoniers), Pereybère, and Poste Lafayette. (ESA Study, 2010, Ministry of Environment & SD);
- *Damage to coastal infrastructure* such as, roads, houses and recreational amenities. Most of the coastal hotels sites are located within an elevation between 1 to 5 m amsl; and
- *Disturbance of port activities.* Part of the ports infrastructure which is 2.6 m amsl is flooded during adverse weather and sea conditions. The number of days where operations could not be carried out has increased from 3 days in 1999, 11 days in 2004 to 15 days in 2010.

5.2.5.1.1 Sea-level rise

Since monitoring started in 1987 in Port Louis, an increase in sea-level has been noted as indicated in **Figure 5.4 below**. The projection in the different time horizon are contained in **Table 5.3.**

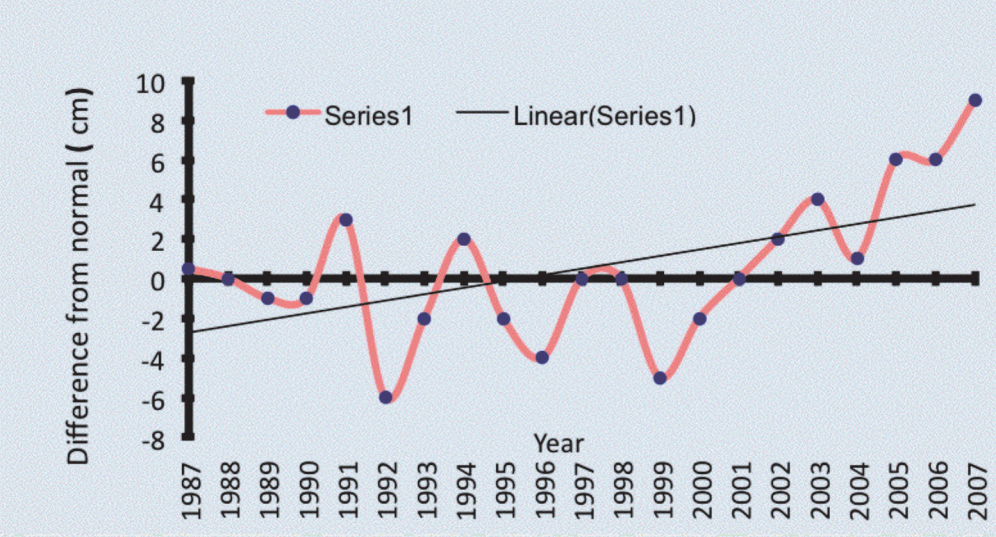


Figure 5.4 - Sea level rise monitored at Port Louis

(Source: Mauritius Meteorological Services)

Table 5.3 - Projection of sea-level

	2020	2050	2100
	SLR (mean- cm)	SLR (mean- cm)	SLR (range- cm)
B2	0.055	0.138	0.21- 0.43
A1B	0.055	0.151	0.21 - 0.48
A2	0.053	0.146	0.23 - 0.51
A1F1	0.054	0.162	0.26 - 0.59

a. Rapid Assessment /Surveys of Representative Beaches Profile

Rapid assessment survey of representative profile of accuracy 1 mm vertical and 5 mm horizontal has been carried out on 5 beaches around Mauritius at Pereybere, Flic en Flac, La Preneuse, Le Morne and Belle Mare.

Result: The profile have been used to calculate the horizontal distance that will be affected by SLR over the various horizons. The findings are given in the **Table 5.4 below. Figure 5.5** show an indicative extent of the projected beach that will be inundated due to SLR at La Preneuse.

Table 5.4 - Projected Inundation at selected beaches (under A1F1)

Location	Distance of projected inundation at selected beaches (m)			
	2020	2050	2080	2100
Pereybere	0.97	3.42	7.57	11.00
Flic en Flac (Beach near Police Station)	1.83	6.57	6.88	31.61
Flic en Flac (around central part)	0.68	2.00	5.87	8.55
La Preneuse (Public Beach)	3.06	8.51	15.83	21.00
Le Morne (Public Beach)	0.67	1.95	4.47	7.49

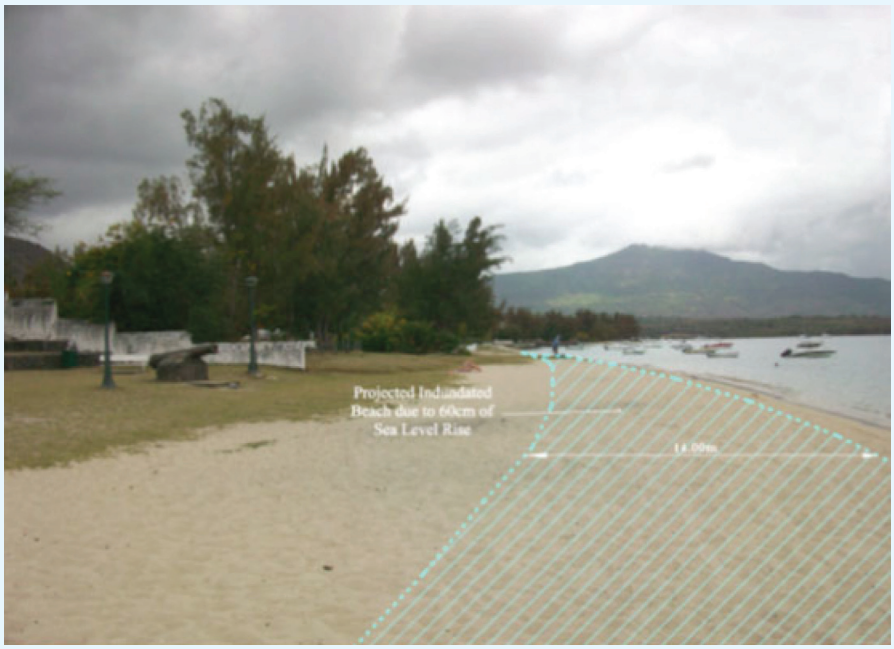


Figure 5.5 - Likely inundation of beach from high water mark at La Preneuse

It is projected that with a sea level rise of the order of 0.60 m, the beach loss at the four coastal areas mentioned above will amount to some 25 000 m^2 representing a loss, in potential rental value, of about Rs 1.5 million/ year (calculated on basis of valuation rate as at 2006. *b. Rapid Assessment / Inundation Map of Baie du Tombeau.*

The purpose of the Inundation Map of Baie du Tombeau region is to assess the number of buildings and length of road that will be at risk due to waves run up of different height interval of 1m, 2m, 3m and 4m. An indicative inundation map generated for the Baie du Tombeau area is given at **Figure 5.6**. The findings and estimated costs of damage for the Road of Categories B and C are presented in **Table 5.5.**

Figure 5.6 - Inundation map generated for the Baie du Tombeau area in the event of 4 m wave run up

