Second National Communication on Climate Change for Saint Lucia

December 2011

Prepared on behalf of

The Government of Saint Lucia

Ministry of Physical Development & the Environment

Sustainable Development & Environment Division

In fulfilment of its obligations under the

United Nations Framework Convention on Climate Change

December 2011

ACKNOWLEDGEMENTS

*This **Second National Communication (SNC) on Climate Change** for the Country of Saint Lucia was made possible through the funding support of the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP). The Sustainable Development and Environment Division (SDED) in the Ministry of Physical Development & the Environment of the Government of Saint Lucia served as the focal point for the co-ordination and the implementation of activities required for the development of the SNC.*

The SNC was prepared through the collaborative effort of local, regional and international resource persons.

The invaluable support of the UNDP – National Communications Support Programme (NCSP) team, is also gratefully acknowledged through training support and document reviews.

The Sustainable Development and Environment Division (SDED) wishes to extend its gratitude to the contributors of the various reports, participants of consultations, persons assisting with document reviews as well as the overall co-ordination and implementation of key components, all essential to the completion of Saint Lucia's Second National Communication on Climate Change.

TABLE OF CONTENTS

ACRONYMS

AC	Air Conditioning
ACCC	Adapting to Climate Change in the Caribbean
AETS	Application Europeenne de Technologies et de Services
ALERT	Automated Local Evaluation in Real Time
AOSIS	Alliance of Small Island Developing States
APESL	Association of Professional Engineers of Saint Lucia
AWMS	Animal Waste Management System
BPoA	Barbados Programme of Action
BAU	Business-as-usual
CAC	Conventions and Advisory Committee
CADM	Caribbean Disaster Management Project
CAFE	Corporate Average Fuel Economy
CAMPAM	Caribbean Marine Protected Areas Managers
CANARI	Caribbean Natural Resources Institute
Carib-HYCOS	Caribbean Hydrological Monitoring
CARICOM	Caribbean Community
CARILEC	Caribbean Electrical Utility Services Corporation
CBA	Community Based Adaptation
CBBRAS	Coconut Bay Beach Resort and Spa
CBD	Convention on Biodiversity
CBDAMPIC	Capacity Building for the Development of Adaptation Measures in Pacific Island Countries
CBO	Community Based Organisation
CBWMP	Caribbean Basin Management Programme
CCCCC	Caribbean Community Climate Change Centre (5Cs)
CCCDF	Canadian Climate Change Development Fund
CCEA	Climate Change Enabling Activity
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CCST	Caribbean Council for Science and Technology
CCTNA	Climate Change Technology Needs Assessment
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDM	Clean Development Mechanism
CEHI	Caribbean Environmental Health Institute

CEIS	Caribbean Energy Information System
CFCs	Chlorofluorocarbons
CFRAMP	CARICOM Fisheries Resource Assessment and Management Programme
CH_4	Methane
CIDA	Canadian International Development Agency
CIMH	Caribbean Institute of Meteorology and Hydrology
CIPORE	Caribbean Information Platform on Renewable Energy
CITES	Convention on the International Trade in Endangered Species of Wild Fauna and Flora
CO	Carbon Monoxide
CO_2	Carbon dioxide
CO_2e	Carbon Dioxide Equivalent concentration.
COP	Conference of Parties
CPACC	Caribbean Planning for Adaptation to Climate Change
CREDP	Caribbean Regional Agency Development Programme
CRET	Caribbean Renewable Energy Technologies
CRFM	Caribbean Regional Fisheries Mechanism
CRMI	Caribbean Risk Management Initiative
CSDEO	Chief Sustainable Development and Environment Officer
CSG	Climate Studies Group
CUBiC	Caribbean Unified Building Code
CXC	Caribbean Examinations Council
CYEN	Caribbean Youth Environmental Network
CZM	Coastal Zone Management
CZMAC	Coastal Zone Management Advisory Committee
CZMU	Coastal Zone Management Unit
DAC	Development Cooperation Assistance
DCA	Development Control Authority
DNA	Designated National Authority
DOC	Degradable Organic Content.
DSM	Demand Side Management
EAW	Energy Awareness Week
ECA	Economics of Climate Adaptation
EEBC	Energy Efficiency Building Code
EIA	Environmental Impact Assessment

EMF	Environmental Management Fund
EMLEE	Electronic Mailing List for Environmental Education
EPA	Environmental Protection Agency.
EPAC	Energy Policy Advisory Committee
ESCO	Energy Service Company
ESTs	Environmentally Sound Technologies
EU-SFA	European Union-Special Framework for Assistance
FAO	Food and Agriculture Organization of the United Nations
FNC	First National Communication
GCC	Global Climate Change
GCM	Global Climate Models
GCOS	Global Climate Observing System
GCSI	Global Change Strategies International
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagram
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GLISPA	Global Island Partnership
GOS	Global Observing System
GOSL	Government of Saint Lucia
GPS	Global Positioning System
Gt	Gigatonne
GTZ	German Agency for Technical Co-Operation (Deutsche Gesellschaft fur Technische Zusammenarbeit)
GWP	Global Water Partnership
GWP	Global Warming Potential
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
HPMP	HCFC Phase-out Management Plan
HYdata	Hydrological Data
IAMs	Integrated Assessment Models
ICC	International Code Council
ICSL	Insurance Council of Saint Lucia
ICT	Information and Communications Technology

IDB	***Inter-American Development Bank***
IDP	***Integrated Development Planning***
IFF	***Investment and Financial Flows***
IICA	***Inter-American Institute for Cooperation on Agriculture***
INC	***Initial National Communication***
INRMP	***Integrated Natural Resource Management Plan***
IPCC	***Inter Governmental Panel on Climate Change***
IWCAM	***Integrating Watershed and Coastal Area Management***
JICA	***Japan International Cooperation Agency***
KAP/B	***Knowledge Attitude and Practice/Behaviour***
Kt	***Kilotonne***
LEAP	***Long-range Energy Alternatives Planning System***
LPG	***Liquefied petroleum gas***
LUCELEC	***Saint Lucia Electricity Services Limited***
LULUCF	***Land Use and Land Use Change and Forestry***
M&E	***Monitoring and Evaluation***
MACC	***Mainstreaming Adaptation to Climate Change Project***
MALFF	***Ministry of Agriculture, Lands, Forestry and Fisheries***
MCF	***Methane Correction Factor.***
MDGs	***Millennium Development Goals***
MEA	***Multilateral Environmental Agreement***
MOU	***Memorandum of Understanding***
MPDE	***Ministry of Physical Development and the Environment***
MRV	***Measuring, Reporting, and Verification***
MSD	***Meteorological Services Department***
MSI	***Mauritius Strategy for Implementation***
MSW	***Municipal Solid Waste.***
MTES	***Medium Term Economic Strategy***
MTSP	***Medium Term Strategic Plan***
N_2O	***Nitorous Oxide. A greenhouse gas.***
NAMAs	***Nationally Appropriate Mitigation Actions***
NBSAP	***National Biodiversity Strategy and Action Plan***
NCCC	***National Climate Change Committee***
NCCPAP	***National Climate Change Policy and Adaptation Plan***
NCSA	***National Capacity Self Assessment***
NCSP	***National Communications Support Programme***

NCSTD	***National Science Council for Science, Technology and Development***
NDMS	***National Disaster Management System***
NEB	***National Energy Balance***
NEC	***National Environmental Commission***
NEEP	***National Environmental Education Policy***
NEES	***National Environmental Education Strategy***
NEIS	***National Environmental Information System***
NEMAC	***National Emergency Management Advisory Committee***
NEMO	***National Emergency Management Organisation***
NEMP	***National Emergency Management Plan***
NEP	***National Energy Policy***
NEP/NEMS	***National Environment Policy/National Environmental Management Strategy***
NFP	***National Focal Point***
NGO	***Non Governmental Organisation***
NIPRO	***National Insurance Property Development and Management Company Limited***
NLP	***National Land Policy***
NMVOC	***Non-methane Volatile Organic Carbon.***
NOU	***National Ozone Unit***
NOx	***Nitrogen Oxides.***
NTN	***National Television Network***
NWP	***National Water Policy***
OAS	***Organisation of American States***
ODS	***Ozone Depleting Substance(s)***
OECD	***Organisation for Economic Cooperation and Development***
OECS	***Organisation of Eastern Caribbean States***
OPAAL	***OECS Protected Areas and Associated Livelihoods Project***
PAD	***Project Appraisal Document***
PCU	***Project Coordinating Unit***
PDA	***Personal Data Assistants***
PEO	***Public Education and Outreach***
PPA	***Power Planning Associates***
PPCR	***Pilot Programme on Climate Resilience***
PSEPA	***Pointe Sable Environmental Protection Area***

PV	***Photo-voltaic***
RAP	***Regional Action Plan***
RCM	***Regional Climate Models***
RECC	***Review of the Economics of Climate Change***
REDD	***Reducing Emissions from Deforestation and Forest Degradation in Developing Countries***
RET	***Renewable Energy Technologies***
RSO	***Research and Systematic Observation***
SBAs	***School-Based Assessments***
SBI	***Subsidiary Body for Implementation***
SBSTA	***Subsidiary Body for Scientific and Technological Advice***
SCBD	***Secretariat Convention on Biological Diversity***
SDED	***Sustainable Development and Environment Division***
SEP	***Sustainable Energy Plan***
SGD	***Saint Georges Declaration of Principles for Environmental Management***
SGP	***Small Grants Programme***
SIDS	***Small Island Developing States***
SLBS	***Saint Lucia Bureau of Standards***
SLHTA	***Saint Lucia Hotel and Tourism Association***
SLM	***Sustainable Land Management***
SLNT	***Saint Lucia National Trust***
SMMA	***Soufrière Marine Management Association***
SNC	***Second National Communication***
SO_2	***Sulphur Dioxide***
SOPs	***Standard Operating Procedures***
SPACC	***Special Programme on Adaptation to Climate Change***
SRSC	***Sub-regional Steering Committee***
STDC	***Southern Tourism Development Corporation***
SWDS	***Solid Waste Disposal Site***
SWMA	***Solid Waste Management Authority***
TDM	***Transportation Demand Management***
TFP	***Technical Focal Point***
TJ	***Terajoule. A metric unit of energy.***
TNC	***The Nature Conservancy***
TOE	***Tonne Oil Equivalent***

UNCCD	***United Nations Convention to Combat Desertification***
UNCSD	***United Nations Commission for Sustainable Development***
UNDP	***United Nations Development Programme***
UNDPAPF	***United Nations Development Programme Adaptation Policy Framework***
UNEP	***United Nations Environment Programme***
UNFCCC	***United Nations Framework Convention on Climate Change***
UNICEF	***United Nations International Children's Emergency Fund***
USAID	***United States Agency for International Development***
UWI	***University of the West Indies***
V&A	***Vulnerability and Adaptation***
VCA	***Vulnerability and Capacity Assessment***
WASCO	***Water and Sewerage Company***
WED	***World Environment Day***
WEDO	***Women's Environment and Development Organisation***
WHO	***Word Health Organisation***
WIBDECO	***Windward Island Banana Exporting Company***
WIDECAST	***Wider Caribbean Sea Turtle Conservation Network***
WMO	***World Meteorological Organisation***
WRI	***World Resources Institute***
WRMA	***Water Resources Management Agency***
WRMIS	***Water Resources Management Information System***
WRMP	***Water Resources Management Programme***
WRMU	***Water Resources Management Unit***
YEF	***Youth Environmental Forum***

Summary for Policy Makers

SUMMARY FOR POLICY MAKERS

BACKGROUND

The preparation of Saint Lucia's Second National Communication (SNC) to UNFCCC was made possible through the financial support of the Global Environmental Facility (GEF) through the United Nations Development Programme. The report compilation was the result of the combined input and participation of a wide range of stakeholders across the various sectors of the Saint Lucian economy, including government agencies, statutory bodies, non-governmental organizations and civil society. The process, which commenced in June 1999, was executed by the Sustainable Development and Environment Division (SDED) of the Ministry of Planning, Development and the Environment and coordinated through the broad-based National Climate Change Committee.

The main components of the SNC are integrated vulnerability and adaptation assessments; identification of national circumstances that affect the assessments; conduct of green house inventory; mitigation exercises; and identification of challenges experienced by various sectors, and lessons learned. In undertaking this assessment, the output of the Initial National Communication prepared in 2002, was considered against the background of emerging development challenges and the impact of weather systems on key sectors of the economy. In addition, the vulnerability of key physical, social and economic sectors and the consequences of these impacts on sustainable national development weighed heavily in selecting the sectors for the assessments. These analyses, along with the wider vulnerability of Small Island Developing States, generally led to the selection of agriculture, coastal sector, critical infrastructure, disasters, financial services, forest and marine biodiversity, health, human settlements and Tourism as the sectors of interest in this assessment. The decision to expand the range of sectors (compared to those in the initial national communication) to include Critical Infrastructure, Disasters and Financial Services reflects both the growing importance of these sectors and recent impacts on them by weather-related events since the publication of the INC.

A key objective of the SNC was to facilitate enhanced capability of critical sector experts to integrate climate change. Technical studies were thus undertaken using a combination of local and regional expertise. Geographic Information System technology was used to generate temporal sea level rise scenarios and spatial data platforms for analysis and decision making. Additionally, the water sector was selected as the cross-cutting sector, given its importance to all economic and social sectors of the economy.

Systemic, institutional and individuals capacity needs to respond to the effects of climate change have been identified for the following focal areas: policy, legislative and regulatory, institutional frameworks; human and financial resources; information management and reporting; and research and systematic observation, monitoring and evaluation.

This Second National Communication is arranged as follows:

- National Circumstances.
- National Inventory of Greenhouse Gases.
- Measures to Mitigate Climate Change.
- Measures to Facilitate Adequate Adaptation to Climate Change.
- Other Relevant Information to the Achievement of the Objectives of the Convention.
- Constraints, Gaps and Financial, Technical and Capacity Needs.

CHAPTER 1: NATIONAL CIRCUMSTANCES

Saint Lucia is a Small Island Developing State (SIDS) located at latitude 13° 59' N, and 61° within the Lesser Antillean Arc of the Caribbean Archipelago, and situated on a volcanic ridge connecting to Martinique and St. Vincent and the Grenadines, towards the north and south respectively. The island has a very steep, rugged landscape, characterized by a centrally located north-south oriented mountain range, deep valleys and fast flowing rivers.

Saint Lucia lies within the north-east Trade Wind belt and is normally under an easterly flow of moist, warm air. The island experiences a tropical maritime climate, characterized by warm air temperature averaging approximately 28° C. The island's weather is influenced by synoptic weather systems, with two climatic seasons based on rainfall. The wet season extends from June to November while the dry season runs from December to May. The quantity of rainfall in the wet season is determined mainly by the frequency and intensity of tropical disturbances (waves, depressions, storms, hurricanes). The geographic influence of rainfall is quite pronounced with amounts varying from about 1265 mm in the relatively flat coastal regions to about 3420 mm in the elevated interior region.

Saint Lucia has an population of 166,526 (Census, 2010) with 24.1% under 14 years and 33% between 14 and 34 years. 51.1% of the population is female. Large segments of the island's population are located along the coastal belt, where low land agriculture, coastal resources, reefs, fisheries and tourism are the main sources of livelihood. The island's population is rapidly becoming urbanized, with approximately 41% of the total population residing in the city of Castries and 55% of the population residing in the Castries- Gros-Islet corridor. Historically, Saint Lucia's economy has been based primarily on mono-crop agriculture (most recently bananas). However, over the last decade-and-a-half, tourism has emerged as the main revenue earner of the economy, with services, manufacturing and industry being the other important productive sectors.

The country's economic fundamentals remain solid, at the global level, but there are a number of externalities that continue to impact the island's economy, such as rising fuel prices, the international financial crisis, and changing trading regimes. Global trading arrangements have eroded traditional markets for primary products and cheaper imports are threatening local industries. Unemployment remains high, particularly among the youth, who make up over 56% of the population. The combined impact of these has contributed to a slowdown in economic

activity in Saint Lucia over the last three years, evidenced in the contraction in the real GDP in the medium term, as a result of declines in tourism receipts and foreign direct investment.

Saint Lucia's economy showed clear signs of recovery in 2010 despite the lagged effects of the global crisis, a severe drought in the earlier part of the year and the devastating effects of Hurricane Tomas in the last quarter. Preliminary estimates, based on a rebased GDP series, indicate real growth of 4.4 percent in 2010 compared with a decline of 1.3 percent in 2009. This performance was influenced by growth in the tourism and construction sectors and supported by developments in the distributive trade services and real estate sectors.[1]

Country data shows good social indicators, including low levels of maternal and infant mortality, universal primary education, low fertility, and increasing life expectancy, existing alongside high and increasing levels of poverty – 25.1% in 1995 and 28.8% in 2005/06. According to the 2008 United Nations Development Programme (UNDP) Human Development Report, Saint Lucia was ranked 66 out of 179 countries. However, there are also considerable social gaps and deficiencies, one of the most important being a high level of poverty, primarily in rural areas, linked to high unemployment and under-employment rates. Declines in the key economic sectors, such as agriculture, have also exacerbated the effects of unemployment and poverty.

Development Priorities

Saint Lucia's development agenda is guided by a number of national, regional and international policy imperatives and instruments. At the international level, Saint Lucia is committed to achieving the Millennium Development Goals (MDGs) agreed upon by the international community at the UN Millennium Summit in 20002. Saint Lucia is also committed to the implementation of the Barbados Programme of Action (BPoA) and the Mauritius Strategy for Implementation (MSI) of Agenda 21. 3 The BPoA and the MSI underscore the particular vulnerability of SIDS in the face of climate change and outline specific response measures to be taken at national, regional and global levels. The regional (CARICOM) development agenda is based on sustainable development, which encompasses economic, social, environmental and governance dimensions, while the sub-regional agenda of the Organisation of Eastern Caribbean States (OECS) is anchored in the dimension of human development.

The country's strategic development objectives are outlined in its 5-year Medium Term Strategic Plans (MTSP). The period of the last MTSP was 2001-2006. Interventions described in the 2006 to 2010 Medium Term Economic Strategy (MTES) are aimed at removing bottlenecks that are endemic to the socio-economic and environmental conditions that provide the context of national sustainable development.[4]

[1] Government of Saint Lucia, (2010) Economic and Social Review
[2] MDG Goal 7, which seeks to ensure environmental sustainability, seeks, in its first target, to "integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources."
[3] The BPoA sets forth specific actions and measures to be taken at the national, regional and international levels to support the sustainable development of Small Island Developing States (SIDS).
[4] Saint Lucia's SPCR, 2011

At the national level, Government has approved a National Vision Plan which is a Sector Development Plan which represents, in broad terms, the development priorities for each of the four main regions of the country. This plan is a broad-based land use plan developed to support the expansion of the tourism infrastructure, support some measure of environmental sustainability, expansion of housing and industry expansion. Whereas it does not speak directly to climate change vulnerability, the need to incorporate these considerations at the implementation stage is clear.

Climate Change

The onset of the climate change phenomenon imposes new hazards on Saint Lucia and exacerbates existing ones. Like most SIDS, Saint Lucia is characterized by unique circumstances that pose serious challenges to sustainable development. Among these are relatively small size; an open economy with a negative balance of trade; a limited natural resource base; fragile ecosystems; limited human capacity and resources; and limited technological capability. Like many other Caribbean SIDS, the island is also susceptible to the vagaries of international trade, exogenous economic and financial shocks. Saint Lucia is a country also highly exposed to natural hazards such as hurricanes and climate related extreme events, which affect population, the economy and the environment. The overall effect of climate change will ultimately depend on the balance of the effects of both climatic variables and non-climatic drivers.

CHAPTER 2: NATIONAL GREEN HOUSE GAS INVENTORY

The GHG Inventory for Saint Lucia was generated on anthropogenic GHG emissions and sinks, on an individual sector basis for the Energy; Industrial Processes; Solvent and Product Use; Agriculture; Land Use, Land Use Change and Forestry (LULUCF); and Waste Sectors. *IPCC Revised 1996 Guidelines* for National Greenhouse Gas Inventories (Volumes 1, 2 and 3) together with the accompanying Software in Microsoft Excel to undertake the necessary calculations on GHG Emissions and Removals. This was complemented by *IPCC Good Practice Guidance* for updating emission factors or other default conversion factors where sufficient data were available. The development of future inventories however, will likely be based on *2006 IPCC Guidelines* that are expected to supplant the Revised 1996 Guidelines in the next few years.

The direct GHGs included are Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and partially fluorinated hydrocarbons (HFCs). Indirect GHGs that contribute to Tropospheric Ozone (O_3) formation, such as Non-Methane Volatile Organic Compounds (NMVOC), Carbon Monoxide (CO) and Nitrogen Oxides (NOx) were also included in the inventory.

Emissions related to fuel combustion from all sectors have been included within the Energy Sector. The primary fuels consumed in Saint Lucia and which lead to greenhouse gas emissions from the energy sector are imported liquid fuels, gasoline, jet kerosene, gas oil and fuel oil. In addition to these charcoal and firewood are also utilized for energy in the residential sector.

Of the fossil fuels imported and consumed in Saint Lucia, the greatest proportions of CO_2 emissions result from the combustion of Gas/Diesel Oil (59.5 % in 2000) used almost exclusively for thermal electricity production, and from Gasoline (34.6 % in 2000) mainly for vehicular road transport, but also for agriculture and fishing. Smaller amounts of CO_2 emissions also result from LPG use (5.3 %) in the residential and industrial sectors and from the use of kerosene and lubricants.

The Manufacturing and Industrial Sector in St. Lucia is relatively small as is its overall contribution to greenhouse gases assessed on a global scale. Substantial emissions are contributed by the *Food and Beverage Industries* and *Road Paving with Asphalt*. Some HFCs are also released through the consumption and use of halocarbons for air-conditioning and refrigeration. All emissions from this sector are classified as non-CO_2. Total emissions of non-methane volatile organic compounds (NMVOCs) Emissions for the Inventory year 2000 decreased approximately 10% from 1994 due to a decrease in the estimate of asphalt used for road paving.

There are no CO_2 emissions reported as being released from the agricultural sector in Saint Lucia, as emissions related to fuel combustion are reported in the energy sector. Emissions of significance to the sector are CH_4 emissions associated with animal livestock, and N_2O arising from fertilizer application to cultivated soils, excretion from animal grazing, from atmospheric deposition of NH_3 and NO_x, and from leaching of agricultural soils.

The anthropogenic effects of managed forests and changes in land-use designation are important. Activities such as land clearing and timber harvesting, increase CO_2 emissions and increase photosynthesis. CO_2 emissions and removals from this sector derive primarily from carbon uptake due to regrowth in forests; from emissions from forest and grassland conversion due to burning and decay of biomass; and from carbon release from forest soils. From the data indications are that Saint Lucia's Land Use Change and Forestry Sector is still a net source of CO_2 emissions. Total CO_2 emissions have however experienced an almost 75% decrease from 1994 to 2000 (approximately 85 Gg emitted in 1994 as opposed to 21 Gg in 2000).

The most important gas (non-CO_2) produced in this source category, the waste sector, is methane (CH_4). The two major sources are solid waste disposal to land, and wastewater treatment. In addition to CH_4 solid waste disposal sites also produce CO2 and non-methane volatile organic compounds (NMVOCs) in very small amounts. Indirect N_2O emissions also result from human sludge. No CO_2 emissions are released from the waste sector. Total methane emissions in 2000 were 7.3 Gg, an 8% increase from 1994 while N_2O emissions from waste handling were negligible.

Calculations of sources and sinks of GHGs for the different sectors incorporate various levels of uncertainty with respect to country activity data as well as the various conversion and emission factors. Overall, there is a low degree of uncertainty for CO_2 emissions. Non-CO_2 emissions (CO_2, CH_4, N_2O, NOx, CO, NMVOC), have a greater degree of uncertainty since emission factors used to calculate these emissions have a much greater range of variability than CO_2 emission factors.

Generally, IPCC default values were used to estimate emissions since country-specific measurements were not available.

With regard to global warming potential, the relative contribution of the main greenhouse gases to total emissions is at follows: carbon dioxide (CO_2) is the most important anthropogenic greenhouse gas followed by methane (CH_4), and nitrous oxide (N_2O). HFC is also an important greenhouse gas released from industrial processes in Saint Lucia. Each of these greenhouse gases can be expressed as an equivalent carbon dioxide concentration (CO_2e) which is the concentration of carbon dioxide that would cause the same amount of radiative forcing as a given mixture of carbon dioxide and other greenhouse gases. In order to convert the various greenhouse gases to CO_2e they are multiplied by their global warming potential (GWP). Total CO_2e emissions for the year 2000 are equal to 579 Gg. This represents an almost 2% increase in total CO_2e emissions from the year 1994.

Major IPCC source / sink categories contributing to total emissions include energy, waste, land use change and forestry, agriculture and industrial processes. The analysis indicates that CO_2 emissions from stationary combustion in the energy sector are the largest overall contributor to emissions. The second largest source is CH_4 emissions from solid waste disposal and then CO_2 emissions from transportation sources.

The way forward, based on the experiences of the preparation of the Second National Communication (SNC) GHG inventory for Saint Lucia, points to a strong need for institutional capacity building and training of government staff and local consultants to do research, data collection and analyses required to reduce inventory uncertainties and improve the quality of activity data and emission factors used to generate the inventory.

CHAPTER 3: MEASURES TO MITIGATE CLIMATE CHANGE

The Mitigation Assessment for Saint Lucia was undertaken by Marbek Resource Consultants of Canada and includes an analysis of potential impacts of various practices and technologies that can mitigate climate change while also supporting the island's sustainable development.
The methodology utilized is based on the UNFCC guidance and involves two major steps. The first of these was the development of a Baseline Scenario, which projects GHG emissions assuming no additional emission reduction measures. The second step involved the development of Mitigation Scenarios which project GHG emissions assuming additional defined emission reduction measures. The period considered for Saint Lucia was up to 2020. Both Baseline and Mitigation Scenarios considered the period to 2010 and were prepared utilising the Long-range Energy Alternatives Planning system (LEAP) Model.

Baseline Scenarios

Baseline scenarios determined from sector end user allocations to GHG emissions were determined for key sectors based on their relative contribution to Saint Lucia's overall GHG emissions profile. Of the sectors represented the transport sector, as the largest contributor is expected to contribute 26.5% to the overall baseline, with waste processing – 24.9%, commercial tourism – 20.7%, agriculture, forestry and fishing – 9.9% and industry – 3.7%.

Mitigation Scenarios

Mitigation scenarios were generated through a process of consultation and analysis to derive a combined effect of mitigation measures. Key measures identified in Mitigation Scenario #1 include among others:

- ***a.*** *Fiscal Measure For Industrial Energy Efficiency*
- ***b.*** *Reforestation*
- ***c.*** *Programme To Promote Use Of Alternative Energy Sources*
- ***d.*** *Regulations For Purchase Of Higher Fuel Efficiency Vehicles*
- ***e.*** *Transportation Demand Management*
- ***f.*** *Legislation For Auto-Generation And Co-Generation*
- ***g.*** *Establish Wind Farm For Power Generation*
- ***h.*** *Establish Minimum Energy Efficiency Standards For Lighting And Appliances*
- ***i.*** *Energy Efficiency Building Code*
- ***j.*** *Audit Programme For Small Hotels*
- ***k.*** *Solar Water Heating*
- ***l.*** *Energy Service Companies (ESCOs)*

Mitigation Scenario # 2 includes all the abovementioned measures as well as two additional measures, namely (xvii) landfill gas capture and energy generation and (xviii) demand side management (DSM) programme for electricity.

Emissions Impact

For modelling purposes it was assumed that all measures began implementation in 2010. In this regard, the emissions impact of Mitigation Scenario #1 relative to the Baseline Scenario (BAU), for the period to 2020, for Saint Lucia as a whole, indicates a 19.6% reduction in overall GHG emissions relative to baseline. The impact of individual measures on sectoral and overall GHG emissions was also modelled. A similar pattern in the magnitude of the reduction in emissions relative to baseline for 2020 was recognised for measures implemented.

The emissions impact of Mitigation Scenario #2 relative to the Baseline Scenario (BAU), for the period to 2020 indicates a 25.7% reduction in overall emissions. Mitigation Scenario #2 includes only two measures not included in Scenario #1, hence the minimal difference between the two. Higher percentage reductions in GHG emissions were also predicted for most of the selected sectors. Most notable are the near to two-fold percentage reductions in emissions under this scenario for Agriculture, Forestry and Fishing (from 0.8 to 1.6%) and Waste (from 23.9 to

43.9%). GHG emission reductions for the Transport sector remained relatively unchanged under this scenario.

Implementation Priorities and Way Forward

The work undertaken as part of this Mitigation Assessment has helped identify GHG emission reduction priorities and opportunities in all sectors in Saint Lucia, addressing all priority emission sources. In addition the assessment process built on previously adopted government policy documents and worked with stakeholders to identify a set of high priority mitigation measures that are appropriate for implementation in the Saint Lucia context. Further, the analysis undertaken as part of this assessment has provided valuable information on the emission reductions that may be available through these defined measures.

The UNFCCC COP16 in Cancun Mexico established a registry for Nationally Appropriate Mitigation Actions (NAMAs) planned/undertaken by developing countries, and enhanced procedures on MRV. As a developing country signatory to the UNFCCC, the concept of NAMAs is highly relevant to Saint Lucia, as the country will have a mechanism to register mitigation initiatives as NAMAs, and in some cases should be able to secure funding from international sources to implement these NAMAs. The measures included in the Mitigation Scenarios in this report are, demonstrably, nationally appropriate for Saint Lucia and fully suitable for consideration as NAMAs.

CHAPTER 4: MEASURES TO FACILITATE ADEQUATE ADAPTATION TO CLIMATE CHANGE

A modified UNDP Adaptation Policy Framework (UNDPAPF) was perceived to be the most appropriate to facilitate a current and future vulnerability assessment to yield adaptation assessment and policy recommendations. A coherent and structured approach to V&A was seen as enabling: the scope and design of the V&A assessment; assessment of current vulnerability and adaptation; characterisation of future climate risks; and, development of the adaptation strategy. The assessments examined the vulnerabilities of the specified sectors nationally, but in some cases specific geographic footprints were used as representative samples of the island systems. In addition to their vulnerability, the sectors that were the focus for this assessment are of importance to national development. The assessments were conducted over three time horizons, viz short term (2030), medium term (2060) and long term (2080).

Climate Change Scenarios

- Historical data, when compared to future scenarios based on Global Climate Models (GCM) and Regional Climate Models (RCM), show that there is a discernible change in the rainfall pattern for the island. The GCMs show less rainfall for Saint Lucia in the future, with annual projections varying from -25 to +18% in the 2030s, -40 to +10% in the 2060s and -56 to

+15% in the 2090s. RCMs also predict less rainfall for the island on an annual basis, ranging from 27% and 57% less annual rainfall by the end of the century.

- The GCM shows that mean temperatures for the island will increase significantly over the 21st century. GCMs project changes of between 1C and 4C by the end of the century, dependent on which scenario is used, with mean annual increases of up to 1.2C by the 2030s, 2.1 C by the 2060s, and 3.6C by the 2090s. This is similar to what obtains with RCM, which shows increases in mean annual temperature ranging from 1.9 - 2.4C by the end of the century.

- Projections from the IPCC suggest that future hurricanes of the north tropical Atlantic will *likely*[5] become more intense, with larger peak wind speeds and heavier near storm precipitation.

- A wind speed study by Vickery (2008) commissioned under the SPACC project in Saint Lucia concluded that the impact of climate change on hurricane will result in 3-4 category V and IV hurricanes on an annual basis by 2025. This is a significant change from the previous longer-term average of 1.4 category V and IV hurricanes on an annual basis in the Atlantic Basin.

- It is not currently possible to project sea level rise for Saint Lucia. However, it is anticipated that changes in the Caribbean area will be near to the global mean. Under the A1B scenario, sea level rise within the Caribbean is expected to be between 0.17 m and 0.24 m by 2050 (IPCC 2007). Soomer *et al* in a 2009 study, juxtaposed projected sea level rise of 0.24m on a model utilized by Cambers (1997) for Saint Lucia and scenarios for 2020, 2050 and 2070 sea level rise were generated. The results of this study suggest that sea level rise will cause the shoreline to recede. The extent of the shoreline retreat as a result of sea level rise has serious implications for the planning of coastal development.

Impact Assessments

The Vulnerability and Adaptation (V&A) assessments conducted during the Second National Communications (SNC) highlighted the vulnerabilities of several sectors including; water resources; land resources; agriculture; coastal sector; marine resources; forest terrestrial resources; health; financial services; and critical infrastructure.

Agriculture and tourism, which are the key economic sectors (as well as all other sectors) are expected to be affected by all the anticipated impacts of climate change. In addition, the anticipated negative impacts on social and economic infrastructure such as housing, water, agriculture, ports, schools, hospitals, tourism plants, health services, communications, inter alia, are likely to cause major social and economic stresses which can be alleviated by appropriate and timely adaptation measures. Another noteworthy conclusion is that all the anticipated impacts are likely to trigger some form of hazard, which may result in a disaster. These impacts include

[5] In the IPCC Summary for Policymakers, the following terms have been used to indicate the assessed likelihood, using expert judgment, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%.

coastal erosion, loss of near shore housing and critical infrastructure, damage to properties and threat to life and livelihoods associated with increases storm intensity, heat related health impacts, landslides, loss of agricultural production and biodiversity, forest fires and damage to forest ecosystems due to wind damage. Any response measure to be implemented will have cross-cutting, multi-sectoral impacts.

Freshwater is a fragile, finite and vulnerable resource vital to human, economic and environmental sustainability and influences national prosperity and quality of life. The water sector is a cross cutting one and plays an important role in all sectors in Saint Lucia as a catalyst for economic development and a vehicle for empowerment and poverty alleviation. Therefore any impact of climate change on the water sector could have far reaching repercussions on the economy of the country and affect life in general.

Adaptation Strategies and Measures

The Vulnerability and Assessment exercise conducted under the SNC proposed an extensive list of potential adaptation strategies for vulnerable sectors in Saint Lucia. These strategies have been identified through the extensive consultative and investigative processes undertaken in the preparation of the Second National Communications. The actions recommended for adaptation to climate change impacts, can be summarised into five components:

- **Adaptation interventions in economic, social and environment/ecosystems dimensions**, paying particular attention to vulnerable communities, vulnerable groups and the private sector, in order to begin building resilience and demonstrating results.
- **Enabling framework** for implementation of interventions for resilience building to include multi-level governance approach: regional, national and community; to provide clear direction on how adaptation programmes can be incorporated into institutional frameworks, ministry operational plans and policies, supported by appropriate legislation and fiscal regimes.
- Provision for multi level **research and systematic observation**, at a regional level, with national level linkages, to develop baselines and scenarios for future impacts, as well adaptation options to address them, including the requisite technical and financial resources required for effective national level adaptation.
- Addressing **information and data gaps** that constrain capable practitioners in regional agencies, government departments and civil society from addressing vulnerabilities.
- Increasing **education and awareness** of publics on issues related to climate change and improving capacities to facilitate climate change adaptation.
- **Monitoring and evaluation** of programme activities for assessing, results for ongoing modifications and adjustments as needed.

Framework for Adaptation

Against the framework of its national policy, environmental management in Saint Lucia is guided by a number of regional and national policy imperatives and instruments. AT the international level, UNDP's Adaptation Policy Framework also is instructive in this regard, in that it has been developed "for implementation of Global Environmental Facility (GEF) and other initiatives including regional projects and national efforts to respond to the challenge of climate change".

Two regional adaptation frameworks are of note: the CARICOM framework is results from decisions of the Conference of Heads of Government and the Council for Trade and Economic Development and is also implicitly an outshoot of the Revised Treaty of Chaguaramas; the Pilot Programme on Climate Resilience is seen as serving to integrate climate risk and resilience into core development planning, while complementing other ongoing development activities.

The National Climate Change Policy and Adaptation Plan states Government's commitment to address the issues of reducing emissions, and Saint Lucia's vulnerability to the effects of climate change and to place urgent and major emphasis to adapting to climate change. This plan has three key objectives, which were to foster the development: of processes, plans, strategies and approaches to avoid, minimize or adapt to the negative impacts of climate change; and application of appropriate legal and institutional systems and management mechanisms for planning for and responding to climate change; and of appropriate economic incentives to encourage public and private sector adaptation measures.

The cost of recent weather related events in Saint Lucia, in terms of loss of life and property, destruction to critical infrastructure, interruption of utility services and impacts on the agriculture and tourism sectors, to name but a few, underscores the urgency with which Saint Lucia needs to build resilience to the effects of climate change.

CHAPTER 5: OTHER INFORMATION RELEVANT TO THE ACHIEVEMENT OF THE OBJECTIVE OF THE CONVENTION

In compliance with the United Nations Framework Convention on Climate Change (UNFCCC) which indicates that Parties shall communicate to the COP a general description of steps taken, or envisaged, to implement the Convention. This also includes other initiatives which contribute in some measure to the overall national response to climate change, and demonstrating linkages between the activities and policies relating to climate change and those of other Conventions, such as the Convention on Biological Diversity and the Convention on Combating Desertification. Other relevant information on the socio-economic and environmental conditions of the country is also presented. Saint Lucia has undertaken many activities that contribute to its implementation of the Convention.

Steps taken to Integrate Climate Change Considerations

At the regional level Saint Lucia is a signatory to the Saint Georges Declaration of Environmental Principles in the OECS (SGD). This is the overarching environmental policy for the sub-region and it addresses climate change issues in a number of its Principles. Following on regional projects such as **Caribbean Planning for Adaptation to Climate Change (CPACC) Project** and **Adapting to Climate Change in the Caribbean (ACCC)** Project[6], Saint Lucia participated in the **Mainstreaming Adaptation to Climate Change (MACC) Project** (2004-2009), which

[6] CPACC was designed to build capacity in the Caribbean Region for adaptation to climate change impacts, especially sea level rise; and ACCC Project was to sustain activities instituted under CPACC and to address issues of adaptation and capacity building not undertaken under CPACC.

sought to mainstream adaptation strategies into the sustainable development agendas of small island and low-lying states of CARICOM and to further strengthen institutional capacity and knowledge base.

Saint Lucia is one of three Caribbean countries, along with Dominica and Saint Vincent and the Grenadines, participating in the GEF-World Bank-funded **Special Programme on Adaptation to Climate Change (SPACC)**: Implementation of Adaptation Measures in Coastal Zones Project.

The UNDP-implemented Climate **Change Vulnerability and Capacity Assessment (VCA)** Project undertaken in 2005-2006 to test a practical approach to vulnerability and adaptive capacity assessment, has also assisted in capturing community-based issues and approaches in the context of changing climatic conditions.

Saint Lucia more recently, has also benefited and continues to benefit from several regional projects and initiatives that have had national impact, including a **Regional Framework for Achieving Development Resilient to Climate Change** prepared under the auspices of the **Caribbean Community Climate Change Centre (CCCCC)**. This provides a roadmap for action over the period 2009-2015 for the continued building of resilience to the impacts of Global Climate Change (GCC) by CARICOM states.

The **Caribbean Disaster Emergency Management Agency (CDEMA) Comprehensive Disaster Management Framework** aims to strengthen regional, national and community level capacity for mitigation, management, and coordinated response to natural and technological hazards, and the effects of climate change.

The overall objective of the **Integrating Watershed and Coastal Area Management (IWCAM) Project** is to strengthen the commitment and capacity of the participating countries to implement an integrated approach to the management of watersheds and coastal areas. The long-term goal is to enhance the capacity of the countries to plan and manage their aquatic resources and ecosystems on a sustainable basis.

At the national level, several policy documents policy and legal instruments which cover a number of sectors and fall under the purview of various agencies that have been developed and/or approved over the last decade, that are specific to climate change or that incorporate or specifically make reference to climate change. Key areas of policy, and to a lesser extent education and research, under which climate change issues have been infused include, environment, land, water, energy, biodiversity and forests, coastal zone management, disaster management. More recently there have been more deliberate steps taken to integrate climate change issues and concerns into aspects of the national processes.

For example, climate change issues have been incorporated into, inter alia, Saint Lucia's National Emergency Management Plan[7]; the Coastal Zone Management Policy and the Draft Saint Lucia Forest Policy.

It is envisaged that the process of mainstreaming climate change issues sectorally and inter-sectorally will be further deepened, as the proposed EMF has more tangible outcomes, such as the establishment of a Department of the Environment. A National Environmental Commission (NEC) endorsed by Cabinet of Ministers in December 2007, was launched in 2008. This multi-sectoral body performs an integral role in facilitating inter-agency collaboration and coordination. An Environmental Management Act has been drafted and several policies and strategies for environmental and natural resources management have been updated as well. Recommendations for the establishment of a proposed Environmental Management Fund have also been specified.

Initiatives: Transfer of Environmentally Sustainable Technologies

Following on the conduct of technical needs assessment for the climate change in 2004, a similar needs assessment was conducted for biodiversity management in 2009, with regard to the transfer of environmentally sustainable technologies.

Several other initiatives have been undertaken with regard to technology use. The Global Environmental Facility (GEF)-World Bank-funded Special Programme on Adaptation to Climate Change (SPACC) Project (2007-11), executed regionally by the Caribbean Community Climate Change Centre (CCCCC)8, focused on the implementation of select adaptation measures was designed to address climate change impacts on biodiversity and land degradation. The Strengthened Critical Coastal Infrastructure sub-component of the Project seeks to demonstrate the design and implementation of appropriate interventions to reinforce critical infrastructure to the effects of intensified hurricanes. The second sub-component focuses on the Sustainability of Water Resources and Supply and seeks to complement the national water supply programme by establishing adaptation measures that would result in increased resilience of surrounding coastal ecosystems to the impacts of climate change and variability.

Under the PPCR, the demonstrated success in the pilot of adaptation measures in these areas will be upscaled for national level implementation. Further, it has been recognised that improving the rate of adoption of Environmentally Sustainable Technologies (ESTs) will require a number of measures, none the least is the provision of policy measures, including incentives to promote the use of ESTs.

[7] The National Emergency Management Plan (NEMP) for Saint Lucia is a set of stand-alone documents that may be activated to support hazard management plans. This overall plan includes a Hurricane Plan for Saint Lucia.

[8] This project has demonstrated the implementation of select adaptation measures designed to address climate change impacts on biodiversity and land degradation, with regard to reinforcement of critical infrastructure to the effects of intensified hurricanes and enhanced water supply systems.

Climate Change Research and Systematic Observation

The GOSL is committed to improving its information management systems or establish new systems to take into account relevant emerging issues, including climate change, by strengthening Research and Systematic Observation (RSO) and Data and Information Acquisition and Knowledge Management for climate change adaptation/resilience building.

Most of the initiatives to date, with regard to climate change research and systematic observation, have been focused on concomitant data and information management to improve the knowledge base for decision making and for effecting attitudinal and cultural changes; to employ the best available tools, methodologies and mechanisms to promote more enlightened responses to the climate change dilemma and to heighten public awareness to the importance of climate change. Long-term meteorological and hydrological observation serves as one of the key bases for detecting climate change. This must, however, be supported by research on relevant biophysical systems and economic sectors in order to determine the actual impacts of climate change on the natural environment and on human existence.

The priority for information management will be the development of fit to purpose data and management system building on Phase 1 Geonode to include data collection, analysis, use of GIS technology, modeling (sea level rise), vulnerability mapping and the modeling of impacts on key identified sectors. Further, Saint Lucia expects to create synergies between the data component of the regional PPCR framework and its national component that will allow the country to expand its knowledge base towards enhance decision making and being more proactive in the face of climate change.

Climate Change Education, Training, and Public Awareness

There have been several efforts undertaken in Saint Lucia on many fronts to increase awareness and understanding of climate change amongst the wider public, as well as amongst specific target audiences. To date, despite the existence of financial, human and other constraints, progress has clearly been made in enhancing awareness of climate change issues in Saint Lucia.

One key initiative to date with regard to CC education and awareness, has been the output from Phase 1 of the PPCR of the second KAP study (which built on the first KAP, 2005) study, and the development of a Public Education and Outreach (PEO) Strategy. The PEO strategy will be implemented in Phase 2 The Public Education Strategic Plan will have defined the target audiences (including women, marginalised young males, community based organisations, the private sector, farmers, fishermen, the poor, etc.) and determined the most appropriate messages (tangible and relatable examples), tools and communication strategies to cause behavioural change.

Measures to Promote Information Exchange and Networking

As is the case for environmental management in general, existing barriers to climate change adaptation are compounded by the critical gaps and overlaps in institutional responsibilities, insufficient collaboration among public sector agencies, and a high degree of fragmentation of authority and roles among the wide range of environmental management agencies. Efforts have

been focused on the addressing the issues of custody, accountability and authority needed to rationalize roles and responsibilities to ensure effective information exchange and networking.

Activities to date to promote information sharing and networking include policy interventions and improvement of legislative and institutional frameworks. Issues of custody, accountability and authority continue to be rationalised to ensure effective climate resilience. In addition, arrangements to foster co-management and participatory approaches need to be clearly defined in various partnerships, including private-public, private-private and private-community partnerships.

Recent initiatives by the GOSL, including the development of an Environmental Management Act (Draft, April 2008) and the establishment of the National Environmental Commission (NEC) as an overarching agency for environmental management, will serve to create the platform for the kind of institutional framework required to resolve the problems of coordination and collaboration among agencies, on environmental management issues, particularly important for climate change.

Gender, Youth, Children and Poverty

To date, climate change initiatives undertaken in Saint Lucia have been deemed to be both gender-inclusive and gender-equitable. Issues of gender, youth, children and poverty have also been well addressed within national development in various national policy and legislative instruments, albeit without a strong link to climate change.

Due cognisance has been given to the importance of economic and social vulnerability[9] and of considerations for gender, youth children and other vulnerable groups in the design and implementation of adaptation responses. In addition, most of the national climate change initiatives undertaken at the community level, have integrated gender sensitivity and vulnerable groups, but not in terms of concrete adaptation interventions, but rather with a greater emphasis on workshops and limited levels of awareness building. Consequently, as measures to address climate change continue to be planned and implemented, the island has recognised the need for forging a stronger nexus between these issues and the climate change phenomenon, in designing and implementing the necessary response measures.

[9] The concept of social vulnerability focuses attention on susceptibility of households in the face of weak social capital, sub-standard housing, and residence in disaster prone areas. See: http://mdgguide.undp.org/files

Capacity Building Activities, Options and Priorities

Building capacity and the knowledge base at all levels (systemic, institutional and individual) of the society is a key requirement for climate change resilience building. In particular, agency capacity with regard to a science base of information for validating, monitoring and linking climate change with indicators of climate change requires strengthening. Accurate climate detection instruments, data management, including development or expansion of computerised databases, and capacity to undertake predictive analysis has also been recognized as a prerequisite for enhancing the country's climate change adaptive capacity.

Specific needs, options and priorities for capacity building to address climate change issues have been identified in reports such as the Initial National Communication (INC), the National Capacity Self Assessment (NCSA), the Climate Change Technology Needs Assessment (CCTNA).

CHAPTER 6: CONSTRAINTS, GAPS AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS

This final chapter highlights the Gaps and Constraints and associated Financial, Technical and Capacity Needs. The preparation of Analysis on Constraints, and Gaps, and Related Financial, Technical and Capacity Needs was undertaken in accordance with national circumstances and development priorities. The following includes the identified gaps and constraints, financial and technical needs required to implement mitigation and adaptation measures in response to climate change. In general in Saint Lucia there are constraints to economic growth and development of all sectors. Some of the overarching issues are as follows:

- **a.** Limited availability of financial resources.
- **b.** Inadequate availability of human resources. This includes inadequate availability of specialist skilled resources.
- **c.** Loss of institutional / sector memory with change in the Human Resource composition.
- **d.** Inadequate availability of data to facilitate information for management decisions. Inadequate emphasis on research in all sectors.
- **e.** Ineffective high level co-ordination of major development sectors/ issues such as: Development Control & Land Management, Water Sector Development, Strategic Tourism Development.
- **f.** Inadequate infrastructure development to meet the development needs of the country.
- **g.** Ineffective public sensitization and public education programmes to educate the populace on key issues as it relates to the development of the country.
- **h.** Inadequate Institutional co-ordination.
- **i.** Lack of an integrated development planning approach to sector development.

Proposed Initiatives

The SNC review which included a compilation of all other climate change and other relevant information highlighted a number of key areas where attention was required in building national capacity and improving the institutional and technical framework to facilitate cross sectoral solutions for climate change impacts. The table below highlights these multi-sectoral issues and associated strategies and actions.