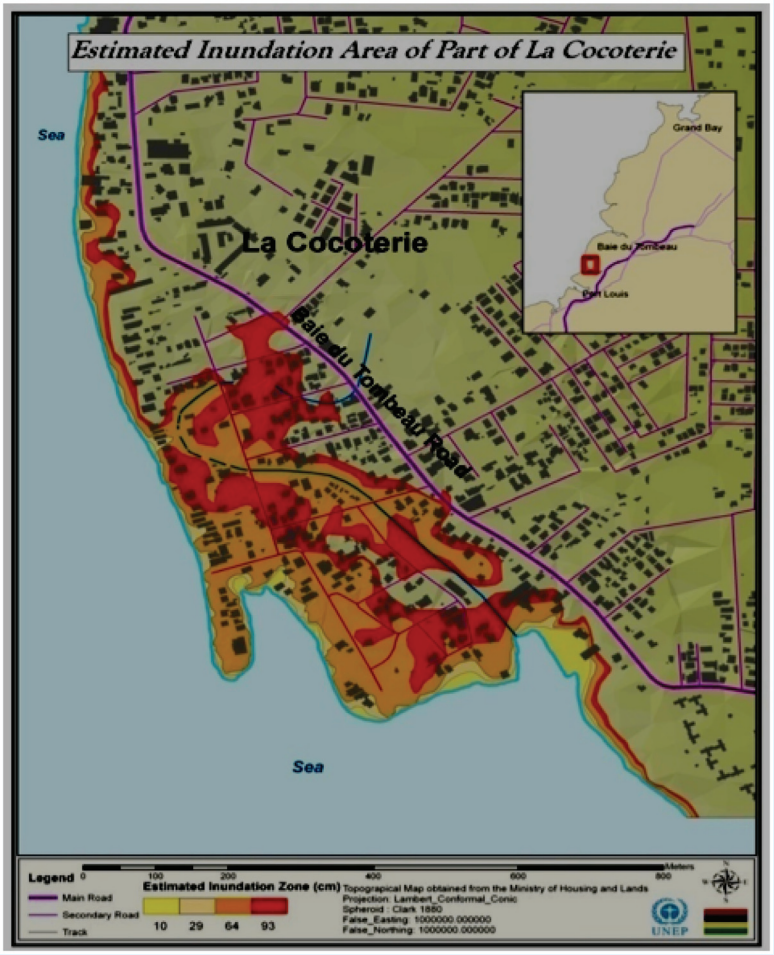


Table 5.5: Buildings and roads at risks at Baie du Tombeau due to wave run up

Inundation height (m)	Buildings at risk	Road of Category B at Risk		Road of Category C at Risk	
	No.	Length (m)	Est. cost of damage (Rs M)	Length (m)	Est. cost of damage (Rs M)
1	418	200	6	2 065	20.65
2	958	2 537	76	5 181	51.81
3	1 344	4 063	122	9 137	91.37
4	1 662	4 224	127	12 085	120.85

(Cost of construction: Road Category B – Rs 30 million/ km and Category C – Rs 10 million/ km)

c. Preliminary rapid assessment of inundation due to 4m wave run up in Mauritius

A preliminary rapid assessment of the length of road that will be affected due to a 4 m wave run up around Mauritius showed that some 8.7 km of Road B and 32.4 km of Road C may be at risk due to 4m wave run up, as shown in the **Figure 5.7** below. The damages to road infrastructure are estimated to be of the order of Rs 260 M and Rs 324 M, respectively.

The projection does not take into account further increases in storm surges during cyclones. According to Brunn's Rule[2] the differential increase in height of storm surges can be several times the value of the 'passive' increase resulting from global warming.

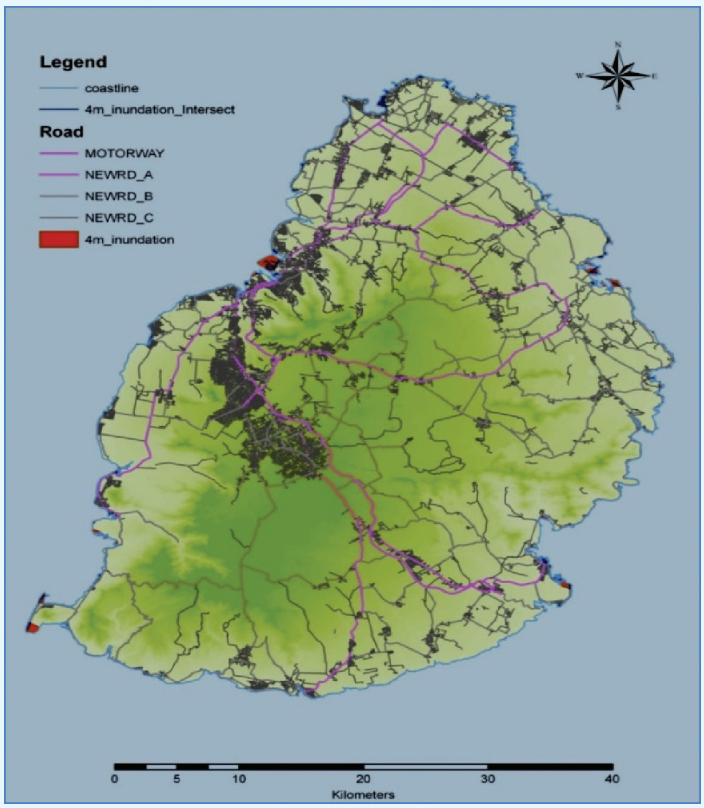


Figure 5.7 - Roads that will be affected by inundation due to 4 m wave run up

5.2.5.2 Adaptation

Coastal protections works have been carried out over some 7 000 m of the public beaches around Mauritius to the tune of Rs 150 million for the last two decades. The maintenance cost incurred at some of the beaches where soft measures have been implemented following extreme events and surges amounts to some Rs 5 million/year. This figure relates only to the cost incurred at some of the public beaches due to additional costs incurred through the beach contractor's works under the Beach Authority.

Adaptation strategies include:

a. Management of ESAs and implementation of Integrated Coastal Zone Management Plan

[2]Brunn's Rule describes the cross-shore response of a beach to sea level rise. According to this rule, one unit of SLR produces 50-100 units of water movement landwards thereby accelerating inundation and beach erosion.

b. Coastal protection and rehabilitation works – consolidation of existing reefs and or building of artificial ones. An example is the placement of break water structures at Rivière des Galets for the protection of the residential zone in the village. Beach protection works at affected beaches, such as at Mon Choisy, Grand Baie, Mon Choisy, Pointe aux Sables, Flic en Flac, Rivière des Galets, Bain Boeuf, Cap Malheureux and Poudre d'Or. The costs of coastal protection works and beach maintenance would undoubtedly become very high. The present estimated cost of construction of 100 m of wavebreaker is of the order of Rs 100 million. For a 3.28°C rise in temperature by the year 2100 under the worst case scenario, the cost for 200 km of coastal protection (wave breaker) would be of the order of Rs 20 billion on top of rising infrastructural maintenance costs;

c. Preparation of detailed inundation maps and monitoring of flood prone areas;

d. Policy review in the Environment sector;

e. Adaptation of public infrastructure on the coastal zone and the Ports Area; and

f. Strengthening of capacities for disaster risk reduction and disaster management.

5.2.6 Fisheries

The fisheries sector is one of the key economic pillars of Mauritius. It employs about 12 000 persons, including those involved in fishing, canning and marketing and contributes about 1.3% to the GDP.

5.2.6.1 Observations

Analysis of data indicates the followings:

- A gradual decline in the overall landings for artisanal fishery However, being given the over-exploitation of our lagoon resources, this decline cannot be attributed to climate change only; and
- Fish mortalities noted around Mauritius due to abnormal SST over the last decade is shown in the **Figure 5.8.**

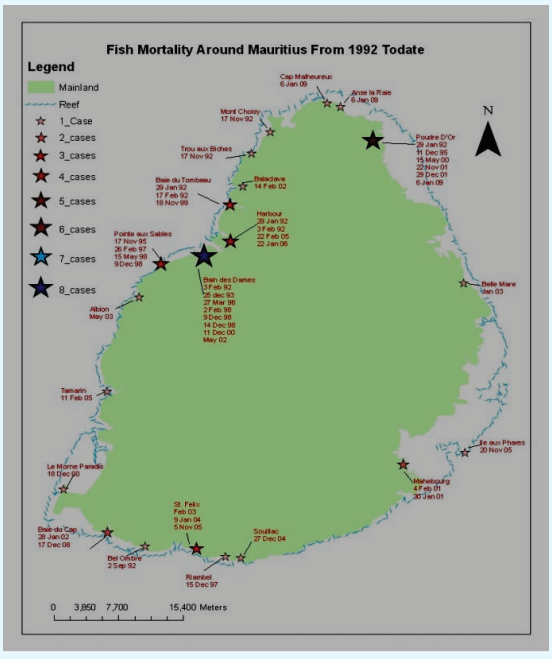


Figure 5.8 - Fish mortalities around Mauritius over the last decade *(Source: MOE & SD)*

5.2.6.2 Vulnerability

With anticipated warming, the following effects are anticipated:

- Migratory shifts in tuna aggregations thereby disrupting fish based industries and may result in conflict over the stock both at an international and national level;
- Changes in fish stock distribution and fluctuations in abundance of conventionally fished and "new" species may disrupt existing allocation arrangements;
- Spatial management schemes such as closed areas to protect spawning or migration areas, or those based on EEZ boundaries may become inappropriate; and
- The calcification rate of corals could decrease by about 14 to 30 % by 2050 based on the projected rise in Carbon dioxide levels. Thus corals will be threatened due on one hand, to bleaching and on the other, to their restricted growth as a result of ocean acidification. It is estimated that live corals will be reduced by 80–100 % in the event of 3.28°C rise in temperature by the year 2100.

5.2.6.3 Adaptation

One of the important adaptation measures pertaining to the fisheries sector is the implementation of an aquaculture master plan. Other measures are:

a. The creation of marine protected areas and marine parks and the introduction of closed seasons for certain fisheries and for commercial fishing will help in protecting and conserving the marine biodiversity. In addition, the introduction of the voluntary buy-back scheme of nets since 1996 is also a contributory factor in preventing further degradation; and

b. The sensitisation of fishers on climate change and its effects on marine ecosystem.

5.2.7 Marine biodiversity

Fisheries, coral reefs, mangroves, seaweeds, and sea grasses make up the major living resources within the coastal and marine areas. To date, only 1 700 marine species have been recorded around Mauritius including 786 fish of which about 5% (42 species) are of commercial value.

In Rodrigues, taxonomic studies and checklists have been published for marine algae, corals, crustaceans (amphipods and isopods), molluscs, echinoderms and coastal fishes. These include:

- 160 species of coral identified including an endemic specy, Acropora rodriguensis;
- 494 fish species recorded, 9 new fish species recorded, out of which 2 are endemic; and
- 109 species of bivalve and 74 species of echinoderms.

5.2.7.1 Vulnerability

Abnormal high temperatures and heavy rainfall have caused several coral bleaching episodes at a number of sites around Mauritius and in Rodrigues. The major ones that have been recorded are as follows:

1998: Coral bleaching was observed in the lagoonal waters of Mauritius since February. Surveys carried out at 4 selected sites around the island revealed different extents of bleaching:

The highest percentage of complete bleaching was 21.6 % at le Bouchon in the south while the highest percentage of partial bleaching was 55.7 % at Ile aux Bénitiers in the South-west. However the weighted average of complete bleaching was less than 5% for all surveyed sites. The same sites were resurveyed 9 to 12 months later. The surveys showed that most of the corals have recovered except for about 10% which had been irreversibly affected. Bleaching was most pronounced in digitate Acropora (77.9%), followed by sub massive corals (51.9%), tabular Acropora (32%) and foliose coral (30%).

2002: In Rodrigues, unusually warm and calm conditions which occurred during February 2002 resulted in coral bleaching, particularly at sites in the north and west of Rodrigues (Hardman et al. 2004). Surveys showed occurrences of severe bleaching leading to mortality of up to 75 % of corals at some sites. The SST recorded was persistently higher than normal (>30°C).

2003: Coral bleaching was observed at four sites in the lagoonal patch reefs, reef flats and reef slopes in February 2003. The sites were Ile aux Benitiers, Belle Mare, Poudre d'Or and Albion. The percentage of completely bleached corals at these sites was 56, 11, 22 and 2 while that of partially bleached corals were 8, 27, 17 and 16% respectively. Branching and tabular corals were mostly affected in the back reef while massive corals were affected in the fore reef. By June, 95% of the bleached corals had recovered while 2% were recovering and 3% have died.

2005: In Rodrigues, severe bleaching was again noted in the north and west of the island, where up to 50 % of coral bleached.

5.2.7.2 Adaptation

The following adaptation measures could be envisaged:

a. Coral farming and transplantation need to be systematically maintained and intensified;

b. Strengthening management of coral reef ecosystem including setting up of monitoring programme; and

c. Ongoing mangrove propagation programme needs to be strengthened.

5.2.8 Forests

As per the Digest of Environmental Statistics (CSO, 2008), 25 % of Mauritius is under forests, shrub and grazing lands, 43% under agriculture and 3% abandoned cane fields. However, the native forest cover amounts to less than 2% and is the habitat to most of the remnant terrestrial biodiversity species

5.2.8.1 Vulnerability

While decrease of forest land has been governed by pressure on demands for agricultural and residential purposes, change in rainfall patterns are affecting some species of forest trees. Thus the decrease in rainfall amount is leading to a shrinking in the habitat of endemic species.

Table 5.6 - Degree of impacts by factors on forest land

FRA 2010 category	Affected forest area (1000 hectares)		
	1990	2000	2005
Disturbance by insects	0	0.001	0.007
Disturbance by diseases	0	0.003	0.004
Disturbance by other biotic agents	0.002	0.010	0.038
Disturbance caused by abiotic factors	0	0.183	0.050
Total area affected by disturbances	**0.002**	**0.197**	**0.099**

(Source: Forestry Service)

Disturbance can be seen **(Table 5.6)** to be increasing during the past 15 years. Abiotic factors are mainly cyclones. The insects and diseases impacts are largely as a result of climatic factors.

5.2.8.2 Adaptation

In line with the approved National Forest Policy (2006) the strategy on adaptation of forestry to climate change includes the improvement of the forestry planning and management system (forest inventory, long-term plans of the forestry development, monitoring, database) and the efficiency of forestry activities (feasible work scheduling, grazing control along with the other anthropogenic stress).

Ongoing adaptation measures include:

a. Ongoing re-afforestation through the introduction of species that are more adapted to the new climatic conditions and its accompanying effects;

b. Cutting down and removal of all trees affected by disease; and

c. Keeping in force an ESA Policy for the protection of ecological systems, including forestry and wetlands.

5.2.9 Terrestrial biodiversity

5.2.9.1 Vulnerability

There are already visible effects of climate change in certain regions of the island where plantations are affected by pests and diseases as a result of increased climatic variability.

Increase in temperature and carbon dioxide concentration will increase the rate of photosynthesis and the production of oxygen. However, the predicted change in rainfall pattern and shift in seasonal changes makes the equation much more complicated, since the benefits of increased carbon dioxide and temperature would also benefit invasive plants and definitely change in the density of photosynthesizing plants as a chain reaction change the food chain pattern. Major shifts in ecosystem types and ecosystem composition is expected.

5.2.9.2 Adaptation

One approach would be to induce the migration of

species to cooler areas. However, due to limited availability of land, this action cannot be seriously contemplated.

5.2.10 Natural Hazards

5.2.10.1 Tropical Cyclones

Research in the evolution of cyclone intensity and frequency have shown that while their total number has not seen any increase, the number of intense cyclones (wind gust of up to 299 Km/hr), are seen to be increasing at the expense of weaker ones. Other natural disasters, such as floods (coastal and inland) storm surges and landslides are likely to increase in frequency and intensity.

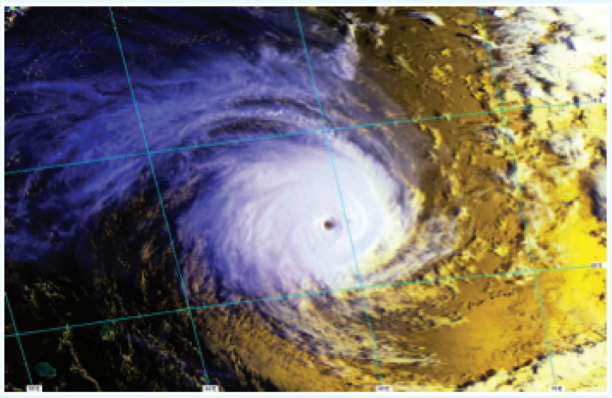


Figure 5.9 - Intense cyclone Dina which caused havoc (2002)

(Courtesy photo: R Maujean)

Figure 5.10 – Extreme flooding resulting from a decaying storm (Photo Courtesy : P Goolaup)

5.2.10.2 Inland Flooding

A survey conducted in 2006 identified 326 flood-prone areas out of which half are highly vulnerable ones often necessitating interventions from authorities such as the Fire and Police departments. More river banks have been noted to burst in recent years. The number of these sites has increased by more than half in the past decade as a result of more frequent and intense episodes of natural disasters and where new infrastructural developments were not designed to cater for events of such magnitudes. These latter have often led to substantial damages to agriculture and other properties and even to loss of human lives recently.

5.2.10.3 Landslides

Mauritius and Rodrigues are experiencing an increasing number of sites with landslide occurrences. While in the late nineties there was only one dangerous site in Mauritius requiring strict precautionary measures, their number rose to 22 in 2005. With more frequent events of torrential rain some of these zones may even require to be evacuated. A similar situation is gradually developing in Rodrigues where there are small landslide occurrences but which are likely to grow in severity in the future.