Table 6.1: Capacity building needs in key areas related to climate change [SNC, Other Relevant Information, 2010]

Key Area	*Required Strategies and Actions*
Climate change education and awareness	▪ *Development and implementation of an integrated, coordinated and sustained climate change education and awareness programme targeting all sectors and relevant interest groups* ▪ *Establishment of a climate change information storage and exchange mechanism*
Incorporation of climate change issues into the development planning process	▪ *Undertaking of training activities in areas relating to planning and data processing* ▪ *Establishment of a National Climate Change Unit* ▪ *Development of a national climate change framework in the context of a larger national planning framework*
Implementation of Saint Lucia's Sustainable Energy Plan	▪ *Building institutional capacity for energy sector planning and evaluation of renewable energy technologies (RETs.)* ▪ *Development appropriate regulatory framework for the successful implementation of the SEP* ▪ *Development and implementation of education and awareness programme to support SEP* ▪ *Conduct of research into RET potential and energy efficiency measures*
Sectoral and Resource Management Options	
Coastal and Marine resources	▪ *Undertaking review of existing coastal monitoring and data collection systems* ▪ *Implementation of integrated coastal zone management plans*
Human settlements	▪ *Development of adaptation plan for human settlements including zoning, defences, building codes, etc.*

Key Area	*Required Strategies and Actions*
Terrestrial resources, terrestrial biodiversity and agriculture	▪ *Establishment of a system for improved monitoring and research of key terrestrial and agricultural processes and resources.*
Freshwater resources	▪ *Undertaking inventory of freshwater resources and develop and implement a National Water Resources Management Plan*
Tourism	▪ *Improvement/ development of a regulatory framework with emphasis on enforcement*
Regional initiatives	▪ *Establishment of a Caribbean Climate Change Centre to coordinate Caribbean response to climate change*
National communication process and follow-up activities	▪ *Building capacity to resolve issues regarding emissions factors and to better address LULUCF computations* ▪ *Enhancing data collection, management and processing* ▪ *Identification and implementation of country-specific Stage II and III adaptation measures* ▪ *Developing national capacity for water resource planning and management* ▪ *Establishing systems for enhanced exchange of information and experiences within the region, as well as between regions* ▪ *Developing and implementing integrated resource/spatial management plans Implementing energy conservation and renewable energy pilot projects* ▪ *Enhancing capacity for disaster planning and management* ▪ *Enhancing early warning systems for extreme weather events* ▪ *Enhancing capacity to participate in international climate change initiatives and negotiations*

PROPOSED PROJECTS FOR FUNDING

There are a number of projects being proposed in various sectors and through various agencies.

1. **Pilot Project for Climate Resilience (PPCR):**
   Through the Sustainable Development and Environment Department a number of climate change related projects are being planned for implementation with the more recent being the Pilot Project for Climate Resilience. The projects being proposed are detailed in SNC Report on Constraints, Gaps and Related Financial, Technical and Capacity Needs are summarised as follows:

Health Sector

1. Effective Surveillance and Control of Schistosomiasis in Saint Lucia: Duration 10 weeks: US$50,000.
2. Enhancing the Water Quality Surveillance Programme of the Department of Environmental Health: US$16,000.
3. Mitigating The Mental Health Impacts Of Climate Change and Climate Variability In Saint Lucia: Duration: 3 years. (Cost to be determined).
4. Short-Term Rodent Control Project: Duration 6 months: US$81,038.
5. Mainstreaming the Lessons of Hurricane Tomas and Other Recent Climate Events : Cost & Duration to be determined.

Coastal Zone Management

6. Coastal Stabilization of Pigeon Island to Prevent and Mitigate Coastal Erosion Caused by Climate Change : US$1,718,963.
7. Climate Change & Ports: US$15,380,000.

Data Management

8. Events Mapping – Hurricane Tomas : Duration 9 months: US$150,000
9. Enhanced capacity of the Physical Planning and Survey and Mapping Departments in the management of digital geo data: Duration 1 year: US$200,000.
10. Enhancing the capacity of The Ministry of Agriculture – Pest Control and Surveillance Services: Duration 3 months: US$100,000.
11. Enhancing the capacity of WASCO in the use of GIS technology: Duration 18 months: US$260,000.

Other

12. Development of Landslide Hazard Maps based on newer comprehensive Hazard Models: duration 3 years: US$1 million.
13. Rehabilitation of Main Landslides resulting from Hurricane Tomas: Duration 3 years: US$5million.
14. Enhancing the capacity of the Fire Department to address climate-induced fires : Duration 1 year: US$100,000.
15. Climate Proofing the Laborie Community: Duration 3 years: US$245,000.
16. Building Climate Resilience through Sustainable Land Management: Duration 3 years: Cost to be determined.

17. Increased Climate Resilience through Improved Food Provisioning and Food Security: Duration 3 years: Cost to be determined.

2. Water Sector Proposed Projects:

The water sector has been going through a reform process for a while with many challenges in both the Management of the Water Resource and Management of the Water Supply and Sewerage Services. There are a number of critical interventions being proposed in the short to medium term. Out of a myriad of critical interventions required in this sector a few priority projects have be selected and submitted to the Japanese Government for consideration under the Climate Change Fund. Projects in the amount US$7 million have been identified and proposed for implementation. These projects cover critical interventions as it relates to water resources management as well as critical improvements in the water supply infrastructure.

Water Resources Management Project

The planned activities for this component totalling approximately US$1 million are various expert studies to establish a baseline of information required to manage the water resources of the country

Water Supply Infrastructure Improvement Project

The planned activities for this component totalling US$6 million are various upgrades to the Water Supply Systems island-wide in an effort to improve the reliability especially in extreme situations of drought and heavy rainfall.

3. Coastal Zone Management Project

In an effort to continue the work already initiated, a second phase has been approved for mainstreaming Saint Lucia's national plan of action through a North West Coast Water Quality Demonstration Project. The overall project objective is to improve Recreational Water Quality along the North-West Coast of Saint Lucia through the implementation and demonstration of best practices for pollutant discharge reduction. This project component is expected to cost US$35,000.

Proposed Projects – Mitigation Initiatives:

The following projects as detailed in Chapter 3 have been proposed as specific mitigation interventions both by reducing emissions or enhancing removal by sinks [SNC Measures to Mitigate Climate Change, 2011]:

1. **Waste Reduction across sectors:** the reduction of waste sent to the landfill through a Reduce, Reuse, Recycle programme and introduction of composting incentives for households (kitchen gardens).
2. **Refrigerants phase out:** the establishment of an accelerated programme to phase out refrigerants that deplete the ozone layer and contribute to global warming.
3. **Fiscal measures for industrial energy efficiency:** the provision of fiscal incentives for energy efficiency measures in industry.

4. **Reforestation program for marginally used agricultural lands: the** implementation of a programme to support reforestation of marginally used agricultural lands and to sustain the existing forest, including coastal dry forest habitats and mangroves.
5. **Reforestation of marginally used agricultural lands** and to sustain the existing forest, including coastal dry forest habitats and mangroves.
6. **Regulation for purchase of higher efficiency vehicles:** the establishment of regulations establishing minimum fuel efficiency levels for light duty vehicles (cars, vans and light duty trucks) imported into Saint Lucia, including vehicles used for public transportation.
7. **Transportation demand management, including a range of initiatives:** the implementation of a transportation demand management (TDM) programme including a range of initiatives such as promotion of greater use of low cost public transport, tele-work, car pooling and other elements.
8. **Auto-generation and co-generation:** the encouragement of auto-generation and co-generation by passing legislation to allow entities to generate electricity for their own use using renewable energy or co-generation plants with a maximum capacity of 500 kW and located at the site of energy consumption.
9. **Wind farm:** Acquire the necessary land and establish a wind farm providing power to the local grid.
10. **Improved energy efficient appliances and lighting through the use of standards:** the introduction of minimum energy efficiency standards for selected types of appliances used in the residential and commercial sectors.
11. **EE Building Code (strengthen energy efficiency in the Building Code):** the development of an Energy Efficiency Building Code (EEBC) for new construction and retrofits in commercial, institutional and residential buildings.
12. **Auditing for small hotels:** the implementation of an audit programme for small hotels, addressing their use of energy and water and generation of waste.
13. **Solar water heating:** the encouragement greater use of residential solar water heaters by maintaining or expanding fiscal incentives for the purchase of solar water heaters, supported by promotion activities
14. **Landfill gas capture with energy generation:** the implementation of a landfill gas capture initiative, and generation of electricity using the captured gas for sale to the grid.
15. **Demand-side management (DSM) programme for electricity:** the implementation of a comprehensive programme encompassing and adding to certain Scenario #1 measures (Measures #3, 5, 11, 12, and 13), in an effort to increase the uptake of energy efficiency and on-site renewables in the commercial, residential, industrial, and agricultural sectors.

OPPORTUNITIES FOR IMPLEMENTATION OF ADAPTATION MEASURES

The National Climate Change Policy and Adaptation Plan underscores the Government's commitment to address the issues of reducing emissions, and Saint Lucia's vulnerability to the effects of climate change. The Plan identified the following priority activities for immediate implementation [SNC V&A Synthesis Report 2011]:

Table 6.6: Sector Strategies Recommended for Adaptation Initiatives

SECTOR	ACTIVITY/STRATEGY
Coastal & Marine Resources	Undertake review of existing coastal monitoring and data collection systems
Human Settlements	Develop adaptation plan for human settlements including zoning, defences, building codes etc.
Terrestrial Resources, Terrestrial Biodiversity& Agriculture	Establish a system for improved monitoring and research of key terrestrial and agricultural processes and resources.
Freshwater resources	Undertake inventory of freshwater resources and develop and implement a National Water Resources Management Plan
Tourism	Improve/ develop regulatory framework with emphasis on enforcement.
Cross-cutting	Development and implementation of an integrated, coordinated and sustained climate change awareness programme targeting all sectors and relevant interest groups

Barriers / Constraints Regarding Implementation

There are a number of challenges which need to be overcome in an effort to successfully implement the required adaptation measures. This includes many institutional changes. The following tables provide examples of the Public Sector, Private Sector and Public/Private Sector Partnerships required for adaptation to the effects of Climate Change. There is a need for a central agency to co-ordinate and facilitate these required changes to ensure effective implementation.

The implementation of adaptation to Climate Change will require the management of human, material and financial resources to achieve the stated goals and objectives. At present there is very little consideration given disaster prevention, mitigation or preparedness when appraising projects or programmes financed by the Government. This suggests that costs for rehabilitation post disaster, simply recurs as opposed to the development of climate resilient projects. Little or no action is taken to ensure disaster risk reduction in the future.

Way Forward

Climate change impacts are cross-sectoral in nature and are usually manifested in effects on the country's natural resources and the population. Climate change impacts may however, be further exacerbated by the realities of indirect drivers of climate change such as socio-economic and ecological challenges, including trade regimes, demographics of people, poverty and unemployment. In responding to the impact of climate change, there is a need for a coordinated, broad-based, multi-sectoral response aimed at mainstreaming climate change issues into the planning and development process.

Introduction

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) was adopted at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. In keeping with Article 4 1 (a) and Article 12 of the Convention, all Parties to this Convention are required to submit reports on the progress of its implementation. At the core of these national communications is information on greenhouse gas emissions as well as steps taken or envisaged by the Party to implement the Convention.

The preparation of the Second National Communication (SNC) for Saint Lucia is a continual step towards further implementation of the UNFCCC at national level and in compliance with Article 12 of the Convention. Its main objective is preparing a comprehensive report on the climate change related issues. In addition, through the SNC, a viable institutional and procedural framework will be established to ensure continuous reporting of national communications to the UNFCCC. The preparation of the SNC will further ensure that climate change issues are integrated into the national sustainable development framework and strategic planning processes of Saint Lucia.

The SNC was prepared according to The User Manual for SNC Preparation[1],[2] the UNFCC Convention and the SNC Project Document. Work conducted under the SNC builds on activities undertaken during the Initial National Communication (INC), which defined the basis on which the country proposed to address climate change and its impacts. The analysis conducted within the Initial National Communication (INC) was upgraded and extended. Relevant information was extracted and summarised from the reports, chapters and other outputs from the SNC process to produce a synthesised advanced national report. The SNC builds as well on subsequent activities under the CPACC, ACCC, MACC, and SPACC projects, led by the Caribbean Community Climate Change Centre (CCCCC).

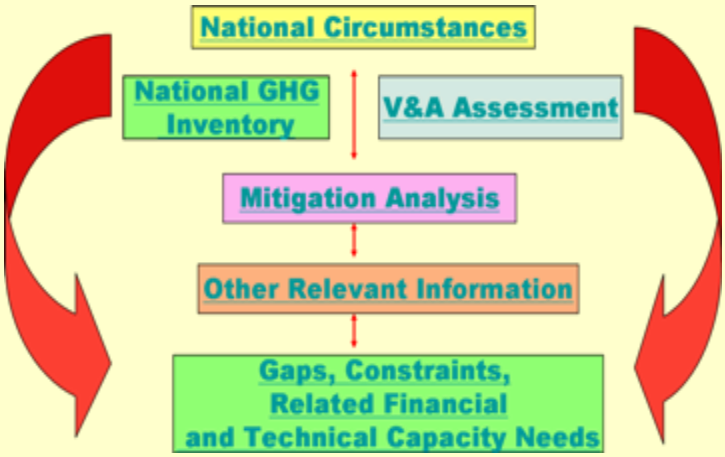
The main components are:

1. ***National Circumstances;***
2. ***Green House Gas Inventory;***
3. ***Programmes Containing Measures to Facilitate Adequate Adaptation to Climate Change (V&A Assessment);***
4. ***Programmes Containing Measures to Mitigate Climate Change;***
5. ***Other Information Relevant to the Achievement of the Objective of the Convention;***
6. ***Constraints, Gaps and Related Financial, Technical and Capacity Needs.***

[1] UNFCC, 2003. Reporting on Climate Change: User Manual for the Guidelines on National Communications for Non Annex 1 Parties.

[2] UNFCC, 2007 Integration of Information Contained in National Adaptation Programmes of Action into Second and Subsequent National Communications.

In pursuance to the Guidelines provided in the National Communications Support Programme Resource Kit, the SNC proposed to describe the institutional structure that has been put in place to sustain the national communication process. As such, information is provided on the roster of institutions involved in the preparation of the national communication; and terms of reference for the various committees, task groups and/or expert/thematic working groups involved in the preparation of the national communication.



Thematic Components of the SNC

The process of preparation of the SNC was also utilized as a mechanism to raise public awareness of climate change issues in the country, to strengthen integration of climate change concerns into national policies and development planning frameworks, and to enhance national capacity to respond to the impacts of climate change.

The preparation of the Second National Communication involved a two-fold process:

1. The conduct a detailed analysis of ***"Constraints, and Gaps, and Related Financial, Technical and Capacity Needs"***, articulated in all the thematic components of the second national communication.

2. The preparation of a ***synthesised Second National Communication*** document assembled on the SNC Thematic Components.

Saint Lucia has identified new areas for the SNC, including the Financial sector; economic impacts of climate change, and human Health. This is in addition to updating and expanding on coastal resources, freshwater, agriculture, human settlements, fisheries, tourism and forestry.

Chapter 1: National Circumstances

CHAPTER 1: NATIONAL CIRCUMSTANCES

1.0 OVERVIEW

This chapter briefly describes the physical characteristics, history, climate and demographics of the country, followed by an overview of the economic context under which the Second National Communication (SNC) has been prepared. Also included is an outline of the Energy Sector which seeks to contextualize various aspects of the SNC, particularly the GHG Inventory. This chapter also seeks to set the stage for the vulnerability and adaptation analysis which is highlighted in Chapter 2.

1.1 PHYSICAL CHARACTERISTICS

1.1.1 Location

Saint Lucia is a Small Island Developing State (SIDS) located at latitude 13° 59' N, and 61° W within the Lesser Antillean Arc of the Caribbean Archipelago. The land area is approximately 616 km² and it is situated on a volcanic ridge connecting to Martinique and St. Vincent and the Grenadines, towards the north and south respectively.

Figure 1.1 - Map of Saint Lucia

The island is 42 km long and 22 km wide at its widest point, and a coast line of approximately 158 km, The island's coastal shelf has an area of 522 km^2, is relatively narrow and drops off sharply along the west coast. Saint Lucia's Exclusive Economic Zone is approximately 4700 km^2. The Map of Saint Lucia is illustrated in Figure 1.1.

1.1.2 Topography

The island has a very steep, rugged landscape, characterized by a centrally located north-south oriented mountain range, deep valleys and fast flowing rivers. The highest point on the island is Mount Gimie, which stands 950m above sea level, while the most spectacular landmarks are the Pitons. These two volcanic spires rise side by side from the sea to heights of 770m and 743m respectively, and are the focal points of the Pitons Management Area, World Heritage Site.

1.1.3 Geology

Saint Lucia is predominantly of volcanic origin with the oldest rocks dating back to the Early Tertiary period. Similar to the other islands of the Lesser Antilles, Saint Lucia originated as a series of submarine volcanoes. The island's volcanic centres are divided into 3 broad groups based on age and geographic distribution, as follows:

- Group 1: Eroded Basalt and Andesite centres (the Northern Series)
- Group 2: Dissected Andesite Centres (the Central Series)
- Group 3: The Soufrière Volcanic Centre (the Southern Series)

1.1.4 Climate and Climatic Elements

In an effort to establish a climatic baseline for Saint Lucia, which would set the stage for determining how these parameters are influenced by climate change, it is necessary to consider the following: changes in wind patterns, rainfall distribution and air temperature. Saint Lucia lies within the north-east Trade Wind belt and is normally under an easterly flow of moist, warm air. Under normal circumstances, the island's weather is influenced by synoptic weather systems such as the Atlantic High Pressure system (Bermuda Azores), surface, mid and upper level low pressure systems, the Inter-Tropical Convergence Zone, tropical waves and cyclones and the occasional frontal system. Mesoscale and microscale weather features also affect the island.

Temperature

The island's location in the Atlantic Ocean/ Caribbean Sea causes the ambient sea surface temperatures to vary slightly from 26.7°C at any given time. In general the island receives a constant amount of surface solar radiation. A combination of these factors, facilitate a tropical maritime climate characterized by warm air temperature averaging approximately 28° C This temperature rarely rises above 33° C or falls below 20° C. Temperatures are lowest in the months of December to March and highest around June to September. Figure 1.2 shows mean maximum and minimum annual temperatures from 1980-2007 at Hewanorra Airport in the south of the island.

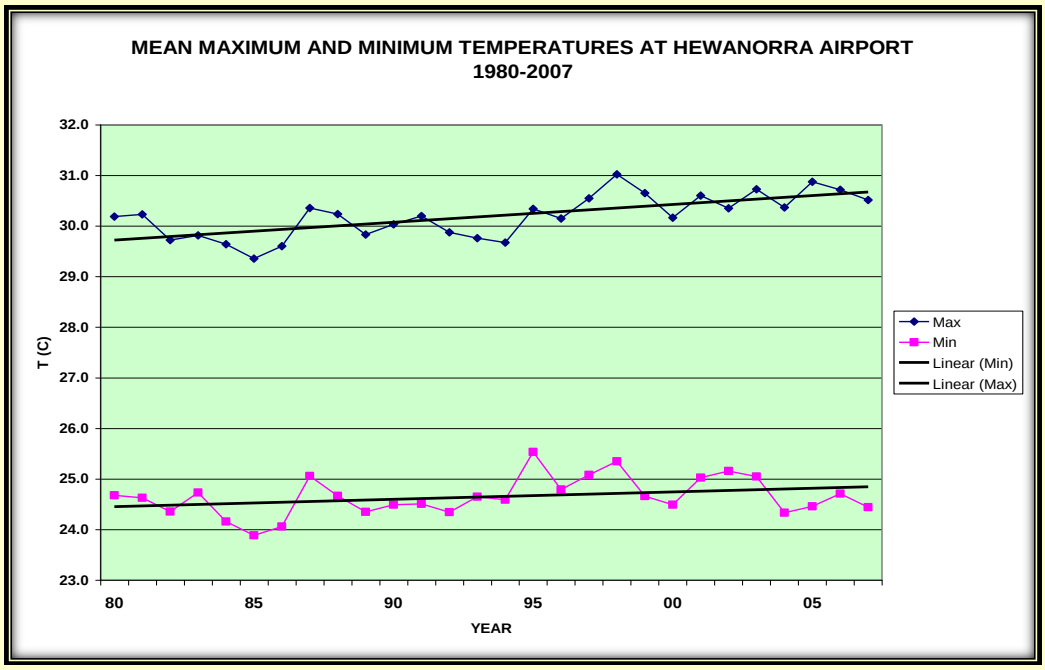


Figure 1.2: Mean Maximum and Minimum Temperatures at Hewanorra Airport 1980 – 2007 [Source: Meteorological Services Department]

Rainfall

The island has two climatic seasons based on rainfall. The wet season extends from June to November while the dry season runs from December to May. The quantity of rainfall in the wet season is determined mainly by the frequency and intensity of tropical disturbances (waves, depressions, storms, hurricanes). These disturbances account for the greater amount of the recorded rainfall during that season. Local convectional showers and other weather systems account for the remainder.

In the dry season, most of the rainfall originates from mid-latitude systems (troughs, frontal troughs, jet streams) intruding into the region. The intrusion of the dry season rain-producing systems is randomly distributed temporally, thus the rainfall they produce over the island is highly variable over time. On the other hand, tropical disturbances in the wet season tend to occur with a predictable frequency of roughly one every four days.

The geographic influence of rainfall is quite pronounced with amounts varying from about 1265 mm in the relatively flat coastal regions to about 3420 mm in the elevated interior region. Figure 1.3 shows annual rainfall at Hewanorra Airport from 1973-2007. while Figure 1.4 shows average monthly rainfall at Hewanorra for the same period.

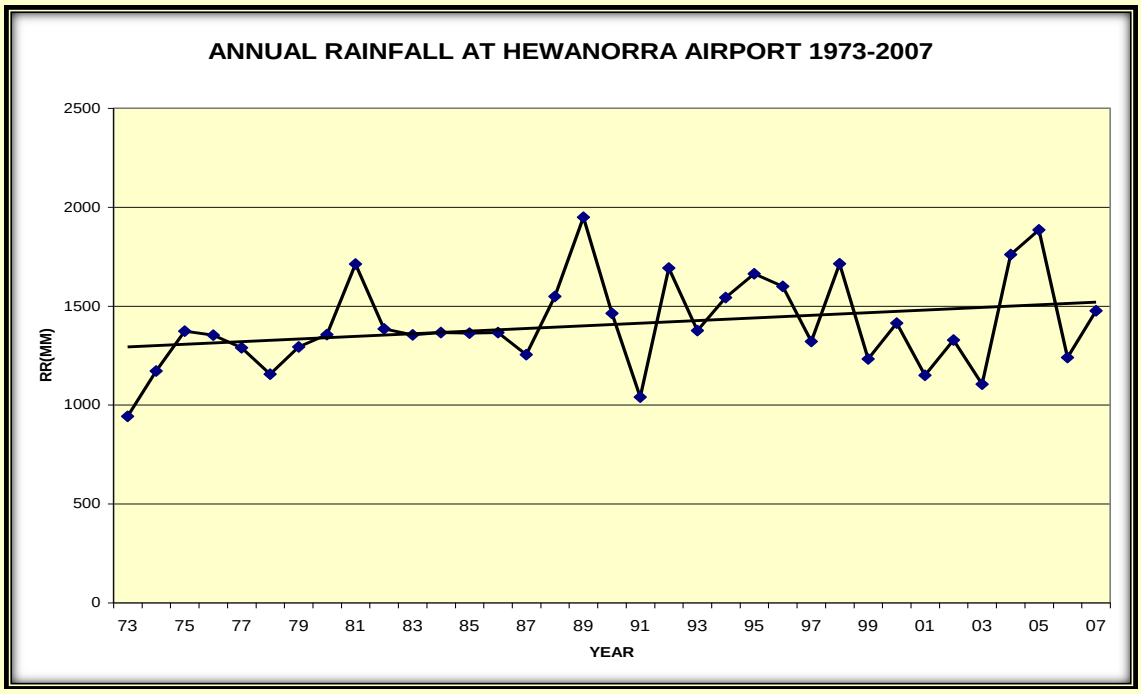


Figure 1.3: Annual Rainfall at Hewanorra Airport 1973-2007
[Source: Meteorological Services Department]

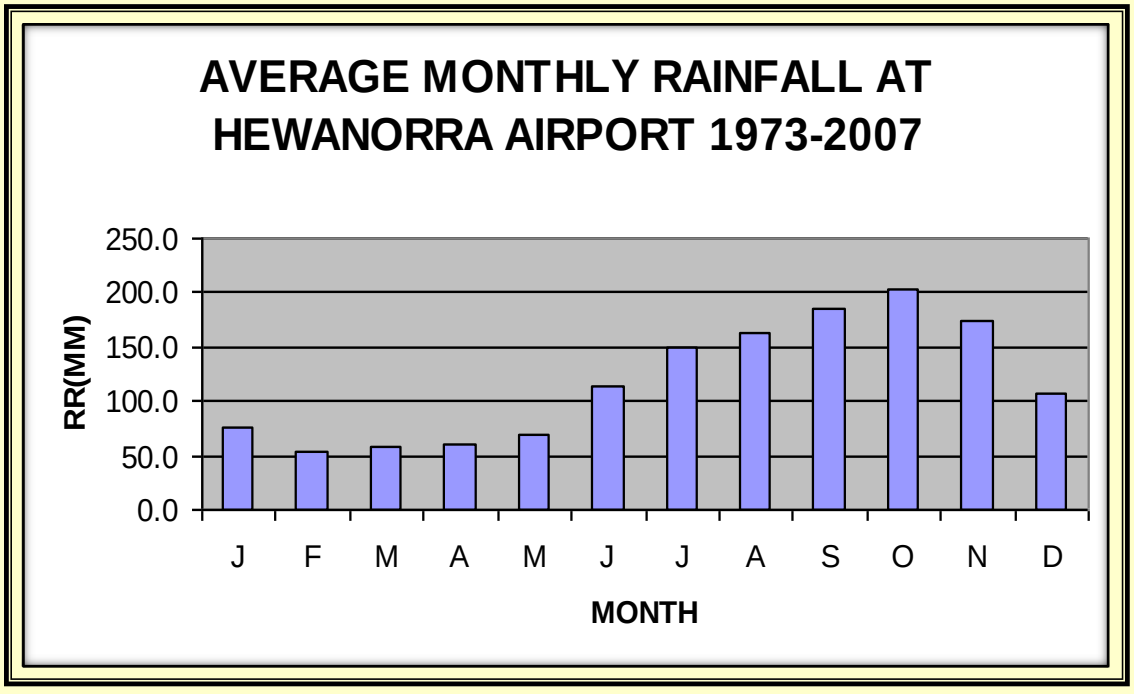


Figure 1.4: Average Monthly Rainfall

Winds

Saint Lucia lies within the northeast Trade Wind belt. Wind speeds are highest on average during the months of January to July, corresponding roughly with the dry season, when the average is 24kmh^{-1}. Between August and December the speeds average 16kmh^{-1}. Higher gusts are occasionally experienced with the passage of tropical disturbances and cyclones. Mean monthly wind speeds for the period 1973-2007 are shown in Figure 1.5.

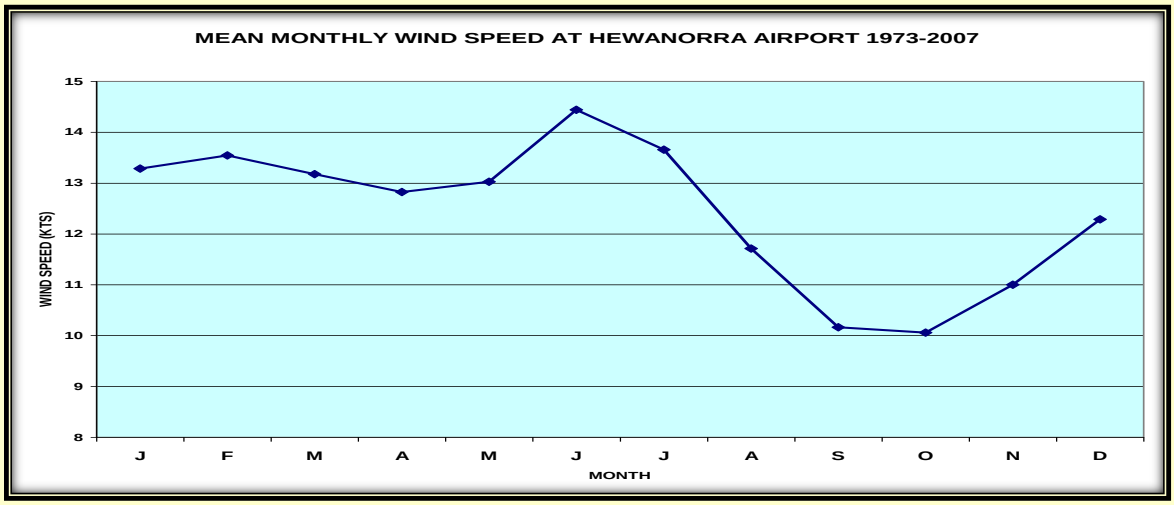


Figure 1.5: Mean Monthly Wind Speed at Hewanorra Airport: 1973 - 2007

Humidity

Daily variation in relative humidity is at a maximum during the warmer months. The lowest value ever reported at Hewanorra was 31% in February 1998. The annual range is very small with a mean of about 77%. Figure 1.6 shows mean annual relative humidity at Hewanorra Airport while Figure 1.7 shows mean monthly relative humidity for the same period.

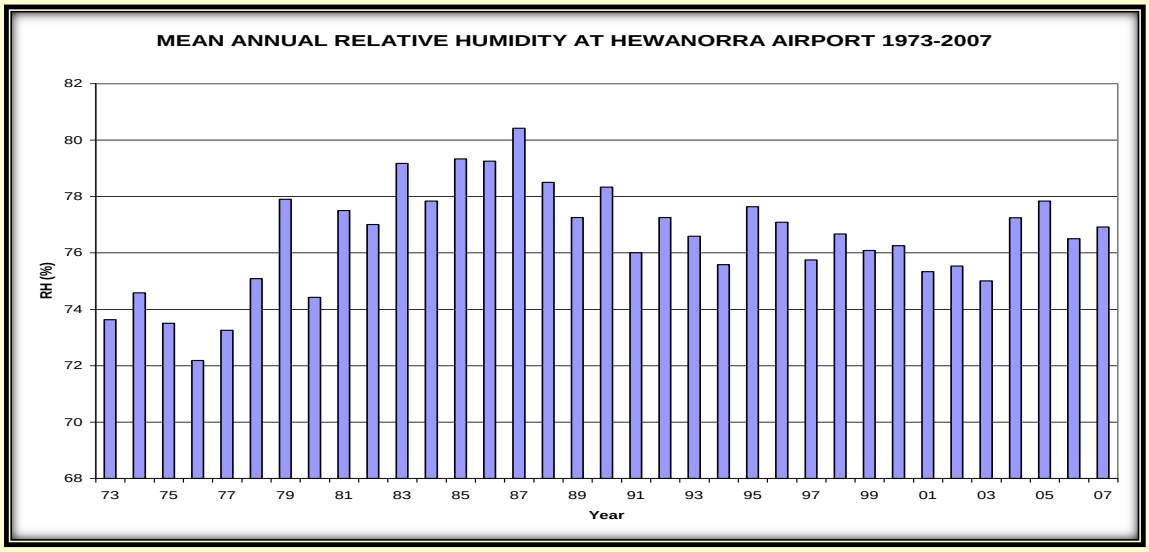


Figure 1.6: Mean Annual Relative Humidity at Hewanorra Airport: 1973 – 2007

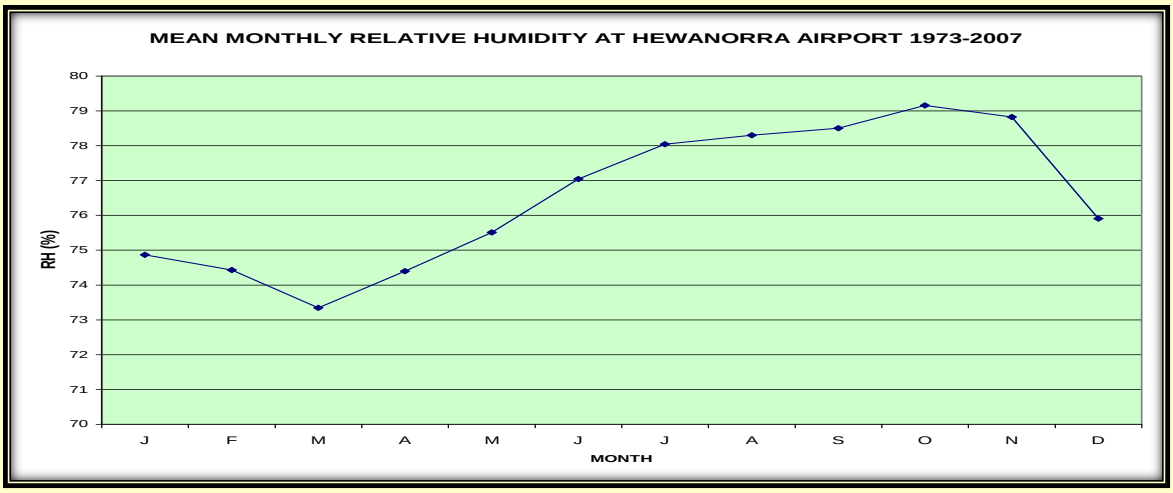


Figure 1.7: Mean Monthly Relative Humidity: 1973 - 2007

Sunshine

The amount of daily sunshine received over Saint Lucia is at a maximum from February to May and at a minimum around September. Radiation values vary widely over the island and this is mainly due to cloud cover. As such, elevated regions with greater cloud cover receive less direct radiation than the low-lying coastal regions. Figure 1.8 shows mean monthly sunshine at Hewanorra Airport from 1982 to 2007.

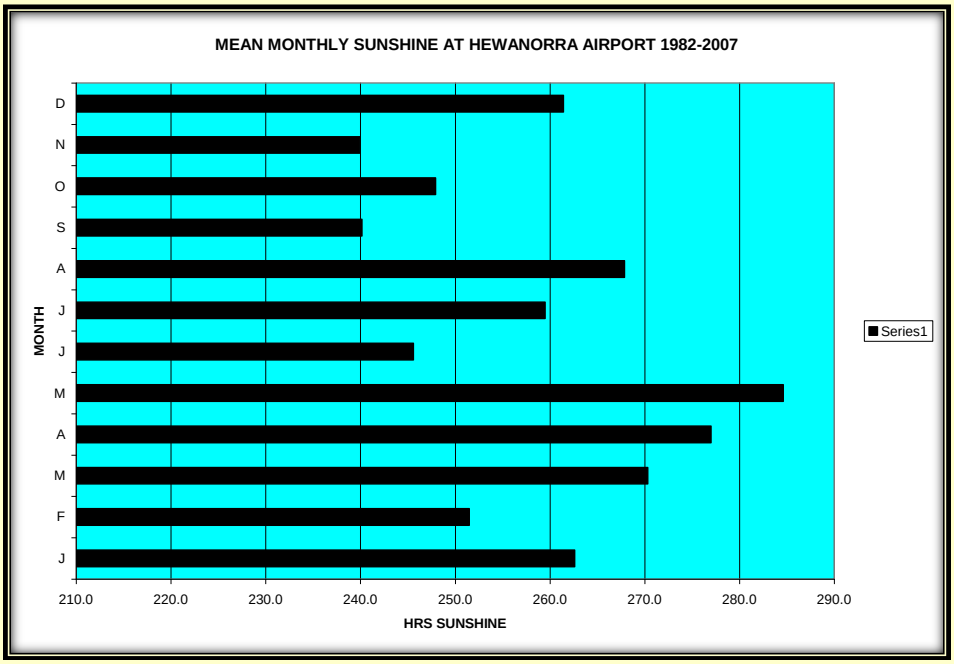


Figure 1.8: Mean Monthly Sunshine at Hewanorra Airport: 1982 to 2007 [Source: Meteorology Services Department]

1.2 HISTORY

The earliest settlers of Saint Lucia were the Ciboneys. They were an Amerindian culture who lived on the island about 2000 years before Columbus. The island was next occupied by the Arawak Indians from about 200 A.D. for a period of about 800 years. They, in turn were invaded by the Kalinago – Carib Indians whom the first Europeans found on the island.

In the seventeenth and eighteenth centuries England and France fought for ownership of the island, which changed hands fourteen times between the two countries. Saint Lucia was eventually ceded to Britain in 1814 under the Treaty of Paris. During the period of conflict, Saint Lucia's economy was based on plantation agriculture. Early crops included coffee, tobacco and indigo. Agriculture remained the mainstay of the economy but is now superseded by tourism as the main economic activity on the island.

1.3 POPULATION AND DEMOGRAPHICS

Saint Lucia has a population of 166,526 [Census 2010], with 24.1% under 14 years and 33% between 14 and 34 years. The population is concentrated along the coastal regions, where low land agriculture, coastal resources, reefs, fisheries and tourism are the main sources of livelihood. Approximately 60% of the population resides along the north-west corridor. The island's population is rapidly becoming urbanised, with approximately 41% of the total population residing in the city of Castries and 55% of the population residing in the Castries-Gros-Islet corridor. A further 28% reside within the regions/districts of the Southern Quadrant, with the North-East and West-Central Quadrants being the least populated regions of the island, each having less than 10% of the total population [PPCR Report 2011].

Table 1.1 Saint Lucia at a Glance, shows good social indicators (including low levels of maternal and infant mortality, universal primary education, low fertility, and increasing life expectancy) existing alongside high and increasing levels of poverty – 25.1% in 1995 and 28.8% in 2005/06.

Table 1.1 Saint Lucia at a Glance

Population	**166,526**		
Area	616 km2	**Habitable Area**	539.1 km2
Basic Demographics Birth Rate (per 1000) 13.1 Death Rate (per 1000) 7.7 Infant Mortality Rate (per 1000) 13.43	**Population Density** Per sq. km - 839.2	**Urban Population**	41%
Structure of Economy %GDP (2009 est.) Agriculture 4.9 Industry 18.2 Manufacturing 6.4 Services 76.9	**Age Structure** 0-14 years: 24.4% (male 20,035/female 19,021) 15-64 years: 66.4% (male 51,593/female 54,843) 65 years and over: 9.2% (male 6,668/female 8,107)		
Prices and Employment (2010) Inflation Rate (period average) 1.9% Unemployment Rate (average) 20.6 %	**Poverty Statistics (2005/2006 vs 1995)** 05/06 1995 % poor 28.8 25.1 % indigent 1.6 7.1 Rural Poverty 29.6% - Urban Poor 16.3% - Vulnerability 40.3% -		
School Enrolment (2010) Primary School Enrolment 18,594 Secondary School Enrolment 15,655 Tertiary 2,929	**Central Government Fiscal Operations (MXCD) FY10/11** Total Revenue and Grants 858.3 Current Revenue 789.5 Total Expenditure 1,032.7		

Source: Adapted from World Bank, 2008 / PPCR Report 2011

1.4 GOVERNANCE

Saint Lucia is an independent country, having gained independence from Great Britain on February 22nd, 1979. The country has a Westminster style government. Its parliament comprises 17 elected district representatives, and a Senate or Upper House comprising of 11 members. Elections are constitutionally due every five (5) years. The Head of State of Saint Lucia is the Governor General, who represents the British Monarch. The Administrative arm of Government comprises the Office of the Prime Minister, the Office of the Attorney General and thirteen line Ministries. Whereas the Ministerial Portfolios and configurations of the Ministries undergo changes based on decisions of the Prime Minister, certain key portfolios of relevance to climate change include: The Ministry of Agriculture, Forestry and Fisheries, The Ministry of Communications, Works Transport and Public Utilities, the Ministry of Health, the Ministry of Physical Development, Environment and Housing, the Ministry of Social Transformation, The

Ministry of Tourism and The Office of the Prime Minister (National Emergency Management Office, NEMO).

1.5 DEVELOPMENT PRIORITIES

1.5.1 Regional Development Priorities

The thirteen Member States of the Caribbean Community and Common Market (CARICOM) and the five Associated Member States have agreed to a single vision for sustainable development which encompasses economic, social, environmental and governance dimensions, grouped into six broad elements:

a) Self-sustaining economic growth based on strong international competitiveness, innovation, productivity, and flexibility of resource use;
b) A full-employment economy that provides a decent standard of living and quality of life for all citizens; elimination of poverty; and provision of adequate opportunities for young people, constituting an alternative to emigration;
c) Spatially equitable economic growth within the Community, having regard to the high growth potential of member states with relatively low per capita incomes and large resources of under-utilised land and labour;
d) Social equity, social justice, social cohesion and personal security;
e) Environmental protection and ecological sustainability; and
f) Democratic, transparent and participatory governance.

At the level of the Organisation of Eastern Caribbean States (OECS), Member States agreed to a human development agenda with eight key elements:

a) Reducing the levels of poverty;
b) Substantially increasing the number and quality of jobs;
c) Providing access to quality education for all;
d) Improving access to and the delivery of health services;
e) Sustaining an adequate stock of natural resources;
f) Empowering disadvantaged groups, at the household, community, national and regional levels to take charge of their own lives;
g) Developing sports and enhancing participation at the national and regional levels; and
h) Strengthening the institutions and practices of good governance.

These development agendas embrace the sustainable development paradigm, seeking to meet key social and economic goals sustainably. Member States are expected to implement policies and measures to achieve these development goals.

1.5.2 National Development Priorities

At the national level, Government has approved a National Vision Plan which is a Sector Development Plan that represents, in broad terms, the development priorities for each of the four main regions of the country. This plan is a broad-based land use plan developed to support the expansion of the tourism infrastructure, support some measure of environmental sustainability, expansion of housing and industry expansion. Whereas it does not speak directly to climate change vulnerability, the need to incorporate these considerations at the

implementation stage is clear. The impacts of Hurricane Tomas on the landscape and economy of the country demonstrated this very effectively.

1.6 THE ECONOMY

1.6.1 Education and Employment

Saint Lucia recently (2006) attained universal secondary education. However, the evidence is that females out-perform males at examinations. According to the 2001 population census, 8470 females had as their highest academic qualification, secondary school level (GCE and CXC) certificates compared to 5940 males. At the post secondary level (up to post graduate certification) 6242 females were in possession of formal qualifications compared to 5208 males. Over the years, the opportunities for employment have become very diverse from that focused on Agriculture to one based on Tourism and other Services. Employment data for 2006 is presented in Table 1.2 below. This table highlights the diverse number of sectors contributing to the economy through employment, most of which are non traditional sectors such as financial services. The Construction Industry is also a major contributor to employment.

	% of male Population	% of Female Population	% of Total population
Agriculture, Hunting and Forestry	**14.3**	**8.5**	**11.9**
Fishing	**1.7**	**.01**	**1.0**
Mining & quarrying	**…**	**…**	**…**
Manufacturing	**5.2**	**7.1**	**6.0**
Electricity, Gas and Water Supply	**1.2**	**0.8**	**1.1**
Construction	**20.5**	**1.2**	**12.6**
Wholesale & retail trade, etc.	**11.9**	**19.5**	**15.0**
Hotels and restaurants	**9.9**	**14.2**	**11.7**
Transport/communications/storage	**8.3**	**2.4**	**5.8**
Financial Services	**1.2**	**3.2**	**2.0**
Real estate, renting and business activities	**3.0**	**4.4**	**3.6**
Public administration and social security	**9.3**	**17.1**	**12.5**
Education	**0.3**	**17.1**	**8.97**
Health, Social Work, etc.	**4.4**	**2.2**	**7.2**
Other/not stated	**8.8**	**6.7**	**7.9**

Table 1.2: Employment by Sex and Industry – 2006
[Source: GOSL Statistical Department]

1.6.2 Key Economic Indicators

Since 1990 the Saint Lucia's economy has undergone a structural adjustment that saw the service sector, and in particular tourism leading economic growth. Between 1990 and 2006, the contribution of agriculture declined from 13.85% to 3.24% of GDP while the tourism sector's contribution moved from 9.18% to 12.55% in the same period. The contributions of key economic sectors to GDP between 2000 and 2006 are listed in Table 1.3:

SECTORS	2000	2001	2002	2003	2004	2005	2006
Agriculture, Livestock, Forestry, Fishing	31.62	23.89	24.94	21.01	20.41	15.36	16.86
Mining and Quarrying	2.84	2.11	2.15	2.16	2.11	2.04	2.44
Manufacturing	27.29	27.43	29.86	29.36	31.78	33.67	35.93
Construction	38.60	36.67	34.90	35.46	35.81	40.29	45.62
Electricity and Water	22.61	23.65	23.06	23.49	23.94	20.73	23.87
Wholesale and Retail Trade	54.09	46.24	46.81	50.45	54.70	57.89	63.11
Hotels and Restaurants	57.63	51.56	51.24	59.76	63.28	67.29	65.44
Transport	47.09	46.48	44.70	46.65	50.07	49.56	50.25
Communications	39.91	44.63	47.99	50.16	52.46	56.31	56.19
Banking and Insurance	46.08	47.30	47.89	48.83	51.24	55.70	65.70
Occupied Dwellings	52.37	54.13	55.42	57.27	59.14	62.51	64.14
Government Services	54.03	55.34	54.43	53.31	55.49	60.13	66.01
Other Services	21.31	19.75	20.11	20.10	20.22	20.59	21.40
Less: Banking Service Charge	-38.57	-39.34	-40.09	-40.72	-42.67	-45.80	-55.80
TOTAL	*456.90*	*439.85*	*443.41*	*457.28*	*477.99*	*496.26*	*521.17*
Growth Rate (%)	2.47	-1.46	0.39	4.92	6.39	7.65	7.37

Table 1.3: Sector Contributions to GDP (US$ millions)

Taken together, the sectors in italics, which have climate change sensitivities accounted for 74.5% of the GDP in 2006. This underscores the vulnerability of the local economy to climate impacts.

Government has set a target economic growth at 7% (2010) and has laid out a development strategy, key components of which are to:

- Encourage and facilitate private sector investments.
- Infrastructural expansion, including the expansion of air and sea ports and the redevelopment of the Castries business district.
- Expansion of the tourism plant by an additional 2500 rooms.
- Agricultural diversification through a focus on non- traditional crops and livestock development.
- Privatization of the water sector.
- Expansion of the housing stock.
- Promote energy independence be supporting energy efficiency and conservation and the exploitation of new and renewable sources of energy.
- Implement a range of environmental conservation measures.
- Develop and promote a quadrant approach to national development under which development priorities will be identified and promoted for each of four quadrants into which the island is divided.

1.6.3 Economic Policies and Measures

Saint Lucia's economic growth and development is centred around tourism, agriculture, infrastructural development and commercial sectors, with tourism being at the centre of the thrust. The key policies and measures are summarized in Table 1.4:

Policy Areas	Key measures and initiatives
Sustainable Development	Preparation of a ten year National Sustainable Development Strategy
	Development of a Sector development Strategy
	Approval of Quadrant Development Plan
Tourism	Branding and increased marketing
	Incentives for hotel construction and upgrade
Agriculture	Food security
	Promotion of Agribusiness
	Upgrade of feeder roads
	Livestock development and meat processing
	Investments in the Fisheries sector
	Investments in agricultural diversification
Private Sector	Encourage entrepreneurship
	Promote ICT
	Implementation of the CARICOM Single market and Economy
	Buy local Campaign
	Promotion of small and micro business development
	Development of a National Export Strategy

Infrastructure	Construction of hospitals and health centres
	Castries re-development
	Cruise Port expansion
	Cargo port expansion
	Airport expansion
	Construction of a water reservoir in the south of the island
	Improvements to road network
Environment	Protection of wetlands and open spaces
	National Environment Act to be Enacted
	Creation of a National Environmental Commission
	Sewage treatment system for the capital city
	Investments in air quality monitoring
Energy	Duty concessions on renewable energy technologies and energy efficient devices
	Promote Energy Service Companies (ESCOs)
	Construction of a wind farm
Social issues	Universal health care
	Privatization of water
	Private sector engagement in home construction

Table 1.4: Key Public Sector Policies and Measures

1.7 KEY ECONOMIC SECTORS

1.7.1 Tourism

The tourism sector is the lead growth sector of the local economy. After falling by 2.7% in 2005 and a further 7.4% the following year, the sector contributed 11.7% of GDP in 2007. This contribution is increasingly supported by the cruise sector which grew by 69.7%, passing the 500,000 arrivals mark in 2007.

The overall performance of the tourism sector was constrained by a number of factors. These include the impact of high international oil prices on consumer spending, the cost of travel and increased competition from destinations within the region and beyond which offer similar products and experiences. Tourism planners are trying to address the latter challenge by developing local nature and heritage tourism experiences, the dive and yachting sectors and the development of a new cruise port in the south of the island. This trust is based on the continued availability of a pristine environment, including the marine environment.

Whereas average occupancy has held steady at about 65%, considerable investments are being made in increasing the number of hotel rooms through a number of pipeline projects which will add an estimated 2500 units over the next 4 years. Of concern in the context of sea level rise is that most hotels, both existing and proposed, are coastal developments close enough to the sea

to be impacted by this phenomenon. Another key concern is energy consumption which has experienced steady growth, paralleling the growth in the industry.

1.7.2 Agriculture:

The contribution of Agriculture to GDP declined steadily from 17% in to 6% in 2006. Whereas the contribution of Agriculture to GDP is likely to show further decline because of emerging external market conditions, the sector will remain a key component of the local economy for employment generation, foreign exchange earnings and food security as well as to retard urban drift. In this regard, the climate sensitivities of the sector must be factored into future plans to ensure its resilience against increased temperatures, precipitation variability, possible land degradation and storm events. These matters are to be addressed in the Vulnerability and Adaptation Chapter of this Communication.