5.2.10.4 Adaptation

Adaptation to the above natural disasters requires considerable redesign of buildings and infrastructure and such actions will require much needed resources.

5.2.11 Infrastructure

5.2.11.1 Buildings

Under a warmer climate, buildings which are generally made of steel-reinforced concrete are likely to become more vulnerable. For several decades, the building culture has been geared towards protection against strong cyclone winds. However, with time, it has been found that the present designs are not ideal for hot climates. Wall or roof temperatures may become 15-20°C warmer than outdoor air temperature. With a 3.28 °C rise in temperature adverse impacts will become evident not only to buildings and infrastructure but also to human comfort and human health. Adaptation will necessitate climate-friendly designs and adoption of new technology in the building sector.

5.2.11.2 Electricity

The electricity sector in Mauritius faces major challenges as a result of a changing climate response to the increase in energy demand. Currently, air conditioning is the main driver of increased peak summer demand for electricity and warmer temperatures will provoke a spiralling effect.

5.2.11.3 Vulnerability

The electricity sector and its infrastructure are highly vulnerable to:

1. Stronger cyclones and other extreme weather conditions, like lightning and torrential rainfall;
2. Decrease in global rainfall amount which lead to a decrease in hydro-power generation; and
3. Sea-level rise which may affect the two major fuel oil power stations and coastal networks infrastructure.

5.2.11.4 Adaptation

In order to adapt the utility sector will need to consider the:

a. Reduction of peak demand through demand side management initiatives;
b. Application of new standards and labeling schemes to restrict import of inefficient electrical appliances;
c. Contribution to a building design code to ensure that energy need for air conditioning and lighting is minimized;
d. Implementation of a small scale renewable energy generation mainly from solar and wind by individual customers; and
e. Modernisation of infrastructure at thermal power stations.

CHAPTER SIX

OTHER INFORMATION RELEVANT TO THE CONVENTION

6.1 INTEGRATION OF CLIMATE CHANGE IN DEVELOPMENT

In line with the Convention, Government has taken various actions to address global warming through the reduction of anthropogenic emissions and by increasing the sink capacity. More recently the gain in awareness of the urgent threat posed by climate change to the sustained economic development, the integration of climate change concerns into the economic and environmental policies has been given more attention. There is, however, the need for a holistic approach to climate proof all development processes in a coordinated way to ensure enhanced preparedness of the population to cope with, and build resilience to, climate change as it manifests itself more frequently and strongly in the short-, medium- and longer- terms.

Within this line of action, climate change is being mainstreamed slowly but more systematically within national plans and strategies. Thus in 2008, and following the worldwide energy crisis, the "Maurice Ile Durable" (Sustainable Mauritius) vision, which laid emphasis on the sustainable development for the country, was adopted to reduce dependence on fossil fuels.

Box 6.1: Maurice Ile Durable vision

Maurice Ile Durable (MID) vision

(i) The setting up of the Maurice Ile Durable (MID) Fund under the aegis of the Ministry of Energy and Public Utilities.

(ii) Conduct of a study to chart out a new grid code for IPPs to supply renewable energy and to allow Small Independent Power Producers (SIPPs) to feed into the grid of the regulating institution;

(iii) Proclamation of a Utility Regulatory Authority Act in September 2008;

(iv) Introduction of an Energy Efficiency Bill for the setting up of the Energy Efficiency Unit which will be mandated to develop guidelines and recommend strategies and policies for energy efficiency improvements; and

(v) The review of the building codes and regulations under the planned GEF/UNDP-funded "Energy Efficiency and Energy Conservation in Buildings in Mauritius". The New Building Control Act will also incorporate components for sustainable buildings.

Concurrently, climate change concerns are gradually finding their way in other sectoral development policies, plans and strategies such as agriculture and food security, water

resources, tourism, land use, transport, health, forest, infrastructure and coastal zone management among others to ensure sustainable development while aiming at poverty reduction. With the financial support of the Government of Japan, UNDP is implementing the Africa Adaptation Programme, a regional project pertaining to 22 countries. The objectives of this project are *"to integrate and mainstream climate change adaptation into the institutional framework and into core development policy, strategies and plans for the Republic of Mauritius"*. They are dispersed within different areas.

Box 6.2: Policy decisions that will tackle climate change issues

Some policy decisions and actions

A number of policy decisions and actions that will tackle climate change issues are now embedded within Governments programme, including:

- A Climate Change Division has been created within the Ministry of Environment & Sustainable Development;
- The Environment Protection Act 2002 has been amended to provide, inter alia, for the setting up of a Multilateral Environmental Agreements (MEAs) Coordinating Committee to ensure better their mainstreaming of all MEAs;
- The major reform programme in which Government has embarked includes implementation of Programme Based Budgeting (PBB) as well as the Medium Term Expenditure Framework (MTEF). In doing so, clearly defined targets and indicators are necessary. This serves as an important tool in mainstreaming climate change concerns in government plans and projects;
- A number of weaknesses have been identified in existing policies, laws and regulations and these will be addressed

6.2 TECHNOLOGY TRANSFER

Figure 6.1 - Harnessing wind energy at Grenade, Rodrigues. *(Courtesy photo : Y. Boodhoo)*

Mauritius completed its assessment on its needs for environmentally sound technologies (ESTs) to address climate change mitigation in the energy, transport and waste sectors as well as within agriculture, forests and other land use, water resources and the coastal zone to enhance adaptation potential. The assessment clearly indicated that Mauritius presents an environment

conducive for successful technology transfer to combat climate change and its impacts. Existing barriers were identified and can be quite easily overcome with the support of the international community. Already, Mauritius is promoting cleaner technologies within its capability to guarantee sustainable development.

Key factors preventing technology transfer to cope with climate change are inadequate integration in long-term development plans, policies and strategies and insufficient institutional synergies. The already existing enabling environment has to be enhanced for further development and transfer of ESTs. Moreover, the needs for transfer of identified ESTs have to be prioritised.

Access to information on ESTs is through the Internet primarily from sites such as TT Clear of the UNFCCC. Technology transfer remains nonetheless a delicate and difficult issue, namely because of Intellectual Property Rights and the usually high costs often associated with them. In addition, the slow rate of technology diffusion and uptake of new technologies are other constraints.

Mechanism resorted to by Mauritius comprised grants, bilateral and multilateral agreements, soft loans and mechanism such as Build, Operate and Transfer (BOT) and Private Public Partnership (PPP), among others for the successful transfer of technologies. It will be of utmost necessity to maintain such flow of funds to enable the Republic to pursue its efforts in addressing climate change while ensuring its sustainable development.

6.3. RESEARCH AND SYSTEMATIC OBSERVATION

6.3.1 Research

Research is quite recent on climate change issues. A project, launched by the Meteorological Services (MMS) to study climatic trends, yielded conclusive results. These tally with IPCC findings and are of regional significance as the coverage of the study spanned the entire EEZ of the Republic. A few other institutions also have implemented research projects to quantify the impacts of climate change in some sectors and the mitigation potential of some measures.

Box 6.3: Examples of research initiatives

Examples of research initiatives

- MMS has intensified efforts to derive climate indices, a parameter indicative of the onset of climate-related events;
- There is an ongoing research programme to monitor any movement in the interface of sea and freshwater and to detect possible salt water intrusion;
- Other studies relate to modeling of projected water availability, soil erosion and crop responses to climate change.;
- Studies are under way to determine the contributing role of various parameters which affects the coastal zone;
- Some studies have been initiated to assess the effects of climate change on land management, crops and livestock production; and.
- Research on the effect of climate change on ecosystems and biodiversity has also started.

Given the expected dire consequences of climate change on the Republic, it is of vital importance to ensure that climate change is included within national research programmes. Results from these programmes will be instrumental in *climate proofing* future development. Existing research programmes have some components on climate change. Thus, there is a need to integrate research into them of all relevant institutions and universities to conduct in-depth research on the impacts of climate change on the socio-sectors of the economy such as agriculture, water resources, coastal zone, fisheries, health, and ecosystems. The results from these studies are deemed important for further enhancing risk avoidance and build preparedness of the population and economic operators, for working out adaptation for vulnerable sectors and to build up resilience of all stakeholder groups.