1.7.3 Infrastructure

In Saint Lucia, the major towns and villages in Saint Lucia are located on the coast, as are the major roads which connect them as illustrated in figure 1.. In addition, key economic infrastructure such as airports, sea ports, fuel storage and hotels are also on the coast, while social infrastructure such as hospitals, schools and security services tend to be centred around population centres, which themselves are concentrated in coastal areas. Telecommunications infrastructure are generally further inland as is the major power supply network, but the distribution networks are located in the population centres.

With regards to the housing sector, the number of structures in or near disaster prone areas (areas susceptible to floods and landslides) is a cause for concern as is the number of structures not built to hurricane resistant specifications. In addition, unplanned developments continue to escalate in-spite of government's interventions to regularize this practice. Policies to address these challenges are in place but enforcement is inadequate. The *status quo* is cause for concern as the anticipated impacts of climate change will only exacerbate current vulnerabilities of the housing and critical infrastructure sub-sectors.

OTHER SECTORS OF INTEREST

1.7.4 Water

The water sector is critical to national development. Current potable water shortages in some parts of the island are due to both supply deficiencies and treatment and distribution constraints. Anticipated changes to temporal distribution and intensity of precipitation are likely to exacerbate supply deficiencies and may require the construction of storage facilities to bridge periods of reduced rainfall. The severe drought of 2009/10 underscores this point and has unveiled the key supply deficiencies which are likely to be exacerbated by the impacts of climate change and variability. Adaptation measures in the water sector will have major cost implications for the local economy and if not addressed will exert downward pressures on key components, including tourism, agriculture, industry and health.

1.7.5 Health

There is a number of existing health related issues likely to be exacerbated by climate change. These include, *inter alia*, increases in vector-borne diseases such as dengue fever, *Leptospirosis* and yellow fever as well as increases in water-related diseases such as *Schistosomiasis* and cholera. In addition, trends in the incidences of food borne diseases, diarrhoea, gastroenteritis and respiratory diseases are likely to increase as well as heat-related health issues.

1.7.6 Energy

One of the primary sources of global greenhouse gas emissions is the combustion of fuels such as petroleum and coal. Saint Lucia is almost totally dependent on imported petroleum fuels for its energy needs and, as such, would have to focus much of its mitigation effort on abating emissions generated from these sources.

Demand for imported fuels has continued to increase over the last several years, despite sharp petroleum price rises between 2005 and 2008. Power generation is the largest energy sub-sector in which Saint Lucia Electricity Services (LUCELEC), a private company in which the Government is a shareholder, is the only service provider. LUCELEC's power generation was based entirely on conventional diesel. However, the company has expressed an interest in moving into renewable forms of energy, such as wind and geothermal. Electricity consumption has grown steadily over the last decade, particularly in the domestic, hotel and commercial sectors. LUCELEC's generation capacity has therefore had to increase in order to keep up with this trend. The following figures highlight the electricity consumption by sector.

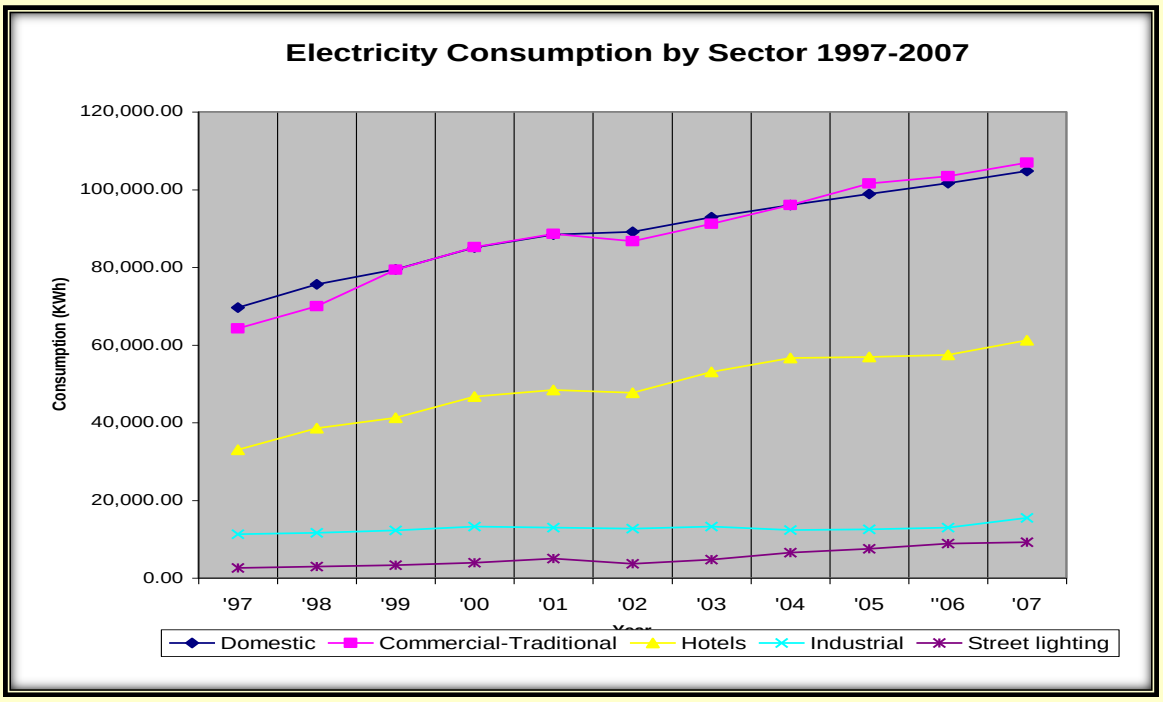


Figure 1.9: Electricity Consumption by Sector

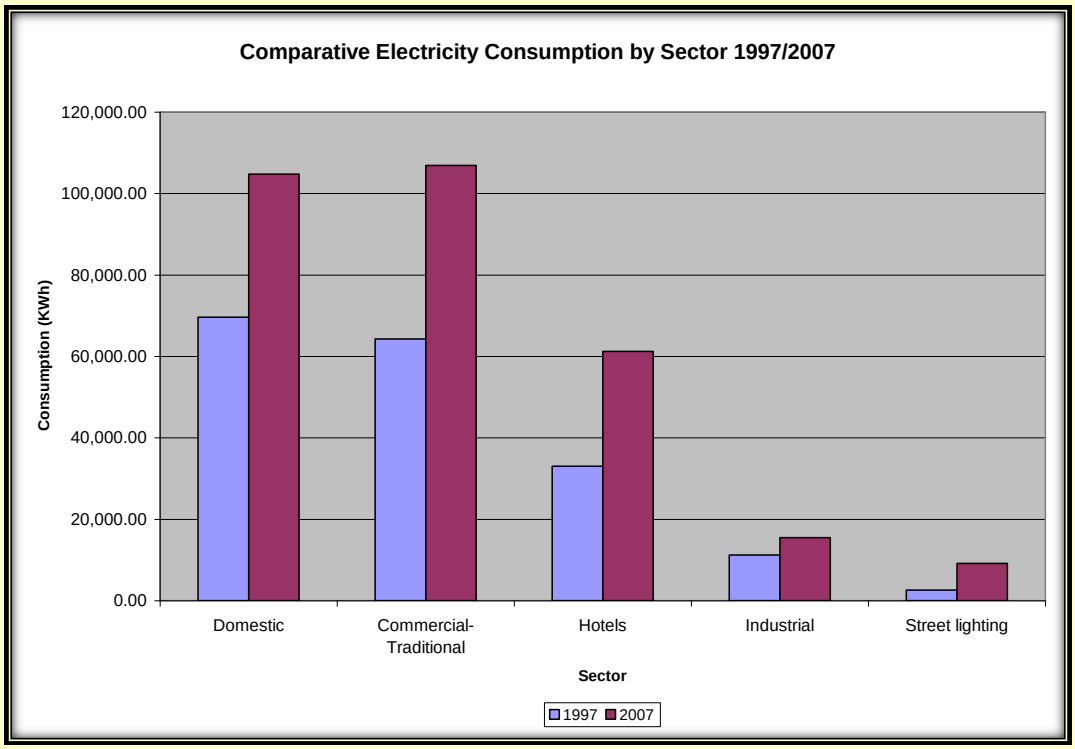


Figure 1.10: Comparative Consumption by Sector

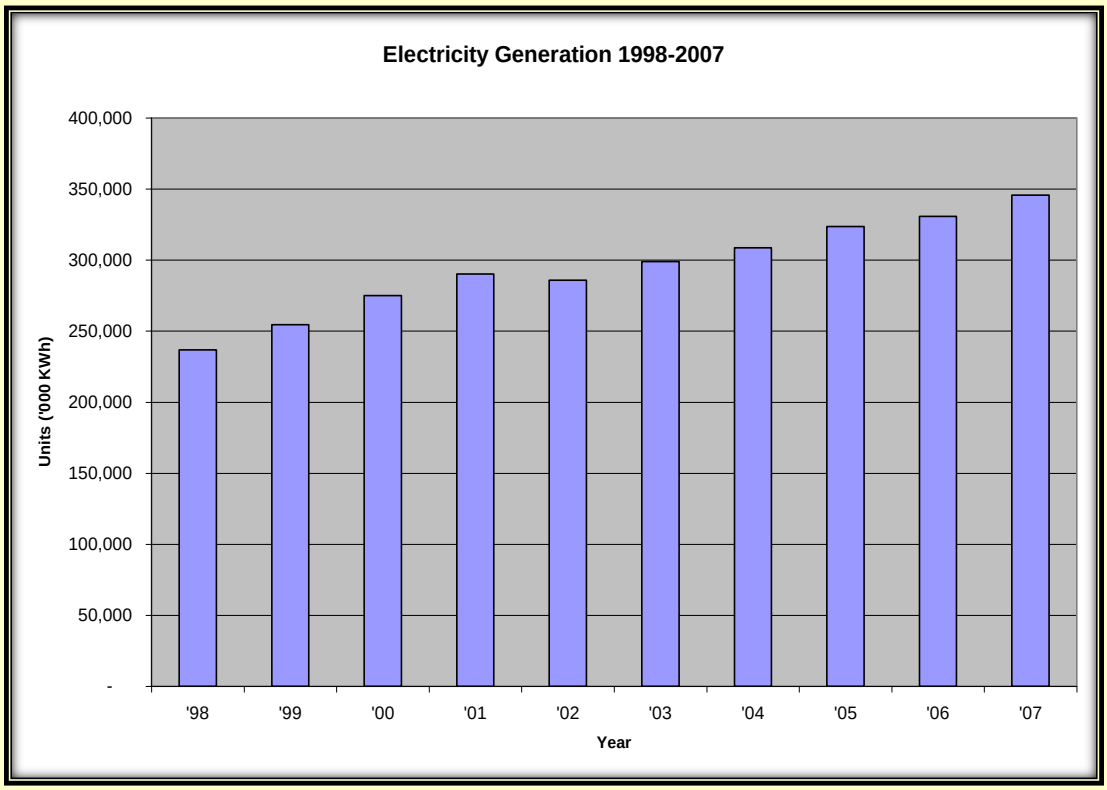


Figure 1.11: Electricity Generation

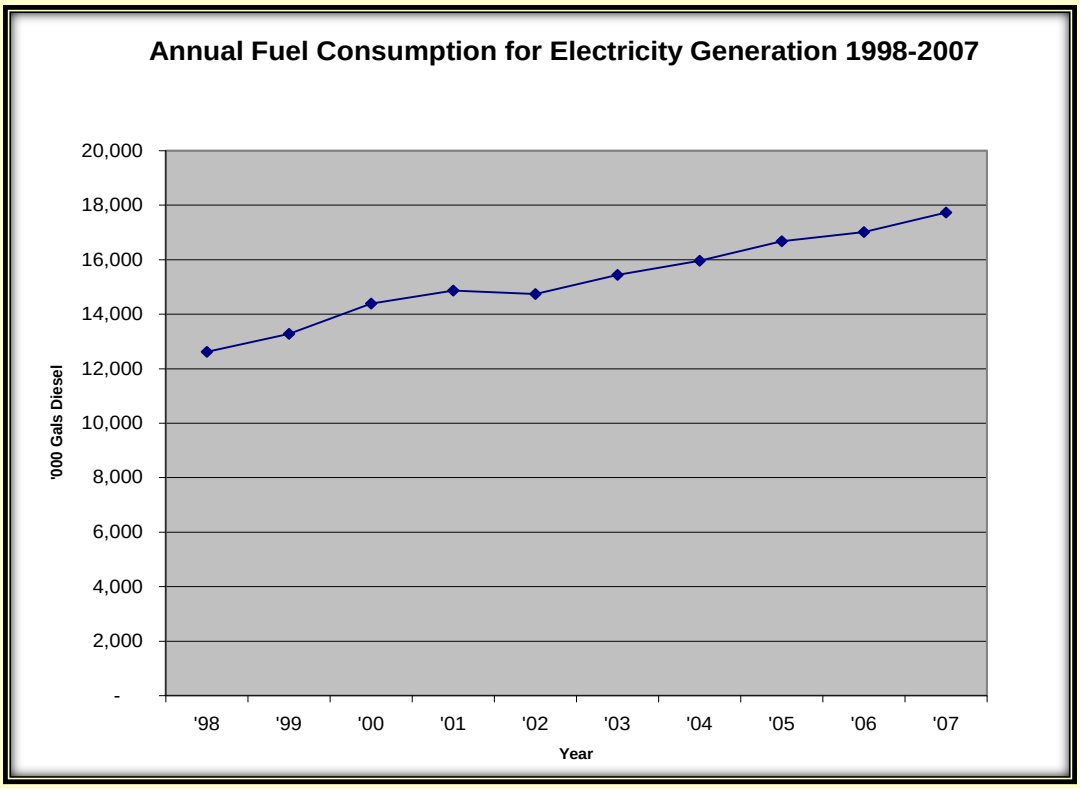


Figure 1.12: Annual Fuel Consumption

Non Electrical Domestic Energy Use

The major use of non-electrical energy in the domestic sub-sector is for cooking. National census data reveal a shift away from the use of charcoal and fuel wood towards liquefied propane gas (LPG) as the primary cooking fuel, between 1980 and 2001. In 1980, while 68 percent of households used wood or charcoal, only 12.1 percent relied primarily on this fuel source in 2001.

1.7.7 Transport Sector

Transportation is the second largest consumer of fossil fuels in Saint Lucia. Recorded increases in vehicle imports, over the last several years, has resulted in a net increase in registered vehicles, resulting in increasing in fuel consumption by this sector. To date, there are currently very few alternatively-powered vehicles in operation in the country.

Notwithstanding the growth in the number of registered vehicles, it is difficult to determine the exact number of vehicles on Saint Lucia's roads. This is due to the fact that official databases do not contain accurate information on vehicles taken off the roads due to accidents, obsolescence and other factors, nor do they reflect the number of unlicensed vehicles. There is currently not a true public transportation sub-sector in the country. In existence, however, are a large number of 12-to 15 seat minibuses and a smaller number of larger buses operated by private individual owners.

1.7.8 Housing and Infrastructure

The total road network of Saint Lucia comprises just over 1000 km of road of which approximately 20% are primary roads, 17% secondary and 63% tertiary. The entire road network traverses rugged coastal and inland terrain. The housing stock, which comprises approximately 58,891 households (2010 census) is concentrated mainly within coastal communities or from the coast inland along ridge lines, spurs and plateaus. Critical infrastructure such as schools, libraries, medical facilities, banks and administrative services are located within, or close to, population centres while economic infrastructure, including tourism plants are located close to the shore. The air and sea ports are also either on, or close to the shore.

The susceptibility of the island's housing and infrastructure to the impacts of climate change is a consequence of both their location and the island's topography. Whereas near-shore structures are likely to be impacted by sea level rise, storm events pose the greatest risk. High wind and rainfall events are likely to result in increased floods, land slippages and tree fall events Historically, these impacts have constituted the major cost following storm events and these are likely to be exacerbated by the anticipated increases in the severity and possible frequency of these events.

1.7.9 Biodiversity

Notwithstanding its small size, Saint Lucia possesses a high degree of ecosystem diversity and is home to a wide range of flora and fauna. An estimated 35% of the island's landmass is under forest cover, although the clearing of natural vegetation continues for agriculture, construction and other purposes.

The biological diversity of the island consists of at least 1,310 known species of flowering plants, cycads and gymnosperms belonging to 143 families. These include 105 plants of known medical value and 241 recorded forest tree species. There are 118 fern species with the majority found within the forest ecosystem. Seven of the fern species are considered endemic to Saint Lucia. There are also twenty-seven endangered plants recorded in Saint Lucia, most of which are found in the coastal and lowland habitats. Further to this one can find nine endemic plants in Saint Lucia.

There are over one hundred and fifty (150) bird species, seventeen (17) reptiles, nine (9) mammals and four (4) amphibians found in the terrestrial environment of Saint Lucia. The island is home to five endemic bird species among which is the rare Saint Lucian parrot or *Jacquot* (*Amazona versicolor*). The island possesses five endemic reptiles, one endemic sub-species, (the Saint Lucia Boa Constrictor) and six regionally endemic reptiles. There is one known threatened invertebrate sub-species of the Hercules beetle (*Cymnastes Hercules reide*) which is confined to the mountain areas.

The freshwater and mangrove wetlands of Saint Lucia are relatively small but are representative of most wetland ecosystems. The total area of wetlands has been reduced from 320 hectares to 193 hectares, with some areas under considerable stress. There are five species of mangroves found in the island, namely: red mangrove (*Rhizophora mangle*), white mangrove (*Laguncularia*

racemosa), two species of black mangroves (*Avicennia germinans* and *A. schaurenia*) and buttonwood or "paltivyè" (*Conocarpus erecta*).

Coral reef systems along the west coast are more diverse that those on the east coast. In general, fringing reefs are located along the southeast (Anse de Sables), central west (off the districts of Anse-la-Raye, Soufriere and Laborie) and the northwest coast (Choc Bay). The healthiest and most diverse reefs are found along the central west coast, off Soufriere. Reefs in Saint Lucia are under threat from high levels of sedimentation and other land based pollutants and, therefore, near-shore fisheries are also threatened. Natural disasters such as hurricanes and storms have also taken a toll on Saint Lucia's reefs.

Seagrass beds are common along Saint Lucia's coasts and are composed mainly of turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*) and to a lesser extent, shoal grass (*Halodule wrightii*) species

Three species of sea turtles are known to nest in Saint Lucia: the hawksbill (*Eretmochelys imbricata*), the green turtle (*Chelonia mydas)* and the leatherback (*Dermochelys coriacea*). Grande Anse beach on the north-east coast is the largest nesting site for leatherback turtles.

Current threats to biodiversity include poor land use practices which threaten land based biodiversity through habitat loss as well as marine biodiversity through siltation and land based pollution. These threats are likely to be exacerbated by the additional pressure they will face from the impacts of climate change. These include loss of habitats, increased risks of landslides, soil erosion, siltation of rivers and near shore habitats, changes in wild life populations, storm impacts on near shore marine biodiversity, loss of coastal forests, and the impacts of floods and droughts on habitats and biodiversity.

1.7.10 Land Use

Inappropriate land use and management is a central factor contributing to environmental degradation in Saint Lucia. As a consequence of current practices, increased stress on natural resources and biodiversity are evident, as are some of the consequences such as diminished food and water productive capacities through degradation of the terrestrial and marine environments.

In addition, the absence of effective forward planning coupled with the ineffective enforcement of existing laws are contributing to the growth of unplanned settlements, increased incidence of settlements in unsafe areas such as steep hillsides and flood plains, deforestation and poor building standards. In the long term, it is expected that soil fertility will be affected and sedimentation of the near shore marine environment will be accelerated. In 2009 the Government of Saint Lucia approved a National Vision Plan which seeks to rationalize land use throughout the country. Notwithstanding the above, it is noteworthy that of the total land mass of 616 km^2, approximately 35% is under some form of forest cover, 55% under some type of Agriculture and 9.14% is used for human settlements (See Table 1.5 and Figure 1.13).

Land Type	Use % of Total Land Area
Natural Tropical Forest	19.60
Mangrove	0.30
Plantation Forest	0.67
Scrub Forest	12.45
Grass and Open Woodlands	2.04
Mixed Farming	23.58
Intensive Farming	26.37
Densely Vegetated Farming	2.66
Flatland Intensive farming	2.02
Eroded Agricultural lands	0.39
Rural Settlements	3.86
Urban Settlements	5.28
Rocks and Exposed Soils	0.70
Water	0.08
Total	100

Table 1.5: Land Use Data

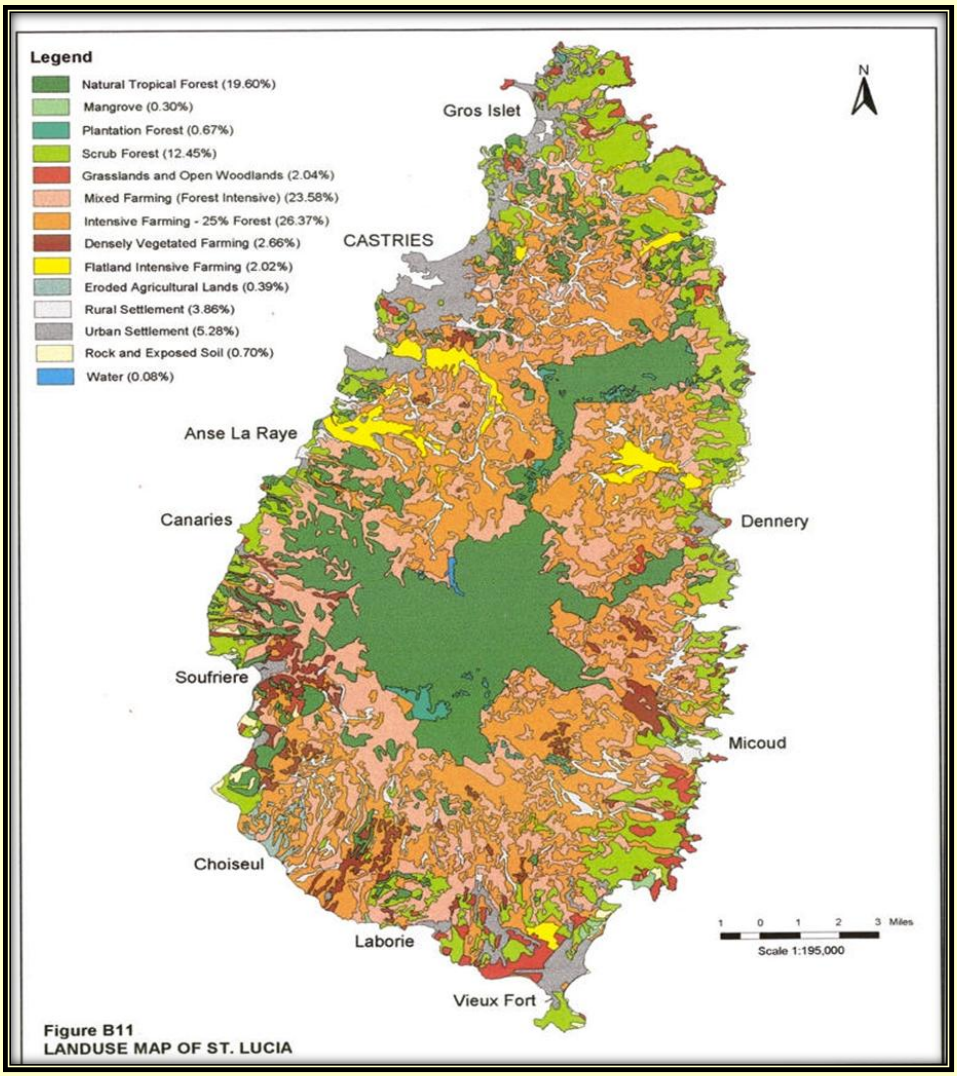


Figure 1.13: Land Use Map – 2000 [Source: Government of Saint Lucia]

1.8 POLICY ENVIRONMENT

Institutional and Policy Framework for Environmental Management

Environmental management in Saint Lucia is guided by a number of national, regional and international policy imperatives and instruments. At the global level, Saint Lucia is party to the UNFCCC, the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol, the United Nations Convention on Biological Diversity and the United Nations Convention to Combat Desertification, among others.

Saint Lucia is committed to achieving the Millennium Development Goals (MDGs), including Goal 7, which seeks to ensure environmental sustainability, by "integrating the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources". Actions called for under this target include immediate action to contain rising greenhouse gas emissions and limiting the use of ozone-depleting substances.

Saint Lucia is also committed to the implementation of the Barbados Programme of Action (BPoA) and the Mauritius Strategy. The BPoA, adopted at the first Global Conference on Sustainable Development of Small Island Developing States held in Barbados in 1994, sets forth specific actions and measures to be taken at the national, regional and international levels to support the sustainable development of Small Island Developing States (SIDS). The Mauritius Strategy was adopted at the International Meeting to Review the Implementation of the SIDS Programme of Action in Mauritius in 2005. Both documents underscore the particular vulnerability of SIDS in the face of climate change and outline specific response measures to be taken at national, regional and global levels.

CARICOM, to which Saint Lucia became a member in 1974, is currently finalizing a regional strategy on adaptation to climate change. Saint Luca is also member of the Organization of Eastern Caribbean States (OECS), established in 1981. Environmental management in the OECS is guided by the St. Georges Declaration of Principles for Environmental Sustainability (SGD), which was adopted in 2001 and revised in 2006. The overall aim of the SGD is to "Foster Equitable and Sustainable Improvement in the Quality of Life in the OECS Region". Principle 8 of the SGD seeks to "Address the Causes and Impacts of Climate Change".

At the national level, Saint Lucia has established an extensive policy framework to guide national action on a wide range of environmental and related issues. While the general approach has been an iterative one that has seen the formulation of policies to address specific areas, there have also been attempts to address environmental management from a more holistic standpoint. To this end, a Legal and Institutional Review of Environmental Management was commissioned in 2001 to guide future expansion and strengthening of the legal, policy and institutional arrangements for the sector. In addition, some specific policy instruments of relevance to addressing climate change have been adopted. These include a National Environment Policy (NEP) and a National Environmental Management Strategy (NEMS). In 2001, Saint Lucia adopted a National Climate Change Policy and Plan which sets the stage for implementing an integrated response to the impacts of climate change. A Sustainable Energy Plan (SEP) was adopted in 2002 which, among other things, identifies a number of short and medium-term renewable energy targets.

Other relevant instruments include the National Water Policy, the National Land Policy and the National Biodiversity Strategy and Action Plan and a National Energy Policy approved by the Cabinet of Ministers in June 2010. To date, Saint Lucia has promulgated no legislation to deal specifically with climate change. However, in 2001, Saint Lucia enacted the Montreal Protocol Act. At present, steps are being taken to revise the Electricity Supply Act, which addresses electricity generation, in order to, among other things, more effectively allow for the generation of electricity from renewable energy sources. Work is also underway on the development of an Environmental Management Act which is expected to include references to climate change. This Act was completed in 2008 utilising funds made available through the European Union Special Framework of Assistance for 2003 (SFA-2003) The Bill has been further revised under Phase 1 of the Pilot Programme for Climate Resilience (PPCR) with a view to ensuring that climate change considerations have been adequately addressed and is expected to be finalized in the near future.

1.9 INSTITUTIONAL ARRANGEMENTS TO IMPLEMENT THE CONVENTION AND TO SUPPORT THE NATIONAL COMMUNICATIONS PROCESS

An informal climate change team has been established within the Sustainable Development and Environment (SDED) Division and this is led by the *de facto* operational focal point, in this case, the Chief Sustainable Development & Environment Officer (CSDEO). The CSDEO reports to the Permanent Secretary of the Ministry of Physical Development and Environment, who is the National Focal Point (NFP). The NFP communicates as necessary with the UNFCCC Secretariat.

The Climate Change Team coordinates the implementation of Convention-related activities on behalf of Government and currently includes the operational focal point and three other technical officers, one of whom functions primarily as the Coordinator for the SNC Project. The Coordinator is assisted by a Climate Change assistant who is assigned to the SNC Project. At the national level, the work of the Coordinator and the Team is supported by the National Climate Change Committee. This is a multi-sectoral committee with representatives from both the public and private sector.

The Coordinator also maintains regular contact with the United Nations Development Programme (UNDP) office in Barbados. The National Communications Support Programme (NCSP) based in New York provides technical support for the in-country activities while the Caribbean Community Climate Change Centre based in Belize provides administrative support.

Addressing climate change in a holistic manner requires coordination and collaboration between organizations and across sectors. The National Climate Change Policy and Adaptation Plan outlines several approaches to this end. The Policy is expected to be reviewed under the SNC preparation process and will guide the further evolution of the climate change portfolio within the government structure.

In recognition of the need to adopt a holistic, cross-sectoral approach to the preparation of the SNC, a number of technical teams and expert groups have been established. These include teams to work on the various sectors covered under both the Greenhouse Gas Inventory and the Vulnerability & Adaptation Assessment. The following chapters highlight the specific assessments, reviews and consultation undertaken in preparation of this SNC.

Chapter 2: National Green House Gas Inventory

CHAPTER 2: NATIONAL GREEN HOUSE GAS INVENTORY

2.0 SECTION OVERVIEW

In accordance with Article 4.1(a) of the UNFCCC, all parties to the convention are requested to update and report periodically on their inventory of anthropogenic emissions and removals of greenhouse gases (GHGs) not controlled by the Montreal Protocol. Saint Lucia is a Non - Annex 1 Party to the United Nations Framework Convention on Climate Change (UNFCCC) and in November 2001, Saint Lucia submitted their first inventory with Saint Lucia's Initial National Communication (INC). The INC inventory was prepared for the reference year 1994 in compliance with Articles 4 and 12 of the UNFCCC and in accordance with the Inter-governmental Panel on Climate Change (IPCC) Guidelines of 1996.

Following the recommendation of the Intergovernmental Panel on Climate Change (IPCC) Revised (1996) Guidelines, the Second National Communication (SNC) reports greenhouse gas emissions and removals by sinks for the year 2000 and also revises emissions that were reported in the reference 1994 inventory. Revisions of the 1994 inventory were required as a result of the emergence of more accurate activity data and emission factors and to correct a number of errors that were present in the INC. The use of the *Revised 1996 IPCC Guidelines* for both the year 1994 and 2000 fulfills the objective of the Conference of the Parties for the use of comparable methodologies.

a) The goal of St. Lucia's Emission Inventory was:
b) Prepare and submit the GHG Inventory of Saint Lucia's SNC including all GHG emissions taking place within national territory and offshore areas
c) Enhance the capacity of stakeholders to conduct, prepare and report on GHG Inventory.

The process commenced in June 2007 through to February 2008 and comprised Team members as presented in Table 2.1:

Table 2.1 : Process Team Members

Sector	Sector Leads	Sector Team Members
1. ENERGY	Neranda Maurice	Barrymore Felicien, Crispin D'Auvergne, Ms. Virgely Daniel, Makeda George (transport)
2. INDUSTRIAL PROCESS	Fulgence St. Prix	Public Works Dept., Physical Planning, Mandy St. Rose (Quarries), Gisele Amedee

3. SOLVENT AND OTHER PRODUCT USE	Gedeon Alexander	Customs, Statistics Department, Lesmond Magloire
4. AGRICULTURE	Anita James	Agriculture Colleagues, Cenisius St. Mark (SLBC)
5. LAND-USE CHANGE & FORESTRY	Adams Touissant	David Alphonse (Physical Planning) Donatian Gustave (Forestry), Rebecca Rock (Forestry), LaVerne Walker, Lyndon John
6. WASTE	Edgarfue Felicite	Errol Frederick, Emerson Vitalis, Camille Roopnarine

Following an Inventory Stakeholder Workshop (January 18, 2007) and a training Workshop (July 23 to 27, 2007), the GHG Inventory was undertaken on an individual sector basis for the Energy; Industrial Processes; Solvent and Product Use; Agriculture; Land Use, Land Use Change and Forestry (LULUCF); and Waste Sectors.

This section summarizes the main findings from the analysis and interpretation of the data generated on anthropogenic GHG emissions and sinks, on a sector-by-sector basis, for Saint Lucia. The GHG Inventory was done on an individual sector basis for the Energy; Industrial Processes; Solvent and Product Use; Agriculture; Land Use, Land Use Change and Forestry (LULUCF); and Waste Sectors.

The direct GHGs included are Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O) and partially fluorinated hydrocarbons (HFCs). Indirect GHGs that contribute to Tropospheric Ozone (O_3) formation, such as Non-Methane Volatile Organic Compounds (NMVOC), Carbon Monoxide (CO) and Nitrogen Oxides (NO_x) were also included in the inventory.

The *IPCC Revised 1996 Guidelines* for National Greenhouse Gas Inventories (Volumes 1, 2 and 3) together with the accompanying Software in Microsoft Excel were used as the basis to undertake the necessary calculations on GHG Emissions and Removals. *IPCC Good Practice Guidance* complementary to the *Revised 1996 IPCC Guidelines* was used to update emission factors or other default conversion factors where sufficient data were available. In accordance with the Guidelines set out by the IPCC, CO_2 emissions from International Bunkers and burning of biomass fuels are not included in the national totals, but are reported separately as Memo Items in the Inventory. Any IPCC emission sources not addressed in the inventory report either do not occur in St. Lucia, or are believed to be insignificant.

2.1 1994 Inventory Update

A number of changes and corrections were made to Saint Lucia's 1994 Greenhouse Gas Inventory that was reported in the Initial National communication (INC). The changes or corrections were required as a result of the emergence of more accurate activity data and emission factors and to correct a number of mathematical errors. The changes impacted all six source / sink categories that are identified in the *Revised 1996 IPCC Guidelines* (Energy, Industrial Processes, Solvent and Other Product Use, Agriculture, Land-Use Change & Forestry and Waste). Some of the changes resulted in substantial differences in overall emissions from these sectors; in particular, the Waste and Land-Use Change & Forestry sectors were impacted.

A summary of those changes and the impact on CO_2 and non CO_2 emissions are presented in the Figures below:

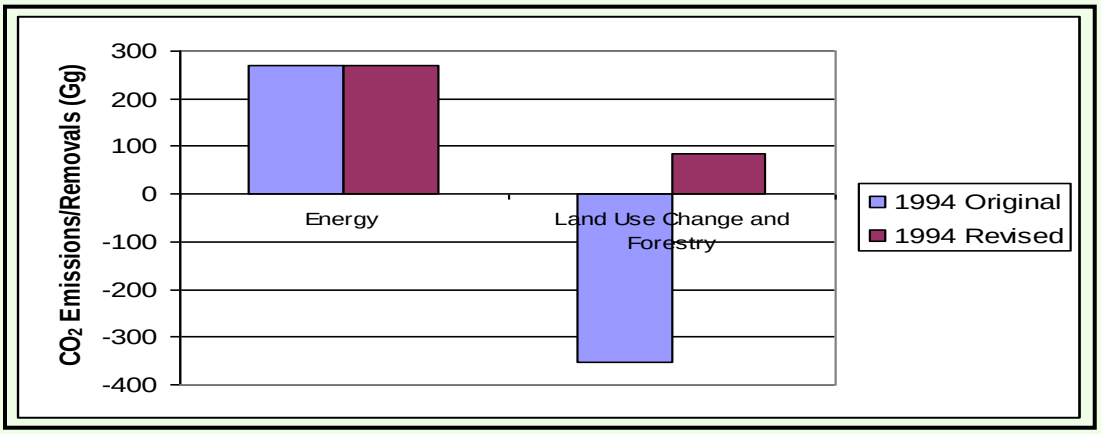
Table 2.2: Summary of Changes Made to Saint Lucia's 1994 GHG Inventory

IPCC Source /Sink Categories	Change Made	Reason for Changing Parameter?	Relative Impact (1)
Energy	Removed Spraytex as a fuel	Spraytex is not an energy source (i.e., not used as a fuel or combusted)	↓
	Fraction of carbon oxidized for gas /diesel oil changed	Fraction was inadvertently 0. Changed to 0.99	↑
	Fraction of carbon stored for lubricants changed	Fraction was inadvertently 0. Changed to 0.5	↓
	All emissions reported under process heat category	Emissions were not previously aggregated between auto-generation and process heat	-
	Fuel consumption of manufacturing and construction corrected.	Parameter was not reading correct cell	↑
	Emission factor for CH_4 from charcoal corrected	Original emission factor did not include production of charcoal	↑
	Added emission factors for oil for international bunker fuels	Emission factors not included in 1994 inventory	↑
	Removed abatement efficiency of 45% for SO_2	There appears to be no basis for SO_2 abatement efficiency of 45% for all fuels	↑
Industrial Processes	Loss of HFCs in assembly of refrigeration products changed	Assembly losses were inadvertently 0.02%. Changed to 2%.	↑
	Total halocarbons emitted from refrigeration products changed	Automatic calculation in software had been inadvertently altered	↓
Solvent and Product Use	Added Spraytex initially reported in energy sector as a solvent	Spraytex was included in energy sector; according to IPCC methodology it should be included in solvent and product use sector	↑
	Added general household solvent use to inventory	Emissions from household solvents were not included in the 1994 Inventory, but to be consistent with the 2000 inventory it has been added	↑

IPCC Source /Sink Categories	Change Made	Reason for Changing Parameter?	Relative Impact [1]
Agriculture	Number of sheep changed	Sheep number doesn't match previous number provided in inventory	↑
	Fraction of manure nitrogen per animal waste management system revised	Fraction of manure nitrogen per AWMS revised as fraction should be 100% for each livestock as no other system is identified.	↑↑
	Number of "Other animals" changed	Number of "Other animals" provided doesn't match numbers provided elsewhere.	↑
	Fraction of nitrogen excreted during grazing changed	Input was inadvertently 0.02%. Changed to 2%.	↑
	Emission factor for direct soil emissions (kg N_2O - N/ha/yr)	New 2003 Good Practice Guidance updated this factor from 10 to 16	↑
Land Use Change and Forestry	Other land use category (39.7 kha) removed from calculation of carbon sink	Assumes that land-uses other than forest add biomass at a rate that equal to natural regenerating forests. This is incorrect and does not follow IPCC guidance.	↑↑
	Annual biomass growth rates for moist forest (12.444 kha) were revised downward	Annual growth rate representative of plantation forest, not a regular forest	↑
	Biomass conversion expansion ratio modified to include expansion ratio for non-commercial biomass	Expansion ratio does not include only conversion, so should be revised from 0.5 to 0.95 for logged forests	↑
Waste	Fraction of Degradable Organic Content (DOC) in MSW changed	Fraction is 0.5, where IPCC guidance indicates that the maximum possible is likely 0.21. Composition was assumed to be similar to year 2000 inventory and the year 2000 DOC estimate of 0.17 was used.	↓↓
	Total MSW lowered from 107 kt	Total MSW seems inordinately high (twice as much as year 2000), and was revised to be consistent with per capita estimates completed for 1994 Inventory.	↓

Note: [1] An arrow pointing upward (↑) indicates an increase in emissions relative to the INC inventory. An arrow pointing downwards (↓) indicates a decrease in emissions relative to the INC inventory. Changes that resulted in a large change in overall emissions are indicated with double arrows (↑↑).

Figure 2.1: Summary of Changes to CO_2 Emissions in Saint Lucia's 1994 GHG Inventory

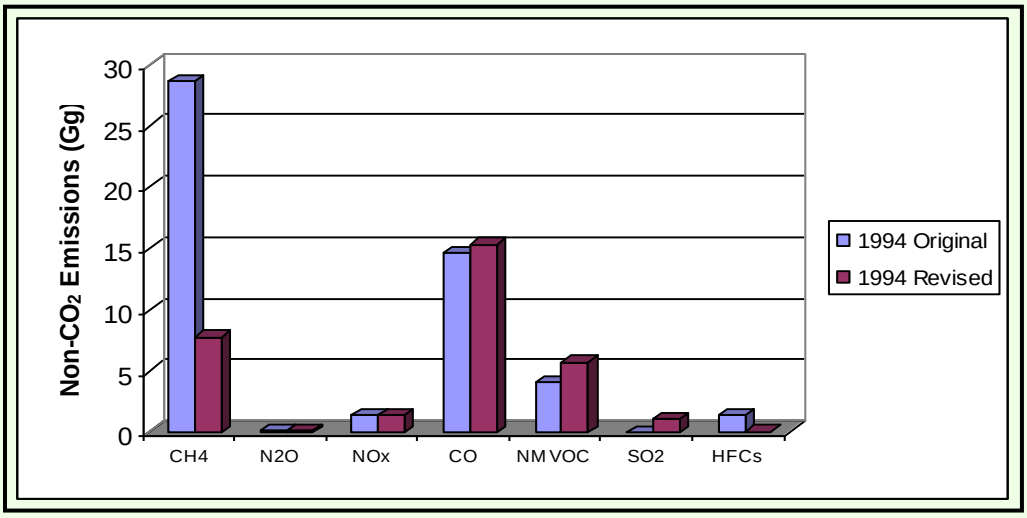


In the 1994 Inventory there are only two IPCC Source/Sink Categories that have substantial CO_2 emissions or sinks, the Energy sector and the Land-Use Change and Forestry sector. Changes as a result of revisions to the inventory are indicated in Figure 2.1. The change of the Land use Change and Forestry sector from a significant sink to a significant source of emissions is due to the fact that all land-use areas in Saint Lucia not designated as forest, were mistakenly classified as regenerating forests that sequester large amounts of carbon. In reality these land-uses do not have substantial changes to their carbon stocks over time.

In the case of Non-CO_2 emissions, in the waste sector, the fraction of Degradable Organic Content (DOC) in Municipal Solid Waste (MSW) was changed from 0.5 to 0.17. In addition the amount of garbage going to landfill was revised down to match more recent and reliable estimates. This revision resulted in a substantial decrease in methane released from the Waste sector.

The second major revision was related to a correction made to a calculation cell in the UNFCCC software that had been inadvertently changed. As a result the estimated HFCs released fell by approximately 100 times. The correction was significant because HFCs are a very potent GHG with a global warming potential much higher than for other gases. Without the correction, the overall inventory would have indicated that the release of HFCs in Saint Lucia was a far bigger source than all other sources combined (when expressed as CO_2e). Figure 2.2 below, indicates the changes in non-CO_2 emissions.

Figure 2.2: Summary of Changes to Non-CO_2 Emissions in Saint Lucia's 1994 GHG Inventory



2.2 2000 Inventory

2.2.1 Energy Sector

Saint Lucia is not a primary or secondary producer of fossil fuels and is therefore heavily dependent on the importation of fossil fuels for electricity and transport – the main end uses for fossil fuels

Methodology

Two Approaches were utilized to calculate the GHG data for the Energy Sector, viz; te aggregate fuels supply based top-down Reference approach and the policy-oriented source categories bottom-up Sectoral Approach. Local activity data for fuels imported and changes to local stocks in the year 2000 were used to estimate the consumption of fuels in tonnes of oil equivalent (TOE). Apparent consumption in TOE was converted to an energy equivalent (Terajoules) using the conversion factor 0.041868 (TJ / TOE)[1]. Default IPCC emission factors (kt of emissions / TJ) were then used to convert energy consumption into emissions. Default IPCC carbon oxidation factors were also used to calculate carbon dioxide emissions.

The calculation of emissions was assisted using *UNFCCC's Non-Annex I National Greenhouse Gas Inventory Software* (version 1.3.2).

Energy Activity Data

The primary fuels consumed in Saint Lucia and which lead to greenhouse gas emissions from the energy sector are imported liquid fuels, gasoline, jet kerosene, gas oil and fuel oil. Information in this regard was sourced from the Department of Statistics which provides a national energy

[1] Organisation for Economic Co-Operation and Development. Glossary of Statistical Terms. Website. http://stats.oecd.org/glossary/detail.asp?ID=4109

balance for Saint Lucia that tracks imports and changes to fuel stocks and allows the consumption of these fuels to be estimated for any year.

In addition to these charcoal and firewood are also utilized for energy in the residential sector. Estimates of consumption of charcoal were based on recent survey data from the Forestry Department. A comparison of the fuel consumption for different types of fuel between 1994 and 2000 is provided in Table 2.3 below.

Table 2.3: Comparison of Fuel Consumption between Year 1994 and Year 2000

Fuel Import Category	Fuel Consumption (TJ)		
	1994	2000	% change (1994-2000)
Gasoline	1,378	1,748	26.9%
Gas / Diesel Oil	2,138	2,815	31.7%
Kerosene	24	16	-31.3%
LPG	149	293	96.9%
Lubricants	51	41	-19.5%
TOTAL	**3,739**	**4,913**	**31.4%**
Memo Items			
International Bunkers	957	1,418	48.2%
Solid Biomass	186	72	-61.0%

CO_2 Emissions

Of the fossil fuels imported and consumed in Saint Lucia, the greatest proportions of CO_2 emissions result from the combustion of Gas/Diesel Oil (59.5 % in 2000) used almost exclusively for thermal electricity production, and from Gasoline (34.6 % in 2000) mainly for vehicular road transport, but also for agriculture and fishing. Smaller amounts of CO_2 emissions also result from LPG use (5.3 %) in the residential and industrial sectors and from the use of kerosene and lubricants. All aviation fuels are considered to be international bunker fuels and are not reported as part of the domestic inventory but under Memo Items (Section 9). Utilizing the methods mentioned previously, data analysis of CO_2 emissions totaled 346.95 Gg (Reference) and 347.65 Gg (Sectoral) for Saint Lucia. Figure 2.3 identifies the relative contributions of different fossil fuels to domestic energy.

Figure 2.3: Relative Share of Domestic CO_2 Emissions from Different Fossil Fuels (2000)

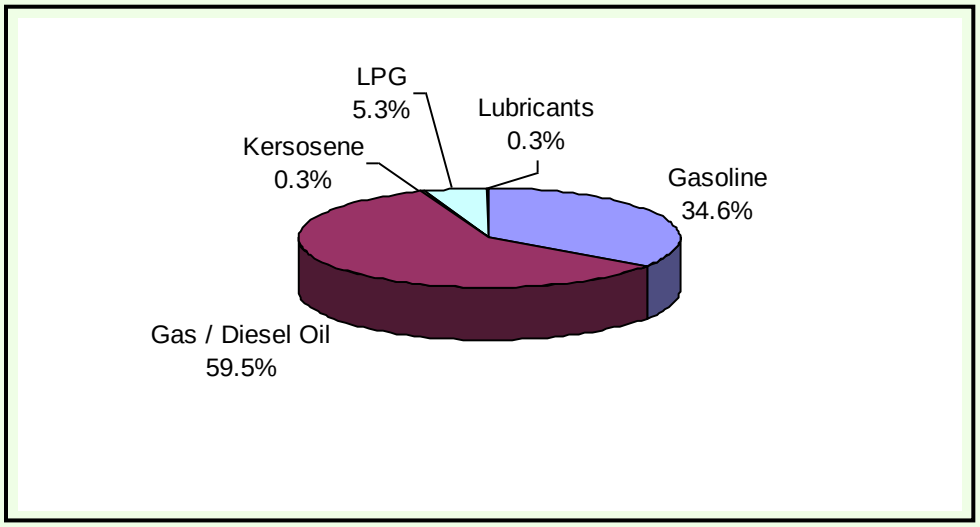
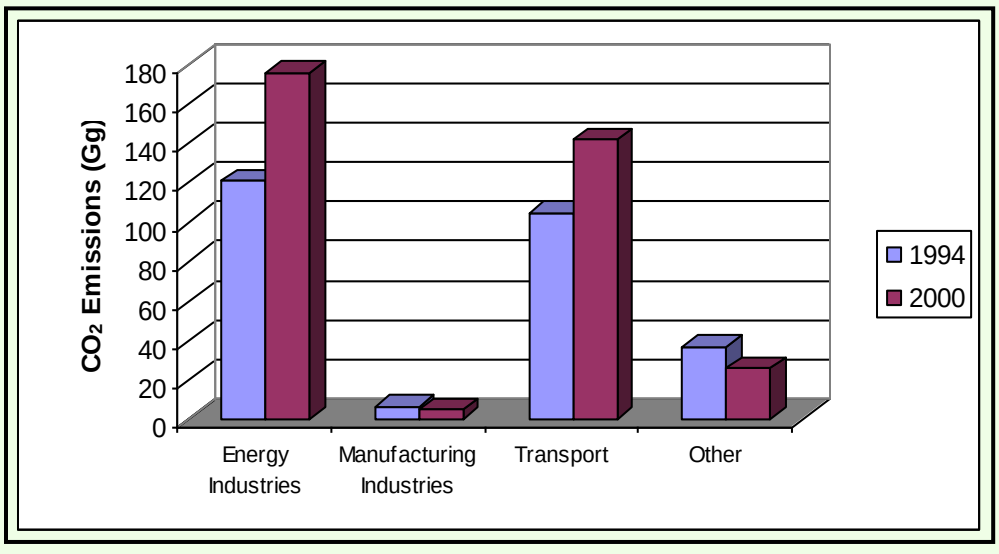


Figure 2.4 compares emissions from the different fuel combustion sectors in 1994 and 2000. The large growth in the energy sector can be attributed to rapid growth in the tourism sector, an increase in population and an increased energy intensive lifestyle in Saint Lucia.

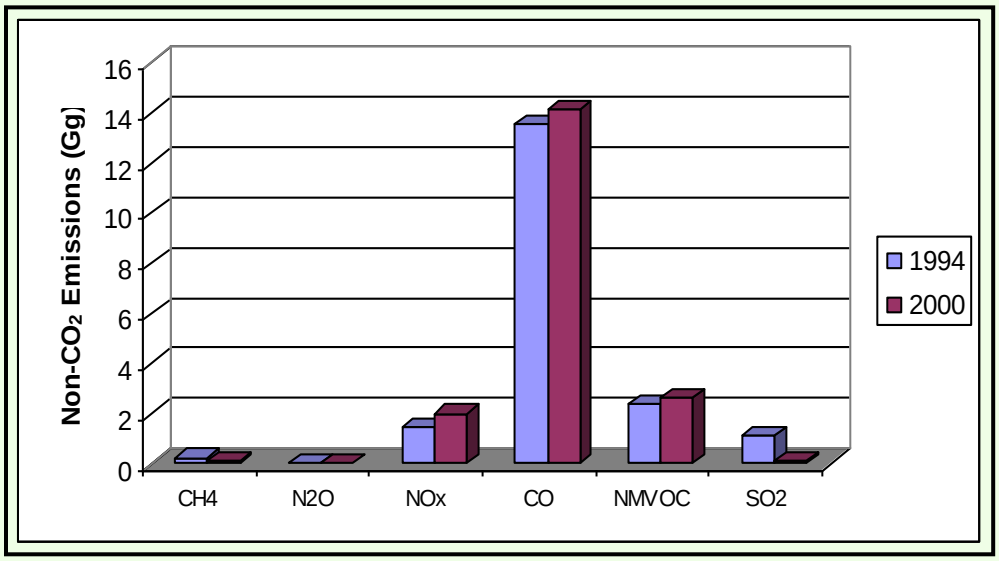
Figure 2.4: Comparison of CO_2 Emissions from Fuel Combustion Sub-Sectors (1994 and 2000)



Non – CO_2 Emissions

With respect to non-CO_2 emissions of methane (CH_4) and sulphur dioxide (SO_2), there was a significant decrease between 1994 and 2000. The 60% reduction in SO_2 emissions was due to the lower sulphur content of fuels imported in 2000 as compared to 1994. In the case of methane emissions, the reduction was due to the reported decrease in wood and charcoal consumption between 1994 and 2000. The other non-CO_2 emissions (N_2O, Nitrogen Oxides (NO_x), NMVOC and CO increased from 1994 to 2000 primarily as a result of increased fuel usage over the same time period. This is illustrated in Figure 2.5.

Figure 2.5: Comparison of Non-CO_2 Emissions from Fuel Combustion (1994 and 2000)



2.2.2 Industrial Processes

The Manufacturing and Industrial Sector in St. Lucia is relatively small as is its overall contribution to greenhouse gases assessed on a global scale. Substantial emissions are contributed by the *Food and Beverage Industries* and *Road Paving with Asphalt*. Some HFCs are also released through the consumption and use of halocarbons for air-conditioning and refrigeration.

Methodology

Emissions identified on reviewing the relevant industrial processes were: emissions of NMVOC from bitumen used in road paving asphalt; the manufacture of alcoholic beverages (rum and beer) and from food production (primarily bread and cakes; alcoholic beverages; and margarine and solid cooking fats). As well HFC emissions from the import and consumption of halocarbons, including leakage and disposal, in refrigeration and air-conditioning activities were identified.

Default IPCC emission factors[i] based on production levels or on import data were applied to available country specific data and then used to estimate emissions following the *Revised 1996 IPCC guidelines*.

The *Revised 1996 IPCC Guideline* Tier 1 methodology to estimate the potential emissions of HFCs was used. The estimate was based on the number of products imported that likely contain HFCs, including refrigerators reported in Customs data for the year 2000. IPCC defaults were used to estimate the quantity of HFC material in each product and potential losses.

The calculation of emissions was assisted using UNFCCC's Non-Annex I National Greenhouse gas Inventory Software (version 1.3.2).

Industrial Processes Activity Data

Road paving estimates were derived from estimates of imported bitumen (available from the Department of Statistics 2000 Energy Balance), all assumed to be used in asphalt production. Domestic Asphalt production was assumed to have a 10% bitumen content. Alcohol beverage production data was gathered directly from sole producer breweries and from data published for the year 2000[2].

The Department of Statistics provided data on flour import (for bread production; also supplemented by data from local bakers), meat, fish and poultry production and consumption, and animal feed production.

The potential release of HFCs was based on customs import data from the Department of Statistics provided for products that contain HFCs and for bulk import of HFCs.

CO_2 Emissions / NON-CO_2 Emissions

All emissions from this sector are classified as non-CO_2. From the data available (production statistics and import data) default IPCC emission factors were utilized to estimate emissions based on the Revised IPCC guidelines. Teir 1 methodology was used to estimate potential emission of HFCs and the calculation of emissions was assisted using UNFCCC's Non-Annex I National Greenhouse gas Inventory Software (version 1.3.2).

NMVOC Emissions for the Inventory year 2000 decreased approximately 10% from 1994 due to a decrease in the estimate of asphalt used for road paving. HFC emissions decreased as a consequence of reduced bulk imports and reduced imports of HFC containing products. Total emissions of non-methane volatile organic compounds (NMVOCs) and HFCs are reported in Figure 2.6. NMVOC emissions by industrial process sub-sector are reported in Table 2.4.

[2] Department of Statistics

Figure 2.6: Comparison of Non-CO_2 Emissions from Industrial Processes (1994 and 2000)

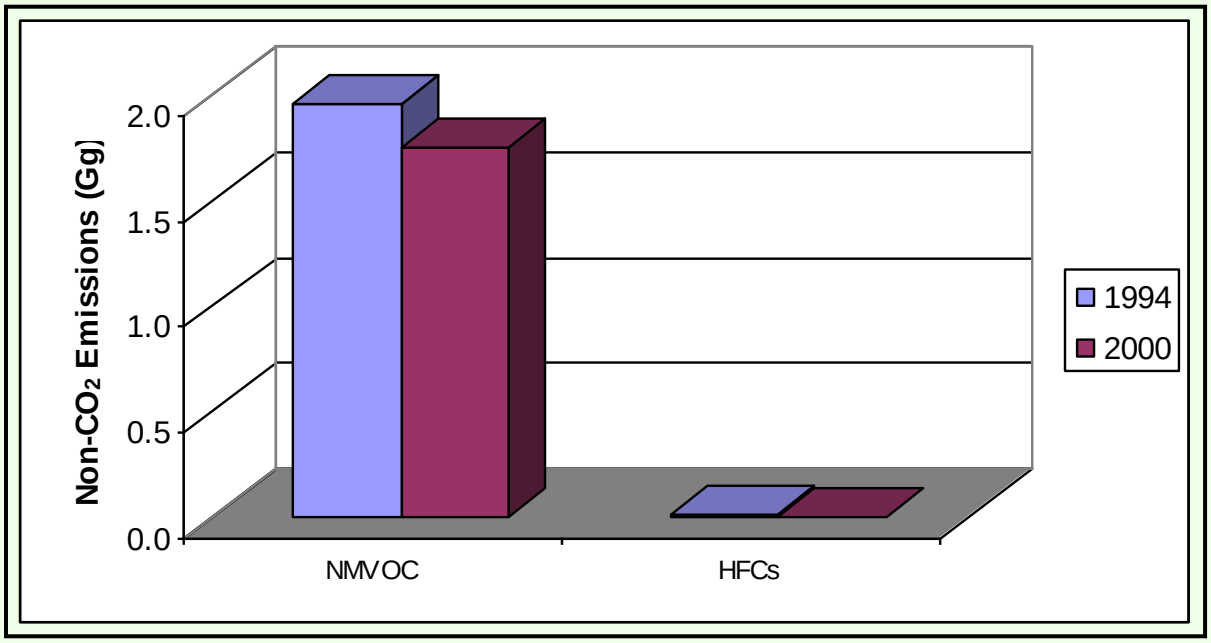


Table 2.4: NMVOC Emissions from Industrial Processes (2000)

NMVOC Emissions by Sector	Gg	% of Total
Road Paving with Asphalt	1.45	82.3%
Production of Alcoholic Beverages	0.178	10.1%
Production of Food	0.133	7.6%
TOTAL	**1.760**	**100.0%**

2.2.3 Solvent and Other Product Use

Emissions of non-methane volatile organic compounds (NMVOCs) occur as a result of the use of solvents and certain products while nitrous oxide is released in certain medical applications. Estimations of NMVOC emissions were generated for products where import data was available including paints, varnishes, thinners, enamels and Spraytex (pesticide used in banana production). NMVOC emissions from household product use (e.g. personal care products, adhesives,

automotive products) were also estimated based on typical use of these products estimated in other countries. Finally emissions of N_2O were also estimated based on bulk imports.

Methodology

Improvements in the assessment methodology and in available information resulted in NMVOC emissions from paints and N_2O emissions not reported in the 1994 Inventory, being included in the 2000 Inventory. The overall increase in NMVOC emissions by approximately 13% was also because of an increase in the use of household products due to population growth. Table 2.5 summarises the overall change in total NMVOC emissions and N_2O emissions from Solvents and Produce Use.

Table 2.5: Non-CO_2 Emissions from Solvent and Product Use (1994 and 2000)

Non-CO_2 Emissions	1994 (Gg)	2000 (Gg)	% change (1994-2000)
NMVOC	1.94	1.62	-16.5%
N_2O	-	0.002	-

2.2.4 Agricultural Sector

There are no CO_2 emissions released from the agricultural sector in Saint Lucia as emissions related to fuel combustion are reported in the energy sector. Emissions of significance to the sector are CH_4 emissions associated with animal livestock, and N_2O arising from fertilizer application to cultivated soils, excretion from animal grazing, from atmospheric deposition of NH_3 and NO_x, and from leaching of agricultural soils. Because no significant quantity of cultivated organic soil is reported in St. Lucia, no emissions are attributed to this source.

Methodology

A Tier 1 simplified approach was used to calculate enteric fermentation and manure management emissions based on regional default IPCC emission factors and the population of each category of livestock.

In order to calculate N_2O emissions from soils, animal production and from the application of fertilizers, the amount of nitrogen input from synthetic fertilizers, animal waste, nitrogen fixing crops and crop residues was estimated. Direct and indirect N_2O releases to the atmosphere were then estimated from these inputs using default IPCC emission factors.

Agricultural Activity Data

Activity data on animal population according to livestock and on types of animal waste management systems used in Saint Lucia for different livestock were obtained from the Ministry of Agriculture of Saint Lucia as well as data on synthetic fertilizer use. Crop production was also provided by that same Ministry as well as the Department of Statistics.

CO_2 and NON-CO_2 Emissions

No CO_2 emissions in Saint Lucia were released from the agriculture sector. Emissions related to fuel combustion are reported in the energy sector. Total annual CH_4 emissions were slightly reduced from the year 1994 primarily as a result of fewer number of cattle and a reduction in enteric emissions (Enteric emissions accounted for over 90% of total CH_4 emissions from the agricultural sector). N_2O emissions on the other hand increased by approximately 27% between the years 1994 and 2000. The increase is primarily due to increased use of animal waste and crop residues as nitrogen fertilizers in soils. Table 2.6 compares CH_4 emissions while Table 2.7 compares N_2O emissions in 1994 and 2000 for the agriculture sector.

Table 2.6: CH_4 Emissions from Agriculture Sector (1994 and 2000)

Agriculture Sub-Sector	CH_4 Emissions		
	1994 (Gg)	2000 (Gg)	% change (1994-2000)
Enteric Emissions	0.494	0.415	-15.8%
Manure Management Systems	0.0472	0.0466	-1.3%
TOTAL	**0.541**	**0.462**	**-14.6%**

Table 2.7: N_2O Emissions from Agriculture Sector (1994 and 2000)

Agriculture Sub-Sector	N_2O Emissions		
	1994 (Gg)	2000 (Gg)	% change (1994-2000)
Manure Management Systems	-	0.011	-
Cultivation of Agricultural Soils	0.035	0.041	16.2%
Grazing Animals	0.018	0.019	3.4%
Atmospheric Deposition	0.004	0.005	24.0%
Leaching	0.020	0.023	132%
TOTAL	**0.077**	**0.099**	**27.2%**

2.2.5 Land Use Change and Forestry

The anthropogenic effects of managed forests and changes in land-use designation are important considerations as in the absence of significant human disturbance the flux of CO_2 from the atmosphere to the terrestrial biosphere is believed to be largely in balance. Activities such as land clearing and timber harvesting, increase CO_2 emissions and increase photosynthesis. CO_2 emissions and removals from this sector derive primarily from carbon uptake due to regrowth in forests; from emissions from forest and grassland conversion due to burning and decay of biomass; and from carbon release from forest soils.

Methodology

Changes in forest and land-uses that impact biomass stocks were accounted for by estimating the net average annual change in biomass over a 10 year time frame by considering both growth and loss of biomass. Changes that impact biomass stocks include harvesting of wood, establishing plantations and converting forested areas to agricultural or urban developments. In addition to forest and land-use changes the change in the carbon content of soils were considered based on cultivation and soil liming practices. Regional IPCC default emission factors were used to estimate the growth rate of biomass for different forests. Conversion factors relating to Carbon Fraction, Biomass Conversion/Expansion, and Fraction of Biomass Oxidized were taken as default values from the IPCC Workbooks. *Revised 1996 IPCC guideline* Tier 1 methodologies were used to estimate CO_2 emissions from land-use change and forestry; and, the calculation of emissions was assisted using UNFCCC's Non-Annex I National Greenhouse gas Inventory Software (version 1.3.2).

Land Use Change and Forestry Activity Data

Activity data on Species and Areas (hectares) of forest/biomass stocks for the years were obtained from the Department of Forestry of the Government of Saint Lucia for the years 1994 and 2000 (the only reliable data available). The categories of land-use considered and the changes between 1994 and 2000 and forest are presented in Table 2.8, 2.9, 2.10 and in Figure 2.8.

From the data indications are that Saint Lucia's Land Use Change and Forestry Sector is still a net source of CO_2 emissions. Total CO_2 emissions have however experienced an almost 75% decrease from 1994 to 2000 (approximately 85 Gg emitted in 1994 as opposed to 21 Gg in 2000).

Table 2.8: Areas and Change in Land-Use (1994 and 2000)

Saint Lucia Land-Use Category	Land Areas		
	1994 (ha)	2000 (ha)	% change (1994-2000)
Water	30	30	0.0%
Densely Vegetated Farming	2,037	2,552	25.3%
Eroded Agricultural Land	258	236	-8.7%
Flatland Intensive Farming	1,024	1,020	-0.4%
Grasslands and Open Woodlands	2,820	2,765	-1.9%
Intensive Farming (25%Forest)	13,391	12,339	-7.9%
Mangrove	172	213	24.2%
Mixed Farming (Forest/Intensive Farming)	10,816	10,667	-1.4%
Natural Tropical Forest	13,515	12,970	-4.0%
Plantation Forest	1,286	1,342	4.4%
Rock and Exposed Soil	488	537	10.2%
Rural Settlement	3,326	4,815	44.8%
Scrub Forest	7,983	7,059	-11.6%
Urban Settlement	3,160	3,741	18.4%
TOTAL	**60,303**	**60,286**	**0.0%**

Table 2.9: Average Land Use Conversion per Year (1994-2000)

Conversion	Hectares
Natural tropical forest to mixed farming	17.1
Natural tropical forest to densely vegetated farming	56.6
Scrub forest to rural settlement	7.0
Scrub forest to urban settlement	26.2
Scrub forest to densely vegetated farming	4.3

Table 2.10: Forest Land-Use Categories (2000)

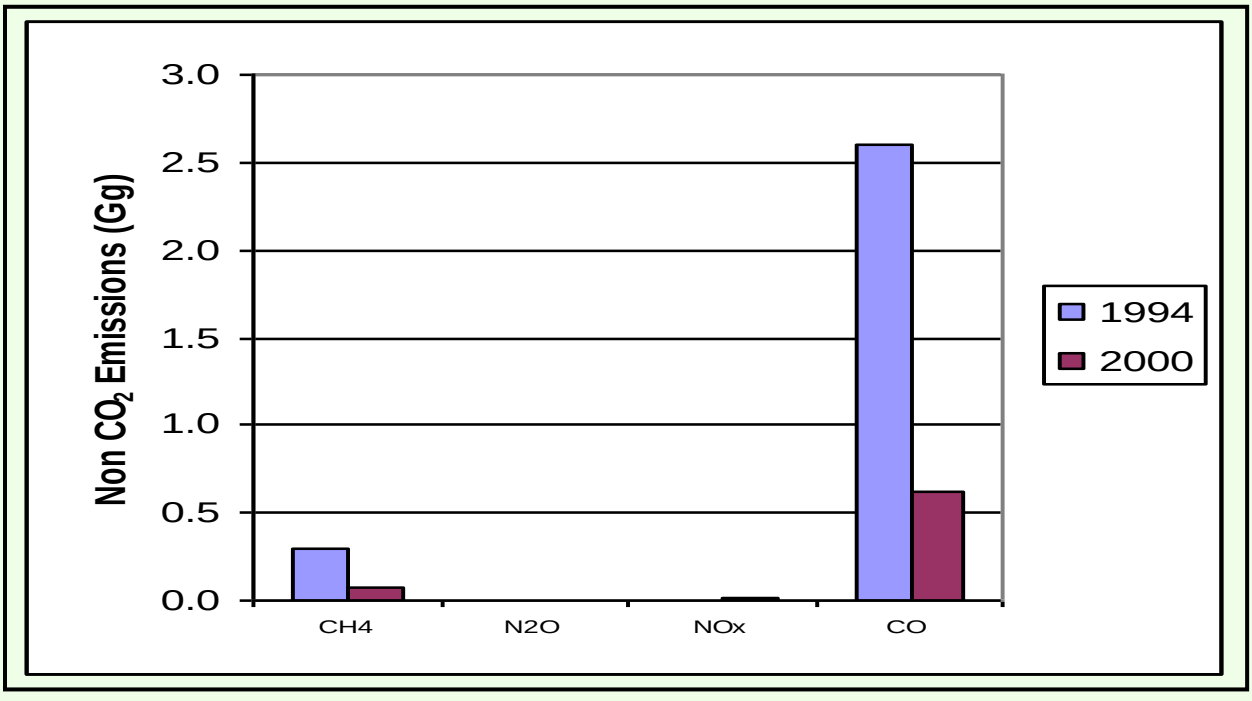
Saint Lucia Forest Land-Use Categories	Forest Area in 2000 (ha)
Cloud Forests	1,062
Drought-deciduous Forests	6,668
Elfin Forests	792
Evergreen Forests	143
Lowland Forest	29,762
Plantation Forests	1,206
Seasonal Forests	72
Semi-deciduous Forests	320
Transitional Cloud Forests	6,493
TOTAL	**46,517**

Table 2.11: CO_2 Emissions for Land-Use Change and Forestry Sector (2000)

Saint Lucia Land-Use Category	CO_2 Removals / Emissions		
	Removals	Emissions	Net Source
	(Gg)	(Gg)	(Gg)
Changes in Forest and Biomass Stocks	20	0	-
Forest and Grassland Conversion	-	35	-
Abandonment of Managed Lands	0	-	-
CO_2 Emissions and Removals from Soil	-	7	-
TOTAL	**20**	**41**	**21**

Non-CO_2 emissions from this sector are relatively small and these experienced a further decrease in emissions from 1994 to 2000 primarily as a result of the decrease in the burning of biomass that occurs during land clearing.

Figure 2.7: Comparison of Non-CO_2 Emissions for Land-Use Change and Forestry Sector (1994 and 2000)



2.2.6 Waste Sector

The most important gas (non-CO_2) produced in this source category is methane (CH_4). The two major sources are solid waste disposal to land, and wastewater treatment. In addition to CH_4 solid waste disposal sites also produce CO2 and non-methane volatile organic compounds (NMVOCs) in very small amounts. Indirect N_2O emissions also result from human sludge.

Methodology

Methane emissions from waste were estimated using the default IPCC methodology that uses a mass balance approach. The mass balance approach involves estimating the degradable organic carbon (DOC) content of the solid waste (i.e., the organic carbon that is accessible to biochemical decomposition), and using this estimate to calculate the amount of CH_4 that can be generated by the waste from the total volume of waste generated. The degradable organic carbon content of the waste was estimated from surveys conducted on the composition of waste being sent to landfills in Saint Lucia[3].

IPCC default emission factors were used to find:

- The fraction of DOC that degrades and the fraction of carbon released as methane;
- Indirect N_2O emissions from human sludge (kg N_2O / Kg human Sludge N).

The major centralized wastewater treatment plants in St. Lucia, and most packaged treatment plants, are aerobic and as such are not treated as sources of CH4 emissions. Small on-site systems (e.g. septic systems) were not assessed in this inventory due to lack of data.

Waste Sector Activity Data

Activity data pertaining to Municipal Solid Waste (MSW) disposed to Solid Waste Disposal Sites (SWDSs) are country-specific data obtained from the Saint Lucia Solid Waste Management Authority for the year 2000. The per capita protein consumption of people in Saint Lucia (used to estimate N_2O emissions (0.02 Gg in 2000) from wastewater handling operations) was estimated based on a regional factor published for Caribbean countries by the World Health Organization. Most waste is handled through two managed landfill sites, and open burning is discouraged. According to the Solid Waste Management Authority Annual Report 2003, sectoral waste composition at the main landfill site in Vieux Fort is as follows: Residential 66%, Industrial 15%, Commercial 9%, Green 6%, Other 4%."

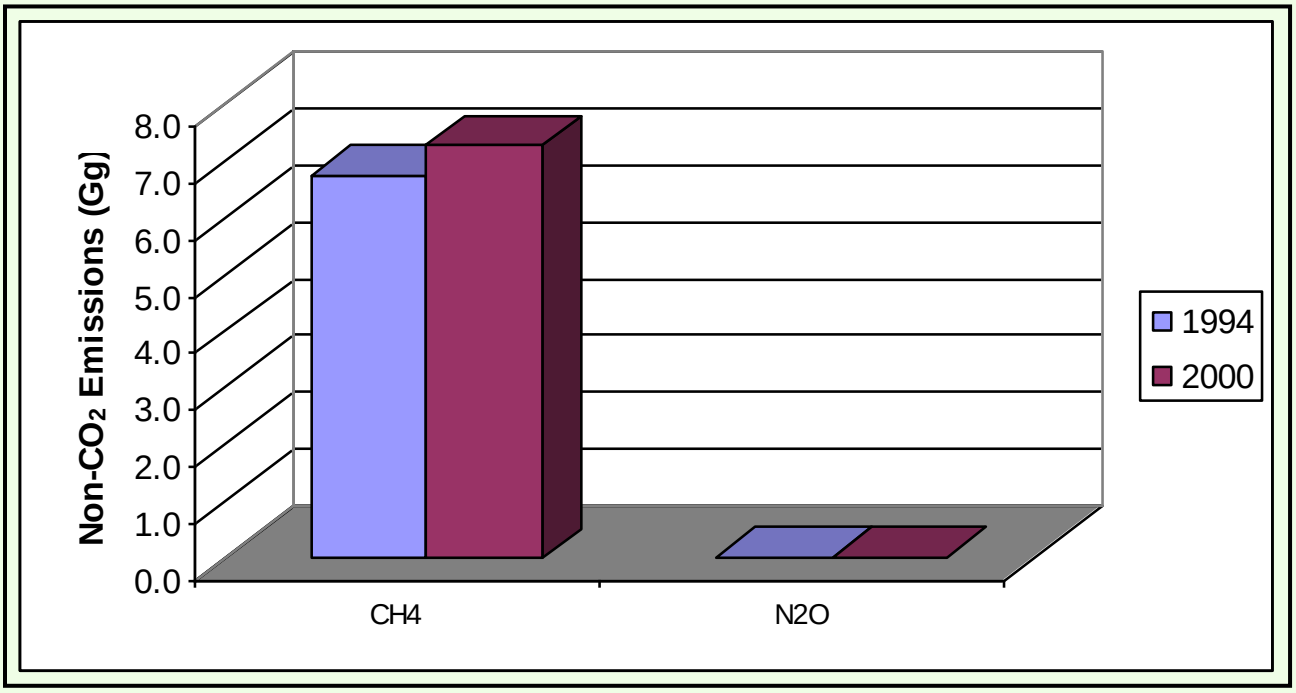
CO_2 and Non-CO_2 Emissions

No CO_2 emissions are released from the waste sector. Emissions related to fuel combustion have been included within the Energy Sector.

Total methane emissions in 2000 were 7.3 Gg, an 8% increase from 1994 while N_2O emissions from waste handling were negligible *(0.021 Gg in 2000)*. This is illustrated in Figure 2.8.

[3] Saint Lucia's Solid Waste Management Authority 2003 Annual Report.

Figure 2.8: Non-CO_2 Emissions for Waste Sector (1994 and 2000)



IPCC methodology requires that emissions from International Bunkers and Biomass be reported separately in the GHG Inventory of a country. CO_2 and non-CO_2 emissions for each of these categories are reported below.

2.2.7 Memo Items

International Bunker Fuels

Emissions from international bunkers are limited to emissions from jet kerosene and jet gasoline sold to aircrafts that fly internationally and to diesel/oil gas used for international marine travel. For Saint Lucia all air travel is designated as international and therefore all reported fuel use was assumed to be international bunker.

International bunker marine fuel usage in the year 2000 was estimated based on bulk sales data from major fuel distributors. Fuel sold by these distributors account for the vast majority of fuel sold in Saint Lucia for marine purposes. An estimate of the proportion of fuel sold to smaller domestic fishing vessels and international vessels that is reported under international bunker fuels was made based on fuels sales data recorded.

CO_2 Emissions

CO_2 emissions from international bunker fuels increased substantially since 1994. This may be partly explained by an increase in air and marine traffic; but some of the difference is likely due to different approaches in estimating the activity data of marine vessels. Table 2.11 presents a comparison of CO_2 emissions from international bunker fuels between 1994 and 2000.

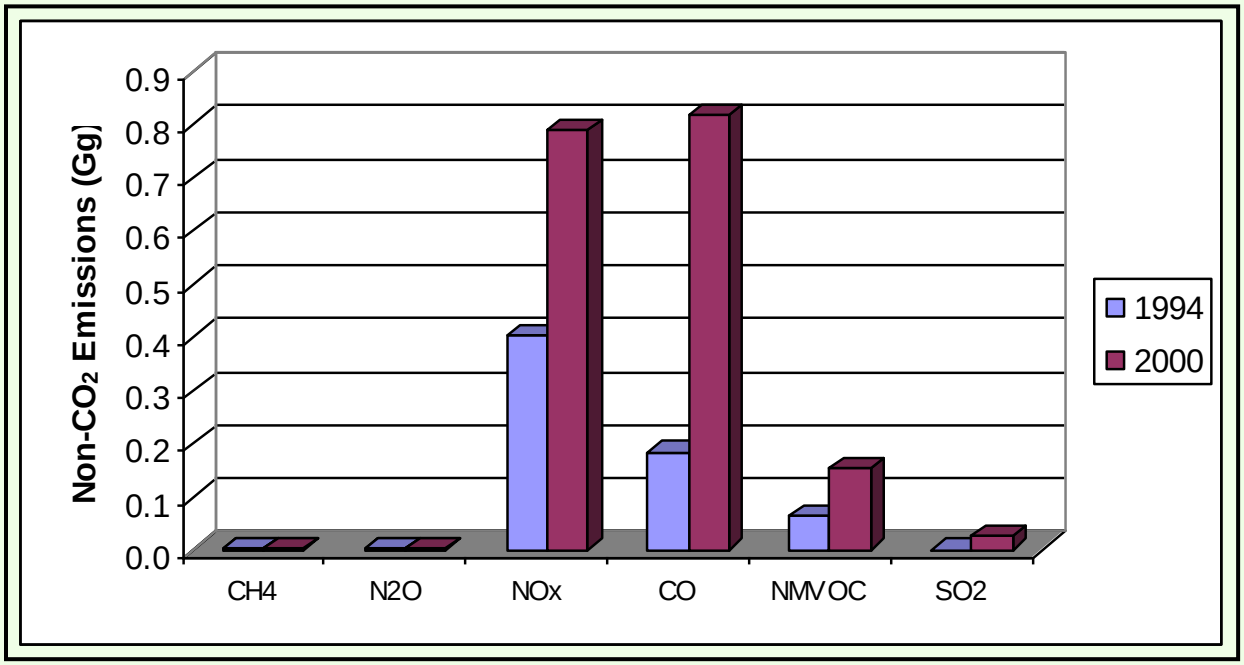
Table 2.12: Comparison of CO_2 Emissions for International Bunker Fuels (1994 and 2000)

International Bunker Categories	CO_2 Emissions		
	1994 (Gg)	2000 (Gg)	% change (1994-2000)
Aviation	60.8	78.4	28.9%
Marine	7.0	23.6	238.5%
TOTAL	**67.8**	**102.0**	**50.4%**

Non-CO_2 Emissions

Non-CO_2 emissions from international bunker fuels increased substantially since 1994. This may be partly explained by an increase in air and marine traffic; however, some of the difference is likely due to different approaches in estimating the activity data of marine vessels. Figure 2.9 presents a comparison of non-CO_2 emissions from international bunker fuels between 1994 and 2000.

Figure 2.9 : Comparison of Non-CO_2 Emissions for International Bunker Fuels (1994 and 2000)



Co_2 Emissions From Biomass Fuels

In Saint Lucia biomass fuels that are burned for energy are primarily firewood, charcoal and some agricultural waste. Table 2.12 indicates that CO_2 emissions from biomass fuels increased by 14% to 7.9 Gg between 1994 and 2000.

Table 2.12: Comparison of CO_2 Emissions from Biomass (1994 and 2000)

CO_2 Emissions from Biomass	1994 (Gg)	2000 (Gg)	% change (1994-2000)
Biomass	7.0	7.9	14.0%

2.3 Sources of Uncertainty

Calculations of sources and sinks of GHGs for the different sectors incorporate various levels of uncertainty with respect to country activity data as well as the various conversion and emission factors.

2.3.1 Energy Sector

Fuel usage in Saint Lucia is tracked through import data and changes in domestic stocks and in general there is a low degree of uncertainty for CO_2 emissions. There are however two main sources of uncertainty; partitioning of the total fuels used in the marine international bunker fuels category and domestic fishing category; and calculation of emissions from biomass that are reported under Memo items. Fuel use activity data for international and domestic marine vessels was estimated based on bulk sales data from fuel distributors but since there is much ambiguity in this data there is a high degree of uncertainty. Biomass emissions were estimated based on activity data from country specific surveys. However, these surveys were not comprehensive and not intended to generate accurate estimates of biomass removed for charcoal production and fuel wood and therefore have a higher degree of uncertainty.

Non-CO_2 emissions (CO_2, CH_4, N_2O, NOx, CO, NMVOC), have a greater degree of uncertainty since emission factors used to calculate these emissions have a much greater range of variability than CO_2 emission factors. Only IPCC default values were used since country-specific measurements were not available.

2.3.2 Industrial Sector

Greenhouse gas emissions in this sector are restricted to NMVOC in the Road Paving and Alcoholic Beverages and Food Production industries and to HFCs emission from refrigeration and air-conditioning systems. NMVOC emission factors used to estimate emissions from road paving and alcoholic beverages are based on the IPCC default values, which may be somewhat unrepresentative based on the age and condition of the factories. Here again, country specific conversion factors are not available.

HFC emissions predicted in the inventory have a high degree of uncertainty because it is unclear how accurately customs data is able to track the import of HFCs in products or in bulk. There is very little local information to make accurate predictions of the amount of HFC contained in imported refrigeration and air conditioning equipment.

2.3.3 Solvent and Product Use Sector

A high degree of uncertainty is associated with the NMVOC emissions that are a result of household product use. NMVOC emissions are based on average per capita emissions published by the US Environmental Protection Agency (EPA) for American consumers. As a result the data is not country specific and emissions may be overestimated or underestimated depending on the product usage pattern that would be particular to Saint Lucia. However, due to a lack of data on household product use and the average NMVOC content of these products the EPA data was used.

2.3.4 Agriculture Sector

The main area of uncertainty encountered in the agricultural sector is related to the types of Animal Waste Management Systems (AWMS) that are present in Saint Lucia and therefore the methane emissions generated by these systems. Estimates of the proportion of animal waste management systems by type were provided by staff at the Ministry of Agriculture; however, these estimates have a high degree of uncertainty. In addition, regional default IPCC emissions factors from studies conducted in Latin America were used to estimate methane emissions from enteric fermentation that will have a high degree of uncertainty.

2.3.5 Land Use Change and Forestry

In the year 2000 inventory land-use GIS data was analyzed to determine potential changes in land-use between the years 1994 and 2000. This included making estimates of the level of deforestation due to conversion of forested lands to agriculture or urban development. It is likely that these estimates are much improved over estimates used in the previous inventory that relied on default FAO data published in the *Revised 1996 IPCC guidelines*. However, there remains a fair degree of uncertainty associated with this data and it would have been better if a minimum time span of 10 years had been used instead of only 6 years.

The timber harvest, fuel wood harvesting and charcoal production that lead to removals in biomass were estimated based on country specific survey data. However, these surveys were not comprehensive and not intended to generate accurate estimates of biomass removed for charcoal production and fuel wood and therefore have a higher degree of uncertainty.

With regards to biomass conversion factors, such as annual growth rate of forests, IPCC default values were used and actual values may be quite different and this could mean significant uncertainty in the GHG emissions and removals calculations for this sector.

2.3.6 Waste Sector

The highest degree of uncertainty is associated with the default values for the Methane Correction Factor (MCF). In the case of N_2O emissions from human sewage, the IPCC default

values were used. This may not be applicable to Saint Lucia and is a source of uncertainty. Also, the per capita protein consumption value used was derived from Department of Statistics "Crude Estimates of Food Availability", and this could also be a source of uncertainty.

2.3.7 Summary Of Uncertainties

A summary of the most important parameters leading to highest degree of uncertainties related to GHG emissions and removals for Saint Lucia for the different sectors, include:

1. Estimates of the biomass growth rates of managed forests in Saint Lucia
2. Estimates of the biomass removal from managed forests in Saint Lucia (i.e., timber harvest, fuel wood harvest, charcoal production)
3. Estimates of the annual land-area deforested in Saint Lucia (i.e.,. converted to other land-uses)
4. Estimates of the potential methane generation rate per unit of waste landfilled (i.e., kg of methane produced per kg of Municipal Solid Waste)
5. Estimate of the HFCs imported in bulk and in products into Saint Lucia
6. Estimates of the types of Animal Waste Management Systems in Saint Lucia and the resulting N_2O and CH_4 emissions.

Strengthening data collection capacities related to these parameters will be important in enabling Saint Lucia to more accurately meet its future obligations under Articles 4 and 12 of the UNFCCC.

2.4 Summary of Emissions and Removals

In this Section CO_2 emissions, non-CO_2 emissions, and total GHG emissions expressed as CO_2e (carbon dioxide equivalent) are presented by Source and Sink Category.

2.4.1 CO_2 Emissions and Removals

Table 2.13 compares CO_2 emissions by Source and Sink Categories between 1994 and 2000. This exhibit indicates that only the energy and land-use change and forestry sector contribute to CO_2 emissions or removals. While CO_2 emissions in the energy sector have increased, a slower rate of deforestation and natural regeneration of biomass in managed forests has led to a net sink of emissions in the land-use change and forestry sector in 2000. Overall, net emissions of CO_2 have increased from 1994 to 2000 by approximately 4.5%.

2.4.2 Non-CO_2 Emissions

Non-CO_2 emissions for the year 2000 are indicated below in Table 2.14 for each source and sink category.

Table 2.13: Comparison of Saint Lucia CO_2 Emissions by Source and Sink Categories (1994 and 2000)

Greenhouse Gas Source and Sink Categories	CO_2 Net Emissions [1]		
	1994 (Gg)	2000 (Gg)	% change (1994-2000)
Energy	268.2	347.7	29.6%
Industrial Processes	0.0	0.0	-
Solvent and Product Use	0.0	0.0	-
Agriculture	0.0	0.0	-
Land-Use Change and Forestry	84.6	21.2	-75.0%
Waste	0.0	0.0	-
Total National Net Emissions	**352.8**	**368.8**	4.5%

Note: [1] Negative Net Emission Values indicate Removals

Table 2.14: Comparison of Saint Lucia Non-CO_2 Emissions by Source / Sink Categories

Greenhouse Gas Source and Sink Categories	CH_4 (Gg)	N_2O (Gg)	NOx (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)	HFC (Gg)
Energy	0.07	0.003	1.98	13.8	2.55	0.101	-
Industrial Processes	-	-	-	-	1.76	-	0.00415
Solvent and Product Use	-	0.002	0.00	0.0	1.62	-	-
Agriculture	0.46	0.10	0.00	-	-	-	-
Land-Use Change and Forestry	0.07	0.000	0.02	0.6	-	-	-
Waste	7.26	0.021	-	-	-	-	-
Total National Net Emissions	**7.86**	**0.125**	**2.00**	**14.4**	**5.93**	**0.101**	**0.00415**

A comparison of Non-CO_2 emissions from the year 2000 to the year 1994 (Table 2.15) indicates a growing trend in emissions for N_2O, CH_4 and NO_X and a declining emissions for CO, NMVOC, SO_2 and HFC. An increase in methane emissions is primarily the result of an increase in the quantities of solid waste produced in Saint Lucia. SO_2 emissions have dramatically declined as a result of a significantly lower sulphur content reported for diesel and heavy fuel oils used in Saint Lucia for electricity production. An increase in NOx emissions is largely due to an increase in transportation emissions. N_2O emissions have increased largely due to increased emissions related to the increased use of confined manure management systems (e.g., solid storage and drylot) in livestock production.

Table 2.15: Comparison of Saint Lucia Non-CO_2 Emissions (1994 and 2000)

Non CO_2 Emissions	1994 (Gg)	2000 (Gg)	% change (1994-2000)
CH_4	7.77	7.86	1.2%
N_2O	0.10	0.125	26.0%
NOx	1.41	2.00	41.5%
CO	15.30	14.38	-6.0%
NMVOC	6.20	5.93	-4.2%
SO_2	1.10	0.10	-90.8%
HFC	0.01	0.004	-70.4%

2.4.3 Global Warming Potential (CO2 Emissions)

Carbon dioxide (CO_2) is the most important anthropogenic greenhouse gas followed by methane (CH_4), and nitrous oxide (N_2O). HFC is also an important greenhouse gas released from industrial processes in Saint Lucia. Each of these greenhouse gases can be expressed as an equivalent carbon dioxide concentration (CO_2e) which is the concentration of carbon dioxide that would cause the same amount of radiative forcing as a given mixture of carbon dioxide and other greenhouse gases. In order to convert the various greenhouse gases to CO_2e they are multiplied by their global warming potential (GWP).

Total CO_2e emissions for the year 2000 are equal to 579 Gg. This represents an almost 2% increase in total CO_2e emissions from the year 1994. Figure 2.10 below indicates the relative contribution of the four main greenhouse gases (i.e., CO_2, CH_4, N_2O and HFC) to total emissions. Figure 2.11 indicates the relative contribution of each IPCC source / sink category to total emissions.

Figure 2.10: Comparison of Total Greenhouse Gas Emissions (CO_2e) for Saint Lucia by four main types of GHGs (1994 and 2000)

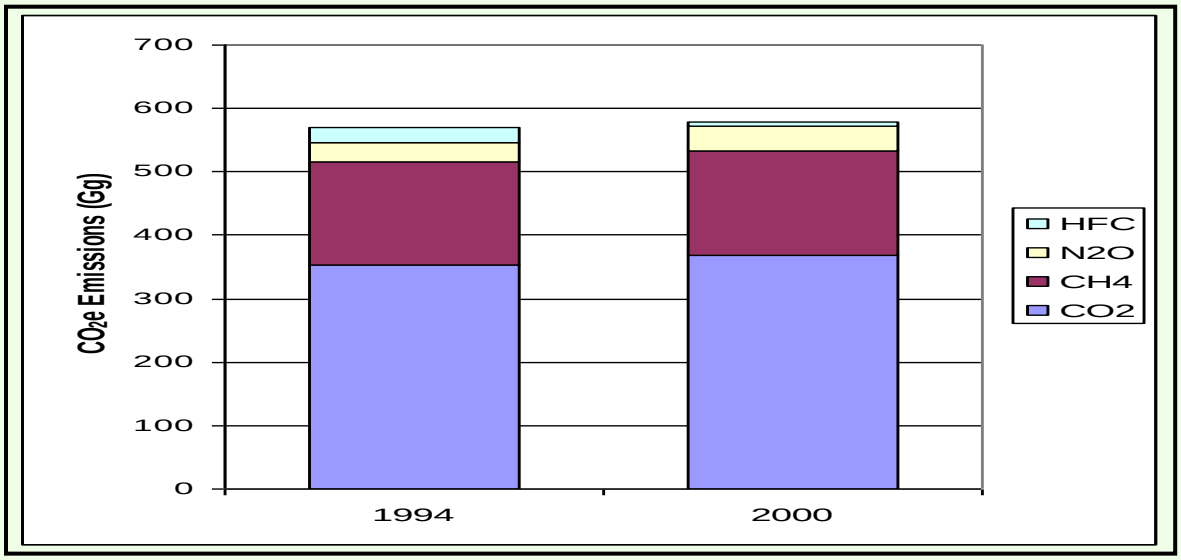


Figure 2.11: Comparison of Total Greenhouse Gas Emissions (CO_2e) for Saint Lucia by Major Source / Sink Categories (1994 and 2000)

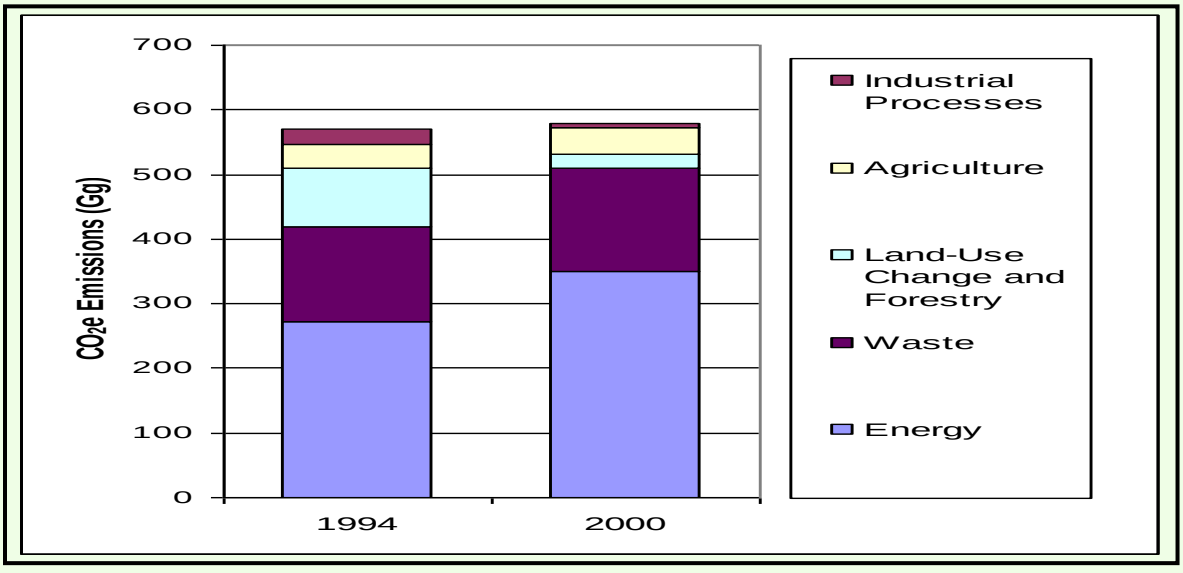


Table 2.14 indicates the key source categories that were identified using the Key Source Category Tool in the UNFCCC Software v.1.3.2. The analysis indicates that CO_2 emissions from stationary combustion in the energy sector are the largest overall contributor to emissions. The second largest source is CH_4 emissions from solid waste disposal and then CO_2 emissions from transportation sources.

Table 2.16 : Comparison of Total Greenhouse Gas Emissions (CO_2e) for Saint Lucia (1994 and 2000)

Sector	Key Source Categories	Applicable GHG	Level Assessment excluding LULUCF (%)	Level Assessment including LULUCF (%)
Energy	CO_2 Emissions from Stationary Combustion	CO_2	31.6%	29.3%
Waste	CH_4 Emissions from Solid Waste Disposal Sites	CH_4	27.5%	25.5%
Energy	CO_2 Mobile Combustion: Road Vehicles	CO_2	23.6%	21.9%
LULUCF	Forest Land Converted Into Cropland or Settlement	CO_2	n/a	5.8%
Agriculture	N_2O Emissions from Agriculutural Soils	N_2O	4.9%	4.5%
Energy	Other Sectors: Residential CO_2	CO_2	2.6%	2.4%
Energy	CO_2 Mobile Combustion Water Borne Navigation	CO_2	2.0%	1.8%
Agriculture	CH_4 Emissions from Enteric Fermentation	CH_4	1.6%	1.5%
Energy	Other Sectors: Commercial CO_2	CO_2	1.5%	1.4%
LULUCF	CO_2 Emissions and Removals from Soil	CO_2	n/a	1.1%

The key source category analysis is a useful tool to identify key areas where resources can be spent on improving the emission inventory. Specifically because it is known that the uncertainty associated with methane emissions from landfills and CO_2 emissions from conversion of forests to other land-uses is high, improvements to emission estimation methodologies (e.g., using a Tier 1 versus a Tier 2 methodology) and improving activity data and emissions is a priority for these categories.

2.5 RECOMMENDATIONS: WAY FORWARD

2.5.1 Capacity Building

Based on the experiences of the preparation of the Second National Communication (SNC) GHG inventory for Saint Lucia, there is a strong need for institutional capacity building and training of government staff and local consultants to do research, data collection and analyses required to reduce inventory uncertainties and improve the quality of activity data and emission factors used

to generate the inventory. Capacity building is required at both the institutional level and at the personnel level and multi-sectoral representation is critical.

In the interest of enhancing long-term national capacity building, a need was identified for the development of a training course for trainers that would instruct a small number of individuals from both the public and private sectors to deliver low cost and ongoing GHG inventory training in Saint Lucia. Stakeholders who attended the workshop also expressed the need to have integrated training rather than solely sectoral training based on the IPCC source / sink categories to encourage integrated planning between the various requisite agencies.

The development of an emission inventory is critical to the entire GHG process including the preparation and implementation of plans for mitigation. It is recommended that updating of the emission inventory occur at regular and frequent intervals to facilitate these other processes. Ideally updating of the emission inventory should occur every two years. It is also recommended that preparation of future inventories be conducted where possible on an on-going basis rather than a project basis as has been done for the INC and SNC. The main benefit is that stakeholders can remain engaged in the emission inventory process instead of having a lapse of several years. Additional benefits include:

- Higher retention of capacity to conduct inventories and collect data.
- Inventory data improvements can be addressed and not simply shelved until the next inventory.
- Improved integration with other on-going processes such as mitigation and vulnerability and adaptation.

2.5.3 Data Collection and Research

A major recommendation is that a data repository be established for the inventory that would house and store the inventory, information sources, assumptions and methodologies for future reference. It is recommended that the inventory data be housed at the Sustainable Development and Environment Division (SDED) because they currently have the best capacity to manage and update inventory data, methodologies and assumptions on an on-going basis. It is also critical that detailed notes on assumptions and data sources be included directly with the software workbook sheets for future reference.

There are a few key areas in the inventory were improvements in activity data or emission factors could provide a substantial improvement to the quality of the inventory. These actions are highly recommended:

i. Conduct surveys to estimate the amount of biomass removed (tonnes of dry biomass) for both charcoal production and fuel wood consumption for the whole island.
ii. Develop a national land classification system applicable to the six land-use categories (Forest, Land, Cropland, Grassland, Wetland, Settlements and Other Land). This would require processing of existing GIS data with future GIS data to develop integrated maps of land-use subdivided by ecological region type (e.g., forest types) and soil types to accurately identify changes in land-use categories.

iii. Evaluate CO_2 emissions and removals from managed forests using a more detailed Tier 2 approach due to the importance of this category to overall emissions.
iv. Evaluate CH_4 emissions from waste disposal sites using a more detailed Tier 2 approach due to the importance of this category to overall emissions.
v. Conduct surveys to determine whether emission factors for the use of household solvents based on US EPA data are representative of the household solvent use in Saint Lucia.
vi. Improve customs tracking system to identify HFCs not covered under the Montreal Protocol that are imported into Saint Lucia.
vii. Conduct surveys to improve estimates of the distribution and profile of animal waste management systems for different livestock.
viii. Develop a system to monitor and report fuel sulphur content in imported fuels.
ix. Consider the development of a mechanism/strategy that makes it mandatory for agencies and the private sector to supply data that is essential for the emission inventory. This mechanism could be a Memorandum of Understanding (MOU) among critical sectors. An MOU would have to clearly articulate the type of data to be collected, the responsible entity and possible repositories, as well as the usefulness of the data to the collecting agency. It is recommended that SDES facilitate a high level meeting of the requisite agencies to facilitate this development. In addition, legislation could be modified to grant the Minister with responsibility for the Environment the authority to request relevant data from any agency or organization.