Figure 6.2 - Vegetable cultivation
Courtesy photo : Y. Boodhoo

Research will help to prioritise Government actions in relation to economic activities and should be extended to the Outer Islands. It is also essential to implement research projects to evaluate measures to be adopted within the local and regional context towards reducing GHG emissions. This will enhance mitigation. Research into the development of appropriate emission factors has to be started to enable more precise GHG inventory compilations.

Regional initiatives comprise programmes under the IOC Regional Committee for the Western Indian Ocean and the development of the SADC Science and Technology framework to support climate change responses. Initiatives aim at incorporating climate change issues in the strategic work plans in particular, on variability of fisheries, food security, coastal ecosystems and coastal zone biodiversity (Figure 6.3), forecasting of severe/extreme weather events, mitigation and risk assessments.

Figure 6. 3 - Mangrove plantation, at Diamant, Rodrigues

6.3.2 Systematic observation

Systematic observation of climate is the continuous monitoring of related parameters as per WMO regulations. These are performed at climate reference stations with standards as stipulated in the WMO Guide to Climatological Practices and are continuously maintained in conditions that safely allow for comparison of data obtained from them internationally. Systematic observation for addressing climate change is also undertaken by other institutions, namely in relation to impacts and for mitigation purposes.

The MMS is the key institution for observing the climate and has been systematically doing so since several decades on the entire territory of the Republic. The oldest station which recorded rainfall dates as far back as 1853. Systematic observations are being performed since the early 1950's as a result of improved infrastructure. Temperature, rainfall, atmospheric pressure, wind, relative humidity, evaporation, solar radiation, cloud cover, sea surface temperature, waves and tides are parameters of interest for the study and research on climate change.

Figure 6.4 - An automatic weather station and, a tide gauge (right). *(Courtesy : MMS)*

Several of the stations in Figure 6.5 below are very old and need updating with modern equipments and infrastructure, including automation. Some of the stations are located on remote locations and islets. Details on the observation stations on Mauritius and the length of continuous records are given in Table 6.1. Others are located on outer islands.

Table 6.1: Details of systematic observation and their length of records.

Parameter	No. of observation points	Length of continuous records (years)	Remarks
Rainfall	250	60	23 are considered for trend analysis
Temperature	20	60	5 are climate reference stations (CRS)
Atmospheric pressure	10	60	5 are CRS
Wind	50	60	9 sites are selected for trend analysis
Relative humidity	20	60	
Solar radiation	20	60	
Evaporation	50	18	
Sea-level	4	15	Two in Mauritius, one in Rodrigues and one in Agalega

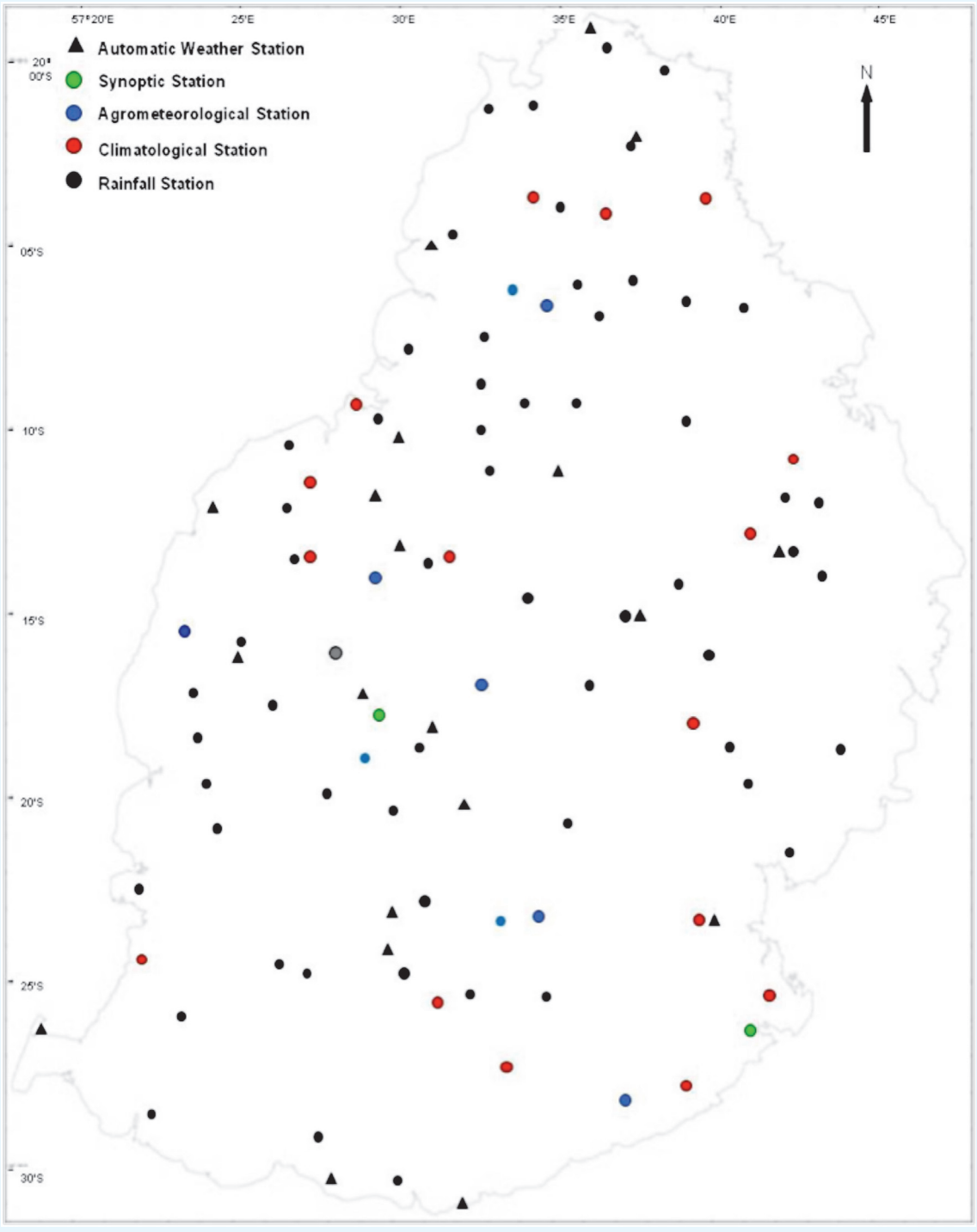


Figure 6.5 - Distribution of selected stations for climate monitoring over Mauritius

Even if systematic observation is relatively well-organized for climatic parameters, there is a need to strengthen and extend the coverage for observation of other variables with regards to climate change mitigation and adaptation. Parameters of regional importance such as ocean currents and fish migration also have to be addressed.

6.4. EDUCATION, TRAINING AND PUBLIC AWARENESS

6.4.1. Education

Free compulsory education has been at the basis of the rapid socio-economic development of the country and the objective is to develop Mauritius into a centre of excellence in the region now. The Ministry of Education, and Human Resources (MoEHR) and the Ministry of Tertiary Education, Science, Research & Technology have the responsibility for policy formulation and planning of education at all levels in the country, in collaboration with other ministries, the private sector, the civil society and international agencies.

The MoEHR's policy document entitled *'Towards a Quality Curriculum – Strategy for Reforms'* and the recent *National Curriculum Framework for Primary Education (2008)* considered climate change as a component of education on sustainable development. Climate change is covered mainly at the upper secondary level. The curriculum of subjects such as Biology, General Paper, and Marine Science also address climate change topics. However, the draft *Curriculum Framework for Secondary Education* envisages the teaching of climate systems and climate change in much greater depth at secondary level.

With the Ministry's new policy of broadening the curricular base, even those students opting for the non-science stream will be required to learn some science subjects, and will get exposure to climate and climate change topics. The Ministry also has a unit under the Curriculum Development and Evaluation Directorate to look after co-curricular and extra-curricular activities to include climate change within them.

Tertiary education is provided by public institutions as well as private ones in partnership with foreign universities. While there is no full-fledged formal programme on climate change per se, the curriculum of several of the programmes includes modules that partially address climate change issues.

6.4.2 Training

Mauritius has a long and successful history of vocational training within its development agenda. Climate change does not formally form part of these courses even if informally the role of climate and climate systems and extremes are addressed when these do have a strong bearing on the areas concerned. Some of the areas concerned are agriculture, fishing and tourism among others.