In addition, there is a need to conduct on-going monitoring of major new industries that may be established in Saint Lucia. As an example, the establishment of a proposed major oil refinery would significantly increase GHG emissions from the Energy and Industrial Process IPCC source / sink categories.

2.5.3 Integration With Other Planning Processes

It is recommended that for future inventories, sector teams and leads from different government departments establish clear linkages with other aspects of the national communications namely the vulnerability, adaptation and mitigation components since such interaction will assist in identifying appropriate and consistent measures and policies.
In addition government departments should collaborate to establish a system and/or mechanisms to collect and report data on an annual basis to support institutional needs as well as GHG needs.

There are many opportunities to integrate data collection requirements for GHG inventories with other data collection programs. For example, an agricultural census for Saint Lucia is completed every ten years. Data collected on animal livestock numbers for this census is already used directly to estimate methane emission from enteric fermentation in the GHG inventory, but the census could be altered to also identify what type of animal waste management system is used to provide more accurate and reliable data then is currently estimated.

In addition results from the GHG inventory can also contribute to information required for other programs. For example, the GHG inventory provides an estimation of the amount of methane that could be captured from landfills that could be used to generate sustainable energy.

2.5.4 Recommended Methodologies for Future Inventories

The development of future inventories will likely be based on *2006 IPCC Guidelines* that are expected to supplant the Revised 1996 Guidelines in the next few years. As a result training research and planning initiatives should be based on new guidance that is provided in these documents.

[i] US EPA. August 1996. *Emission Inventory Improvement Program. Volume III:* Chapter 5. Consumer and Commercial Solvent Use

Chapter 3: Measures to Mitigate Climate Change

CHAPTER 3: MEASURES TO MITIGATE CLIMATE CHANGE

3.0 SECTION OVERVIEW

The Mitigation Assessment summarized here was undertaken by Marbek Resource Consultants of Canada and includes an analysis of potential impacts of various practices and technologies that can mitigate climate change while also supporting the island's sustainable development.

This Assessment will enable Saint Lucia to provide information on programmes to mitigate climate change by addressing anthropogenic emissions of greenhouse gases (GHGs) by sources and removals by sinks, for those GHGs not controlled by the Montreal Protocol. The assessment includes analysis of the potential impacts of various technologies and practices that can mitigate climate change, while also supporting sustainable development in Saint Lucia. The information is intended to be useful to policy makers, in particular by supporting formulation and prioritization of mitigation programmes.

The scope of the Mitigation Assessment was based on the GHG Inventory for Saint Lucia, with selection of priority sectors based on the relative contribution to Saint Lucia's overall emissions profile. The methodology utilized is based on the UNFCC guidance and involves two major steps. The first of these was the development of a Baseline Scenario, which projects GHG emissions assuming no additional emission reduction measures. The second step involved the development of Mitigation Scenarios which project GHG emissions assuming additional defined emission reduction measures. The period considered for Saint Lucia was up to 2020.

3.1 METHODOLOGY

The Mitigation Assessment involved two major steps. The first of these was the development of a Baseline Scenario in which the assumption is made that GHG emissions will continue in the absence of any additional mitigation measures. In the second step, two (2) scenarios were developed where GHG emissions were projected assuming additional defined emission reduction measures. Both Baseline and Mitigation Scenarios considered the period to 2020 and were prepared utilising the Long-range Energy Alternatives Planning system (LEAP) Model. LEAP is a flexible "bottom up" modelling framework that provides a comprehensive and integrated system covering energy supply-side and demand-side mitigation options. LEAP was developed by the Stockholm Environment Institute (Boston). Further information is available at www.energycommunity.org

The selection of key parameters was guided by international practice and UNFCCC guidance. Although the scope of the Assessment was based on the GHG Inventory for Saint Lucia, with the selection of priority sectors based on relative contribution to Saint Lucia's overall emissions profile, attention was also paid to sectors making a relatively lower contribution to emissions, if meaningful and cost-effective emission reduction opportunities were available.

The base year selected (reflecting the most current data available), is 2008, and new inventory data was gathered accordingly. The Assessment considered the period to 2020, supported by a brief qualitative discussion of potential over a somewhat longer time period.

National Consultants, under the guidance of the Marbek team, were responsible for data collection. Some of the required data is available in official government socio-economic publications. Other data is available directly from the responsible government agency, energy utilities/suppliers, and others. In still other cases, informed estimates were required (for instance, activity levels in some sectors). Where local data or credible estimates were unavailable, default (international) inputs were used where possible. The following National Consultants coordinated the research of three thematic groups of consultants, all of whom contributed data for this Mitigation Assessment: Judith Ephraim, Donnalyn Charles, Adams Toussaint. In addition, Marbek met directly with a number of other agencies to obtain available data, including the following:

- SDED regarding all available data
- Department of Statistics regarding projections in GDP, population and housing
- LULULEC regarding current generation, end-use demand and future projects
- Ministry of Agriculture, Forestry and Fisheries regarding land use data and timber harvesting.

The *National Inventory of Greenhouse Gases for Saint Lucia* (Marbek, 2008) forms a key foundation for this mitigation analysis. This inventory determined that Saint Lucia's largest GHG emissions were CO_2 emissions from electricity generation (30%), methane emissions from landfills (26%), CO_2 emissions from road vehicles (22.4%), CO_2 emissions from deforestation (5.9%), N_2O emissions from application of fertilizer and manure management, and CO_2 residential sector emissions (2.4%). All other emission sources comprised of less than 2% of the total national emissions of 457 Gt CO_2e in 2000.

3.2 BASELINE SCENARIO

The main steps undertaken were as follows:

- Based on the 2000 National Inventory of Greenhouse Gases for St. Lucia (Marbek 2008), and updating with more recent activity and energy data, estimates for GHG emissions for 2008 were obtained.
- Again utilising available St. Lucia data, sector end-user allocations were determined (the sectors selected were based on their relative contribution to Saint Lucia's overall emissions profile. For those sectors with relatively low contributions, if realistic emission reduction possibilities were possible, these were included as well).
- Finally, future emissions were estimated based on a number of assumptions regarding technology adoption and utilising the limited forecast data available for the energy sectors and historical socio-economic trends for the non-energy sectors.

Step 1: Estimating Emissions in 2008

The emissions documented in the 2000 *National Inventory of Greenhouse Gases for Saint Lucia* (Marbek, 2008), were used as a starting point for estimating emissions in 2008 (the most recent year for which data was available when the project began in July 2009).

Wherever possible, activity data and energy use data were collected to allow the consultant team to prepare new emission estimates for 2008. The updated estimates were developed by entering the new activity data into the UNFCCC GHG Inventory Software, which had previously been used to develop the original year 2000 inventory.[1]

As part of this process a 2008 energy balance was developed to determine sectoral fossil fuel consumption. This energy balance includes the main imported fuels (gasoline, diesel, kerosene, LPG and aviation gas) and was primarily based on data collection and analysis conducted by the Sustainable Development and Environment Division. In the case of gasoline and diesel fuel, total consumption could not be determined as not all fuel distributors reported for this assessment period. For these fuels, overall 2008 import data available was used to generate estimates based on sectoral distributions of the complete year 2000 energy balance. In non-energy related sectors data was gathered to estimate how emissions changed between 2000 and 2008.

Step 2: Allocating Emissions and Energy Use to Sector End-Uses

In order to analyse the potential effects of mitigation measures using LEAP the baseline scenario must be disaggregated by end use (e.g., residential appliances, vehicles, air conditioning units, etc.). This, in turn, means that input data must also be disaggregated by end-use. To generate these disaggregated inputs, it is necessary to allocate the total sectoral emissions and energy consumption data gathered in Step 1 to sector end-uses. Many different sources of information were gathered from national consultants between July 2009 and September 2010 to establish this allocation. In some cases a "bottom-up" approach was used and detailed data on fuels, technologies and energy efficiency ratings were collected to determine the appropriate allocation. In other cases a "top down" approach was used and the energy demand of end-uses was based on available socio-economic data.

Step 3: Estimating Future GHG Emissions

Very little forecast data is available in Saint Lucia to estimate future end-use energy demand and GHG emissions. In most cases growth rates for energy end-use and GHG emissions were estimated based on historical growth in GDP or population. The current population that represented the end-use in the LEAP model (e.g., number of vehicle kilometres travelled, number of air conditioners, and number of households) was adjusted by the estimated sector growth rates to project the future population. Data was also collected to assess how technology changes (e.g., vehicle fuel efficiency) and stock turnover could affect end-use energy efficiency and emissions. Future non-energy sector emissions were typically estimated based only on historical socio-economic trends.

[1] The UNFCCC GHG Inventory Software is available at:
http://unfccc.int/resource/cd_roms/na1/ghg_inventories/index.htm

The data assumptions are provided in Section 3. Based on these assumptions, the estimated growth rates for each energy end-use and for non-energy sector emissions were analysed using the LEAP model, to generate future emission estimates for the Baseline Scenario. These results are presented in Section 3.

Mitigation Scenario Methodology

Mitigation Scenarios can be used to project GHG emissions in the future, assuming implementation of a set of defined emission reduction measures. By definition, the measures included in a Mitigation Scenario must go beyond what would be expected in the business-as-usual case represented by the Baseline Scenario.

The steps involved in the development of two Mitigation Scenarios were as follows:

- By way of a consultative process involving key national experts, the mitigation measures to be included were selected;
- These measures were then analysed individually for estimated GHG impacts using the LEAP model. To do this, additional data, where available, was provided by the national experts. This was further supplemented by data from international sources and by the use of professional judgement as necessary.
- Finally the combined effect of the measures was analysed using the LEAP model with Mitigation Scenario # 1 first and then Mitigation Scenario # 2.

Selection of Measures

Selection of mitigation measures was undertaken via an iterative process involving participation of key national experts. The first task was to identify potential mitigation measures that could be implemented in Saint Lucia (the "long list"). The long list was developed by Marbek based primarily on measures described in existing Saint Lucia policy documents.

The next task was to screen the long list to identify the most promising options for further analysis. The screening process was undertaken by stakeholders at the *Saint Lucia GHG Mitigation Assessment Stakeholder Workshop and Training Session*, which took place 7-8 October 2009. The final screening criteria were as follows:

- Sustainability (weight: high)
- Consistency with national development goals (weight: high)
- Potential for large impact on greenhouse gases (GHGs) (weight: high)
- Potential effectiveness of implementation policies (weight: medium)
- Institutional considerations such as institutional capacity needed, political feasibility, replicability (weight: medium)
- Consistency with national environmental goals (weight: medium)
- Expected cost e.g. cost per tonne of carbon (weight: low)

Workshop participants also proposed that the mitigation scenarios should target all feasible no-regrets options and all least cost options utilizing appropriate technologies.

The final result was a list of 16 measures that was accepted by the SDED as the basis for Mitigation Scenario #1. In addition, Marbek proposed development of Mitigation Scenario #2 incorporating all measures from Scenario #1 plus two additional measures.

Analysis of the Individual Measures

The selected mitigation measures were first analysed individually to determine their standalone impacts, and then analysed together to determine their combined impacts. The assessment of GHG impact of each measure must be based on two key variables: the technical potential of the measure and the expected penetration rate. In turn, these two variables each depend on other factors.

Due to data limitations, a full analysis of all these factors was well beyond the available resources for this project. Relevant data was provided by the National Consultants where available. In other cases indicative international reference data was available within LEAP, or other international "rules of thumb" were used. In still other cases assumptions were made based on the professional judgement of the consultant team and SDED. Based on these assumptions, the estimated GHG impacts of each individual measure were analysed using the LEAP model.

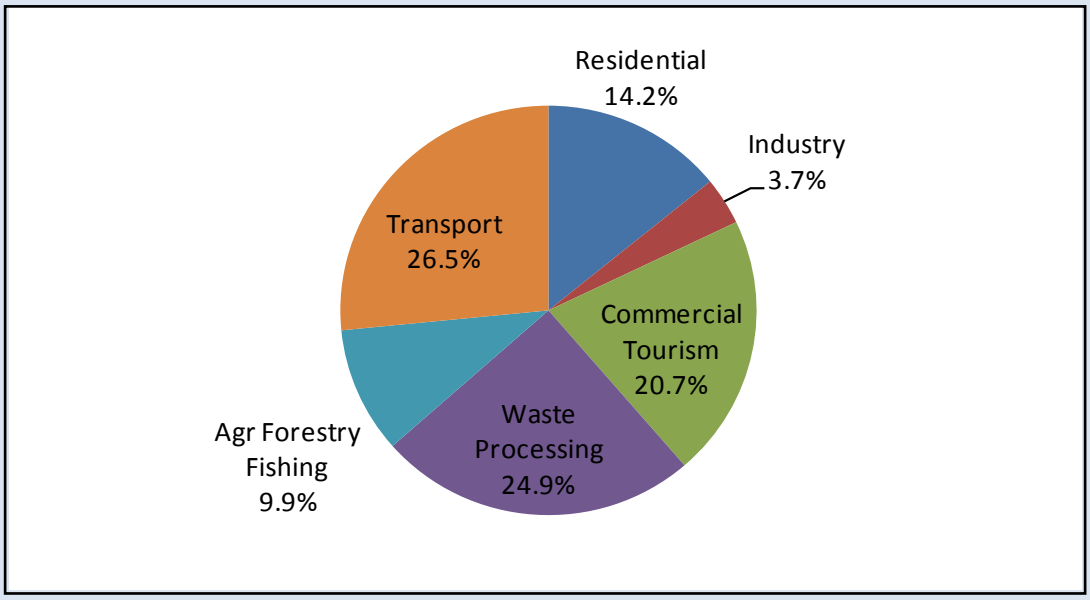
Analysis of Mitigation Scenarios #1 and #2

After completion of the assessment of individual options, the combined emissions impact of the selected measures was determined using the LEAP model, first for Scenario #1 and then for Scenario #2.

The key output of this Step 3 analysis was the estimated emission reductions that would be generated by the two Mitigation Scenarios, relative to the Baseline Scenario. This project made use of two distinct training mechanisms. First, at a number of points in the workplan research tasks were assigned to the National Consultants. Second, the project included two targeted training sessions for the National Consultants. Training Session #1 took place early in the project, and focused primarily on preparation of the Baseline Scenario. The session was one day in duration, concluding with participants undertaking data collection assignments required for preparation of the Baseline Scenario. Training Session #2 took place as part of the *Saint Lucia GHG Mitigation Assessment Stakeholder Workshop and Training Session* described above.

The overall sectoral contribution to baseline GHG emissions is presented as Figure 3.1. Total GHG emissions are projected to rise an overall 16% from 701 kT in 2008 to 813 kT in 2020, an average of 1.2% annually. Of the sectors represented the transport sector, as the largest contributor is expected to contribute 26.5% to the overall baseline. The rest of the section presents the Baseline Scenario on an individual sector basis.

Figure 3.1: Sectoral Contribution to Baseline GHG Emissions (Cumulative from 2000 to 2020)



3.2.1 Residential Sector

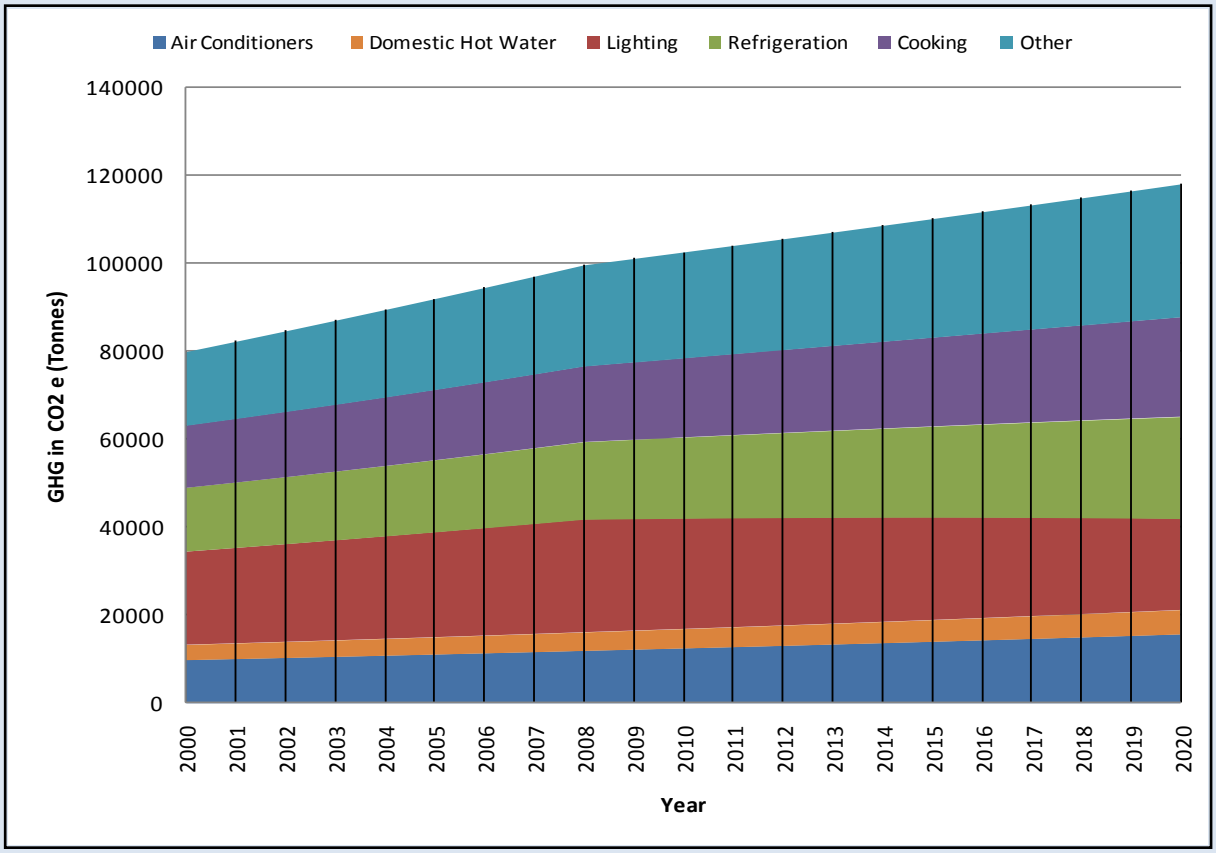
To determine and allocate energy demands and emissions in the residential sector between 2000 to 2008, assumptions were made with respect to the following variables:

- Total direct household energy use (LPG and kerosene usage)
- Total indirect household energy use (electricity as referenced in LUCLEC annual Report)
- Household appliance energy use efficiency (referenced from other jurisdictions)
- Energy use by End Use (referenced from other jurisdictions)
- Number of households (LUCELEC Annual Report)

Based on historic GDP growth in Real Estate and Housing Sector (3.3 % annually, from 1997 to 2006), (see Appendices) and the population growth for the same period, it was assumed that the energy demand for residential end-users in the baseline scenario, would increase by 2.3% annually.

Figure 3.2 below summarises the anticipated baseline emissions in the residential sector. These are expected to rise 18% from 100 kT in 2008 to 118 kT in 2020. Refrigeration is the largest end use (20 % of total emissions) followed closely by cooking (19% of total emissions).

Figure 3.2: Residential Sector GHG Emissions (tonnes CO_2e)



3.2.2 Industry Sector

Key assumptions and data used to determine and allocate energy demand in the industrial sector between 2000 and 2008 considered the following variables:

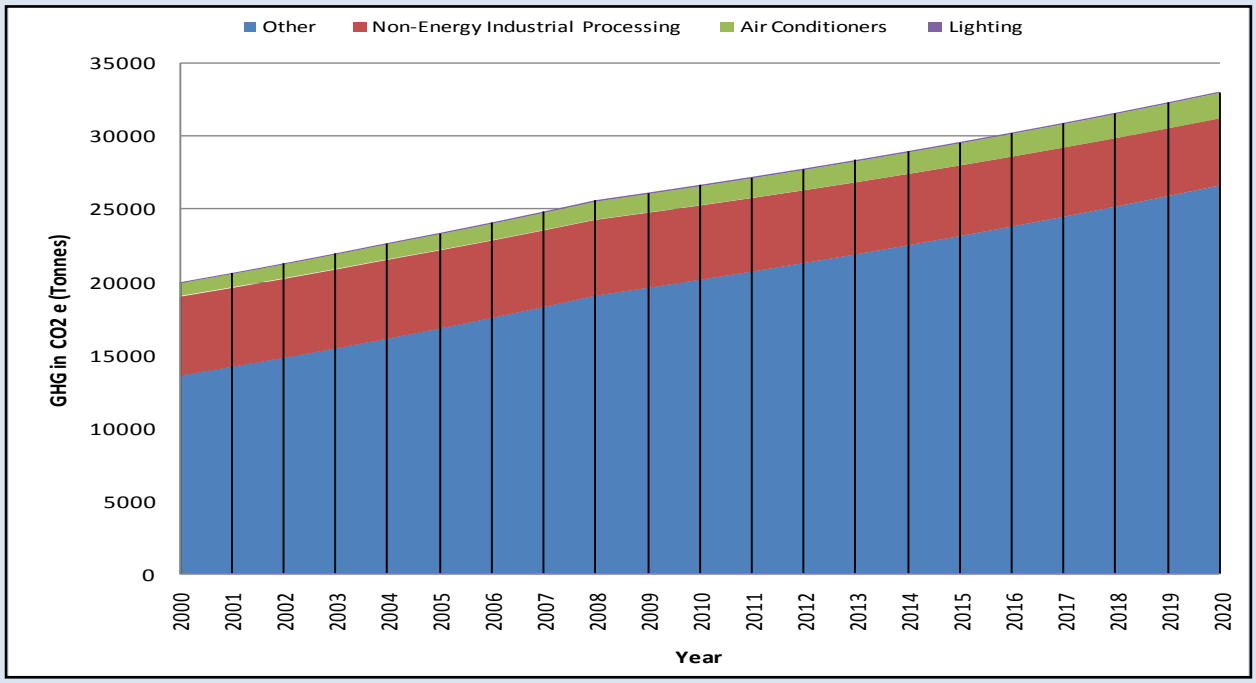
- Total direct energy use (usage of kerosene and diesel in the sector were determined by adjusting the 2000 usage for the average growth in imports for the period 2000 to 2008);
- Total indirect energy use (electricity usage figures as provided from the LUCELEC Annual Report);
- End use energy efficiency (referenced from other jurisdictions)
- Energy use by end use (energy use intensity was referenced from other jurisdictions and from the LEAP data base where applicable; it was assumed energy intensity with respect to air conditioning for this sector was four times that of the commercial and tourism sector and based on available data the penetration of air conditioning in the sector was set at 90%).

Based on an average industrial GDP growth rate (for all subsectors) of 3.8 % per year for the period 1997 – 2006 (See Appendices), and a projected short-term growth of for 2008 of 6 – 7%, a growth rate of 4% was assumed for the baseline period. This estimate was further refined to 3% assuming a 1% improvement in energy efficiency.

Baseline GHG emissions in the industrial sector are expected to rise 29% from 25 kT in 2008 to 33 kT in 2020. Steam and heat demand for various industrial processes is the largest end-use comprising approximately 81% of total emissions in 2020. Non-energy industrial processing emissions in the form of HFC emissions are the second largest source, accounting for approximately 14% of emissions in 2020. The remainder of the emissions are associated with air conditioning and lighting.

Figure 3.3 provides a summary of the overall baseline GHG emissions for the sector. These are expected to rise to 33kT in 2020, a 29% increase over the 2008 figures (25 kT). The largest end use, steam and heat demand for various industrial processes approximates 81% of total emissions in 2020.

Figure 3.3: Industry Sector GHG Emissions (tonnes CO_2e)



3.2.3 Commercial and Tourism Sector

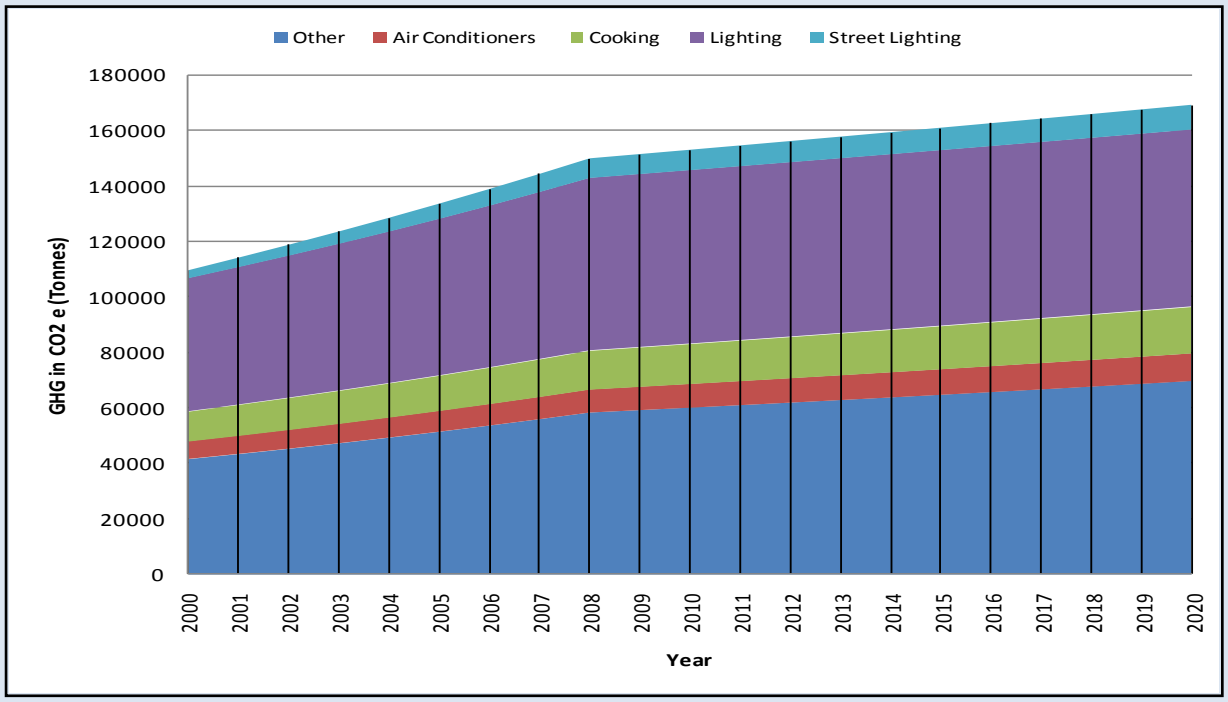
As with the Industrial Sector key assumptions and data used to determine and allocate energy demand in the industrial sector between 2000 and 2008 considered the following variables:

- Total direct energy use (usage of kerosene and diesel in the sector were determined by adjusting the 2000 usage for the average growth in imports for the period 2000 to 2008);
- Total indirect energy use (electricity usage figures as provided from the LUCELEC Annual Report);
- End use energy efficiency (referenced from other jurisdictions)

- Energy Use by End Use (As above energy intensity data was referenced from other jurisdictions and from Leap data where applicable. Estimates for energy intensity for air conditioning were based on a Marbek study completed for medium sized establishments within the St. Lucia Hotel Sector. It was assumed that the penetration of air conditioning within this sector was 60 %).

An energy growth rate of 1.5% was estimated for this sector. This assumes a 1.9% growth in the sector (See Appendices), partially offset by a likely increase in energy efficiency in commercial and hotel buildings. Baseline emissions in the commercial and tourism sector are expected to rise 13% from 150 kkT in 2008 to 169 kkT in 2020. Lighting is the large end-user (38%).

Figure 3.4: Commercial and Tourism Sector GHG Emissions (tonnes CO_2e)



3.2.4 Agriculture, Forestry and Fishing Sector

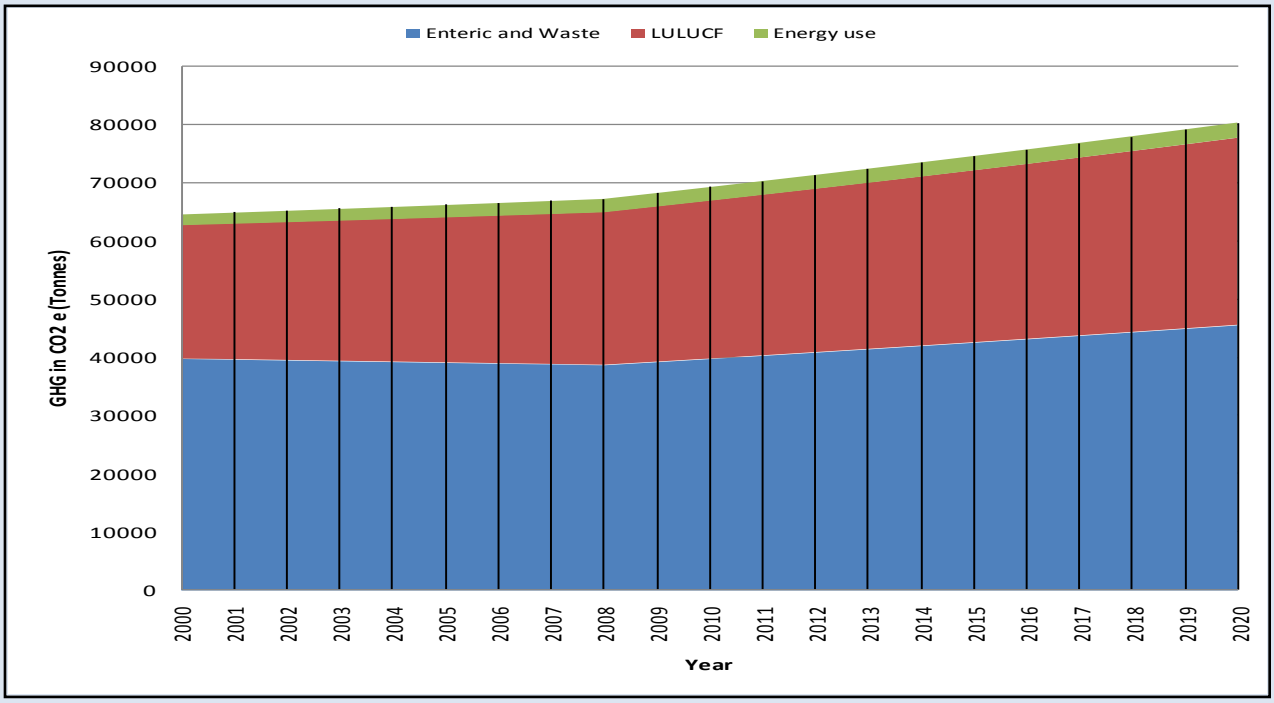
The key assumptions utilised to determine and allocate energy demand and emissions in the agriculture, forestry and fisheries sectors between 2000 and 2008 are as follows:

- Total direct energy use (interpolated for the period from the Saint Lucia Sectoral Energy Balance);
- LULUCF Emissions (Annual rate of deforestation based on land use data available for 2000 to 2004 and assumed to be constant to 2008: other LULUCF emissions assumed to remain the same as 2000);
- Agricultural Enteric Fermentation and Manure Management Emissions (livestock populations for 2008 used and linearly interpolated for the period 2000 to 2008).

GDP for the agricultural sector having been on the decline since 1997, and in the absence of additional data, it was not possible to estimate the growth in the sector. The assumption was made, however, that methane and NO_x emissions will grow at the average rate of overall population growth (1.37% for the period 1992 to 2006) and that energy use would grow at a slightly lower rate of 1%. The average increase in emissions from the LULUCF sector was estimated at 1.69% per year from 2008 to 2020.

The baseline emissions in the agriculture, forestry and fishing sectors as presented in Figure 4 show an expected 19% rise from 60 kT in 2008 to 80 kT in 2020. The enteric and manure waste management emissions represent 57% of total sector emissions.

Figure 3.5 Agriculture, Forestry and Fishing Sector GHG Emissions (tonnes CO_2e)



3.2.5 Transport Sector

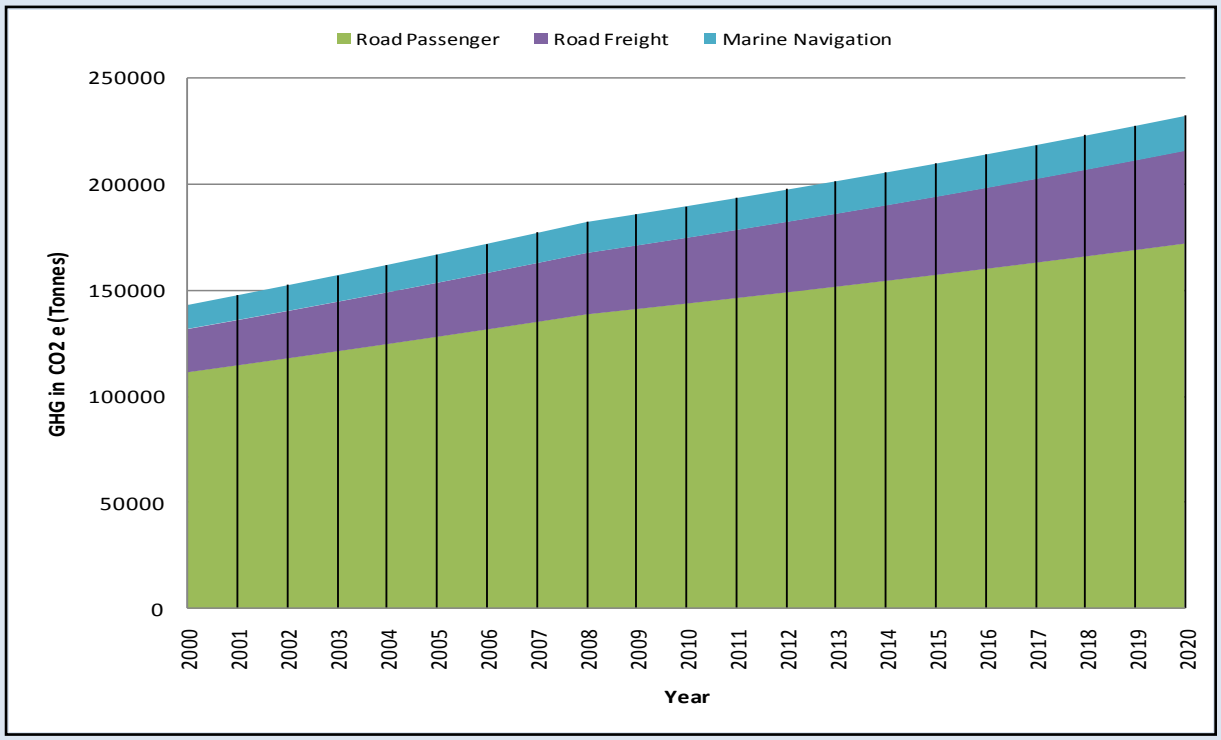
In the determination of energy demand and emissions in the transport sector between 2000 and 2008, the following variables were considered:

- Number and type of vehicles
- Vehicle fuel efficiency
- Average mileage driven annually

A GDP growth rate of 1% (See Appendices) was assumed for the road transport sector and this combined with the increase in the number of on-road vehicles produced a baseline scenario of 1.8 % for total annual increase in energy use.

Baseline GHG emissions in the transport sector (not including international travel) are expected to rise from 182 kT in 2008 to 232 kT in 2020 (27%). The largest end-use is the passenger road transportation category, comprising approximately 74%.

Figure 3.6: Transport Sector GHG Emissions (tonnes CO_2e)



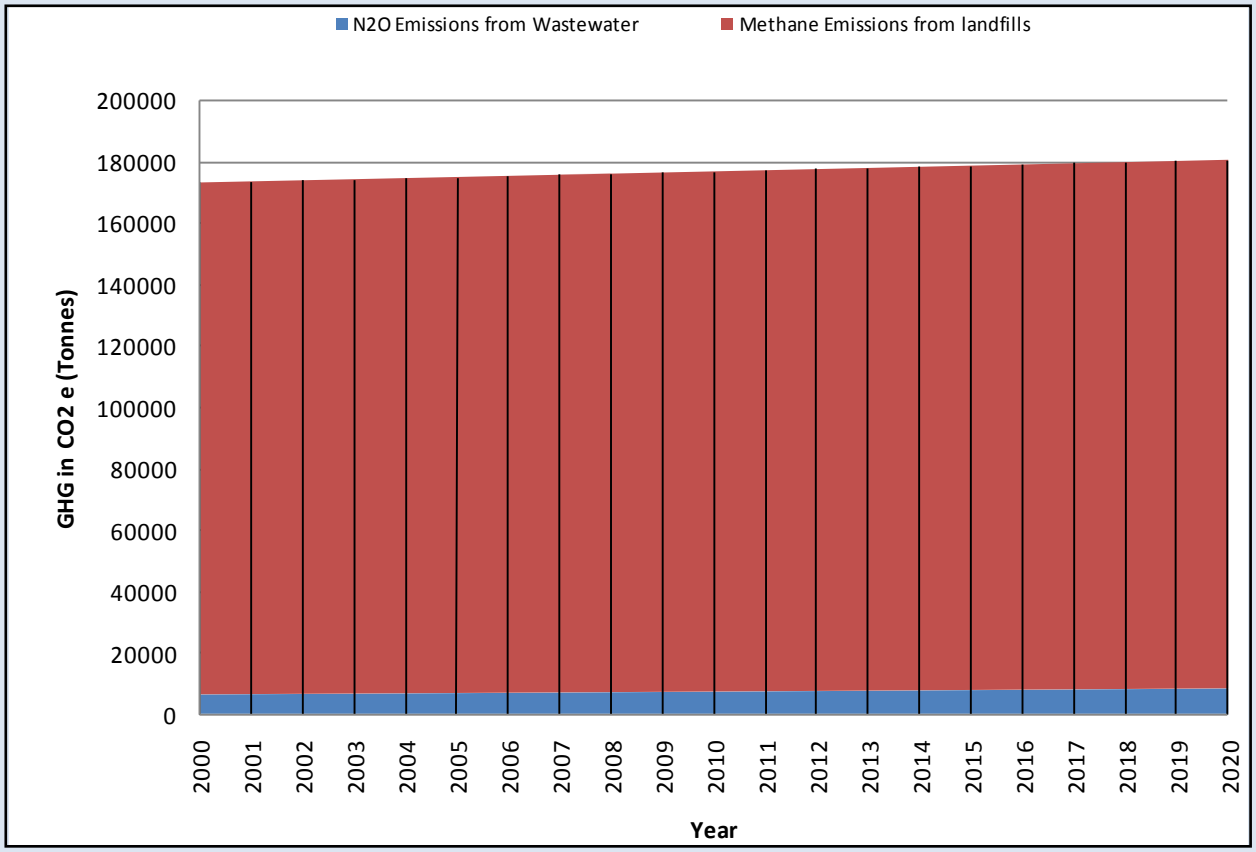
3.2.6 Waste Sector

The variables considered in determining and allocating emissions in the waste sector are as follows:

- Total waste disposal (emissions in 2000 extrapolated to determine the current rate)
- Nitrous oxide emissions from wastewater (assumed to increase with population growth between 2000 and 2008)

In the determination of future growth rates in the waste sector, as no forecasts for future waste disposal were available, the historic population growth rate (1992 to 2006) of 1.3 % per year was utilised. Baseline GHG emissions are expected to rise 3% from 176 kT in 2008 to 181 kT in 2020. Methane emissions from landfills account for 95 % of this total. This is illustrated in Figure 3.7 below.

Figure 3.7: Waste Sector GHG Emissions (tonnes CO_2e)



3.3 MITIGATION SCENARIOS

3.3.1 Description of the Mitigation Scenarios

Measures for Mitigation Scenario #1 (sixteen in total) are presented in Table 3.1. Mitigation Scenario # 2 includes the Table 3.1 measures as well as those included in Table 3.2.

Table 3.1: Measures Included in Mitigation Scenario #1

MEASURE	DESCRIPTION
WASTE	
Measure #1: Waste reduction across sectors	Reduce waste to landfill through a **Reduce, Reuse, Recycle** programme and introduction of **composting** incentives for households (kitchen gardens). This measure includes waste from all sectors.
INDUSTRIAL	
Measure #2: Refrigerants phase out	Establish an accelerated programme to **phase out refrigerants** that deplete the ozone layer and contribute to global warming. This measure applies to refrigerants that are not currently subject to accelerated phase out under the Montreal Protocol.
Measure #3: Fiscal measures for industrial energy efficiency	Provide **fiscal incentives** for energy efficiency measures in industry. This measure includes incentives for energy audits, efficiency improvements, and related R&D.
AGRICULTURE / FORESTRY / FISHING	
Measure #4: Reforestation program for marginally used agricultural lands	Implement a programme to support **reforestation** of marginally used agricultural lands and to sustain the existing forest, including coastal dry forest habitats and mangroves.
Measure #5: Measures to increase farm use of solar, biogas, & other renewables	Implement a programme to encourage the use of **alternative energy** sources where feasible, such as the use of solar energy for drying of crops and substitution of fossil fuels with less carbon-intensive biofuels. This measure includes incentives to encourage farmers to use biomass residues for energy, including production of biogas.
TRANSPORTATION	
Measure #6: Regulation for purchase of higher efficiency vehicles	Establish **regulations establishing minimum fuel efficiency levels** for light duty vehicles (cars, vans and light duty trucks) imported into Saint Lucia, including vehicles used for public transportation.

MEASURE	DESCRIPTION
Measure #7: Transportation demand management, including a range of initiatives	Implement a t**ransportation demand management (TDM)** programme including a range of initiatives such as promotion of greater use of low cost public transport, telework, car pooling and other elements. The TDM programme would include a social marketing component.
ELECTRICITY GENERATION	
Measure #8: Auto-generation and co-generation	Encourage **auto-generation and co-generation** by passing legislation to allow entities to generate electricity for their own use using renewable energy or co-generation plants with a maximum capacity of 500 kW and located at the site of energy consumption. Self-generators would have the right to sell excess electricity to the grid operator and be reimbursed for such supply.
Measure #9: Wind farm	Acquire the necessary land and establish a **wind farm** providing power to the Saint Lucia grid.
COMMERCIAL AND RESIDENTIAL	
Measure #10: Improved energy efficient appliances and lighting through the use of standards	Introduce **minimum energy efficiency standards** for selected types of appliance used in the residential and commercial sectors. These standards would apply new appliances sold in Saint Lucia.
	Introduce regulations or standards to accelerate the adoption of energy efficient lighting. These standards would apply to the lighting products sold in Saint Lucia.
Measure #11: EE Building Code (strengthen energy efficiency in the Building Code)	Develop an **Energy Efficiency Building Code (EEBC)** for new construction and retrofits in commercial, institutional and residential buildings. The EEBC would strengthen the energy-related requirements in the new building code (soon to be adopted). The EEBC would be mandatory for both public and private sector buildings. The code would address some or all of insulation, passive shading, water heating, air conditioning, ventilation, and lighting ("green building").
Measure #12: Auditing for small hotels	Implement an **audit programme for small hotels**, addressing their use of energy and water and generation of waste.

MEASURE	DESCRIPTION
Measure #13: Solar water heating	Encourage greater use of residential **solar water heaters** by maintaining or expanding fiscal incentives for the purchase of solar water heaters, supported by promotion activities. Electric water heaters would not be eligible for fiscal incentives.
CROSS-CUTTING MEASURES	
Measure #14: Public awareness program	Establish a comprehensive and integrated **public awareness program** promoting efficient energy use and sustainable energy throughout the various sectors of the economy.
Measure #15: Support the development of energy service companies	Encourage the establishment of **energy service companies** (ESCOs) to undertake energy efficiency improvements on the premises of consumers by offering financial guarantees for energy performance contracting.
Measure #16: Capacity building initiative for energy efficiency and GHG specialists	Implement a **capacity building initiative** to build the expertise & experience of energy efficiency and GHG specialists. This measure would include a technology transfer component related to the Energy Efficiency Building Code, with training workshops and design handbooks for engineers & architects.

Table 3.2: Additional Measures Included in Mitigation Scenario #2

MEASURE	DESCRIPTION
ADDITIONAL MEASURES FOR SCENARIO #2	
Measure #17: Landfill gas capture with energy generation	Implement landfill gas capture and generate electricity using the captured gas, for sale to the grid
Measure #18: Demand side management (DSM) program for electricity	More comprehensive program encompassing and adding to certain Scenario #1 measures (Measures #3, 5, 11, 12, and 13), in order to increase uptake of energy efficiency and on-site renewables in the commercial, residential, industrial, and agricultural sectors.

Note that Measures 14-16, included in Table 3.1 cross-cutting in nature, designed to support the implementation of the other measures. These cross-cutting measures were not separately modelled, based on the assumption that their impact will be realized through the other measures. In other words, achieving the expected emission reductions of the other measures will depend, in part, on the supportive contribution of the cross-cutting measures. Except as noted in the

individual summaries, for modelling purposes it has been assumed that all measures began implementation in 2010.

3.3.2 Mitigation Scenario #1: Summary

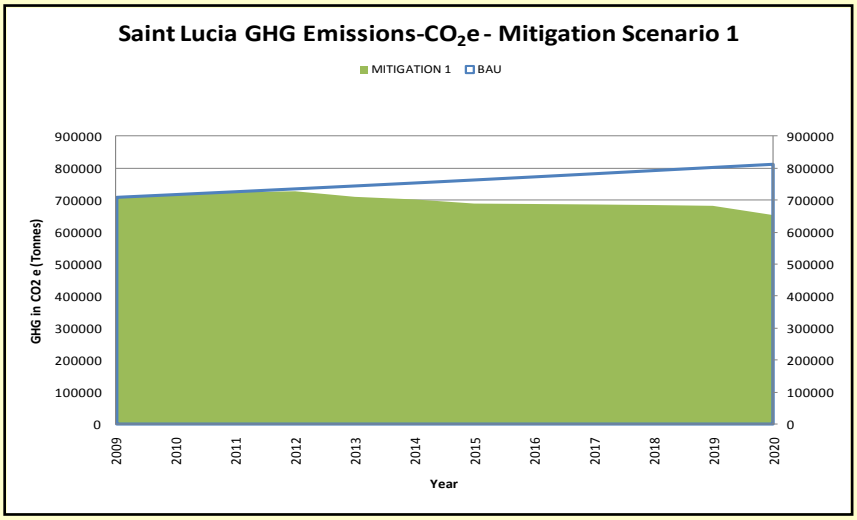
This subsection presents a summary of the emissions impact of Mitigation Scenario #1 relative to the Baseline Scenario (BAU), for the period to 2020. The summary includes results for Saint Lucia as a whole, together with results by sector as illustrated in Table 3.3 below.

Table 3.3: Summary of Impact of Emissions due to Mitigation Scenario #1

Mitigation Scenario #1

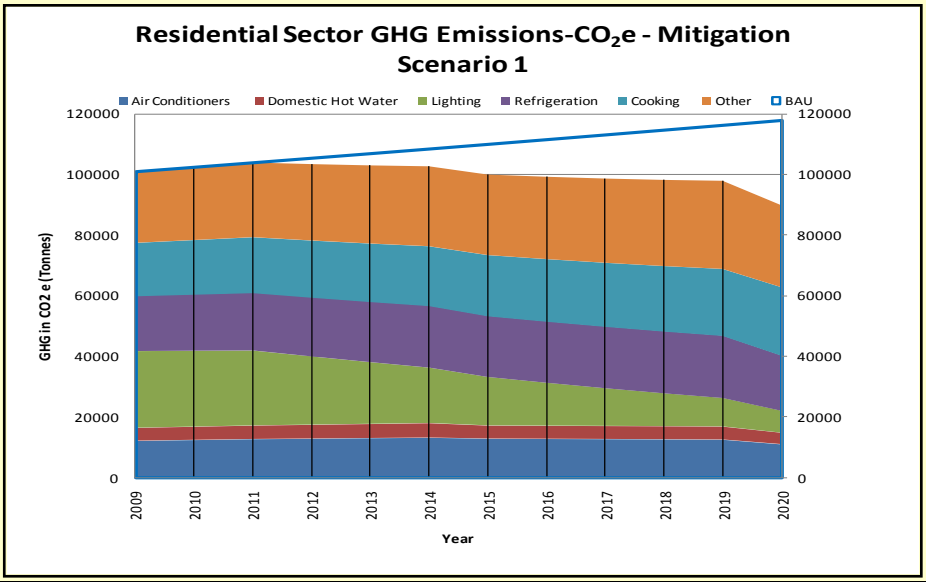
Impact of scenario on overall Saint Lucia GHG emissions:

- 19.6% reduction in overall emissions relative to baseline by 2020.