Training of nationals to deal with climate change issues and to report to the UNFCCC

can be considered as being inadequate. Some training has been acquired through the programmes of, UNEP, IPCC, WMO and other Agencies. Other nationals received some training during their participation in the reporting activities such as during the preparation of the INC, the TNA and presently the SNC. Most of the trained staff have either retired or shifted to other Ministries and Departments, and were not available during the preparation of the SNC. Some 40 persons have acquired some basic skills for dealing with climate change issues in different areas during the preparation of the SNC.

There is need to address this training issue at national level by adopting an integrated approach with climate change included in the syllabi of training courses. Training should also be informal and aimed at all segments of the population. The purpose of the training should be to encourage the latter to adopt daily habits to meet the objectives of the Convention. Specific objectives could include energy saving and sustainable use of resources. One initiative is within the curriculum of the Primary Teachers' Diploma Course that includes climate change issues, such as sea level rise, human interference with natural cycles and the greenhouse effect. This part is mandatory for all primary school trainee teachers.

6.4.3 Public awareness

Sound awareness of all components of the population including policy- and decision-makers at all levels on climate change issues is a must. Awareness campaigns have been conducted by public and private institutions as well as NGOs. A few salient ones well in place are the Green school project that promotes and acknowledges whole school action for the environment, distribution of relevant sensitization materials and special activities on the occasion of World Environment day and World Meteorological Day, the project of setting up of a composting plant and a Nature corner with endemic plants in primary schools. NGOs have, among others, delivered talks and made presentations in all government and some private primary schools. However, all classes have

Figure 6.6 - Climate Change Public Awareness brochure
(Courtesy: MOE & SD)

Figure 6.7 – Fishermen at work at St Brandon
(Courtesy photo : Yen Luk)

not been covered up to now. Another prominent feature has been the publication of a pictorial on climate change in the local creole dialect in addition to the English and French versions in order to reach the public at large. Newspapers, the radio and TV also address the climate change issue regularly.

Despite the considerable efforts made towards sensitising various stakeholder groups, the level of awareness is considered still low. Stakeholder consultations were held and surveys conducted among civil society groups whose livelihood, among other factors, depend on stable climatic conditions. These were fishers, vegetable growers, and livestock breeders including chicken and egg producers. Additionally, students and the general public, representative of persons from the different walks of life, were interviewed.

They covered all age groups but the majority was aged between 40 and 60. A higher number of the participants were of the male gender which probably reflects a bias towards the types of activities covered.

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Future programmes should focus on the root causes of climate change, its direct and indirect impacts on daily activities, on measures to be adopted to contain global warming and its impacts. Programmes have to be well defined so as to reach key target groups, starting with policy-makers and decision-makers, for information to trickle down to the public at large.

Of the different groups, 72% to 100% (students) responded that they were aware of climate change. However, in most cases they were not aware of the causes. Very often pollution was identified as the cause. Almost all, 86% to 100% within the groups recognized they were affected by climate change in their daily activities - socially, in their welfare or economically.

Figure 6.8 - Global warming brochure for public awareness *(Courtesy : MOE & SD)*

Climate change was seen as being closely related to their daily activity. It included changes in tides and sea surface temperature as seen by fishers, changes in season length, sowing dates and pests occurrence reckoned by crop growers, and temperature and pasture availability by livestock breeders. Students reflected on temperature and rainfall changes as observations they have made. Lower productivity and discomfort were frequently cited as being the impacts. This very diverse response may be due to the fragmented and piecemeal approaches in sensitisation that have been adopted up to now.

Other techniques used mainly for schools included awards for environment-improving activities, mural paintings, quiz, elocution contest, celebration of environmental week, debates, sketch, poem and essay competitions, student presentations, rallies and workshops.

In light of these activities and the results achieved, it would be advisable to analyse the effectiveness of past sensitization approaches with a view to increase their impact. Since the general public does not feel the effects of climate change continuously, not many people can clearly identify its impacts, although they have heard of climate change. It is therefore imperative to invest in increasing awareness on climate change, particularly for those whose livelihood depends heavily on climate stability.

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Box 6.4 Proposals for enhanced sensitization campaigns

Proposals for enhanced sensitisation campaigns

- The development of centrally coordinated training and public awareness programmes through the participation of central and local government authorities, educational institutions and the private sector;
- The design and conduct of specific modules on climate change by higher education institutions ;
- The undertaking of a thorough review of curricula at all levels be undertaken to ensure sufficient inclusion of climate change issues;
- The development of simple, pictorial, colourful, easy to understand booklets on climate change related issues for pre-primary and primary school children, to enable them to relate their home, school and other activities to climate change;
- Undertaking capacity building of teachers and other pedagogues to organize co-curricular and extracurricular activities for consolidating learning of concepts linked with climate change; and Promotion of e-learning and use of media at all levels (including households).

6.5 CAPACITY-BUILDING

Proper and adequate capacity is a key factor to address climate change. Appropriate capacity should cover the wide range of activities and issues relating to the root cause of climate change as well as ways and means to mitigate and adapt to climate change. Additionally, there should be enough capacity to ensure that climate change considerations are mainstreamed into the development agenda, included within the educational curriculum and in the daily activities of all segments of the population.

The ***National Capacity Needs Self-Assessment*** (NCSA, ***2005***), acknowledged that the key national institutions dealing with climate change are facing severe shortage of trained staff. This stems from the fact that up to now there has not been any well-structured capacity building programme set up for dealing with climate change issues.

Specific capacity building to meet the reporting needs of the Convention, namely the preparation GHG inventory and national communications did occur under the mandate of the consultative Group of experts of the UNFCCC. Some capacity building has also been possible under the USCSP programme, the IPCC and UNEP Riso to national experts. Some of the specific capacity building areas covered are Inventory of GHGs including running of the GHG inventory software, generation of climate change scenarios using the MAGICC-SCENGEN model, Vulnerability and Adaptation Assessment, Technology Needs Assessment, Technology Transfer and Project writing up for funding and the Clean Development Mechanism of the Kyoto Protocol.

Considering the forthcoming challenges linked to climate change, it is imperative that a comprehensive capacity building programme be worked out and implemented. Capacity building should aim at involving a wide range of stakeholders (government officials, the private sector and civil society organizations). Climate change is a multi-sectoral concern and it is most apposite that capacity building initiatives are appropriately directed to the relevant organizations and individuals to ensure that the knowledge acquired serves its useful purpose. This will enhance national capacity for climate proofing its sustainable development agenda while preparing the population to cope with its impacts and also increase their resilience. Some capacity building initiatives are being taken on board programmes of the IOC and the SADC. The present Africa Adaptation Programme is partially providing for capacity-building for integrating adaptation into medium and long-term planning.

6.6 INFORMATION AND NETWORKING

Access to information is considered good in Mauritius. The national radio and TV offers a series of local, regional and international channels to the public and cover climate change directly and indirectly. Climate change is brought to the wide public in one way or another, directly or indirectly, through its impacts within the local, regional and international contexts in the news or other broadcasts. The broadcasts spans over a wide range of language including English, French, Creole and some Asian ones, thus making the climate change issue available within the reach of one and all. Additionally, the written press, consisting of local and foreign newspapers, magazines, periodicals and scientific publications also serves to avail information to the different group of stakeholders. Very often articles target climate change with assessments for its impacts on various issues including daily activities and mention ways and means to be adopted to combat the negative impacts. Internet access is readily available all over the country. A large proportion of the population has access to it through at home, at their workplace, school or in Internet cafés.

Networking is not very developed locally on climate change. As such, it is not formally included under regional integration initiatives. Informal information sharing and networking do occur, however, under the aegis of the IOC and the FANRPAN programme of the SADC or within the strategies of the latter agreement. The Indian Ocean Commission (IOC) implemented two important projects related to climate change and sustainability:

- The ReCoMaP Programme aims at promoting sustainable development of coastal resources within a regional perspective while the Acclimate Project will enhance information sharing and networking on adaptation assessment.
- The Africa Adaptation Programme is another avenue to institutionalize information sharing and networking within the 22 participating countries. There is presently an initiative by the African Academy of Science to organize meetings on the sharing of scientific findings pertaining to climate change.

The above platforms as well as COMESA could be explored in view of promoting information sharing and networking to cope with climate change which is affecting the development of all Member States.

6.7 CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS

Constraints and gaps areas indicated in **(Table 6.2)**. Whereas some of them require considerable resources, most of them could be addressed with affordable resources or with regional exchanges and cooperation. During the work linked to the SNC, much gap, especially in capacity building, has been closed.

Table 6.2 Gaps and constraints

Thematic area	Constraints	Gaps
National Circumstances	Inadequate knowledge and lack of capacity in integrating climate change concerns into sectoral and national planning processes, *availability*? Lack of of Indian Ocean oceanographic data	Linkage with climate change absent most of the time, lack of SST and SLR data for the lagoon and region,
GHG inventory	EFs for some source categories not appropriate, lack of capacity for Tier 2 compilation and lack of understanding of processes in the industrial source category.	Disaggregated data in the manufacturing, civil aviation, navigation, residential and commercial sub-sectors of the energy source category, on SOP and in the solid waste sector not always available for Tier 2.
Vulnerability and Adaptation	Lack of studies to support reliable assessments, inadequate institutional capacity and knowledge to integrate climate change in activities, Lack of capacity for running models for assessments, lack of technical, technological and finance to implement adaptation measures.	Insufficient quality data and observations relating to vulnerability of the various sectors, lack of assessments and studies on adaptation in the various sectors, economic evaluation of measures for their benefits not yet available.
Mitigation	Lack of studies to support reliable GHG mitigation assessments, inadequate institutional capacity and knowledge to integrate climate change in activities, Lack of capacity for running models for evaluating mitigation options, Technical, technological, human and financial needs to implement mitigation measures.	Reliable good quality data on processes emitting GHGs in the various sectors not readily available, lack of assessments and studies on mitigation in the various sectors, Cost benefit analyses of measures for promoting their adoption almost inexistent.
Others	Insufficient capacity building in all thematic areas, training acquired not necessarily by the appropriate persons to deal with the sectoral issues, inability of sectoral experts to integrate climate change concerns in their activities, due to competing demands on the time of national experts, some of them are unable are not always dedicated and committed to climate change issues,	Knowledge gaps on climate change on the different sectors, integration within policies and plans incomplete, inappropriate regulatory frameworks and legislations.

The "Maurice Ile Durable" – sustainable Mauritius vision, has unveiled the sustainable development path adopted in 2008, in line with the Rio Conventions. However, as a developing SIDS, the Republic's capability to stand to this commitment will rest heavily on the support of Annex I Parties to meet its needs for meeting the objectives of the Convention.

Box 6.5: Priority emerging needs

Some of the priority emerging needs

- The successful mainstreaming of climate change issues, which is presently scanty and fragmented into national development plans and strategies;
- The development of a national adaptation and a mitigation strategy;
- The setting up of the necessary regulatory and administrative framework to ensure that both mitigation and adaptation measures are being adopted and implemented in all sectors;
- The compilation and exchange of reliable and comparable information, enhancement of systematic observation, promotion of research and capacity building to empower national human resources to meet the challenges and seize the opportunities resulting from climate change across all sectors; and
- The increased participation of civil society and non_governmental organizations to play a more active role in decision making, education and public awareness activities on climate change.

The above priorities will demand huge amounts of financial resources made available through the various existing mechanisms. Government has been active in securing funding and will continue to do so. However, taking into consideration that the Republic's contribution to global warming is negligible and that there is a limit to the debt servicing ratio that it can bear without affecting the welfare of the population, a higher flow of funds will be needed as grants. The latter is of capital importance, especially for financing adaptation of the poorest segment of the population such as amateur fisherman, small crop growers and livestock breeders. Adaptation funds will also be needed to protect and safeguard beaches and the coastal zone that are assets for the tourism industry.

Box 6.6 : Projects under way or planned with financing mechanisms

- Wind Park at Curepipe with funding by GOM/SADC/ADB;
- New Hydro Plants at Nicolière and Midlands Dams of 337 KW each to be funded by CentralElectricity Board;
- Construction of wind park in Rodrigues to be funded by Central Electricity Board;
- Construction of Hazardous Waste Facility at La Chaumière with funding by GOM and loanfrom BADEA;
- Plaine Wilhems Sewerage project with funding by GOM/ EU and Loans from EIB and ADB;
- Feasibility of West Coast Sewerage programme funded by grant from France;
- Grand Baie Sewerage project funded by Loan from JICA/ AFD and GOM;
- Rehabilitation/ reprofiling of beaches funded by GOM; and
- Land Drainage programme funded by GOM;

Additional funding which the country has been able to mobilize for mitigation and adaptation projects include: -

- Agence Française de Développement (AFD) providing Euro 125 million of loan for the MID agenda and Euro 1 million as grant;
- The EU is topping this up with a grant of Euro 3 million under the Global Climate Change Alliance;
- UNDP has helped to mobilise about USD 6 million, including contributions from the Global Environment Facility for the "Energy Efficiency and Energy Conservation in buildings" project to the tune of USD 1 M and "Removal of Barriers to Solar PV Power Generation in Mauritius, Rodrigues and the Outer Islands" to the tune of USD 2 M and Government of Japan, to the tune of USD 3 M for the Africa Adaptation Programme.
- Indian Ocean Commission (IOC) has initiated a 3-year project in 2009 entitled 'Project to reinforce the capacity of members of the IOC to adapt to climate change'[3], which has a funding grant of €3,645,000[4]. The main objective of this project is to establish regional cooperation between member states of the IOC (Comoros, Madagascar, La Réunion, Mauritius, and the Maldives) to better facilitate adaptation to climate change. In particular, the project will have four broad areas of intervention; and
- Under the German Programme for Climate Change, a grant of around Euro 1.2 M has been received for the installation of Ammonia Chillers in government buildings

[3] The exact title is 'Projet de Renforcement des Capacités des Pays de la COI dans le Domaine de l'Adaptation au Changement Climatique'.
[4] The total cost of the project is distributed as follows: (1) FFEM - € 1 million; (2) IOC – € 1,935,000 (through the integrated Coastal Zone Management project funded under the 9th EDF); (3) Ministry of Foreign Affairs - € 495,000 (for technical assistance and scholarships); and (4) la Région Réunion - € 215,000.

APPENDICES

Project Concepts

Six project concepts have been conceived based on government programme and the Maurice Ile Durable concept. They relate to the:

Appendix 1 - SETTING UP OF A WIND FARM IN MAURITIUS

Executing : Central Electricity Board

Introduction

Government of Mauritius has recently endorsed a National Outline Energy Policy 2007 – 2025, with the clear objective to promote use of renewable resources for electricity generation. The Central Electricity Board, under the aegis of the Ministry of Public Utilities will spearhead the process from the implementation a Wind farm of 20 MW. The Project is envisaged be a Public Private Partnership and will be developed on a Build Own Operate basis.

Objective

- To diversify the energy mix so as to be less dependent on fossil fuels.
- To minimize environmental impact as compared to power plants using fossils fuels, which generate air, water and land pollution.
- To contribute towards the reduction of Green House Gases emission, thereby mitigating adverse effects of global warming.

Justification

- To be in line with Government policy to promote renewable energy projects as enunciated in its National Outline energy Policy 2007-2025.
- To ensure long term sustainable economic development.
- To achieve the millennium development goals of ensuring energy security
- To mitigate climate change by offsetting CO2 emissions.

Activities

- High level wind resource assessment with the available satellite (2010)
- Installation of a wind mast for the recording of wind data at site (2010)
- Implementation of the first phase of 10MW (2012)
- Implementation of the second phase of 20 MW (2013)

Benefits (CC and socio-economic)

- The project is expected to generate some 35 GWH of electrical energy.
- Some 35 000 tonnes of CO2 emissions will be avoided yearly.
- Climate Change Mitigation and Adaptation Benefits
- Environmental and air quality Benefits
- Energy Security Benefits

Approximate costs

- Estimated cost of investment : 60 Million USD.