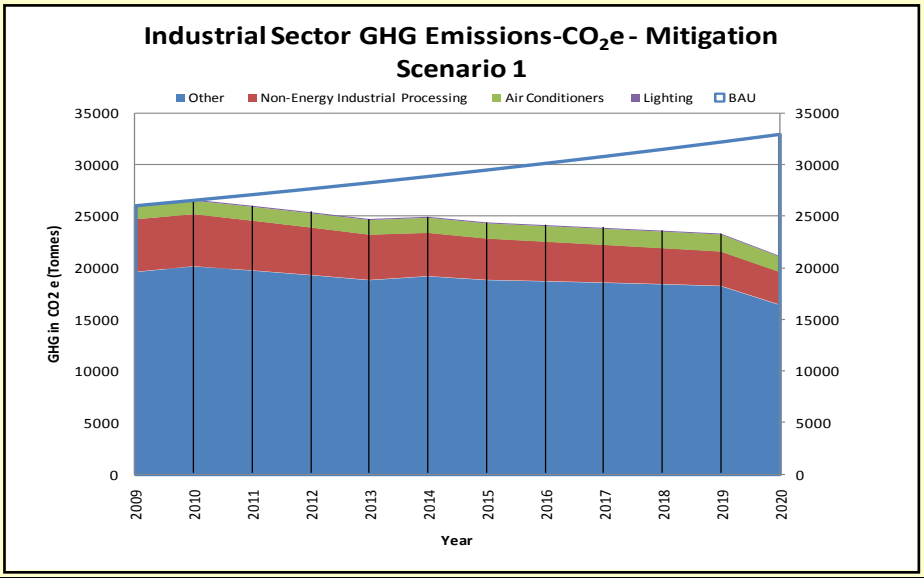


Impact of scenario on sectoral GHG emissions:

- 23.8% reduction in Residential Sector emissions relative to baseline by 2020.

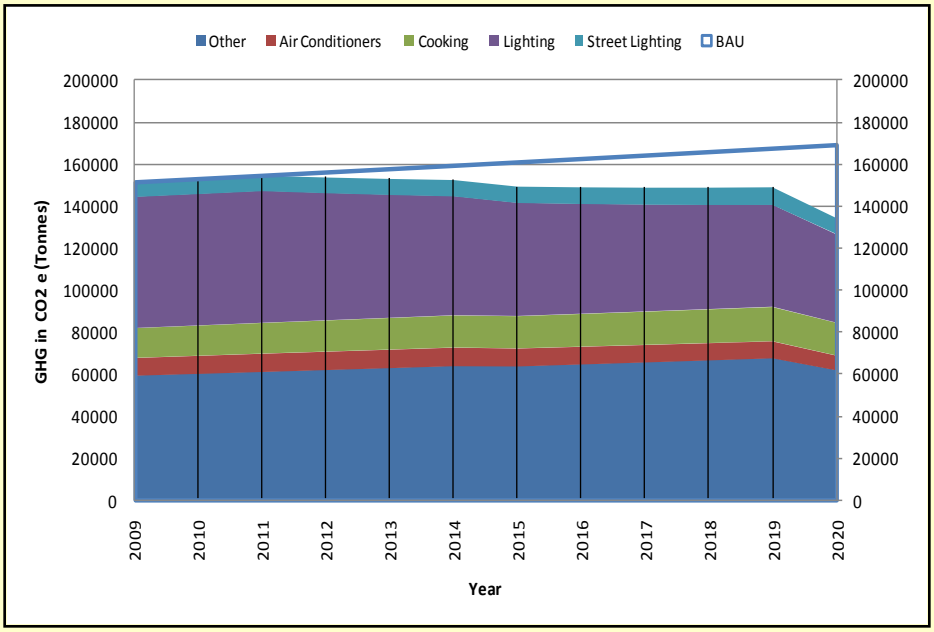


- 35.7% reduction in Industry Sector emissions relative to baseline by 2020.



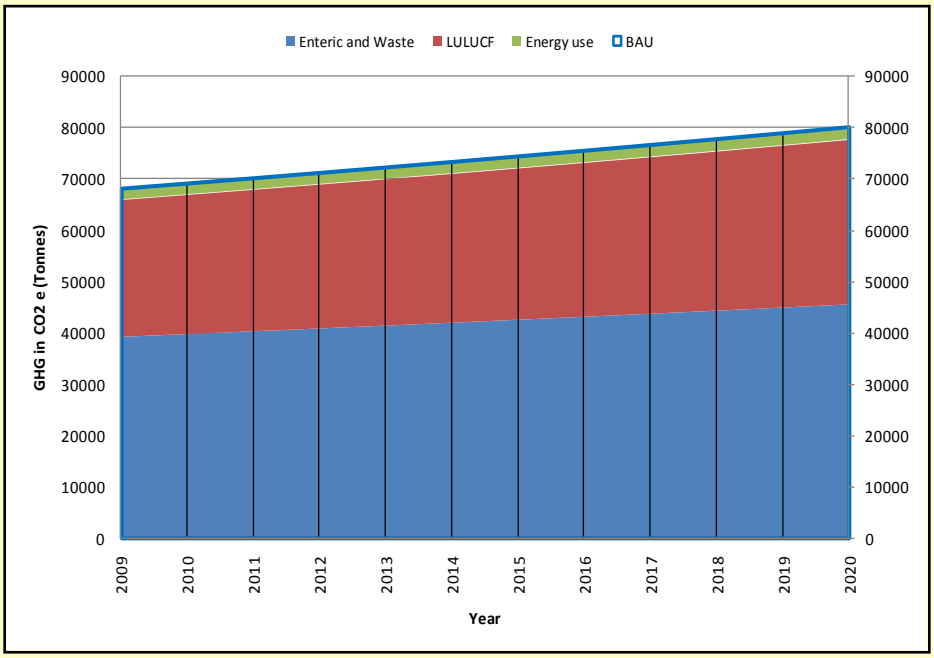
Commercial & Tourism Sector GHG Emissions-CO_2e – Mitigation Scenario 1

- 20.7% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020.

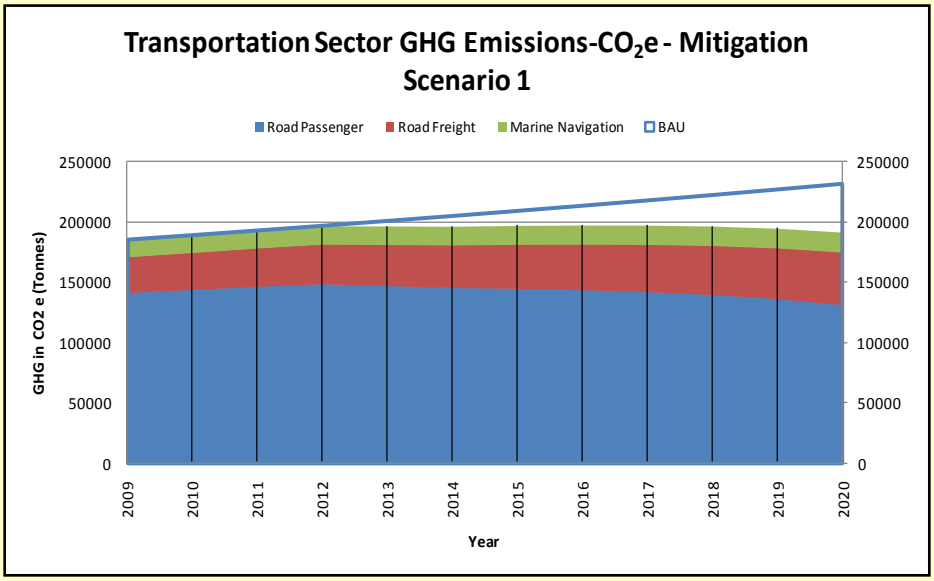


Agriculture, Forestry & Fishing Sector GHG Emissions-CO_2e – Mitigation Scenario 1

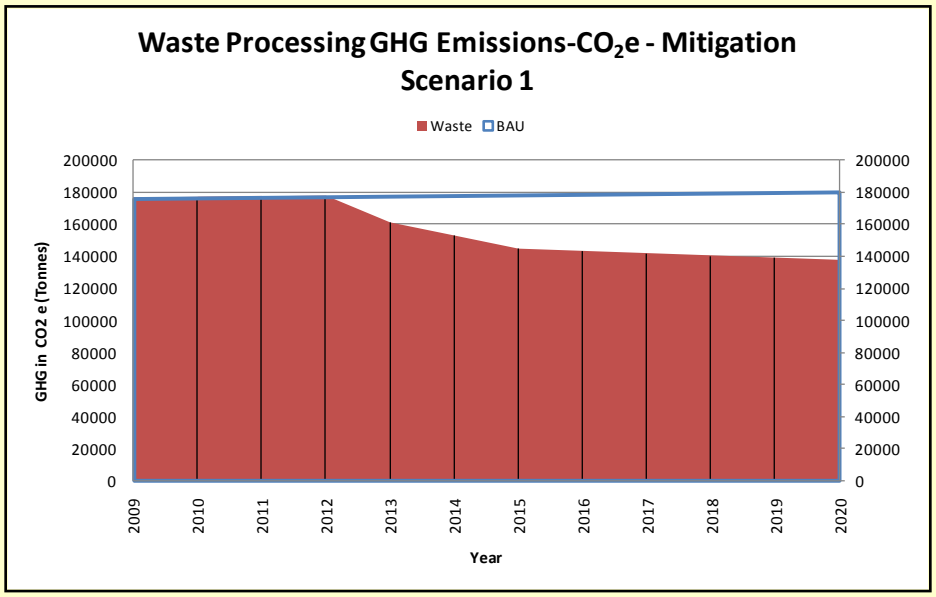
- 0.8% reduction in Agriculture, Forestry, and Fishing Sector emissions relative to baseline by 2020.



- 17.5% reduction in Transport Sector emissions relative to baseline by 2020.



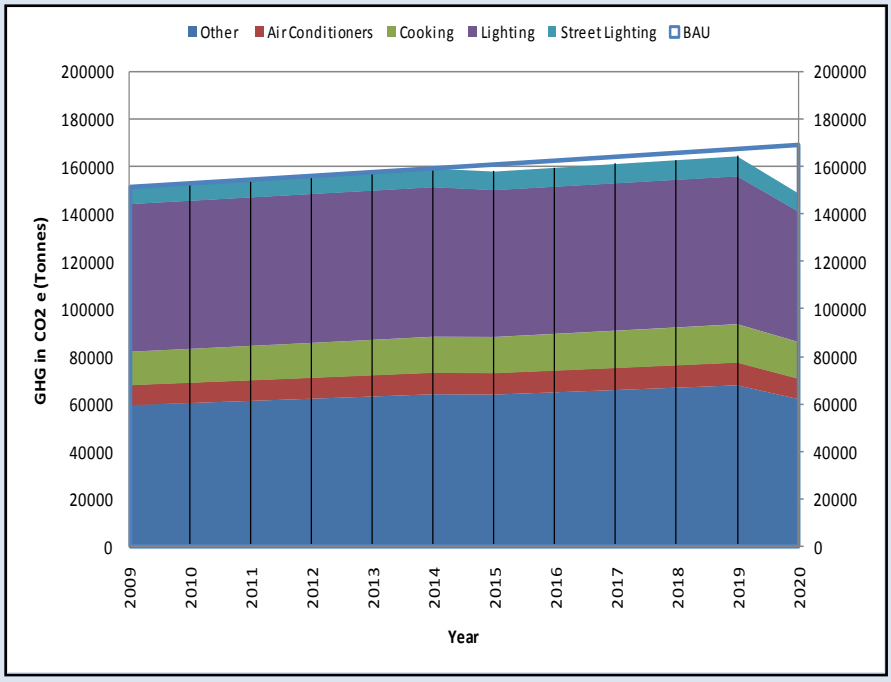
- 23.9% reduction in Waste Sector emissions relative to baseline by 2020.



3.3.3 Mitigation Scenario #1: Details by Measure

This subsection provides a detailed summary of the emissions impact of each of the individual measures included in Mitigation Scenario #1. Specifically, for each measure the summary provides a description; assumptions concerning the physical impact of the measure; the impact of the measure on Saint Lucia GHG emissions; the impact of the measure on emissions from the sectors impacted by the measure; and in some cases additional pertinent information.

The results presented for each measure are a reflection of the assumed design of the measure and of the associated assumptions concerning its physical impacts. For any of these measures, a more or less aggressive design would produce greater or lesser emission reductions. The results presented here should therefore be considered indicative rather than definitive. Graphical representations for these Mitigation Scenarios are included in the Appendices.



Measure #1: Waste reduction across sectors

Description

Reduce waste to landfill through a **Reduce, Reuse, Recycle** programme and introduction of **composting** incentives for households (kitchen gardens). This measure includes waste from all sectors.

Assumptions

10% diversion rate starting in 2012, rising to 20% in 2015 and 25% by 2020

Impact of measure on overall Saint Lucia GHG emissions

- 5.3% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 23.9% reduction in Waste Sector emissions relative to baseline by 2020

Additional Information

The Saint Lucia GHG inventory estimates methane emissions from landfills based on annual waste flow, in accordance with IPCC Tier 1 guidance. Accordingly, emission reductions from waste diversion are also derived from current current year waste quantities only.

Measure #2: Refrigerants phase out

Description

Establish an accelerated programme to **phase out refrigerants** that deplete the ozone layer and contribute to global warming. This measure applies to refrigerants that are not currently subject to accelerated phase out under the Montreal Protocol.

Assumptions

This measure involves an accelerated phase out program for hydrofluorocarbons (HFCs), resulting in an assumed 4.5% annual reduction in HFC use starting 2010. (As noted in Subsection 3.3.2, the baseline scenario assumes a 1% annual decline in HFC use in the period to 2020 due to increased availability of non-HFC equipment and other factors. The net impact of the measure is therefore a 3.5% decline.)

Impact of measure on overall Saint Lucia GHG emissions

- 0.2% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

4.2% reduction in Industry Sector emissions relative to baseline by 2020

Additional Information

The assumed HFC reduction of 4.5% annually is derived from the "Micronesia Proposal" to amend the Montreal Protocol, which calls for 90% reduction of HFC consumption by 2030.

Measure #3: Fiscal measures for industrial energy efficiency
Description Provide **fiscal incentives** for energy efficiency measures in industry. This measure includes incentives for energy audits, efficiency improvements, and related R&D.
Assumptions 5% improvement in industrial energy intensity starting in 2011, rising to 10% in 2012, 15% in 2013, and 20% by 2020 ***Impact of measure on overall Saint Lucia GHG emissions*** • 0.6% reduction in overall emissions relative to baseline by 2020 ***Impact of measure on sectoral GHG emissions*** • 15.3% reduction in Industry Sector emissions relative to baseline by 2020
Measure #4: Reforestation program for marginally used agricultural lands
Description Implement a programme to support **reforestation** of marginally used agricultural lands and to sustain the existing forest, including coastal dry forest habitats and mangroves.
Assumptions (1) On marginally used agricultural lands: reforestation (tree planting) on 10% of land each year from 2012 to 2015 (cumulative 40%), with no change thereafter; (2) On all other lands: 25% reduction in deforestation rate starting in 2012, rising to 50% in 2015, and 100% by 2020. ***Impact of measure on overall Saint Lucia GHG emissions*** • 1.6% reduction in overall emissions relative to baseline by 2020 ***Impact of measure on sectoral GHG emissions*** 15.8% reduction in Agriculture, Forestry, and Fishing Sector emissions relative to baseline by 2020

Measure #5: Measures to increase farm use of solar, biogas, & other renewables

Description

Implement a programme to encourage the use of **alternative energy** sources where feasible, such as the use of solar energy for drying of crops and substitution of fossil fuels with less carbon-intensive biofuels. This measure includes incentives to encourage farmers to use biomass residues for energy, including production of biogas.

Assumptions

5% reduction in farm use of fossil fuels (excluding transportation) through substitution of solar energy and biogas derived from waste biomass by 2014, rising to 10% by 2016, and 25% by 2020.

Impact of measure on overall Saint Lucia GHG emissions

- 0.1% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 0.8% reduction in Agriculture, Forestry, and Fishing Sector emissions relative to baseline by 2020

Additional Information

This measure was applied to agriculture, forestry, and fishing use of diesel and gasoline (excluding transportation).

Measure #6: Regulation for purchase of higher efficiency vehicles

Description

Establish **regulations establishing minimum fuel efficiency levels** for light duty vehicles (cars, vans and light duty trucks) imported into Saint Lucia, including vehicles used for public transportation.

Assumptions

(1) The new regulations would be modelled on the new U.S. vehicle efficiency regulations. See below for further elaboration. (2) Average vehicle life of 12 years (i.e. the vehicle fleet is completely replaced in 12 years).

Impact of measure on overall Saint Lucia GHG emissions

- 2.1% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 7.5% reduction in Transport Sector emissions relative to baseline by 2020

Additional Information

The website pewclimate.org provides estimates of average efficiency of vehicles sold in the US under current and future standards. Using the values for "combined light trucks and cars" (Pew Centre 2010) and de-rating on-road efficiency by an assumed 20% to allow for Saint Lucia conditions yields the following assumed average efficiencies for new vehicles under this mitigation measure: 9.9 L/100 km in 2012; 9.6 L/100 km in 2013; 9.4 L/100 km in 2014; 9.0 L/100 km in 2015; and 8.6 L/100 km in 2016.

Measure #7: Transportation demand management, including a range of initiatives

Description

Implement a **transportation demand management** (TDM) programme including a range of initiatives such as promotion of greater use of low cost public transport, telework, car pooling and other elements. The TDM programme would include a social marketing component.

Assumptions

Passenger vehicle-kilometres travelled decrease by 5% by 2014, 10% by 2017, and 15% by 2020

Impact of measure on overall Saint Lucia GHG emissions

- 5.0% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 17.5% reduction in Transport Sector emissions relative to baseline by 2020

Measure #8: Auto-generation and co-generation, and Measure #9: Wind farm

Description

Measure #8: Encourage **auto-generation and co-generation** by passing legislation to allow entities to generate electricity for their own use using renewable energy or co-generation plants with a maximum capacity of 500 kW and located at the site of energy consumption. Self-generators would have the right to sell excess electricity to the grid operator and be reimbursed for such supply.

Measure #9: Acquire the necessary land and establish a **wind farm** providing power to the Saint Lucia grid.

Assumptions

For Measures #8 and #9 combined, 2.5% of electricity generated from renewables or co-generation by 2015, rising to 15% by 2020 (stepped increase, not linear). See "Additional detail" below for elaboration.

Impact of measure on overall Saint Lucia GHG emissions

- 6.0% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 12.0% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020
- 18.5% reduction in Residential Sector emissions relative to baseline by 2020
- 20.2% reduction in Industry Sector emissions relative to baseline by 2020

Additional Information

The cogeneration component of Measure #8 was applied to industry only. It was assumed that 10% of diesel used for steam generation was displaced starting in 2015, rising to 60% in 2020. This 60% displacement is equivalent to 55.1 TJ displacement of industry diesel, or 1.5% displacement of diesel used for electricity generation in the Baseline Scenario.

The renewables component of Measure #8 was assumed to be provided by wind generation, and so was considered together with Measure #9. For these two measures it was assumed that a 1.33 MW wind facility was constructed in 2015 (2% of electricity demand) and 8.96 MW facility in 2020 (13.5% of electricity demand in the Baseline Scenario).

Measure #10: Improved energy efficient appliances and lighting through the use of standards

Description

(1) Introduce **minimum energy efficiency standards** for selected types of appliance used in the residential and commercial sectors. These standards would apply new appliances sold in Saint Lucia, and (2) Introduce regulations or standards to accelerate the adoption of energy efficient lighting. These standards would apply to the lighting products sold in Saint Lucia.

Assumptions

(1) Air conditioner and refrigerator sales limited to Energy Star appliances, plus ban sales of incandescent bulbs for most applications, both beginning in 2012, and (2) Penetration of improved ACs is 75% by 2020; penetration of improved refrigerators is 50% by 2020.

Impact of measure on overall Saint Lucia GHG emissions

- 3.3% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 6.9% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020
- 13.2% reduction in Residential Sector emissions relative to baseline by 2020

Additional Information

It was assumed that the change to efficient lighting (due to the ban) is linear from 2012, increasing to 100% in 2020. It was also assumed that lighting provided by kerosene (5% in residential) remains unchanged.

Measure #11: EE Building Code (strengthen energy efficiency in the Building Code), and
Measure #12: Auditing for small hotels

Description

Measure #11: Develop an **Energy Efficiency Building Code (EEBC)** for new construction and retrofits in commercial, institutional and residential buildings. The EEBC would strengthen the energy-related requirements in the new building code (soon to be adopted). The EEBC would be mandatory for both public and private sector buildings. The code would address some or all of insulation, passive shading, water heating, air conditioning, ventilation, and lighting ("green building").

Measure 12: Implement an **audit programme for small hotels**, addressing their use of energy and water and generation of waste.

Assumptions

1% annual improvement in efficiency of the residential and commercial building stock, beginning in 2012. This captures efficiency improvements in new buildings (with cumulative impact increasing as the stock turns over); improvements in existing buildings; and the impact of the audit programme in hotels.

Impact of measure on overall Saint Lucia GHG emissions

- 1.0% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 3.9% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020
- 1.6% reduction in Residential Sector emissions relative to baseline by 2020

Measure #13: Solar water heating

Description

Encourage greater use of residential **solar water heaters** by maintaining or expanding fiscal incentives for the purchase of solar water heaters, supported by promotion activities. Electric water heaters would not be eligible for fiscal incentives.

Assumptions

10% of installed stock is solar by 2015, 20% by 2020

Impact of measure on overall Saint Lucia GHG emissions

- 0.1% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 0.9% reduction in Residential Sector emissions relative to baseline by 2020

Additional Information

In 2010, 7-12% of households have solar domestic hot water systems, and an estimated 18% of households have a non-solar domestic hot water system (assumed to be electric). Source: SDED

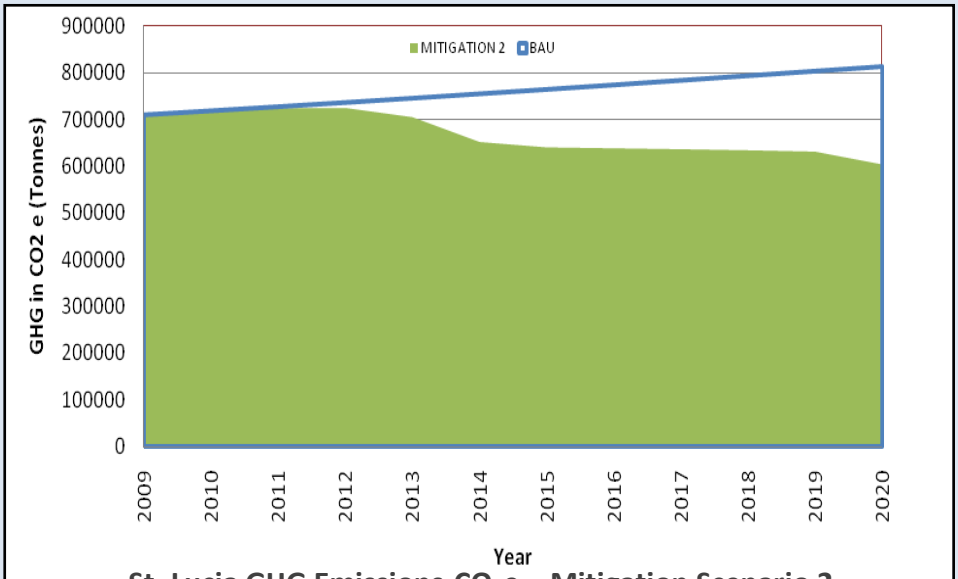
3.3.4 Mitigation Scenario #2: Summary

This subsection presents a summary of the emissions impact of Mitigation Scenario #2 relative to the Baseline Scenario (BAU), for the period to 2020. The summary includes results for Saint Lucia as a whole, together with results by sector.

Mitigation Scenario #2

Impact of scenario on overall Saint Lucia GHG emissions

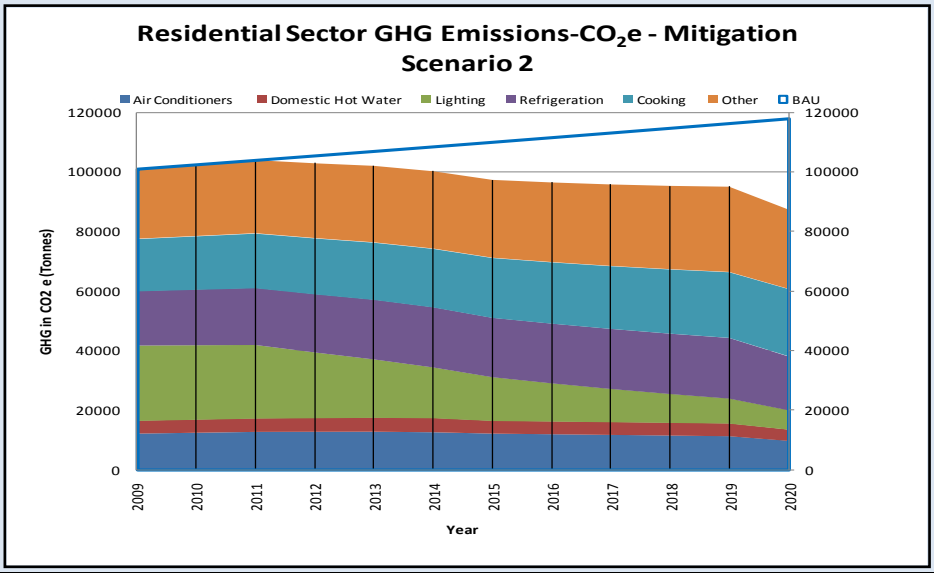
- 25.7% reduction in overall emissions relative to baseline by 2020



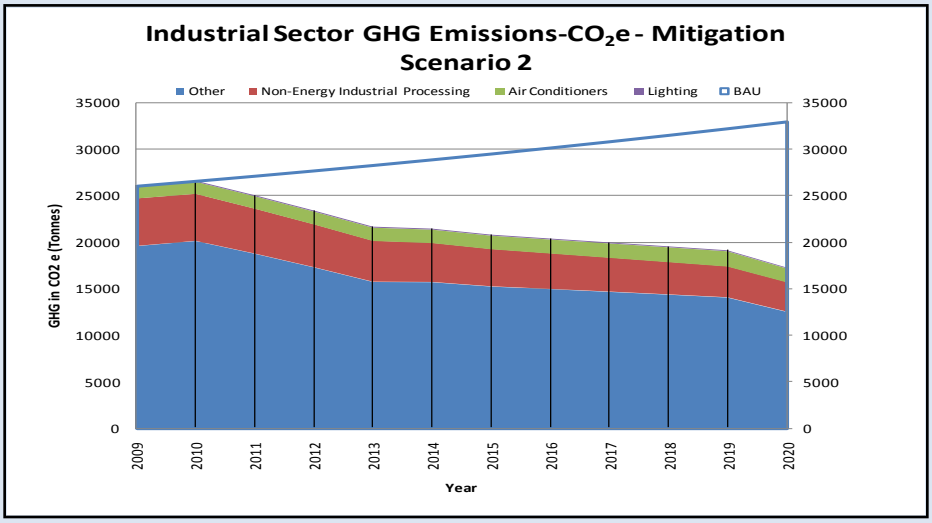
St. Lucia GHG Emissions-CO_2e – Mitigation Scenario 2

Impact of scenario on sectoral GHG emissions

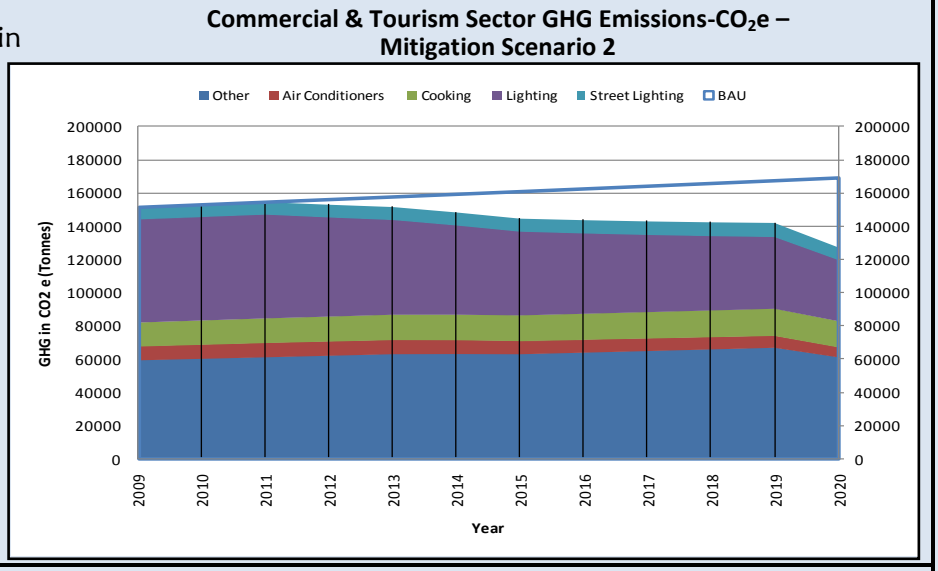
- 25.9% reduction in Residential Sector emissions relative to baseline by 2020



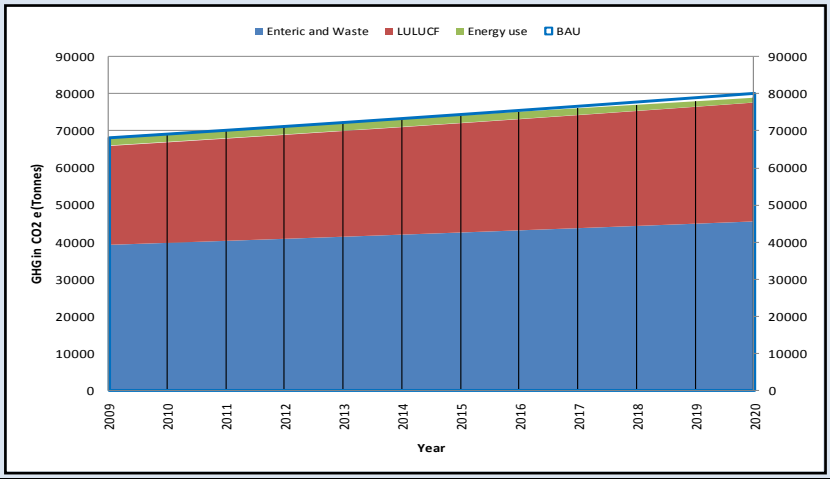
- 47.6% reduction in Industry Sector emissions relative to baseline by 2020



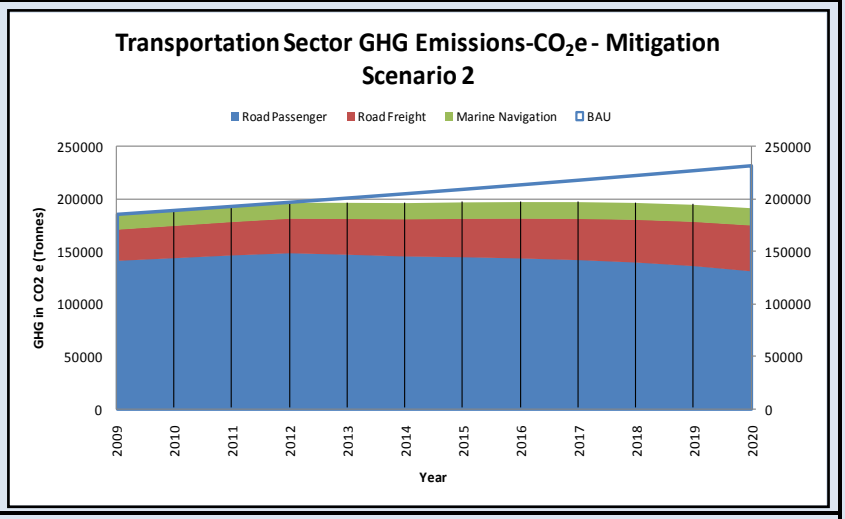
- 24.6% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020



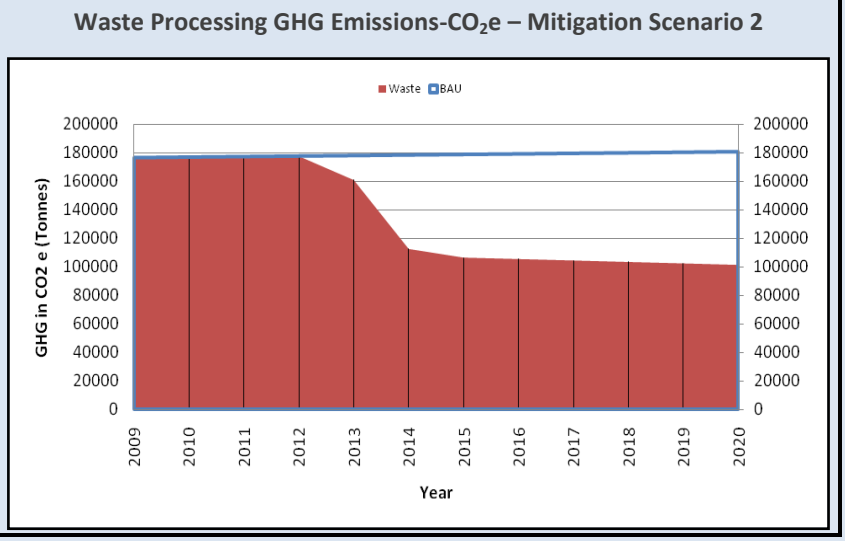
- 1.6% reduction in Agriculture, Forestry, and Fishing Sector emissions relative to baseline by 2020



- 17.5% reduction in Transport Sector emissions relative to baseline by 2020



- 43.9% reduction in Waste Sector emissions relative to baseline by 2020



3.3.5 Mitigation Scenario #2: Details by Measure

A more detailed summary of the impact on overall emissions of each individual measure in Scenario # 2 is presented below and Graphical representations for these Scenarios are included in Appendix 3. The results presented for each measure are a reflection of the assumed design of the measure and of the associated assumptions concerning its physical impacts. A more or less aggressive design would produce greater or lesser emission reductions.

Measure #17: Landfill gas capture with energy generation

Description

Implement landfill gas capture, and generate electricity using the captured gas for sale to the grid

Assumptions

Gas is captured at one of the two major waste disposal sites in Saint Lucia, starting in 2014

Impact of measure on overall Saint Lucia GHG emissions

- 6.6% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 27.3% reduction in Waste Sector emissions relative to baseline by 2020
- Measure also generates small reductions in other sectors

Additional Information

The Saint Lucia GHG inventory estimates methane emissions from landfills based on annual waste flow, in accordance with IPCC Tier 1 guidance. Accordingly, emission reductions from landfill gas capture are also derived from current current year waste quantities only.

This measure has been modelled based on capture of gas associated with 50% of the annual waste (since the facility would be established at one of two landfill sites in Saint Lucia). It is assumed that 60% of this gas is captured, i.e. a 30% gas reduction starting immediately after plant commissioning. Size of plant is estimated at 1.16 MW.

Measure #18: Demand-side management (DSM) program for electricity

Description

More comprehensive program encompassing and adding to certain Scenario #1 measures (Measures #3, 5, 11, 12, and 13), in order to increase uptake of energy efficiency and on-site renewables in the commercial, residential, industrial, and agricultural sectors

Assumptions

Impact of the defined measures is doubled

Impact of measure on overall Saint Lucia GHG emissions

- 4.1% reduction in overall emissions relative to baseline by 2020

Impact of measure on sectoral GHG emissions

- 30.5% reduction in Industry Sector emissions relative to baseline by 2020
- 7.8% reduction in Commercial and Tourism Sector emissions relative to baseline by 2020
- 7.2% reduction in Residential Sector emissions relative to baseline by 2020
- 1.6% reduction in Agriculture, Forestry, and Fishing Sector emissions relative to baseline by 2020

3.4 Analysis and Discussion

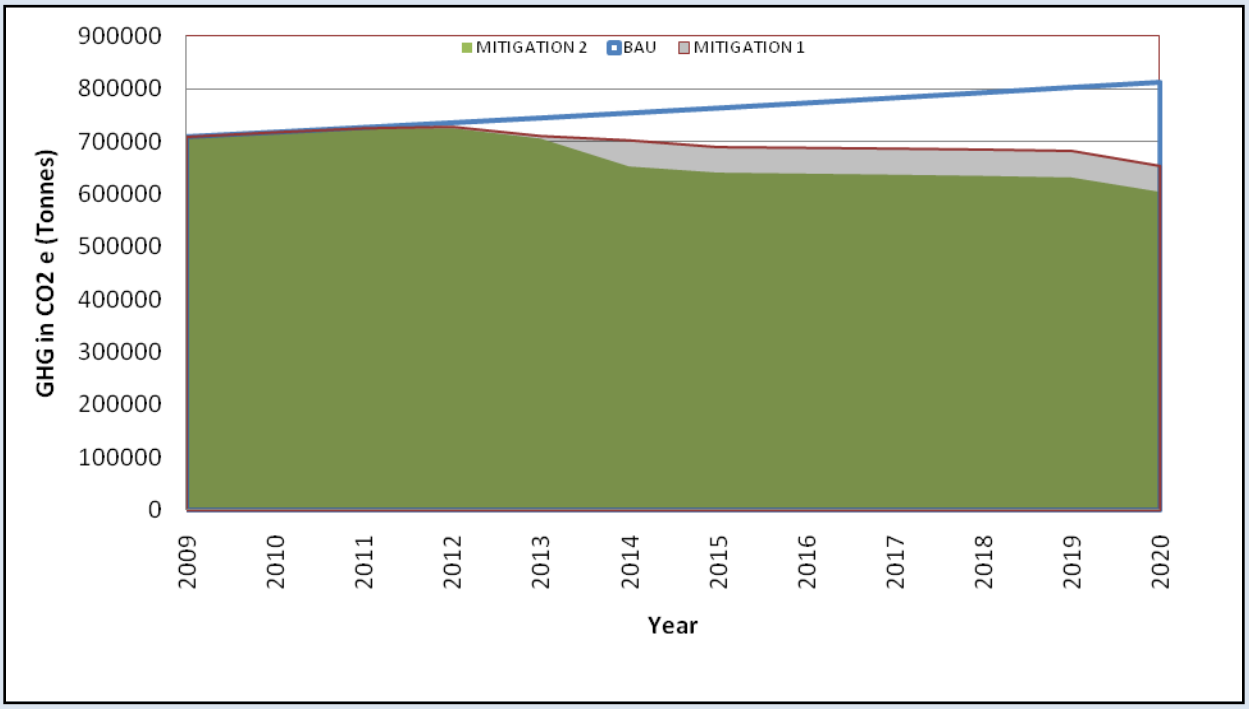
This section presents analysis and discussion of the results presented in the previous sections. The topics addressed are as follows:

1. Comparison of the impacts of Mitigation Scenarios #1 and #2
2. Comparison of the impact of the individual measures
3. Discussion on some co-benefits of the mitigation measures
4. Discussion on costs
5. Discussion on barriers, constraints, and uncertainties.

3.4.1 Emission Impacts: Comparison of Mitigation Scenarios

Figure provides a comparison of Mitigation Scenarios #1 and #2 relative to the Baseline Scenario (BAU).

Figure 1.8 Comparison of Mitigation Scenarios 1 & 2 (tonnes CO_2e)



As illustrated, Scenario #2 provides modest incremental reductions relative to Scenario #1. Specifically:

- Scenario #1 generates a 19.6% GHG emission reduction relative to the Baseline Scenario (654.1 vs. 813.4 kilotonnes)
- Scenario #2 generates a 25.7% GHG emission reduction relative to the Baseline Scenario (604.3 vs. 813.4 kilotonnes)

Mitigation Scenario #2 includes only two measures not included in Scenario #1, hence the minimal difference between the two. It was also recognised that the methodology utilised in estimating the impact of one of the Scenario # 2 measures (# 17 Landfill Gas Capture) does not

reflect the higher historic waste quantities currently in the landfill and so this particular impact may be significantly understated.

3.4.2 Emission Impacts: Comparison of Measures

Table 3.3 Comparison of Emission Reductions Relative to the Baseline Scenario

MEASURE	EMISSIONS REDUCTION (2020)
WASTE	
Measure #1: Waste reduction across sectors	5.3%
INDUSTRIAL	
Measure #2: Refrigerants phase out	0.2%
Measure #3: Fiscal measures for industrial energy efficiency	0.6%
AGRICULTURE / FORESTRY / FISHING	
Measure #4: Reforestation program for marginally used agricultural lands	1.6%
Measure #5: Measures to increase farm use of solar, biogas, & other renewables	0.1%
TRANSPORTATION	
Measure #6: Regulation for purchase of higher efficiency vehicles	2.1%
Measure #7: Transportation demand management, including a range of initiatives	5.0%
ELECTRICITY GENERATION	
Measure #8: Auto-generation and co-generation	6.0%
Measure #9: Wind farm	
COMMERCIAL AND RESIDENTIAL	
Measure #10: Improved energy efficient appliances & lighting through the use of standards	3.3%
Measure #11: EE Building Code (strengthen energy efficiency in the Building Code)	1.0%
Measure #12: Auditing for small hotels	
Measure #13: Solar water heating	0.1%
ADDITIONAL MEASURES FOR SCENARIO #2	
Measure #17: Landfill gas capture with energy generation	6.6%
Measure #18: Demand side management (DSM) program for electricity	4.1%

A number of observations can be made based on Table 3.4:

- No single measure will generate large, economy wide emission reductions. A diverse range of mitigation measures is requires for significant national impact.
- The sectors which present opportunities for relatively significant emission reductions are those which are heavily dependent on fossil fuels and which play a significant role in the country's economy (electricity generation, transportation and waste). The waste opportunities are significant as the associated GHG emissions are primarily methane (a potent greenhouse gas).
- Sectors such as industry present more limited opportunities as the sector is relatively small and makes a significantly smaller contribution to total GHG emissions compared to other sectors.
- Finally, it is important to recognize that the emission reductions generated by the measures will continue after 2020, and in some cases these emission reductions will continue to grow. In particular, the impact of measures that affect buildings, vehicles, and equipment (capital stock with long service lives) will increasingly be felt after 2020. For instance, over time Measure #11 EE Building Code will continuously improve the energy efficiency and emissions performance of the building stock as a whole, as existing buildings are upgraded and/or replaced by more efficient buildings. Similarly, this stock turnover effect will also occur in the case of measures affecting vehicles, appliances, and lighting, for instance.

3.4.3 Co-benefits

Apart from the reduction in GHG emissions there are a number of additional benefits to be realised from the measures recommended. These are as follows:

Table 3.4 Benefits and Co- Benefits of Energy Efficiency

Energy Efficiency and Renewable Energy Related benefits	Other significant Co Benefits
Reduced reliance on imported fossil fuels (through increased efficiency and use of indigenous renewable energy) resulting in improved balance of payments and improved energy security	Reduced waste disposal burden (through waste reduction)
Improved business competitiveness in the commercial and industrial sectors and strengthened household finances in the residential sector (reduction in costs due to improved energy efficiency)	Diverse benefits associated with reforestation and reduced deforestation
Benefits to the environment (e.g through reduced air emissions)	Through Transportation Demand Management, improved traffic flow adn reduced congestion
	New business opportunities and associated economic development

3.4.4 Costs

Indicative costs based on available information are presented in Table 3.5

Table 3.5 Indicative Cost Elements for the Mitigation Measures

MEASURE	COST ELEMENTS (INDICATIVE)
WASTE	
Measure #1: Waste reduction across sectors	• Cost of recycling and composting services • Cost of composting incentives • Promotional (social marketing) costs • Some off-setting revenue will be received from sale of recyclables and compost, and from reduced waste disposal costs.
INDUSTRIAL	
Measure #2: Refrigerants phase out	• Cost depends on measure design • Measure focuses on HFC phase out. Costs would therefore be additional to the cost of Saint Lucia's HCFC phase out program (HCFC budget to 2020 is US$210,000 plus US$120,000 for institutional strengthening).
Measure #3: Fiscal measures for industrial energy efficiency	• Cost of fiscal incentives (for audits and efficiency improvements) (actual costs depend on detailed program design) • For end user, substantial cost savings are available from low and no cost energy efficiency measures and from high return efficiency investments.
AGRICULTURE / FORESTRY / FISHING	
Measure #4: Reforestation program for marginally used agricultural lands	Estimated reforestation cost per hectare: • Planting material = EC$5,000 • Site preparation = EC$2940 • Planting potted plants =EC$1340 • Plantation maintenance for the first 10 yrs = EC$2300/year • Other = EC$2700 • Total = EC$34,980 per ha. Source: National Consultant
Measure #5: Measures to increase farm use of solar, biogas, & other renewables	• Estimated CIF cost for 3 kWp photovoltaic plant, grid connected: Without batteries: 3,600 to 3,800 Euro per kWp (total cost 10,800 to 11,400 Euro). With batteries: The batteries would cost about 50%

MEASURE	COST ELEMENTS (INDICATIVE)
	of the PV system's cost. Source: National Consultant. • Estimated cost for 300 cubic foot concrete chambered bio-digester: For equipment and construction, estimated cost EC$9,400. Source: National Consultant. • Cost would be partially offset by energy cost savings.
TRANSPORTATION	
Measure #6: Regulation for purchase of higher efficiency vehicles	• For otherwise equivalent vehicles, increased fuel efficiency may increase new vehicle purchase price. (Increased fuel efficiency is also available through cost-saving changes such as reduced vehicle size, reduced engine size, and other purchase choices.) • Increased purchase price will normally be offset by reduced fuel costs. Fuel economy regulations balance financial and economic costs and savings.
Measure #7: Transportation demand management, including a range of initiatives	• Promotional (social marketing) costs • Potentially some cost for investment in tools to support improved public transport or facilitate other TDM approaches such as car pooling and telework.
ELECTRICITY GENERATION	
Measure #8: Auto-generation and co-generation and Measure #9: Wind farm	• For wind power: Between US$655-675 per installed kW, with additional US$18 per kW O&M cost. Source: LEAP database (DOE reference for turbines available in year 2010). Revenue from sale of power would depend on negotiated Power Purchase Agreement with LUCELEC. • For co-generation: No information specific to Saint Lucia; however co-generation can be an attractive investment where technical and utility/financial conditions are favourable.
COMMERCIAL AND RESIDENTIAL	
Measure #10: Improved energy efficient appliances & lighting through the use of standards	• Costs for energy efficiency standards for appliances and lighting can be minimized through harmonization with established standards in other jurisdictions. • For the end user the incremental cost of efficient appliances and lighting is recovered through energy

MEASURE	COST ELEMENTS (INDICATIVE)
	savings, particularly relative to highly inefficient products that are often imported into unregulated markets.
Measure #11: EE Building Code (strengthen energy efficiency in the Building Code) **Measure #12: Auditing for small hotels**	• Cost of development of an EE Building Code • Cost of implementation of the Code (cost depends on the degree to which implementation can be integrated with implementation of the existing Building Code). • Cost of small hotel audits: variable, but the cost of walk-through level audits is low (1-2 days per facility for an audit professional). • For the building owner the incremental cost of a more efficient building should be recovered through energy savings, provided the Code and audits focus on the most cost-efficient measures.
Measure #13: Solar water heating	• For a typical home of 4, the cost is between EC$3500 to EC$4500 for a 52 to 80 gallon system. Source: National Consultant. • Cost would be partially offset by electricity cost savings.
ADDITIONAL MEASURES FOR SCENARIO #2	
Measure #17: Landfill gas capture with energy generation	• Capital cost between US$970 - 5400 per installed kW. Additional O&M cost of US$110 - 350 per kW. Source: U.S. EPA 2009. • Revenue from sale of power would depend on negotiated Power Purchase Agreement with LUCELEC.
Measure #18: Demand side management (DSM) program for electricity	• Cost of measure depends on program design and approach adopted (technical support, incentives, promotion, etc.). • For the end user, part or all of the incremental cost of efficiency improvements is likely to be recovered through energy savings.

In addition, the costs of the three supportive cross-cutting measures also need to be considered:

- Measure #14: Public awareness program
- Measure #15: Support the development of energy service companies
- Measure #16: Capacity building initiative for energy efficiency and GHG specialists.

These costs are dependent on measure design. In each case the costs are "soft" costs (as opposed to hard infrastructure costs), and the specific activities to be undertaken are scalable with respect to level of effort, reach, and duration. This provides considerable flexibility in the measure design, and corresponding flexibility in measure cost.

For all measures, the overall cost of program administration must also be considered. Many of the measures are closely related, allowing for coordinated or integrated program delivery arrangements and associated cost efficiencies.

3.4.5 Barriers and Uncertainties

Barriers

The barriers or challenges to implementation identified for Saint Lucia as it moves forward to reduce GHG emissions are as follows:

- **Technical barriers:** Although there are a wide range of technically mature GHG reduction options available, some of these have not been demonstrated at a scale suitable for Saint Lucia. The professional and technical skills required for some of these technologies are also not readily available or may require infrastructure or other support that does not exist..

- **Economic and Financial barriers:**
  A wide range of economic and financial barriers can impede climate change mitigation. At the simplest level, the cost of some measures can exceed available financial resources or may represent a financial risk that governments, the private sector, or individuals are unwilling to take. For some measures this could be a particular problem in Saint Lucia, where the small size of the market and the economy may increase costs. In addition, import duties and other factors often increase costs for some types of equipment. Obtaining financing for actions that reduce GHG emissions may also be challenging, presenting a further barrier to action.

- **Institutional Barriers:** The strong institutional delivery capacity required to ensure program success for some of the proposed measures, include technical, financial and managerial capabilities. Any institutional weakness in these areas or any lack of clarity with respect to institutional mandates, would act as a barrier to implementation of mitigation measures.

In detailing the designs for the individual measures, consideration will need to be given to overcoming barriers which will potentially reduce the effectiveness of these measures.

Uncertainties

There is great uncertainty in the emissions projected for each of the Baseline and Mitigation Scenarios as this analysis is only based on a defined set of future events and plausible assumptions. As well, there are significant data gaps (many of the demographic, economic, and

technical variables which will affect future emissions are unknown and unknowable). The modelling results are therefore indicative rather than definitive.

As a conventional sensitivity analysis was beyond the scope of the study, the consultants a tested the interactive effect of varying the results for the Baseline and Mitigation Scenarios. The interactive impact of the following was tested:

- Varying the GHG emissions growth in the Baseline Scenario by ±25%
- Varying the aggressiveness of the Mitigation Scenarios by ±25%

Table 3.6 presents the emissions that would be expected under these modified sets of assumptions.

Table 3.6: Alternative Emissions Growth and Mitigation Scenarios

	GHG emissions (tonnes (CO_2e)		
	As modelled Minus 25%	**As modelled**	**As modelled Plus 25%**
Baseline Scenario			
2008	700,807	700,807	700,807
2020	785,284	813,443	841,602
Mitigation Scenario #1 2020			
25% less aggressive	669,918	693,940	717,962
As modelled	631,463	654,106	676,749
25% more aggressive	593,008	614,272	635,536
Mitigation Scenario #2 2020			
25% less aggressive	633,833	656,562	679,290
As modelled	583,350	604,268	625,186
25% more aggressive	532,866	551,974	571,082

The two extreme scenarios presented in Table 3.6 show the following results:

- **Highest baseline emissions + least aggressive mitigation:** 2020 emissions are 717,962 tonnes of CO_2e (2.4% above 2008 levels)
- **Lowest baseline emissions + most aggressive mitigation:** 2020 emissions are 532,866 tonnes of CO_2e (24.0% below 2008 levels).

3.5 IMPLEMENTATION PRIORITIES

The following screening criteria are proposed for use in identifying the priority mitigation measures for early implementation. These criteria were derived from the original screening criteria and adapted for use at this subsequent stage in the mitigation planning process.

- Potential for large impact on greenhouse gases (GHGs)
- Feasibility of early implementation
- Potential co-benefits
- Cost to Saint Lucia (considering return on investment & availability of international funding).

A preliminary screening of Mitigation Scenario #1 measures was undertaken applying the first criterion above: Potential for large impact on GHG emissions. The results are presented below in Table 3.7. Measures that generate emissions reductions of 1% or less were assigned a low rating (L); 1% to 5% were assigned a medium rating (M); and 5% and above were assigned a high rating (H).

Table 3.7 Implementation Screening: Emissions Reduction

MEASURE	EMISSIONS REDUCTION (2020)	EMISSIONS IMPACT
WASTE		
Measure #1: Waste reduction across sectors	5.3%	**H**
INDUSTRIAL		
Measure #2: Refrigerants phase out	0.2%	**L**
Measure #3: Fiscal measures for industrial energy efficiency	0.6%	**L**
AGRICULTURE / FORESTRY / FISHING		
Measure #4: Reforestation program for marginally used agricultural lands	1.6%	**M**
Measure #5: Measures to increase farm use of solar, biogas, & other renewables	0.1%	**L**
TRANSPORTATION		
Measure #6: Regulation for purchase of higher efficiency vehicles	2.1%	**M**
Measure #7: Transportation demand management, including a range of initiatives	5.0%	**H**
ELECTRICITY GENERATION		
Measure #8: Auto-generation and co-generation and	6.0%	**H**
Measure #9: Wind farm		
COMMERCIAL AND RESIDENTIAL		
Measure #10: Improved energy efficient appliances & lighting through the use of standards	3.3%	**M**
Measure #11: EE Building Code (strengthen energy efficiency in the Building Code)	1.0%	**L**
Measure #12: Auditing for small hotels		
Measure #13: Solar water heating	0.1%	**L**

Only measures assigned an M or H rating were carried forward as possible priorities for early implementation. These measures were further evaluated relative to the remaining criteria: feasibility, co-benefits, and cost to Saint Lucia. In addition the three cross-cutting measures (Measures #14, #15, and #16) were evaluated against the remaining criteria.

Table 3.8 presents the results of this illustrative screening process. The scoring was done informally on a relative scale; values are not absolute.

Table 3.8 Implementation Screening: Other Criteria

MEASURE	EMISSIONS IMPACT	FEASIBILITY	CO-BENEFITS	COST TO SAINT LUCIA	EARLY PRIORITY?
WASTE					
Measure #1: Waste reduction across sectors	H	M	H	$$	YES
AGRICULTURE / FORESTRY / FISHING					
Measure #4: Reforestation program for marginally used agricultural lands	M	H	H	$$	YES
TRANSPORTATION					
Measure #6: Regulation for purchase of higher efficiency vehicles	M	M	H	$$$	PHASE 2?
Measure #7: Transportation demand management, including a range of initiatives	H	M	H	$$	YES
ELECTRICITY GENERATION					
Measure #8: Auto-generation and co-generation and	H	H	H	$$	YES
Measure #9: Wind farm					

MEASURE	EMISSIONS IMPACT	FEASIBILITY	CO-BENEFITS	COST TO SAINT LUCIA	EARLY PRIORITY?
COMMERCIAL AND RESIDENTIAL					
Measure #10: Improved energy efficient appliances & lighting through the use of standards	M	H	H	$$	YES
CROSS-CUTTING MEASURES					
Measure #14: Public awareness program	NA	H	H	$$	YES
Measure #15: Support the development of energy service companies					
Measure #16: Capacity building initiative for energy efficiency and GHG specialists					

Based on this illustrative screening, all measures presented in **Error! Reference source not found.** would be candidates for priority focus and early implementation in Saint Lucia, except for Measure #6. The other measures in Mitigation Scenario #1, and the measures in Mitigation Scenario #2, remain valid and potentially important, but would be considered as part of a second phase of implementation activity.

3.6 RECOMMENDATIONS: WAY FORWARD

3.6.1 Future Mitigation Assessments[2]

Saint Lucia's future National Communications under the UNFCCC will require preparation of updated Mitigation Assessments, likely on a more frequent basis than in the past.

[22] Marbek, 2011: Saint Lucia Climate change Mitigation Assessment Final Report. P 64

In addition, elements of the Mitigation Assessment process can contribute to ongoing planning of mitigation action in Saint Lucia, as discussed in the next subsection of this report.

Capacity building is required to strengthen Saint Lucia's ability to prepare future Mitigation Assessments, and to strengthen the content and accuracy of these assessments. The key requirements outlined in the *National Inventory of Greenhouse Gases for Saint Lucia*, prepared by Marbek in 2008, are broadly applicable to mitigation assessments as well. Some of the key recommendations in this regard are as follows:

- Specific efforts to address key data gaps identified during this mitigation assessment and documented throughout this report.
- Expanded training of government staff and local consultants to do research, data collection and analyses required to reduce Baseline and Mitigation Scenario uncertainties and improve the quality of input data.
- Periodic updating of the emission inventory and baseline and mitigation scenarios (say every two years). The main benefit is that stakeholders can remain engaged in the inventory and mitigation assessment process, producing steadily improving results and supporting ongoing mitigation planning and action.
- Establishment of a data repository that would house and store the inventory and mitigation assessments, information sources, assumptions, and methodologies for future reference. For reasons of capacity and mandate, it is recommended that the data repository be housed at the Sustainable Development and Environment Division (SDED).

3.6.2 Ongoing Mitigation Planning and Implementation

This Mitigation Assessment is an essential contribution to Saint Lucia's Second National Communication to the UNFCCC, but it can also make an important contribution to continuing Mitigation Planning and Implementation within the country.

The work undertaken as part of this Mitigation Assessment has helped identify GHG emission reduction priorities and opportunities in all sectors in Saint Lucia, addressing all priority emission sources. In addition the assessment process built on previously adopted government policy documents and worked with stakeholders to identify a set of high priority mitigation measures that are appropriate for implementation in the Saint Lucia context. Finally, the analysis undertaken as part of this assessment has provided valuable information on the emission reductions that may be available through these defined measures.

Based on this foundation, the next key step is to further develop the outputs of this assessment into a concrete climate change mitigation strategy and implementation plan, including specific measures and actions. Key steps in this process would include the following:

- Further validation of the findings of the mitigation assessment with national experts and stakeholders

- Setting/confirming priorities for action through a stakeholder workshop, potentially building on the illustrative priorities outlined in Section 6 above.

- Completion of detailed design and analysis of individual measures to confirm feasibility, implementation requirements, and financial/funding needs.

- Development of a draft implementation plan for consultation, followed by revision, finalization, and approval.

- Securing of budgetary commitments, partnerships, and other implementation requirements for the priority mitigation measures/actions, followed by active implementation.

- Particularly in the case of NAMA-related initiatives (see below), undertaking measurement, reporting, and verification activities (MRV) during implementation.

As a developing country signatory to the UNFCCC, the concept of Nationally Appropriate Mitigation Actions (NAMAs) is highly relevant to Saint Lucia. The UNFCCC COP16 in Cancun Mexico established a registry for NAMAs planned/undertaken by developing countries, and enhanced procedures on MRV.

With this framework in place, countries will have a mechanism to register their mitigation initiatives as NAMAs, and in some cases should be able to secure funding from international sources to implement these NAMAs. The measures included in the Mitigation Scenarios in this report are, demonstrably, nationally appropriate for Saint Lucia and fully suitable for consideration as NAMAs. Continued development of the mitigation strategy and implementation plan referred to above, and detailed design of individual measures, should put Saint Lucia in a strong position to seek support for these measures via the NAMA mechanism.

Chapter 4: Measures to Facilitate Adequate Adaptation to Climate Change

CHAPTER 4: MEASURES TO FACILITATE ADEQUATE ADAPTATION TO CLIMATE CHANGE

4.1 VULNERABILITY & ADAPTATION SECTION OVERVIEW

Saint Lucia has a fragile economy which has been evolving over the years from one being heavily dependent on Agriculture, primarily banana production to one which is dependent on Tourism and Other Services. The development of various key sectors, are critical to the economic growth of the country. Therefore any impact of climate change on these sectors could have far reaching repercussions on the economy of the country and affect life in general.

In light of the concerns regarding the island's vulnerability to climate change, there have been initiatives undertaken to date in an effort to assess the impact of climate change on Saint Lucia. In the Vulnerability and Adaptation Assessment of the Iniatial National Communication, a number of sectors were reviewed and the anticipated impacts of climate change on the country's water resources were highlighted. This Second National Communication builds on that previous work through a comprehensive assessment of the sector's vulnerability to the anticipated impacts of climate change and the adaptation options to be pursued.

Emerging weather anomalies globally and locally, as well as weather-related events have exposed critical vulnerabilities as well as the impacts these may have on sustainable national and human development. Two landmark events in the country have been the drought conditions in 2009/10 and Hurricane Tomas in October 2010:

- The drought, which was the worst in approximately 40 years, caused severe damage to the Agriculture sector, and in particular the banana industry. It also exposed the inadequacies of the water sector, particularly as it relates to adequacy of the existing systems and storage in general.

- Hurricane Dean in 2007 and more recently Hurricane Tomas in 2010 exposed other vulnerabilities of the country and its human and economic systems. Extensive landslides, severe flooding and damage to housing and critical infrastructure point to the urgency with which land use, development control, building and design standards need to be addressed. The cost of Hurricane Tomas to the economy was provisionally estimated to be in excess of three hundred and fifty million United States dollars (US$350 million).

The impact of Hurricane Tomas has underscored the urgency with which small, open economies like Saint Lucia must define their vulnerabilities to the impacts of climate change and formulate and implement appropriate policies and measures to adapt to those changes. In so doing, it is important to bear in mind that climate related impacts are not the only threats to the sustainable development of Small Island Developing States, but exacerbate the vulnerabilities inherent in small, open economies dependent on fragile natural resources, an unpredictable and fickle service sector, for social and economic development.

Poor land use planning and associated squatter developments, deforestation and developments in disaster prone areas have exacerbated vulnerabilities while the absence of approved building codes and standards has resulted in a housing stock prone to damage by floods, landslides and high winds. Coral bleaching, physical damage from anchors, suffocation from silt carried in river runoffs and storm damage have reduced the area of coral reefs, with associated increased vulnerability of the coastline to storm activity. This condition is exacerbated by the significant loss of mangals to tourism development and charcoal production.

In considering the outputs of this V&A assessment, therefore, consideration must be given to the fact that climate change impacts are being superimposed on an already vulnerable environment. It is also worth noting that Saint Lucia has actually started experiencing impacts of climate variability and change that have been projected for the future. Under the circumstances, response measures will include no-regrets solutions that are recommended whether or not they are in response to climate change. The water sector has also been used as a case study of integrated assessment to focus discussion on the cross sectoral nature of climate change impacts and adaptation.

4.2 RESULTS OF CLIMATE & SEA LEVEL RISE SCENARIOS

Climate Variability & Current Trends

In an effort to assess the vulnerability due to climate change it is important to appreciate the projections of changes in climatic conditions. Some of these changes are reflected below.

Current temperature projections suggest that:

1. *Minimum temperatures have increased at a rate of ~0.16° C per decade, and maximum temperatures at ~0.20° C per decade.*
2. *The warming trend is expected to continue. The country is projected to be warmer by up to 1° C by the 2020s, 2° C by the 2050s, and 3° C by the 2080s.*
3. *The projected rate of warming is marginally more rapid for December, January, February (DJF) and September, October, November (SON).*
4. *The frequency of very hot days and nights will increase, while very cool days and nights will decrease.*
5. *In general, sea surface temperatures in the Caribbean are projected to warm, perhaps up to 2°C by the end of the century.*

Observations at Hewanorra International Airport indicate that the maximum temperature demonstrates a steady increase of about 0.2 degrees Celsius per decade. This is consistent with the model projections. The minimum temperature on the other hand increased almost steadily from the 1970s to the 90s, then decreased slightly in the 2000s.

Observations suggest that mean annual precipitation shows a steady increase from the 1970s to the 1980s, but remained almost constant in the 1980s and 1990s and decreased slightly in the 2000s. An increase in intense tropical cyclone activity in the North Atlantic since about 1970 has been correlated with increases of tropical sea surface temperatures. Natural variability and the

quality of tropical cyclone records prior to 1970, result in complications in the detection of long-term trends in tropical cyclone activity.

In terms of rainfall, it has been found that:

1. There is no statistically significant trend in historical rainfall which shows considerable inter-annual variability
2. There is a likelihood that the country will be drier (in the mean) by the end of the century. GCMs show a median decrease of up to 22% for annual rainfall while the RCM suggests a decrease of up to 57% by the end of the century.
3. Median GCM decrease in rainfall is 4-6% by the 2030s, 5-10% by the 2050s and 10-23% by the 2080s.
4. The proportion of total rainfall that falls in heavy events also decreases in most GCM projections, changing by -26% to +6% by the 2090s.
5. Climate change will likely make the dry period early in the year and June-July drier.
6. Median GCM decrease in rainfall is 4-6% by the 2030s, 5-1
7. The proportion of total rainfall that falls in heavy events also decreases in most GCM projections, changing by -26% to +6% by the 2090s.
8. Climate change will likely make the dry period early in the year and June-July drier.

Climate Change Scenarios

Saint Lucia's climate change modelling is based on the A2 global emissions scenarios. The A2 scenarios are of a more divided world and as such this A2 family of scenarios is characterized by: a world of independently operating, self-reliant nations; continuously increasing population; regionally oriented economic development; and slower and more fragmented technological changes and improvements to per capita income.

The A2 story line is also characterized by heterogeneity. Self-reliance and local identities are emphasized, and population increases continuously. Population reaches over 10 billion by 2050. Economic development is regionally oriented and economic and technological development is relatively slow, compared to the other story lines. From these major factors, and using Integrated Assessment Models (IAMs), emissions of the major greenhouse gases were developed for the 21st century. Cumulative CO_2 emissions by the middle and end of the 21st century are projected to be about 600 and 1850 GtC respectively, and expected CO_2 concentrations (in parts per million, ppm) for the middle and end of the 21st century in this scenario are about 575 and 870 ppm, respectively. The current concentration of CO_2 is about 380 ppm. Methane and nitrous oxide increases grow rapidly in the 21st century. Sulphur dioxide increases to a maximum value just before 2050 (105 MtS/yr) and then decreases in the second half of the century (60 MtS/yr by 2100).

The A2 scenario is at the higher end of the SRES emissions scenarios (but not the highest), and this is preferable because, from an impacts and adaptation point of view, if one can adapt to a larger climate change, then the smaller climate changes of the lower end scenarios can also be adapted to. A low emissions scenario potentially gives less information from an impacts and adaptation

point of view. In addition, the current actual trajectory of emissions (1990 to present) corresponds to a relatively high emissions scenario.

Optimistically, the B1 scenarios have also been considered and contribute to the determination of possible climate change impacts. The B1 scenarios are of a world more integrated, and more ecologically friendly. The B1 scenarios are characterized by: rapid economic growth as in A1, but with rapid changes towards a service and information economy; population rising to 9 billion in 2050 and then declining as in A1; reductions in material intensity and the introduction of clean and resource efficient technologies; and, an emphasis on global solutions to economic, social and environmental stability.

Rainfall predictions

Historical data, when compared to future scenarios based on Global Climate Models (GCM) and Regional Climate Models (RCM), show that there is a discernible change in the rainfall pattern for the island. The GCMs show less rainfall for Saint Lucia in the future, with annual projections varying from -25 to +18% in the 2030s, -40 to +10% in the 2060s and -56 to +15% in the 2090s. RCMs also predict less rainfall for the island on an annual basis, ranging from 27% and 57% less annual rainfall by the end of the century.

Generally, largest seasonal changes are seen in June, July, August and March, April, May for both GCMs and the RCM. Again the trend analysis shows that dry periods will 3increase. The data also reveal that the proportion of total rainfall in 'heavy' events decreases by as much as 26% by the end of the century. Greatest decrease is evident in March, April, May, with a possibility of increase from September to November.

These observations and model projections demonstrate that Saint Lucia must be prepared to respond to the number of cross-sectoral issues which will arise over the medium-to-long term as a result of the drier periods which are anticipated.

Temperature predictions

The GCM shows that mean temperatures for Saint Lucia will increase significantly over the 21st century. GCMs project changes of between 1C and 4C by the end of the century, dependent on which scenario is used, with mean annual increases of up to 1.2C by the 2030s, 2.1 C by the 2060s, and 3.6C by the 2090s. This is similar to what obtains with RCM, which shows increases in mean annual temperature ranging from 1.9 - 2.4C by the end of the century.

The scenario is the same for seasonal changes throughout the century. GCMs show greater seasonal warming occurring from September to November under the A2 and from December to February under the B1 scenario. The RCM similarly projects greater increases in summer temperatures under the high emissions scenario (A2) by the end of the century, and from September to November and from December to February under the low emissions scenario (B2).

All models project increased frequency of hot days and nights towards the end of the century irrespective of emission scenarios. A very hot day (night) is defined as one with temperatures

greater than the hottest 10% of days (nights) in the current climate. Similarly, very cool days (nights) are those with temperatures less than the coolest 10% of days (nights) in the current climate. By the 2060s, 28-68% of all days and nights in a given year would be classified as very hot by present day standards, with this rising to 37-100% by the end of the century. On the contrary, cold days and nights show marked decreases under all models and all scenarios, and are almost nonexistent by the 2060s. These trends are consistent with historical data for the Caribbean region presented in a study by Peterson *et al*. in 2002.

Hurricanes predictions

GCMs and RCMs do not explicitly model hurricanes. Notwithstanding, projections from the IPCC suggest that future hurricanes of the north tropical Atlantic will *likely*[1] become more intense, with larger peak wind speeds and heavier near storm precipitation. According to Barnett *et al* (2005), stronger hurricanes will result from ongoing and projected increases in tropical ocean temperatures (from surface through 450m) and atmospheric water vapour content. The research suggests that increases in both variables can be linked to warmer air temperatures. The warmer ocean temperatures would satisfy the warm sea surface temperature criterion for hurricane intensification but would also likely limit a natural 'braking' process of hurricanes. Colder Calibri deeper waters typically serve to weaken a storm as they are churned up by the strong wind field. If deeper waters become too warm, the natural braking mechanism will be diminished.

A wind speed study by Vickery (2008) commissioned under the SPACC project in Saint Lucia concluded that the impact of climate change on hurricane will result in 3-4 category V and IV hurricanes on an annual basis by 2025. This is a significant change from the previous longer-term average of 1.4 category V and IV hurricanes on an annual basis in the Atlantic Basin.

Ocean acidification

Although the natural absorption of CO_2 by the world's oceans helps mitigate the climatic effects of anthropogenic emissions of CO_2, it is believed that the resulting decrease in pH will have negative consequences, primarily for oceanic calcifying organisms. As ocean pH falls, so does the concentration of carbonate ions, and when these ions become under-saturated, structures made of calcium carbonate are vulnerable to dissolution. Even if there is no change in the rate of calcification, the rate of dissolution of calcareous material increases. Research has already found that corals, coccolithophore algae, coralline algae, foraminifera, shellfish and pteropods experience reduced calcification or enhanced dissolution when exposed to elevated CO_2. Aside from calcification, organisms may suffer other adverse effects, either directly as reproductive or physiological effects (e.g. CO_2-induced acidification of body fluids, known as hypercapnia), or indirectly through negative impacts on food resources. Ocean acidification may also force some organisms to reallocate resources away from feeding and reproduction in order to maintain internal cell pH (i.e. expenditure of extra energy to run proton pumps). Overall, this would mean potentially reduced production for calciferous marine resources (molluscs, crustaceans,

[1] In the IPCC Summary for Policymakers, the following terms have been used to indicate the assessed likelihood, using expert judgment, of an outcome or a result: *Virtually certain* > 99% probability of occurrence, *Extremely likely* > 95%, *Very likely* > 90%, *Likely* > 66%, *More likely than not* > 50%, *Unlikely* < 33%, *Very unlikely* < 10%, *Extremely unlikely* < 5%.

corals, echinoderms and some phytoplankton) and ecologically related species and declines in yields.

SLR scenarios

Ocean expansion (due to warming) and the inflow of water from melting land ice, have raised the global sea level over the last decade. There are large deviations among the limited set of models addressing the issue. This, unfortunately, makes future estimates of sea level for any region uncertain.[2]

Therefore, Taylor posits that it is not currently possible to project sea level rise for Saint Lucia. However, it is anticipated that changes in the Caribbean area will be near to the global mean. Under the A1B scenario, sea level rise within the Caribbean is expected to be between 0.17 m and 0.24 m by 2050 (IPCC 2007). For comparison, global sea level rise is expected to average 0.35 m (0.21m to 0.48m) under the same scenario by the end of the century (relative to the period 1980-1999). It is important to note, however, that changes in ocean density and circulation will ensure that the distribution of sea level rise will not be uniform across the region.

Soomer *et al* in a 2009 study, juxtaposed projected sea level rise of 0.24m on a model utilized by Cambers (1997) for Saint Lucia and scenarios for 2020, 2050 and 2070 sea level rise were generated. The objective of using this model was to calculate the minimum building line or setback within which construction should be permitted. The results of this study suggest that sea level rise will cause the shoreline to recede. The extent of the shoreline retreat as a result of sea level rise has serious implications for the planning of coastal development. This leaves no doubt that sea level rise will adversely impact the coast and coastal development. This, in turn, has implications for how the Saint Lucia considers such developments.

4.3 RESULTS OF THE IMPACTS ASSESSMENTS

Agriculture and tourism, the key economic sectors (as well as all other sectors) are expected to be affected by all the anticipated impacts of climate change. In addition, the anticipated negative impacts on social and economic infrastructure such as housing, water, agriculture, ports, schools, hospitals, tourism plants, health services, communications, *inter alia*, are likely to cause major social and economic stresses which can be alleviated by appropriate and timely adaptation measures. Another noteworthy conclusion is that all the anticipated impacts are likely to trigger some form of hazard, which may result in a disaster. These impacts include coastal erosion, loss of near shore housing and critical infrastructure, damage to properties and threat to life and livelihoods associated with increases storm intensity, heat related health impacts, landslides, loss of agricultural production and biodiversity, forest fires and damage to forest ecosystems due to wind damage. Any response measure to be implemented will have cross-cutting, multi-sectoral impacts.

[2] Taylor, Michael. Saint Lucia: Current Climate, Future Projections, 2008

This assessment was conducted against the backdrop of environmental and socio-economic conditions which have evolved over time. As such, coping with the anticipated impacts of climate change pose a greater challenge than would have been the case if local traditions had persisted or climate considerations had a greater influence on development, or both.

4.3.1 Agriculture and Food Security

Environmental impacts on agriculture ecosystems are likely to occur under climate change scenarios, particularly with respect to reduced precipitation, extreme events and to a lesser extent sea level rise. This is possible as areas of current microclimatic conditions are lost, and large-scale ecosystem shifts occur either in an acute manner such as in the case of extreme weather events, or though more chronic progression as in the case of annually reducing precipitation. The resultant changes in/replacement or loss of habitats due to either damage or destruction caused by climatic factors are likely to lead to loss in the diversity of habitats and species. While it may be difficult to predict the exact shifts in these areas, some extent of displacement or even loss of these areas to agricultural production is envisaged under the different climate scenarios, causing a dislocation of production and decline in availability of agricultural produce, as well as other attendant issues, such as food scarcity and increased cost of food products.

The various threats posed by climate change, particularly in respect of sea level rise and reduced precipitation are expected to further affect the quality of existing lands that are suitable for agriculture. The impacts of the foregoing include decreased crop yields and overall production levels as a result of decreasing acreages under production arising from land renunciation (abandonment). Given that the island's economy is still dependent on agricultural for export earnings, to support employment and to ensure food availability, climate change poses a substantial threat to the economy and to the nation's food security. The situation is grave when climate change impacts are combined with existing socio-economic and environmental pressures on our agricultural sector.

4.3.2 Coastal Sector

As the area of most economic activity on Saint Lucia, the coastal sector has been assessed for its vulnerability in the context of agricultural production, water supply, fisheries, tourism and coastal resources. It is expected that there will be impacts of sea level rise, extreme changes in precipitation patterns, storms and increased frequency of El Nino events on the sector. Climate change is likely to have both direct and indirect and largely negative effects on tourism while adding to stresses such as pollution and further compromise the long-term viability of coastal (and near-shore) ecosystems. Significant damage to fish landing sites, fish markets, fishermen's locker rooms, and other onshore facilities, could result from any increase in the frequency of intensity of extreme events such as floods, tropical storms and storm surges and while shipping is said to be one of the least affected sectors by climatic change, there is nonetheless need to factor in new/emerging issues such as coastal flooding and restricted access to ports, shifting zones of storminess and potentially stronger hurricanes. It is also suggested that coastal vulnerabilities will increase in light of the realisation of the National Vision Plan.

4.3.3 Critical Infrastructure

Infrastructure is particularly vulnerable to the impacts of climate change, particularly to storm and high rainfall events. This is further exacerbated by Saint Lucia's topography and the location of some of the island's most critical infrastructure along the coast line. Impacts would include (but not be limited to) greater inundation/erosion/ threat/loss of low-lying/coastal development and communities; loss of recreational value and carrying capacity of beaches; poor operational performance of inundated municipal and household septic systems, contaminating drainage and water supplies; reduced capacity/ performance of drainage infrastructure and bridges, increasing risk of flooding in low-lying coastal areas; interruptions in local, regional and international communication resulting from damage to and/or destruction of critical infrastructure; loss of access (temporary/permanent) to, damage or destruction of, critical infrastructure such as coastal roads and bridges, disruptive to several types of economic, social and cultural activities.

4.3.4 Human Settlements and Population Distribution

Since the study area for the assessment is the entire island system, for the purposes of comparison and other forms of analysis, the Human Settlements Sector Team adopted the quadrant systems approach of the Saint Lucia National Vision Plan. In support of the general approach outlined above, the team: focused on the use of local expertise; engaged in comprehensive research to ensure the production of information that is current, relevant and accurate; consulted within and across sectors; and, sought opportunities for integration in recognition of the fact that climate change is cross-cutting, requiring interdependence amongst sectors and the need for one voice to advance the issues.

Given the broad nature of the terms of reference for the assessment, the Human Settlement Sector Team recognized the need to first define the parameters of the Human Settlements Sector, identify areas of overlap with other sectors and consult with the relevant team leaders to determine and discuss the division of labour and focus for each sector team. The approach recognized that Climate Change is inherently a multi-sectoral issue and as such, the Vulnerability and Adaptation Assessment required unreserved collaboration between Sector Teams. The analysis considered existing frameworks / initiatives to address current vulnerability; assessment of future vulnerability; and, proposed adaptations. The team also considered the impact on the main livelihood sectors, namely, agriculture, tourism and the coastal sector.

The impacts on the human settlements sector mirror those seen for the agriculture, coastal, critical infrastructure and tourism sectors as a result of the linkages between and overlap among them.

4.3.5 Forest and Marine Biodiversity

Biological diversity (biodiversity) has been considered in terms of its two main components in Saint Lucia's naturally occurring ecosystems – forest and marine.

Saint Lucia has a relatively large and well managed forest cover. Of a total area of 61,500 ha, the island has a forest cover of 48,133.53 ha, of which 9,186 ha is the protected forest reserve and 14,170 ha is private forests. Table 3 below presents the

island's vegetation cover as of 2009. In addition to serving as a significant sink for greenhouse gases, the forest reserve is the primary source for potable water and a source of livelihood for guides and operators who conduct guided tours along the forest trails. However, the forest is under pressure from demands for housing, tourism and agricultural lands which, if not controlled, will reduce the country's resilience to the impacts of climate change, particularly in the water sector.

Forest Biodiversity can be easily impact on negatively by unusual temperature variations, droughts, floods, wind damage and landslides associated with extreme weather events. Historical effects of climate variations substantiate this potential climate change impacts. The impacts are expected to be many and varied and in addition to impacts on the flora, will also impact on the fauna which rely on the health and extent of the forest for their survival. These impacts may include drought impact on forest ecosystems and habitats; loss of riparian habitats and impacts on dependent habitat species; significantly reduced stream flow and this specialized habitat would be lost as more drought-resistant species would invade former riparian areas and alteration in the range of species. Additionally, increased intensity of rainfall events leads to increase in land slippage, high erosion, increased sedimentation loads in watersheds, while reduced annual rainfall may lead to ecosystem shifts and increased vulnerability of endangered species as well as reduced water flow in watersheds. Numerous openings in the landscape may cause the forest to be less resistant to strong winds and therefore less resilient to natural disasters. In instances like this, flooding occurs in the major valleys and along the coastal areas when landslides carry tons of soil and debris, thereby affecting river channels and consequently the normal flow of these watercourses. At the same time, with the openings in landscape, wildlife can become exposed to the strong winds, storm surges and geographic displacement of individuals

Saint Lucia also has a rich marine ecosystem, which is beginning to show signs of stress. A total of approximately 250 reef fish species and 50 coral species have been identified for the island. Marine ecosystems include coral reefs, mangals and sea grass beds. Saint Lucia's marine biological resources are part of its capital for development. In addition, the health of the country's fisheries, as well as its tourism sector, is tied to the health of its marine environment whose vulnerability is likely to be exacerbated by the anticipated effects of climate change and, as a consequence, to have a significant impact on the natural, social and economic environment of the country.

Whereas increased storm events are predicted to cause physical damage to coral systems and impact negatively on nursery habitats, there will also be direct biological impacts on marine biodiversity. These include destruction of unique coastal and marine habitats (increase in coral bleaching events, could cause the destruction of major reef tracts and mangroves); increased intensity of rainfall events leads to increase in sedimentation on

near-shore coral reefs; reduced reproductive frequency of endangered turtles; photosynthetic groups utilize higher CO_2 availability to increase their biomass; reduced profitability of fisheries; inundation of wetlands, beach erosion, intensified flooding, and increased salinity of rivers, bays and near-shore waters; alteration in larval distribution of pelagic fish species. Indirect impacts such as reduction in quantum and variety of catch, and related economic impacts are also predicted; particularly as they relate to habitats impacted by the realisation of the national vision plan.

4.3.6 Tourism

The tourism sector team's analysis reflected an examination of impacts and vulnerabilities for existing key tourism hotspots which are identified by the intensity of tourism development and popularity of a tourism product/attraction. The northern region was selected because of the concentration of accommodation plant along the coast line and within the area and it represents a cross section of the tourism product. The assessment has adopted an approach consistent with that which was adopted in the Belize Vulnerability and Capacity Assessment (2007), which recognizes that sources of vulnerability can be either supply or demand -based. Supply-based sources focus on the *natural resources* for tourism (marine and coastal ecosystems, land, and forests) and i*nfrastructure (*hotels, natural and man-made attractions, transportation food and beverage, water). Demand-based sources focus largely on visitors' perception. Such vulnerabilities include visitors' perception of the quality of the natural resources; weather in the host countries and countries of origin; perceptions about health and safety conditions. The team recognized the importance of these two sources and examined the associated vulnerabilities.

Adaptation interventions that seek to reduce vulnerability and increase capacity of communities and institutions to deal with climate change were explored. Measures, however, mainly addressed supply-side vulnerabilities because they are major concerns for the sector, particularly in the short term. Observed changes did not only form the basis of adaptation but potential future changes in climate were considered to ensure sustainable interventions. Temporary solutions were recommended to address climate-change driven impacts while longer term measures were be crafted in response to future climate threats.

Supply side impacts

Saint Lucia's tourism industry being environmentally dependent could become more vulnerable with climate change. Like many small island development states, the island is particularly vulnerable because of restricted land area. This is further compounded by the high concentration of tourist population in certain areas and the intensity of tourism activities on coastal areas. Sea-level rise therefore represents the most significant implication for climate change. Observed and potential impacts of climate change

indicate an increase in the incidences of drought. Increased droughts exert additional pressure on water demand to service large scale resort particularly those water-intensive facilities and amenities such as golf courses and spas. Changes in rainfall patterns will also exacerbate flooding and slippage and erosion of soil where there are heritage attractions in such as trails and tours, which are so heavily supported by the cruise sector. As a key element of Saint Lucia's tourism product, natural assets could also experience greater vulnerability to environmental degradation.

Storm surges are known to cause destruction to tourism plant and their frequency can increase vulnerability of tourism plant and infrastructure to greater damage. Hotel and food and beverage plants would not be the only ones susceptible to such destruction but also marine infrastructure (berthing facilities, piers, and airports). Closure of air and sea ports would be inevitable, adversely affecting arrivals to the destination. Loss of other major components of the tourism sector can result from increased storm surges and temperatures, and reduction in water quality.

Coral reefs, a critical element of the dive tourism product, have been at risk from changes in the climate patterns. As far back as 2004, they were under tremendous threat from rising sea surface temperatures, which caused coral bleaching and reduced storm surge protection, resulting in greater economic losses from marine-based tourism activities[3].

Without further adaptation the tourism sector could be rated as highly vulnerable to the impacts of floods, heat-waves, storms and extreme rainfalls. Increasing temperatures are therefore expected, which will increase dependency on energy intensive technologies. Current vulnerability is also high for the accommodation sector due to increasing risk from sea level rise and high potential for structural damage particularly those in coastal areas. Increased operating and capital costs will become a predominant feature of hotel and marine-based operations (insurance, auxiliary utility costs, beach replenishment and refurbishments). The risk of droughts has increased, resulting in moderate to high vulnerability since there are few adaptation measures implemented.

Demand side impacts

The seasonality effects of the tourism industry are driven by climate variables, thereby affecting demand for the tourism product. Given the inextricable link between the environment and the destination's product, the demand for Saint Lucia's tourism product could therefore be easily affected. According to a report by the World Tourism Organization, the Caribbean, whose principal markets include North America, is at serious risk of adverse effects on demand for travel from this region. Saint Lucia's largest source market is from this region which, like other major markets move away from the

[3] This includes fees from dive activities, yachting activities

"…cold and grey winter climate moving to the warmth, sunshine and coastal pursuits." Tourists will avoid this destination or shift the timing of their travel to avoid unfavorable climate conditions[4] .

Strong seasonality can be exacerbated by climate change as the high tourist season coincides with low water regimes in dry season, aggravating water management and environmental issues. The tourism sector's vulnerability to climate change now increases as impacts of climate change (damage to coastal beaches, damage infrastructure, and increased temperatures) manifest. Increasing frequency and severity of extreme weather events, sea level rise and accelerated beach erosion, degradation of coral reefs, (including bleaching) and the loss of cultural heritage through inundation and flooding are likely to reduce the attractiveness of small island states[5]. Not only would the change in climate be a deterrent for visitors, but also the resultant decline in quality of the environmental features that often defines the tourism product and lures them to the island.

Additionally, actions to address climate change such as environmental taxes on fuels used in air transportation could adversely affect the demand for travel to Saint Lucia. Already, such policies and their applicability for maritime transportation have been at the centre of the international climate change fora and will undoubtedly undermine the resiliency of our tourism sector.

4.3.7 Financial Services Sector

The role of the financial services sector in supporting all sectors during the development stage as well as the post–disaster recovery and reconstruction phases underscores both its importance and its vulnerability. These vulnerabilities relate to possible over-exposure to risks based on the IPCC predictions. The absence of enforced codes and regulations requiring construction design and practices to adequately factor in these considerations serve to exacerbate the possible impacts, which include risk reduction by adherence to nationally approved setbacks when approving loans and insuring properties and ensuring that these are in conformity with them.

Critical infrastructure and hotel development located near shores will come under direct threat as a result of sea level rise. The sector may increase premiums which will be passed on to consumers. This will be a direct cost impact to the various sectors. As clients become more aware of the impacts of climate change and they attempt to reduce their vulnerability the Financial Services Sector will see increased requests for insurance coverage and bank loans to address adaptation concerns; this will require a broadening of portfolio to cater to new needs of clientele. As a result of government's inclination to

[4] UNWTO, UNEP, WMO, 2007
[5] UNFCCC

foster climate resilience at a national level Financial Services Sector will be required to shift their portfolios to cater to those need that this will create. Damage to critical infrastructure, housing and beachfront property can result in increased insurance claims. There is likely to be an adverse impact on farmers. Because of the direct threat which livestock and crops will come under as a result of increased intensity and frequency of hurricanes and droughts, a government response will be required to help the sector in adapting. The Financial Services Sector will therefore most likely be required to scale up financing and over coverage for agriculture infrastructure such as greenhouses to protect crops etc. Insurances will likely see increased payouts to clients; an increase in the number of medical claims filed and a possible increase in the number of clients as people seek redress with increasing health costs

4.3.8 Health

In order to fully assess the impacts of climate change on health, the data was collected and analyzed with respect to: climate related events in Saint Lucia; existing and proposed health facilities; population per health region; the number and type of food borne diseases within the past six years; the number and type of vector borne diseases within the past five years; meteorological data; mortality and morbidity cases related to natural disasters; and, existing legislation which can support abatement of climate change effects. In addition, expert judgment also facilitated the process, information was gathered on previous studies conducted in Saint Lucia, the Caribbean region and internationally. This information was then collated and analyzed to determine current and projected vulnerability from which, proposed adaptations were recommended to minimize the impacts on vulnerable areas. Capacity issues and constraints were also identified and appropriate recommendations were made.

Climate change can have both positive and negative impacts, directly and indirectly on the health sector. An example of how increases in temperature can possibly impact health includes direct physical impacts such as heat exhaustion, are likely to increase, whilst direct physical impacts from cold temperatures such as the incidence of influenza may decrease. Impacts on food production and mosquito breeding patterns are highly likely, but the extent and direction of such impacts is unclear at the moment. Other climatic variables, such as changes in rainfall and extreme weather events, will play a role, as will non-climatic variables such as land cover changes, urbanization and salinity. In turn, the potential health impacts of these factors will also depend on a wide range of other determinants (McMichael, A. et. al, 2002).

The impacts of climate change would affect the health of human populations via diverse pathways. These would vary in their complexity, scale and directness. The timing of the various impacts would also differ – some would occur soon; others would be deferred. There would be both positive and negative impacts, although expert scientific reviews

(IPCC 2001, National Assessment [US] 2000) predict that the latter would clearly predominate. This mainly negative impact reflects the fact that climatic change would alter many natural ecological and physical systems that are integral to earth's life-support systems.

The more direct impacts on health include those caused by changes in exposure to weather extremes (heat waves) those due to increases in other extreme weather events (floods, cyclones, storm-surges, droughts), and those due to a rise in production of certain air pollutants and aeroallergens (spores and moulds). In some countries, decreases in winter mortality due to milder winters may compensate for increases in summer mortality due to the increased frequency of heat waves *(Langford and Bentham 1995*, *Rooney 1998)*.However, the extent of future change in the frequency, intensity and location of extreme weather events due to climate change remains uncertain *(McMichael*, *A. et. al*, *2002).*

Climate change will also affect human health via less direct mechanisms. These would include changes in the pattern of transmission of many infectious diseases – especially waterborne, food-borne, vector-borne diseases and food productivity. In the longer term, and with considerable variation between populations because of geography and vulnerability, the indirect impacts may well have greater magnitude than the more direct impacts *(Epstein 1999*, *McMichael et al. 1996b)*.

Various integrated modelling studies have forecasted that an increase in ambient temperature would cause, worldwide, net increases in the geographic distribution of particular vector organisms — such as dengue-transmitting mosquitoes — although some localized decreases may also occur *(McMichael*, *A. et. al*, *2002).* Further, temperature-related changes in the life-cycle dynamics of both the vector species and the pathogenic organisms (flukes, protozoa, bacteria and viruses) would increase the potential transmission of many vector-borne diseases such as malaria (mosquito), dengue fever (mosquito) and leishmaniasis (sand-fly) – although schistosomiasis (water-snail) may undergo a net decrease in response to climate change *(Martens 1998a*, *Patz et al. 1996).*

4.3.9 Disaster Management

Hazard analysis and experience have confirmed that Saint Lucia is at risk from numerous hazards, both natural and technological. With the climate studies group projecting a warming up of 1.2°C by the 2030s, 2.1°C by the 2060s and 3.6°C by the end of the century, one can expect sea level rise, increase in the number of storms as well as an increase in the intensity of the storms. Climate related hazards were categorised as shown below:

Table 4.1 Categorisation of Climate related Hazards

Hazard Analysis	Frequency	Warning Lead Times	Consequences	Max. Population at Risk
Epidemic	Low	Weeks	Catastrophic	Countrywide
Fire	High	None	Medium	Community
Flooding	High	6 Hours	High	Community
Hurricane	Medium	Hours	Catastrophic	Countrywide

4.3.10 Integrated Assessment for the Water Sector

In this section, consideration is also given to the linkages between the impacts on the water sector as these relate to other sectors of the economy. This serves as a basis for consideration of the broader implications for the country as a whole.

Saint Lucia has a fragile economy which has been evolving over the years from one being heavily dependent on Agriculture, primarily banana production to one which is dependent on Tourism and Other Services. Freshwater is a fragile, finite and vulnerable resource vital to human, economic and environmental sustainability and influences national prosperity and quality of life. The water sector is a cross cutting one and plays an important role in all sectors in Saint Lucia as a catalyst for economic development and a vehicle for empowerment and poverty alleviation. Therefore any impact of climate change on the water sector could have far reaching repercussions on the economy of the country and affect life in general.

In light of the concerns regarding the island's vulnerability to climate change, there have been initiatives undertaken to date in an effort to assess the impact of climate change on Saint Lucia. In the Vulnerability and Adaptation Assessment of the Initial National Communication (INC) which was completed in 2001 the Water Sector was reviewed and the anticipated impacts of climate change on the country's water resources were highlighted. This Second National Communication built on that previous work through this comprehensive assessment of the sector's vulnerability to the anticipated impacts of climate change and the adaptation options to be pursued.

The Water Sector is one of the most important sectors to the country of Saint Lucia. It has the potential to dictate the pace of development of the country. Any impact on water resources will have detrimental consequences to all sectors, domestic consumers, commercial consumers, tourism plants, industrial consumers, the agricultural sector, the health sector, as "Water is Life". Inadequate supply of water for all sectors can result in a collapse of the economy as there are very few alternative currently being developed.

The water sector team carried out a comprehensive review of previous climate change assessments for Saint Lucia; a comprehensive review of the Water Sector highlighting the normal development agenda as well as ongoing and future initiatives not taking into consideration climate change; establishment of current modelling scenarios for the periods of interest; an analysis of the impacts and implications of climate change on the water resources and associated features; and, the development of appropriate adaptation options recommended for implementation, which are expected to assist in the reduction or elimination of the potential impacts. The appropriateness of the above initial adaptation options were reviewed and additional options introduced; and modification to existing recommendations were made as required. This was followed by consultation with various stakeholders to assess the feasibility of adaptation options developed; and, the presentation of appropriate recommendations for the policy directorate.

The impacts of climate change on the water sector are typical of anticipated impacts for the sector in small island states such as Saint Lucia. The challenge therefore is to understand the extent to which existing vulnerabilities in the sector, which govern the baseline situation, can exacerbate the future impacts of climate change.

Climate change is a long term phenomenon and as such, this assessment projects its impacts on the water sector up to 2090 with 2010 serving as the baseline year. In this regard, the National Vision Plan which has been approved by the Government in the last quarter of 2009 is the document which set the stage for the future development of the country and is currently being pursued. This has to be the basis of any assessment of the vulnerability of the sector as it relates to meeting the water supply needs of the island.

According to the water sector assessment in the First National Communication (FNC), it is expected that climate change will result in impacts on water resources sources through:

- Changes in surface and groundwater systems
- Changes in water quality
- Increased flooding
- Increased droughts
- Changes in water temperature
- Changes in water chemistry
- Increased water erosion and siltation
- Decreased freshwater availability due to saltwater intrusion

The anticipated impacts in general on the Fresh Water Resources as indicated in the Government of Saint Lucia Initial National Communication on Climate Change are still valid and applicable to this assessment.

- Sea level rise may precipitate the intrusion of salt water into fresh water lenses, particularly in low- lying coastal areas.
- Destruction and/or modification of existing aquatic ecosystems caused by the increased frequency and intensity of precipitation.
- Soil erosion resulting from increased surface run off on exposed soils.

- Siltation of river systems during periods of increased rainfall.
- Extended dry periods or drought periods as a result of low precipitation.
- Increased frequency & Intensity of precipitation:
  - Destruction and/or modification of existing aquatic ecosystems.
  - Siltation of river systems.
  - Increased incidence of flooding.
  - The likelihood of cross contamination from leaching of pit latrines, septic tanks, pig farms into flood plains increases during flooding.
- Possibility of excessive evapo-transpiration associated with the level of temperature increases of the high precipitation scenario.
- Municipal demands are likely to increase as higher temperatures lead to increased water consumption.

Further to these general impacts and implications above, reference is made to the National Vision Plan vis-a-vis areas of development as it relates to the major sources of water supply island-wide. The entire future development of the country is dependent on the availability of water sources and corresponding water supply and sewerage services. The current state of water resource management, as well as that of the water supply infrastructure increases the vulnerability of the island to any changes in climate through extreme event: drought, floods, increased frequency of tropical storm activity, sea level rise. On the basis of the projected changes in the climatic conditions on the island there are key issues that are important to note issues of Water Availability.

The provision of water for various purposes such as domestic use, agricultural use, environmental use, industrial use, touristic use, commercial use is dependant primarily on availability through rainfall as currently the primary source of water is through surface sources. This availability is dependent on rainfall as well as temperature. It is important to note that it is likely that the availability of water through surface sources will decrease.

The current water supply situation without climate change impacts is such that there are critical issues which hinge on the issue of the resource as well as issues of the inadequate infrastructure and associated institutional and regulatory frameworks.

4.4 ADAPTATION STRATEGIES & MEASURES

The literature points to many policy level and sector specific recommendations and approaches for adapting to the impacts of climate change. These come from many sources, including from the Convention Bodies, the IPCC as well as the growing number of technical papers published on the subject. The trend is for multi-level research and systematic observation to develop baselines and scenarios for future impacts as well adaptation options to address them. In this context, adaptation is mooted to have three key components: assessing and understanding impacts; building understanding of adaptive capacity; and reducing vulnerability.

Whereas these concepts are promoted, this is not being done with the requisite technical and financial resources required for effective national level adaptation. There are aspects of existing frameworks that render them unsuitable for a number of reasons: (i) they are top down and do not allow for participation of the relevant stakeholders in the development of the approaches; (ii) these generic approaches assume a one size fits all perspective that does not consider unique SIDS context; (iii) these approaches require rigorous modelling and extensive data requirements that can be difficult to obtain, given the capacity needs. Having those gaps addressed may facilitate the use of these institutional approaches in the future and also sets the context for work to be done under the Pilot Programme on Climate Resilience (PPCR).