Appendix 2
HARNESSING ADDITIONAL WATER RESOURCES FOR THE NORTHERN PLAINS

Implementing agency : Water Resources Unit

Introduction

The effect of climate change is already being felt on the island and the hydrological cycle and water resources management are affected by the following: Decrease of average rainfall of 12% from 1930 to present. The following observations have been made:

- Rainfall recharge over high grounds, where the common recharge zone of the acquifers is located, has decreased by 1 000mm on an average annual basis leading to a decline in yields.
- Salt water intrusion has been detected in coastal aquifers.
- There are longer periods of dry spells (Sept to Dec compared to previously Sept to October).
- Increase of intensity of precipitation which are of shorter duration and result in flash floods, more loss of storm water to the sea and less groundwater recharge.

Objectives

Increase the resilience to climate change to meet the demands up to 2030 through harnessing of flood waters and increase of storage capacity to ensure supplies with a regulating capacity for two years instead of the present one year. This will cater for an adequate water supply for a dry year following a normal year. In this context the capacity of La Nicolière Reservoir need to be increased with additional diversion infrastructure such as canals, pipelines.

Justification

At present the northern plain water requirement rests at 143 Mm3 per year. Of these 17% is from underground. With climate change impacts and increase in industrial, residential, tourism, agricultural and other development projects being contemplated in that area, an even higher volume will be needed with time. The estimated volume of water required by 2030 is in order of 180Mm3. With available water resources the present demand to cater for planned agricultural and industrial development cannot be met.

Activities

- Increase the storage capacity of La Nicoliere Reservoir from 5.3 Mm3 to 16 Mm3 (200%).
- Construct feeder canals and pipelines to channel untapped flood water to La Nicoliere reservoir.

Benefits

Satisfy demands of water to sustain development and ensure food security up to the year 2030 and reduce loss of surface runoff loss of water to the sea. This will also control floods.

Estimated Cost:

Estimated cost of investment :over 100 Million USD

Appendix 3 - COMPOSTING

Implementing Agency : Ministry of Public Utilities

Introduction

Mauritius generates more than 400 000 tons per year, representing a generation of 0.9 kg per capita per day and expected to grow at a rate of 1% p.a. Characterisation studies have shown that more than 70% is biodegradable. The present waste management set up is heavily dependent on landfilling with recycling being carried out at a very low rate and in an informal, uncoordinated and unregulated manner. The project consists of the setting up a Compost Plant of Capacity 100 000 tons of waste p.a.

Objective

To dispose of waste in a more environment friendly and financially sustainable manner

Justification

The project is in line with the Concept of Maurice Ile Durable and Millenium Development Goal of sustainable waste management.

Activities

Item	Activities	Time Frame
1.	Pre-feasibility at the MLG	2 months
2.	Government's approval	2 months
3.	procurement for appointment of a Transaction Advisor	6 months
4.	Feasibility and preparation of PPP bidding docs by TA	6 months
5.	Procurement for selection of Contractor	6 months
6.	Construction of facility	15 months
	Total period before Operation	**37 months**

Benefits

(i) a reduction in the green houses gases through avoided landfilling, transportation and use of inorganic fertilizers.
(ii) a reduction in Government's expenditure on solid waste management
(iii) a more diversified and sustainable waste management disposal option

Cost Estimates

Estimated cost of investment : 8 Million USD

Appendix 4
IMPLEMENTATION OF A BUS MODERNISATION PROGRAMME

Executing Agency : Private Sector

Introduction

Road Transportation is the only mode of land transport in Mauritius. It accounts for 23% of total GHG emissions and has a significant potential for GHG mitigation. Implementation of a bus modernization programme is one of the mitigation options considered. This programme will continue to serve its useful purpose to meet environmental concerns and mobility needs along with any other mass transit system that may eventually be introduced.

Objectives

- To mitigate emissions of GHG from operation of technically more efficient buses.
- To maintain a good air quality.
- To encourage a shift from the use of private transport to public transport.

Justification

- To meet the objective of the United Nations Framework Convention on Climate Change
- To reduce consumption of fossil fuel through non-operation of 10% of private cars daily
- To operate cleaner vehicles to meet the transport needs of the country.

Activities

The bus modernization project will involve the gradual replacement of 1 800 conventional buses by a new generation of comfortable, more accessible and low emitting buses equipped with advanced emission control technologies within the following time frames:

- 30% of fleet within 3 years of start of project
- 200 buses for each year thereafter with the whole project completed by 2022/2023.

Benefits

∑ Reduction of 30 Gg of GHG emissions over life time of project.
∑ Improvement in health condition of population through cleaner air quality.
∑ Improvement in the transport landscape of the country.
∑ Reduction in country's dependence on fossil fuel and related importation costs.

Estimated cost of investment : 300 Million USD. (Private sector input : 120 Million USD; Additional cost required : 180 Million USD)

Project Risk Factor

The project has a low risk factor as:
∑ It will generate revenue from bus fares and other compensation paid by government.
∑ The investment will be in proven technology having a long lifespan.

Appendix 5 -
REEF RESTRUCTURING AND BEACH REHABILITATION AT FLIC EN FLAC

Implementing Agency : Ministry of Environment and Sustainable Development

Introduction

Coastal areas in Mauritius are experiencing adverse impacts of climate change with significant damage to infrastructure and potential threat to life. The impacts are being exacerbated by a reduction in the protective function of fringing coral reefs as those systems are damaged by an increased incidence of high temperatures associated with bleaching events as well as frequency and intensity of extreme weather events.

Such impacts have the potential to undermine the hard won socioeconomic progress as well as the future coastal development on which the tourism industry depends. While the Mauritian government has implemented a number of measures to address vulnerability to existing climate hazards on the coastal zone, these measure alone are not sufficient to secure coastal development in the face of climate change.

Objective

Minimize beach erosion and enhance lagoon/coral reef ecosystem functionalities.

Justification

The Flic en Flac coastal area is one such area mostly affected. The Baird's Report on Coastal Erosion in Mauritius (2003) and the Integrated Coastal Zone Management Study (2010) have identified this area as one of the priority areas for rehabilitation. A set of measures have been initiated at this site over the past years. However, additional works need to be carried out to reinforce the protection functions of the coral reef.

Activities

Pilot innovative long-term adaptation measures in collaboration with relevant government bodies, private sector, and NGOs focusing on adaptation. These inter alia, include:

(i) Reef restructuring and beach rehabilitation using submerge artificial structures in areas where reef damage threatens to intensify erosion over a stretch of 2 Km.

(ii) Integration of other measures into in that area to increase its physical resilience of weather extremes.

Time Frame : 2011 – 2015

Benefits

Specific benefits are expected to include sustainability of tourism sector investments, protection of the livelihoods and assets of coastal communities, and protection of coastal and marine ecosystems.

Estimated cost of investment : 6 Million USD

Appendix 6 -
ADDRESSING SOIL AND LAND DEGRADATION IN RODRIGUES ISLAND

Executing Agency : Rodrigues Regional Assembly

Introduction

Rodrigues, an outer island of the Republic of Mauritius, has a population of some 38 000 inhabitants living on subsistence agriculture. Under the projected climate change scenarios (reduced rainfall, higher rainfall variability, more frequent intense rainfall events, and longer and more severe dry spells), land degradation will be further exacerbated. This will lead to further reduction in water availability for agriculture and domestic use, increased soil loss to the sea, and increased lagoon sedimentation and eutrophication. These impacts will reduce agricultural/fishery productivity and eventually pose a threat to the livelihood and well-being of the communities.

Objectives

- To stop land degradation by establishing a vegetative cover on 1 000 ha of degraded land.
- To establish a carbon sink of 7 to 20 Gg CO2 y-1 from tree cover.
- To improve food security and community well-being.

Justification

Reforestation and afforestation of the degraded land is the most appropriate adaptation measure to contain the impacts of climate change and to avoid the emergence of climate change refugees among the community.

Activities

The project will consist of the reforestation and afforestation of degraded land and exploitation of biomass for use as livestock feed. Planting will be undertaken on 250 ha in the first year of the project followed by the planting of 300 ha in the second year and 350 ha in the third year.

Benefits

- A carbon sink will be created.
- Employment will be created.
- The vegetative cover will reduce erosion and land degradation.
- Soils health will improve with higher rainfall capture.
- Additional forage will be available for livestock.
- The erosion load to the sea will be reduced, thus reducing lagoon sedimentation.
- Agricultural production (crop and livestock) will be raised and food security secured.

Cost of Project

Estimated cost of investment : 12 Million USD (12 000 USD x 1000 ha)

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