Establishing priorities

Decisions for future interventions must take into account previous and ongoing mitigation and adaptation projects. Given the inevitability of the climate change phenomenon, the adaptation strategies proposed focus on building the resilience of the sectors of interest to its anticipated impacts. This is the overarching response. In evaluating the specific response strategies and measures, an assessment is made of the priority and indicative cost of each. These assessments are based on the expert judgment by the sector teams who conducted the vulnerability and adaptation assessment of each sector and are presented below.

Adaptive capacity

Systemic, institutional and individual capacity needs in support of adaptation have been identified for the following focal areas: policy, legislative and regulatory, institutional frameworks; human and financial resources; information management and reporting; and research, monitoring and evaluation. These are summarised in table 2 below.

Implementation Priority Matrix

Given the inevitability of the climate change phenomenon, the adaptation strategies proposed focus on building the resilience of the sectors of interest to its anticipated impacts. This is the overarching response. In evaluating the specific response strategies and measures, an assessment is made of the priority and indicative cost of each. These assessments are based on the expert judgment by the sector teams who conducted the vulnerability and adaptation assessment of each sector and are presented in the table below.

Table 4.2 allows for easy determination of priority response measures based on agreed criteria. Thus, for example, if the criterion for investing limited resources is the range of sectors to benefit from a single response measure, then Natural Defences (mangroves, wetlands, coral reefs), Land Use Plan, Education and Information, Integrated Watershed Management, and Research and Systematic Observation will emerge as areas for attention. On the other hand, if the criteria shift to High Priority and Low Cost interventions, then the areas that emerge for priority interventions are Setbacks, Land Use Plan, Design Standards, Building Codes, Domestic Water Storage and Integrated Watershed Management. The adaptation measures and initiatives proposed by the sectoral V&A assessments, as functions of the climate impacts and the adaptive determinant, are summarized in Table 4.3 (after Louisy, 2011). These have been prioritised based on sector policies and initiatives established locally.

Table 4.2: Capacity Needs for Climate Change Mitigation and Adaptation

FOCAL AREAS	CAPACITY NEEDS		
	Systemic	**Institutional**	**Individual**
Policy Framework	• More effective and consistent implementation of the National Climate Change Policy and Adaptation Plan. • Harmonised policies within the framework of the NEP and NEMS	Increased awareness of policies and measures Inst arrangements to facilitate harmonization, etc	Awareness of relevant policy directions
Legislative and Regulatory Framework	• Legislative and regulatory frameworks in support of integrated environmental management. • Transform obligations deriving from the UNFCCC and related mitigation and adaptation policies and measures into the domestic law regime.	Increased awareness of policies and measures Inst arrangements to facilitate harmonization, etc	Awareness of relevant policy directions
Institutional Framework	• Establish and sustain formal mechanisms for coordination, cooperation and collaboration among national agencies that will promote, *inter alia*, joint programming and planning; policy formulation; collaborative implementation of activities, projects and programmes; budgeting; mobilizing of resources; and negotiating with development and other partners.	• Mandates need to be rationalized to reflect cross-cutting nature of climate change impacts and implications for all sectors.	• Formal networking among all stakeholders including the private sector and civil society. • Enhanced coordination among technical focal points for various MEAs and other environmental management and sustainable development interventions.

FOCAL AREAS	CAPACITY NEEDS		
	Systemic	**Institutional**	**Individual**
	• Provide the minimum institutional structure (including staffing) required for effectively implementing the national environmental management agenda.	• Mainstream Convention Focal Points policy recommendations into national development policies.	
Financial Resources	• Financial resources to maintain and sustain the minimum institutional structure required for the effective implementation of mitigation and adaptation programmes and projects	• Increase financial resources allocated to various components of environmental management including: public education and awareness initiatives; technology development and transfer; research; incentive programmes; and conservation and adaptation.	• Programmes to improve the skills base of the human resource pool especially in respect of the priority areas; facilitate the professional advancement and development of individuals; provide performance incentives to individuals; and increase the human resource pool.
Human Resources	• Increase the level of scientific and technical skills within Government institutions, NGOs, the private sector and local communities. • Environmental issues (in particular environmental science and technology) need to be more effectively infused into educational policies and curricula.	• Adequately trained staff to effectively implement the mandate of institutions. • Minimize the high turnover of staff and movement in the public service.	• Individuals need to be remunerated at a level that will minimize the "brain drain" effect. • Need to create incentives that will promote self-development and self-motivation among individuals. • Need to create increased institutional support for career progression.

FOCAL AREAS	CAPACITY NEEDS		
	Systemic	**Institutional**	**Individual**
Information Management and Reporting[6]	• Establish and maintain an integrated and systematic framework for information management and reporting and clearing house for information dissemination • Formal coordinating mechanisms among agencies data collection, storage, analysis and for reporting. • Formalize and maintain effective mechanisms for the exchange of information (especially scientific and technical information) among all stakeholders in the environmental management process. • Establish systems and mechanisms for the collection of scientific information and facilitate its use to inform policy and decision-making.	• Effective management of information resources • Integrate the sectoral information systems into a national information system. • Use of scientific and other information to inform development of policies, programmes and plans, including early warning and forecasting systems.	• Enhance information management skills. • Increase the number of persons dedicated to scientific research and information collection and analysis. • Greater networking among individuals at all levels.

[6] Includes information gathering, sharing of the results of scientific, technical and socio-economic research as well as general information exchange.

FOCAL AREAS	CAPACITY NEEDS		
	Systemic	**Institutional**	**Individual**
Research, Monitoring and Evaluation	• Provide adequate research and monitoring infrastructure, equipment and materials. • Establish harmonized systems for monitoring and evaluation of policies, programmes and projects. • Establish an integrated and systematic framework for research and observation for environmental management.	• Access to adequately equipped research and monitoring facilities. • Establish bench marks and indicators for monitoring. • Develop partnerships with other stakeholders (for example, with NGOs and CBOs) for the conduct of monitoring and evaluation of activities and projects.	• Enhance research, monitoring and evaluation skills

Table 4.3. Evaluation of Adaptation Strategies and Priorities

Key: P(L): Low priority; P(M): Medium priority; P(H): High Priority
C(L): Low cost measure below US$100k; CB(M): Medium cost measure, below US$500k; C(H): High cost measure below US$1m; C(VH): Very high cost measure above US$1M:

Climate Impact adaptation strategy	Sectors										
	Agriculture	Coastal Zone	Critical Infrastructure	Disasters	Financial Services	Forest Biodiversity	Health	Human Settlements	Marine Biodiversity	Tourism	Water
Abandon and Retreat	P(L) C(L)	P(M) C(H)	P(M) C(VH)		P(M) C(L)			P(M) C(VH)		P(L) C(VH)	
Sea Defences			P(M) C(VH)	P(M) B(VH)	P(M) C(L)	P(H) C(L)		P(M) C(VH)		P(M) C(VH)	
Setbacks (for new construction)		P(H) C(L)	P(H) C(L)	P(M) C(L)	P(M) C(L)			P(H) C(L)		P(H) C(L)	P(H) C(M)
Natural Defences (mangroves, wetlands, corals)	P(H) C(M)	P(H) C(M)	P(M) C(M)	P(H) C(H)	P(M) C(L)	P(H) C(L)		P(H) C(L)	P(H) C(M)	P(H) C(M)	
Land Use Plan	(P(H) C(L)	P(H) C(L)	P(H) C(L)	P(H) C(L)	P(L) C(L)	P(H) C(L)		P(H) (C(L)	P(H) C(L)	P(H) C(L)	P(H) C(L)
Soil Conservation Programmes	P(H) C(M)	P(M) C(M)	P(M) C(M)	P(L) C(M)	P(H) C(L)	P(L) C(M)		P(H) C(M)	P(M) C(M)		P(H) C(M)
Design standards			P(H) C(L)	P(H) C(L)	P(H) C(L)			P(H) C(L)		P(H) C(L)	P(H) C(H)
Building Codes			P(H) C(L)	P(H) C(L)	P(H) C(L)			P(H) C(L)		P(H) C(L)	P(H) C(L)
Early Warning Systems		(PH) C(M)		P(H) C(VH)	P(H) C(L)			P(H) C(H)	P(H) C(H)	P(H) C(L)	P(H) C(M)

Climate Impact adaptation strategy	Sectors										
	Agriculture	**Coastal Zone**	**Critical Infrastructure**	**Disasters**	**Financial Services**	**Forest Biodiversity**	**Health**	**Human Settlements**	**Marine Biodiversity**	**Tourism**	**Water**
Education and Information	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)	P(H) C(M)
Ground Water Exploitation	P(L) C(VH)			P(L) C(VH)			P(H) C(VH)	P(H) C(VH)		P(H) C(M)	P(H) C(VH)
Water Storage (Domestic)		P(H) C(M)	P(H) C(L)	P(M) C(L)			P(H) C(L)	P(H) C(L)			P(H) C(L)
Water Storage (Reservoirs)	P(H) C(H)	P(H) C(H)	P(H) C(H)	P(M) C(H)	P(H) C(VH)		P(H) C(H)	P(H) C(VH)		P(H) C(VH)	P(H) C(VH)
Rain Water Harvesting	P(L) C(L)	P(M) C(L)	P(M) C(L)	(P(M) C(L)	P(H) C(M)		P(M) C(L)	P(H) C(L)		P(M) C(L)	P(H) C(L)
Desalination			P(H) C(VH)		P(L) C(VH)			P(M) C(VH)		P(H) C(VH)	P(M) C(VH)
Alternative/Drought and Heat Resistant Crops	P(H) C(VH)				(PL) C(H)		P(M) C(L)	P(H) C(VH)		P(M) C(M))	
Drainage Infrastructure	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(M) C(L)		P(M) C(L)	P(H) C(H)	(PM) C(L)		
Integrated	P(H)	P(H)	P(H)	P(H)	P(L)	P(H)		P(M)	P(H)	P(H)	P(H)

Climate Impact adaptation strategy	Sectors										
	Agriculture	**Coastal Zone**	**Critical Infrastructure**	**Disasters**	**Financial Services**	**Forest Biodiversity**	**Health**	**Human Settlements**	**Marine Biodiversity**	**Tourism**	**Water**
Watershed management	C(M)	C(VH)	C(L)	C(VH)	C(H)	C(H)		C(L)	C(VH)	C(L)	C(VH)
Irrigation Systems	P(H) C(VH)				P(M) C(M)			P(H) C(VH)			
Research and Systematic Observation	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)	P(H) C(VH)

Table 4.4. Summarised Adaptation Initiatives And Measures

CC Impact	**Sea Level Rise**		**Precipitation Changes**		**Temperature Changes**		**Extreme Events**	
Determinant	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**
Economic Resources	Funding for relocation	Funds procurement Financing mechanisms	Financing infrastructure and technologies	Funds procurement Financing mechanisms	Financing technologies	Funds procurement Financing mechanisms	Resources for disaster response and recovery	Funds procurement Financing mechanisms
Technology	Alternative technologies - Setbacks - Sea defenses - Natural defenses - Alternative fisheries – aqua culture	Research	Soil conservation Alternative Desalination/ ground water/ rain water harvesting Restoration of riverbanks, wetlands	Research re exploitation of alternative water sources	Alternative drought resistant crops Water storage	Research	Drainage and soil conservation Infrastructure design Sea /natural defenses Early warning systems	Systematic observation
Information and Skills	Education and information Data and information management GIS decision support tool	Public Awareness Strategy RSO	Education and information Data and information management	Public Awareness Strategy RSO	Education and information Data and information management	Public Awareness Strategy RSO	Education and information Data and information management Early Warning Systems GIS decision support tool – mapping extreme events Coastal / construction engineering	Public Awareness Strategy RSO

CC Impact	**Sea Level Rise**		**Precipitation Changes**		**Temperature Changes**		**Extreme Events**	
Determinant	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**
Infrastructure	Coastal Setbacks Sea defense infrastructure Natural defenses	Strengthening port infrastructure	Drainage infrastructure Alternative water sources – Desalination, ground water, rain water harvesting		Water conservation Design standards/ building codes		Design standards/ building codes Early Warning Systems Water Storage and distribution	
Institutions (Policy/legal)	Enforcement of appropriate /revised coastal setback policies	Incentive s Framework Integrated Watershed Management Planning	Incentives to encourage building away from flood /landslide prone areas Incentives to promote alternative water sources	Integrated Watershed Management Planning Water rates to reflect costs of water supply – prevent wastage	Incentives to promote CC resilient cooling systems	Building codes/ standards	Incentives to encourage building away from flood /landslide prone areas	Integrated Watershed Management Planning
Equity	Relocation of individuals/communities Safeguarding of livelihoods	Land use Plan	Habitat protection and rehabilitation measures	Land Use Plan	Water conservation		Rehabilitation measures-Restoration of riverbanks, wetlands	

4.5 FRAMEWORKS FOR ADAPTATION

International Policy Frameworks

Regional & National

Against the framework of its national policy, environmental management in Saint Lucia is guided by a number of regional and national policy imperatives and instruments. AT the international level, UNDP's Adaptation Policy Framework also is instructive in this regard, in that it has been developed "for implementation of Global Environmental Facility (GEF) and other initiatives including regional projects and national efforts to respond to the challenge of climate change". Saint Lucia is a member of the Caribbean Community (CARICOM) which is currently espousing a regional strategy on adaptation. Saint Lucia is also member of the Organisation of Eastern Caribbean States (OECS). Environmental management in the OECS is guided by the St. Georges Declaration of Principles for Environmental Sustainability (SGD) in the OECS. The overall aim of the SGD is to "Foster Equitable and Sustainable Improvement in the Quality of Life in the OECS Region", while principle 8 seeks to "Address the Causes and Impacts of Climate Change".

Regional

Two regional adaptation frameworks are of note: the CARICOM framework is results from decisions of the Conference of Heads of Government and the Council for Trade and Economic Development and is also implicitly an outshoot of the Revised Treaty of Chaguaramas; the Pilot Programme on Climate Resilience is seen as serving to integrate climate risk and resilience into core development planning, while complementing other ongoing development activities in pilot countries.

CARICOM Regional Framework

The thirteen Member States of CARICOM and the five Associated Member States have agreed to a single vision is for sustainable development which encompasses economic, social, environmental and governance dimensions. The CCCCC has prepared the regional framework at the request of CARICOM Heads of State participating in the First Congress for the Environmental Charter and Climatic Change, held at Ávila Mountain, Caracas, 11-13 October 2007. The strategic vision driving this regional strategy is to lay the ground for a "regional society and economy that is resilient to a changing climate." The seriousness of the challenge global climate change (GCC) poses to the development prospects of small island and low-lying coastal States is addressed in the Barbados Plan of Action (BPoA), as the first of 14 priority areas for achieving sustainable development.

It is envisaged that the framework will help facilitate the ongoing involvement of the international community with a view to efficiently strengthening the capacity of the CARICOM countries to adapt to a changing climate. Among other activities, the international community will be invited to support training and education for climate hazard risk management, and share information with the region that can address existing hazard management challenges. The CCCCC will have primary responsibility for coordinating the strategy's implementation in collaboration with the relevant regional and national institutions, and for providing technical support and guidance as required by the respective implementing agencies and/or countries through their national contact points.

This regional framework provides a roadmap for action over the period 2009-2015, and builds on the groundwork laid by the Caribbean Community Climate Change Centre (CCCCC). The objectives of this document are to establish direction for the continued building of resilience to the impacts of GCC by CARICOM states. The framework document focuses on the identification and consolidation of a set of complementary activities that utilise the CCCCC and other regional institutions' current capacity and experience in addressing adaptation to climate change. This framework is comprised of four key strategies and associated goals designed to significantly increase the resilience of the CARICOM economies:

1. Mainstreaming climate change adaptation strategies into the sustainable development agendas of CARICOM states.
2. Promoting actions to reduce greenhouse gas emissions through energy efficiency, conservation, and switching to renewable energy sources.
3. Encouraging action to reduce the vulnerability of natural and human systems in CARICOM countries to the impacts of a changing climate.
4. Promoting action to derive social, economic, and environmental benefits through the prudent management of standing forests in CARICOM countries.

Pilot Programme on Climate Resilience

It can be suggested that within the context, and in support, of this regional framework can be found the Pilot Programme on Climate Resilience (PPCR) Caribbean – Regional Track. The programme objectives are to: pilot and demonstrate approaches for integration of climate risk and resilience into development policies and planning; strengthen capacities at the national levels to integrate climate resilience into development planning; scale up and leverage climate resilient investment, building upon other ongoing initiatives; enable learning by doing and lesson sharing at the country, regional and global levels; strengthen cooperation and capacity at the regional level to integrate climate resilience in national and appropriate regional development planning and processes. Five main topics have been agreed as the main areas under the PPCR regional track by Caribbean regional organizations:

1. Monitoring and climate modelling activities
2. Enabling environment (policy and institutional framework)
3. Raising the Political Profile of the Importance of Factoring in Climate Risks into Sustainable land-use management and Spatial Planning
4. Capacity building and awareness raising aimed at different levels, including sectors and policy makers)
5. How to integrate CC into development and budget planning

As part of the PPCR initiative, Caribbean countries have identified a number of ongoing activities that contribute to the implementation of the regional framework.

National

The National Climate Change Policy and Adaptation Plan states Government's conviction to address the issues of reducing emissions, and Saint Lucia's vulnerability to the effects of climate

change and to place urgent and major emphasis to adapting to climate change. This plan has three key objectives, which were to foster the development: of processes, plans, strategies and approaches to avoid, minimize or adapt to the negative impacts of climate change; and application of appropriate legal and institutional systems and management mechanisms for planning for and responding to climate change; and of appropriate economic incentives to encourage public and private sector adaptation measures. The Plan identified the following priority activities for immediate implementation.

Table 4.5 : Priority Activities per Sector for Implementation

SECTOR	ACTIVITY/STRATEGY
Coastal & Marine Resources	Undertake review of existing coastal monitoring and data collection systems
Human Settlements	Develop adaptation plan for human settlements including zoning, defences, building codes etc.
Terrestrial Resources, Terrestrial Biodiversity& Agriculture	Establish a system for improved monitoring and research of key terrestrial and agricultural processes and resources.
Freshwater resources	Undertake inventory of freshwater resources and develop and implement a National Water Resources Management Plan
Tourism	Improve/ develop regulatory framework with emphasis on enforcement.
Cross-cutting	Development and implementation of an integrated, coordinated and sustained climate change awareness programme targeting all sectors and relevant interest groups

It is instructive to note that some years after approval of the Plan in 2002, this current Vulnerability and Adaptation assessment confirms its priorities and identifies new areas of importance, notwithstanding the expected increase in costs over the intervening years. Different strategies and actions will be based on the factors which define priorities at the time of the determination

A number of other documents are part of the policy framework for Saint Lucia's climate change adaptation efforts. Probably the most significant consideration in this regard is that Government has adopted a National Vision Plan which represents in broad terms the development priorities for each of the four quadrants in which the country is divided. This plan is a broad based land use plan developed to support the expansion of the tourism infrastructure, support some measure of environmental sustainability, expansion of housing and industry expansion. The National Vision Plan is the development roadmap plan which is being used to guide the future development of the island.

4.6 CONCLUSIONS

The assessments were conducted, and related adaptation options proposed, taking into consideration a number of initiatives that have either been undertaken, or are proposed, to help build national resilience against the impacts of climate change. Thirteen of these interventions are listed in the National Circumstances document. Given their focus on adaptation, the following initiatives are particularly worthy of mention:

a) Caribbean Planning for Adaptation to Climate Change (CPACC;
b) Adaptation to Climate Change in the Caribbean (ACCC),
c) Mainstreaming Adaptation to Climate Change in the Caribbean (MACC) and
d) Special Programme on Adaptation to Climate Change (SPACC) projects, given their focus on adaptation.

In addition, the ongoing SPACC, and the Pilot Programme for Climate Resilience (PPCR) projects are designed to demonstrate approaches to building resilience in the construction, water and other sectors while the Investment and Financial Flows (I&FF) project was seen as developing national capacity to determine the capital and recurrent costs of climate change mitigation and adaptation in key sectors; this latter exercise has however been postponed indefinitely.

Given the inevitability of the climate change phenomenon, the adaptation strategies proposed focus on building the resilience of the sectors of interest to its anticipated impacts. This is the overarching response. In evaluating the specific response strategies and measures, an assessment is made of the priority and indicative cost of each. These assessments are based on the expert judgment by the sector teams who conducted the vulnerability and adaptation assessment of each sector

The cost of recent weather events in Saint Lucia, in terms of loss of life and property, destruction to critical infrastructure, interruption of utility services and impacts on the agriculture and tourism sectors, to name but a few, underscores the urgency with which Saint Lucia needs to build resilience to the effects of climate change. Existing policy, legal and institutional structures are inadequate to support this resilience building and the analysis above points to the areas in which systemic, institutional and individual capacities need to be developed to support this response.

Finally, it must be pointed out that whereas cost considerations may delay or prevent investments in response measures, there are two components to the cost of doing nothing. The first is the aggregate of the cost of rehabilitation, reconstruction, foregone production, loss of income, diminished productivity, loss of revenue *etc.* associated with the impacts of climate change on the economic, natural and social sectors, while the second is the cost escalation due to inflation of deferred investment. In this context, there are several no-regrets actions, which may be pursued to build resilience to, and by extension reduce the cost to the economy of, the impacts of climate change.

Chapter 5:
Other Information Relevant to the Achievement of the Objective of the Convention

CHAPTER 5: OTHER INFORMATION RELEVANT TO THE ACHIEVEMENT OF THE OBJECTIVE OF THE CONVENTION

5.1 Section Overview

Article 12.1 (b) of the United Nations Framework Convention on Climate Change (UNFCCC) text states that Parties, in accordance with Article 4.1 of the Convention, shall communicate to the Conference of Parties a general description of steps taken, or envisaged, to implement the Convention. Article 12.1 (c) states that parties shall communicate any other information deemed "*relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication…*". This section is intended to highlight such activities. It provides information on the relevant steps taken, consistent with the requirements for communication outlined in Article 12.1 (b) and (c). This information is provided under the following headings:

1. Steps taken to integrate climate change considerations into national development and policy formulation
2. Activities related to transfer of environmentally sustainable technologies
3. Information on climate change research and systematic observation
4. Information on climate change education, training, and public awareness
5. Measures to promote information exchange and networking.
6. Information on capacity building activities, options and priorities
7. Gender, Youth, Children and Poverty, and
8. The Way Forward

5.2 Approach and Methodology

Two types of initiatives were to be reported, viz. actions undertaken under national climate change initiatives as well as other initiatives which contribute in some measure to the overall national response to climate change. In reviewing the literature, it was recognized that information would need to be derived not only from published documents but from unpublished reports as well as personal communication.

The Methodology therefore included the following steps:

i. Literature Review (published and unpublished documents both national and international in origin, web-based data, etc).
ii. Interviews (face to face interviews, email communication and questionnaires with key individuals and agencies);
iii. Compilation and inventory of relevant climate change meetings, products and projects.

5.3 Steps taken to Integrate Climate Change Considerations

At the regional level, Saint Lucia is a signatory to the Saint Georges Declaration of Environmental Principles in the OECS (SGD). This is the overarching environmental policy for the sub-region and it addresses climate change issues in a number of its Principles as follows:

- *Principle 2*: Integration of Social, Economic and Environmental Considerations into National Development Policies, Plans and Programmes
- *Principle 6:* Use Economic Instruments for Sustainable Environmental Management
- *Principle 8*: Address the Causes and Impacts of Climate Change
- *Principle 9*: Prevent and Manage the Causes and Impact of Disasters
- *Principle 15*: Promote Co-operation in Science and Technology
- *Principle 16:* Manage and Conserve Energy

As part of its obligation under the SGD, Saint Lucia is required to report annually on the implementation of the SGD through its National Environment Management Strategy

1. **Other related regional actions /initiatives include the following:** Climate Change and the Caribbean: A Regional Framework for Achieving Development Resilient to Climate Change (2009-2015) prepared under the auspices of the Caribbean Community Climate Change Centre (CCCCC) at the request of CARICOM Heads of Government (CCCCC, 2009)[1].
2. **Caribbean Planning for Adaptation to Climate Change Project:** The goal of the CPACC project was *"to build capacity in the Caribbean region for the adaptation to climate change impacts, particularly sea level rise. This was accomplished through the completion of vulnerability assessments, adaptation planning, and capacity building activities*" (CCCCC website)[2]. CPACC comprised four regional projects and five pilot projects.

Table 5.1 : Regional & Pilot Climate Change Projects

Regional Projects	Pilot Projects
Design and establishment of a sea level/climate monitoring network	Coral reef monitoring for climate change (Bahamas, Belize, and Jamaica)
Establishment of databases and information systems	Coastal vulnerability and risk assessment (Barbados, Guyana, and Grenada)
Inventory of coastal resources	Economic valuation of coastal and marine resources (Dominica, Saint Lucia, and Trinidad and Tobago)
Use and formulation of initial adaptation policies	Formation of economic/regulatory proposals (Antigua and Barbuda, and Saint Kitts and Nevis)
	National Communications (St Vincent and the Grenadines).

Source: Caribbean Community Climate Change Centre: www.caribbeanclimate.bz

[1] CCCCC. 2009. Climate Change and the Caribbean: A Regional Framework for Achieving Development Resilient **to Climate Change (2009-2015)**

[2] Caribbean Community Climate Change Centre: www.caribbeanclimate.bz

Key policy-relevant outputs for Saint Lucia under CPACC included:

a. The preparation of a Saint Lucia Country Paper on National Climate Change Issues[3]. This document help to raise awareness of climate change issues at various levels and laid the groundwork for future policy formulation.
b. The formulation of a National Climate Change Policy and Adaptation Plan (NCCPAP) under Component four of the project. The NCCPAP continues to serve as a useful guide and is to be reviewed under the SNC process.

3. **Adaptation to Climate Change in the Caribbean:** Saint Lucia was also part of the Adaptation to Climate Change in the Caribbean (ACCC) Project, which ran from 2001 to 2004. The ACCC project, funded by the Canadian International Development Agency (CIDA) through the Canadian Climate Change Development Fund (CCCDF) built on the foundation established by the CPACC project and served as a bridge between the CPACC and the Mainstreaming for Adaptation to Climate Change (MACC) Projects (CIDA, 2005[4]).

   The ACCC project involved nine individual components that continued from CPACC in order to consolidate, extend and make sustainable climate change responses. These were also designed to lead into and complement the MACC project, discussed subsequently.

   In a collaborative effort between the Capacity Building for the Development of Adaptation Measures in Pacific Islands Countries (CBDAMPIC) Project and the ACCC Project, with support from the MACC project, funded by the Global Environmental Facility (GEF), a document entitled: "*Guide to the Integration of Climate Change Adaptation into the Environmental Impact Assessment Process*" was developed[5]. The aim of the document is to assist country practitioners with the integration of climate change adaptation considerations into the EIA process, thereby ensuring the selection and implementation of feasible options for development projects (Caribbean Community Secretariat, 2004[6]).

   Other policy-relevant achievements and outputs under the ACCC Project include the development and dissemination of the *Caribbean Risk Management Guidelines for*

[3] Government of Saint Lucia. 2001. Saint Lucia Country Paper on National Climate Change Issues: Towards the Implementation of CPAAC Component 4: Formulation of a Policy Framework for Integrated (Adaptation) Planning and Management. Prepared by Crispin d'Auvergne, Anita James and Devon Barrow.

[4] Canadian International Development Agency. 2005. Final Report Adapting to Climate Change in the Caribbean (ACCC). Global Change Strategies International (GCSI) and deRomilly and deRomilly Ltd.

[5] Caribbean Community Secretariat. 2004. Guide to the Integration of Climate Change into the EIA Process: Adapting to a Changing Climate in the Caribbean and South Pacific Regions.

[6] Caribbean Community Secretariat. 2004. Guide to the Integration of Climate Change into the EIA Process: Adapting to a Changing Climate in the Caribbean and South Pacific Regions.

Climate Change Adaptation Decision Making and guidelines for climate change adaptation in the water, health and agriculture/food security sectors (CIDA, 2005[7]). Many of the documents generated under the ACCC continue to be referenced on a regular basis by various agencies, stakeholders and consultants.

4. **Mainstreaming Adaptation to Climate Change Project:** The GEF-World Bank MACC Project was a regional project implemented in the Anglophone CARICOM countries from 2004 to 2008. The Project, executed by CARICOM, through the CCCCC, was to build further capacity in the small island and low-lying coastal states of the Caribbean, thereby increasing their resilience to climate change risks through the identification and implementation of feasible adaptation options. The project consisted of five components, namely:
   a. Build capacity to assess vulnerability and risks associated with climate change
   b. Build capacity to reduce vulnerability to climate change (adaptation)
   c. Build capacity to effectively access and utilise resources to reduce vulnerability to climate change
   d. Public education and outreach
   e. Project Management.

   Policy-relevant outputs of the MACC Project included:
   a. Efforts towards implementation of a regional Public Education and Outreach (PEO) strategy, including the conduct of a survey on Knowledge, Attitude and Practices (KAP)
   b. Future regional climate projections derived through statistical and dynamic downscaling of global climate models
   c. Baseline survey on awareness of climate change
   d. Regional climate change scenarios
   e. Development of a regional climate change adaptation strategy and implementation plan.

   The MACC Project also played a significant role in harmonising regional negotiation positions by bringing regional negotiators and focal points together ahead of UNFCCC sessions. This served as a precursor for the preparatory meetings now regularly convened by AOSIS.

5. **Special Programme on Adaptation to Climate Change Project (2008 – 2012)**: Saint Lucia is one of three Caribbean countries, along with Dominica and Saint Vincent and the Grenadines, participating in the GEF-World Bank-funded Special Programme on Adaptation to Climate Change (SPACC): Implementation of Adaptation Measures in Coastal Zones Project. The SPACC Project focuses on the implementation of select

[7] Ibid.

adaptation measures designed to address climate change impacts on biodiversity and land degradation. Saint Lucia's two sub-components focus on the Sustainability of Water Resources and Supply of the Vieux-Fort Region and Strengthened Critical Coastal Infrastructure in the Castries Area.

a. *Strengthened Critical Coastal Infrastructure in the Castries Area:* This is a pilot adaptation measure that seeks to demonstrate the design and implementation of appropriate interventions to reinforce critical infrastructure to the effects of intensified hurricanes.

The Project aims to do so through the National Emergency Management Organisation (NEMO) and the Physical Planning Section of the Ministry of Physical Development and the Environment (MPDE), as follows:

- The National Emergency Management Plan (NEMP) for Saint Lucia is a set of stand-alone documents that may be activated to support hazard management plans. A revised prototype (from 1996) was first approved by the Cabinet of Ministers via Cabinet Conclusion 649 of 2007. This overall plan includes a Hurricane Plan for Saint Lucia. NEMO, in collaboration with the SDED of the MPDE, has obtained the approval of the Cabinet of Ministers (Cabinet Conclusion 1159/2009 of September 24, 2009) for the adoption of "*The Impact of Climate Change on Design Wind Speeds in Saint Lucia*" (CCCCC, 2008[8]) and the "*Engineering Guidelines for Incorporating Climate Change into the Determination of Wind Forces*" (CCCCC, 2008[9]) as planning documents or guidelines, forming part of the Hurricane Plan and the NEMP as a whole.
- The Physical Planning Section of the MPDE is seeking to legalise the application of the new design hurricane wind speed standards developed under the SPACC Project and actively enforce them. It is proposed that this be done via the Terms of Reference submitted by the Development Control Authority (DCA) to developers, with a clause that stipulates that the design criteria to be submitted by the Registered Professional Engineer for the development, building, structure or facility, demonstrate clear evidence of the use of the said design hurricane wind speed standards.
- Saint Lucia has, for several years, possessed a draft Building Code, developed in the 1990s under the Caribbean Unified Building Code (CUBIC) process. The Code

[8] Caribbean Community Climate Change Centre and Government of Saint Lucia. 2008. Impact of Climate Change on Design Wind Speeds in Saint Lucia. Prepared as an output put of the SPACC Project. International Code Council.

[9] Caribbean Community Climate Change Centre and Government of Saint Lucia. 2008. Engineering Guidelines for Incorporating Climate Change into the Determination of Wind Forces. Prepared as an output put of the SPACC Project. International Code Council.

is intended to provide standards to guide building construction and renovation in the country. Steps are underway to formally adopt the Code. In a recent SPACC workshop on Engineering for Climate Change held in July 2010, engineers confirmed the importance of the Building Code, the need for its adoption and the inclusion of the new design hurricane wind speed standards into the Code.

b. *Sustainability of Water Resources and Supply of the Vieux-Fort*: This pilot adaptation measure seeks to complement the national water supply programme by establishing adaptation measures that would result in increased resilience of surrounding coastal ecosystems to the impacts of climate change and variability. The proposed pilot SPACC Project will comprise the construction of a hybrid rainwater harvesting, irrigation and sewage recycling facility on the property at a private hotel in the south of the island that uses the water equivalent of twelve percent of the Vieux-Fort population.

   The ultimate goal of the project, that gives due recognition of the impacts of climate change, is the institution of guidelines for the installation of water conservation systems, as part of the DCA approval process of the GOSL for all new hotels and other commercial establishments in Saint Lucia.

A number of National actions have also been undertaken as follows :

- National Environment Policy (NEP) /National Environment Management Strategy (NEMS): (both make reference to the implementation of Saint Lucia's climate Change Policy).
- National Land Policy (approved in 2007; incorporates climate change considerations).
- National Water Policy (approved in 2004; also incorporates climate change considerations) - A Water Resources Management Agency (WRMA) has been established within the Ministry of Agriculture, Lands, Forestry and Fisheries policy that should include (MALFF) to, *inter alia*, spearhead implementation of the Policy.
- Sustainable Energy Plan (approved in 2001).
- National Energy Policy (June 2010).
- Draft National Environmental Education Policy and Draft National Environmental Education Strategy.
- Draft Environmental Research Policy.
- National Climate Change Policy and Adaptation Plan (NCCPAP) formulated in 2001.
- Draft Revised Climate Change Adaptation Policy (2011).
- Draft Climate Change Public Education Strategy (2011).
- Environment Impact Assessment process (Climate change considerations are currently being added to the Physical Planning Act and Regulations, including the Drat EIA Regulations).
- Coastal Zone Management Policy and Strategy (Towards the Development of a Coastal Zone Management Strategy and Action Plan for Saint Lucia).
- Saint Lucia's Coastal Zone Management (CZM) in Saint Lucia: Policy, Guidelines and Selected Projects (2004).
- National Environmental Commission (established in 2007).

- Draft Environmental Management Bill.
- National Emergency Management Plan (this includes: Hazard Mitigation Policy (GOSL, 2006[10]), Disaster Management Policy Framework or Saint Lucia (GOSL, 2009[11]) and Comprehensive Disaster Management Strategy (GOSL, 2009[12]).
- Biodiversity-related policy documents.
- Forest-related policy documents (National Action Plan to Combat Desertification and Drought (SFA 2003 Project[13]), revised legislation (draft) for the Forestry Department, draft Saint Lucia Forest Policy of 2008[14], Strategic Planning for Watershed Management Activity (2007[15]), Wildfire Management Plan (GOSL, 2008[16]).
- Enhanced institutional arrangements to create a sustainable national communication process (Including the designation of national and Technical Focal Points for the UNFCC; appointment of an informal Climate change Team within the SDED, appointment of an SNC team etc.).

The respective policy and legal instruments cover a number of sectors and fall under the purview of various agencies, many of which might not give climate change primary consideration to in their routine operations. For the integration of climate change concerns, it will be necessary to:

1. Ensure a cooperative approach, among stakeholders, to policy implementation and monitoring and the pursuit of synergy in this regard
2. Strengthen the existing Climate Change Team within the SDED to not only coordinate projects such as the National Communication, but to also take the lead in monitoring policy implementation
3. Expeditiously finalise draft policy instruments such as the Building Code, EIA Regulations, and the Environmental Management Act
4. Establish a repository of all relevant policy documents. This would facilitate access by stakeholders
5. Ensure that future policy instruments, where feasible, address climate change issues
6. Mainstream climate change into agency work programmes.

---

[10] Government of Saint Lucia. 2006. Hazard Mitigation Policy. Document of the National Emergency Management Plan. Approved by Cabinet Conclusion 649/2007 (2 August, 2007). Supported by Caribbean Disaster Emergency Response Agency / Caribbean Development Bank.

[11] Government of Saint Lucia. 2009. Disaster Management Policy Framework for Saint Lucia. Document of the Saint Lucia National Emergency Management Plan. Approved by Cabinet Conclusion No. 1151/2009 (24 September, 2009).

[12] Government of Saint Lucia. 2009. Comprehensive Disaster Management Strategy and Programme Framework. National Emergency Management Organisation.

[13] Government of Saint Lucia. 2008. National Action Plan to Combat Desertification and Drought. Commissioned under the EU-SFA 2003 Project. Ministry of Agriculture, Lands, Forestry and Fisheries.

[14] Government of Saint Lucia. 2008. Saint Lucia Forest Policy. Final Draft. Commissioned under the EU-SFA 2003 Project. Ministry of Agriculture, Lands, Forestry and Fisheries.

[15] Government of Saint Lucia. 2007. Strategic Planning for Watershed Management Activity: An Internal Document of the Department of Forestry, Ministry of Agriculture, Lands, Forestry and Fisheries.

[16] Ibid.

5.4 Initiatives: Transfer of Environmentally Sustainable Technologies

Two technology-needs assessments were undertaken as follows:

- Climate Change Technology Needs Assessment (2004), and;
- Biodiversity Needs Assessment (2009)

The Climate Change Technology Needs Assessment addressed the technology needs for adaptation within the a number of sectors, namely Coastal Zone, Freshwater Resources, Tourism, Agriculture, Health, Human Settlements and Disaster Response. Technology needs for mitigation are addressed with respect to Energy Generation, Road Transport, New and Renewable Energy and Land Use, Land Use Change and Forestry (LULUCF) and Waste.

The Biodiversity Needs Assessment identified the need for adaptive management as a mitigation measure in response to long-term climate change and also identified the limited application of technology in biodiversity assessment and monitoring activities as a capacity constraint. It also called for, among others, the development of a science and technology sector and complimentary national research policy and the increased use of Information and Communications Technology (ICT) between persons engaged in research and monitoring.

The need for a **Database for Climate Change** has been identified. Initiatives undertaken in this regard include the following:

- National Energy Balance (NEB) electronic database and repository of printed documents - SDED
- Compendium of Environmental Statistics (2001) – SDED
- GIS databases – Housed in the Ministry of Physical Development and the Environment, Department of Forestry (MALFF).Special Projects Unit, Ministry of Economic Affairs
- Digital Database of Coastal Habitats and Resources

Under the new Pilot Programme on Climate Resilience (PPCR), Saint Lucia is undertaking further work on data capture, analysis and sharing of climate relevant data and information.

A summary of the number of case studies which have been undertaken, including the major activities and recommended measures is presented in Table 5.1.

Table 5.1: Summary of Case Studies and Recommended Measures

Case Study	Issue Addressed	Major Activities	Recommended Measures
SPACC Project	Adaptation	**Strengthened Critical coastal infrastructure in the Castries Area** **Sustainability of Water Resources and supply in the Vieux fort area**	Retrofitting and strengthening of hurricane shelter
			Informing development of guidelines for Category 2, 3 and 4 Buildings in response to increasing wind intensity
			Demonstrating the application of climate change adaptation responses in an effort to encourage and promulgate adaptive replication by hotel owners, managers other entrepreneur
			Informing and encouraging the development of guidelines for the installation of water conservation systems, as part of the GOSL approval process for all new hotels and other commercial establishments in Saint Lucia.
			Reducing the hotel's consumption of the potable water supply in a region that regularly faces a water deficit
			Eliminating the discharge of grey water into the nearshore marine environment, which is rich in biodiversity
Photovoltaic systems	Mitigation	PV Net-Metering Pilot project	4 systems (with a 5th on the way) connected to power grid and net contributions to the power grid monitored.
			Local persons trained in PV installation
Phase-out of Ozone Depleting Substances: Chloroflouro-carbons (CFCs)	Mitigation	Training and Certification of Technicians	GHG emissions reduction, capacity building, public education and awareness and technology transfer.
		Procurement and Distribution of refrigerant recovery and recycling equipment and accessories	
		Conduct of public awareness and education programmes	

Improving the rate of adoption of Environmentally Sustainable Technologies (ESTs) will require the adoption of a number of measures and recommendations. These have been identified as follows:

Table 5.2 Measures and Recommendations identified for Adaptation and Mitigation

Adaptation	Mitigation
Policy Measures/Recommendations for Financing: ▪ Introduction and enforcement of technology standards (e.g. for low water use flush toilets, and rainwater harvesting) that will ensure introduction of these technologies ▪ Direct government spending, through integrating climate change concerns into existing recurrent expenditure programmes and projects ▪ Tax and fiscal incentives for persons and enterprises engaging in an identified set of adaptive actions (e.g. coastal or watershed protection) ▪ International and regional financing sources (Caribbean Development Bank, World Bank, Inter-American Development Bank), by integrating climate change adaptation concerns into bilateral and multilateral loans and assistance ▪ Support for indigenous research and development activities utilizing available educational and technical facilities ▪ International assistance from the Global Environmental Fund ▪ International assistance through the Climate Change Adaptation Fund to be established under the Clean Development Mechanism of the Kyoto Protocol[17].	***Measures/Recommendations for Energy Conservation:*** ▪ Use of energy efficiency standards to promote use of mitigation oriented energy technologies. This involves regulating public use of particular technologies and thereby enforcing their use ▪ Voluntary standards (e.g. among hoteliers) to advance introduction of agreed environmental standards ▪ Regional and international development agencies (e.g. CDB, World Bank, GEF) can provide financing and technical assistance for mitigation related projects ▪ The CDM of the Kyoto Protocol which allows developed countries to invest in and gain international emission credits, from GHG mitigation projects in developing countries

[17] The coming into effect of the Kyoto Protocol will trigger the implementation of the CDM designed to encourage, *inter alia*, the transfer of environmentally sustainable technologies to developing countries. A proportion of funds generated from the CDM are to be applied to implementation of adaptation projects in developing countries.

Adaptation	Mitigation
Cross-cutting measures to overcome barriers to awareness: ▪ Improving awareness of potential implications of climate change among decision-makers at all levels (from grass-roots to national level policy makers) ▪ Increasing knowledge of climate change and climate variability, including through improved understanding of long-term weather and of short-term weather forecasting ▪ Enhancing research, development, and demonstration efforts of climate change adaptation technologies	*LULUCF and Wastes:* ▪ Expansion of credit and savings schemes ▪ Improvement of disaster warning systems ▪ Strengthening research and development into impacts of climate on tropical agriculture and forestry
	Road Transport: ▪ Traditional sources of financing for public sector investments in transport e.g. road taxes, and loans from various sources ▪ Introduction of mandatory and voluntary standards

Source: GOSL, 2004[18]

A number of constraints have also been identified with respect to the transfer of ETSs. The following recommendations aim to address some of the constraints:

1. Systematically implementing the recommendations of the TNA
2. Regularly reviewing and updating the TNA
3. Establishing databases on ESTs. For example, Saint Lucia may be able to share experiences in community-based approaches to environmental management
4. Encouraging the efforts of innovators through grants, fiscal incentives and competitions, for example
5. Encouraging and supporting South-South cooperation with other developing countries in the region and beyond
6. Revitalising and strengthening the NCSTD
7. Activating the DNA
8. Encouraging the establishment of EST concerns in order to derive direct and indirect benefits from their research and technological development
9. Ensuring the replication of viable pilot projects.

[18] Ibid

5.5 Climate Change Research and Systematic Observation

Long-term meteorological and hydrological observation serves as one of the key bases for detecting climate change. This must, however, be supported by research on relevant biophysical systems and economic sectors in order to determine the actual impacts of climate change on the natural environment and on human existence. In this context, d'Auvergne (2004) [19]provides an indicative list of areas upon which research should be conducted and data collected for Saint Lucia, namely:

1. Meteorology
2. Agriculture
3. Coastal, marine and fisheries resources
4. Human health
5. Water resources
6. Terrestrial biodiversity
7. Tourism
8. Financial sector (including Insurance)
9. Disaster and weather extremes

Of most relevance is the collection of meteorological data and this is undertaken by two Governmental Agencies: The Meteorological Services Division (MSD) of the Ministry of Communications, Works Transport and Public Utilities, and the Water Resources Management Agency of the Ministry of Agriculture, Lands, Forestry and Fisheries.

The MSD submits data to a regional body, the Caribbean Institute of Meteorology and Hydrology (CIMH), which serves as a training institute and a repository for meteorological data for the English-speaking Caribbean. Through the MSD, as well, Saint Lucia participated actively in the preparation of the Global Climate Observing System (GCOS) Regional Action Plan (RAP) for Central America and the Caribbean. The RAP seeks to address needs for improving atmospheric, terrestrial and ocean observing systems. To date, however, Saint Lucia has not advanced significantly in the specific implementation of the Plan. However, a number of initiatives to be implemented or completed in the Caribbean in the near future are expected to support the overall aims and objectives of the RAP. These include the Caribbean Hydrological Cycle Monitoring (Carib-HYCOS) Project, under which two stream gauges will be provided to Saint Lucia (Venantius Descartes, pers. comm). Further to this a number of initiatives are currently underway related to the provision of additional equipment for meteorological and hydrological monitoring.

Table 5.3 below provides a summary of the types of data collected and managed by the MSD.

[19] d'Auvergne, E. C. 2004. The Acquisition, Use and Management of Data in Responding to the Effects of Climate Change in a Small Island Developing State: The Case of Saint Lucia. A Thesis submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Natural Resources Management of The University of the West Indies. Faculty of Pure and Applied Sciences.

Table 5.3 Summary of Data Managed by the Meteorological Services Department

Station	Number of Stations	Location	Parameters
Airport Base Station	2	▪ Hewanorra International Airport ▪ George F. L. Charles International Airport	Air temperature (incl. max and min); Soil temperatures; Dew point temperature; Rainfall; Relative humidity; Pressure; Wind Speed; Cloud type and cover; Duration of sunshine; Evaporation; Horizontal visibility
ALERT System[20]			
Full Automated Weather Stations	5	▪ Souci Moule-a-Chique, Bocage, Desraches, Desbarras	Rainfall; Humidity; Air temperature; Wind Speed; Barometric pressure; Wind direction; Radiation[21]
Other Stations	6 4	▪ Anse-la-Raye (2), Errard, Barre-de-l'Isle, Grace, Edmund Forest ▪ Mahaut, Forestierre, Millet, Blanchard	Rainfall only Rainfall; Relative humidity; Air Temperature
Repeater only	1	▪ Piton Flore	
Marine	1	▪ Castries Harbour	Wave height; Air temperature; Wind speed; Wind direction; Atmospheric pressure

In the case of the Water Resources Management Agency (WRMA), this agency has assumed responsibility for the management of the agro-meteorological network which has been under the management of the Ministry of Agriculture from inception. The WRMA also has responsibility for stream gauging and does some level of water quality monitoring although this mandate is severely hampered by the inadequacy of available human and material resources, as well as the necessary equipment.

With respect to the other research areas, the following Table summarises other agency involvement in relevant areas.

[20] Some of the active ALERT stations serve as primary or secondary repeaters, in addition to collection weather data.

[21] One station only

Table 5.4: Research Portfolios for Various Agencies

Agency	Research Area(s)
Department of Forestry	Birds, insects, timber, plant taxonomy, reptiles, amphibians and mammals (National Forest Demarcation and Biophysical Resource Inventory)
Department of Fisheries	Fish landings:1984-present; Status of coral reefs at a number of points:1999-2006; Beach profiles on representative beaches around the island[22] Marine water quality data at a number of points in collaboration with the Ministry of Health[23]
Soufrière Marine Management Association (SMMA)	Coral reef monitoring; Water quality monitoring; Nutrient monitoring; Role of marine reserves in reef fishery; Reef fish stock assessments; Impact of sediment pollution on coral and reef fish communities, and the spread of coral diseases
Sustainable Development and Environment Department (SDED)	National Compendium of Environmental Statistics; Draft Environmental Research Policy (2008)
Environmental Health Department	Analyses of wastewater, potable water and recreational water
Caribbean Environmental Health Institute (CEHI)	Drinking and recreational water analysis; Industrial and sewage effluent testing; Heavy metal testing; Pesticide residue analysis.
Water and Sewerage company (WASCO) Inc.	Monitoring water volumes and quality within its supply and distribution network
Insurance Council of Saint Lucia: Ministry of Finance; Ministry of Tourism; Department of Agriculture; Statistics Department; LUCELEC; Transport Division	Socio-economic and other data useful for climate change assessments

[22] Started in 1990; break 1991-1993; recommenced in 1994; break 1995; 1998-present

[23] Started 1982-2001 in an *ad hoc* manner, leading to major gaps in the dataset; improved regime 2002-present.

In summary, the priority needs for sustained Research and Systematic Observation (RSO) and the steps to strengthen these at the national level include:

1. Wider and more representative deployment of field monitoring equipment, including stream water-level recorders and meteorological stations, as well as deployment of sensors to cover additional meteorological parameters.
2. Increased and enhanced human resource capacity (numbers, as well as training in GIS, Hydrology, Climatology, Hydrogeology, Water Resources Management and other key areas) for data collection and analysis, particularly with respect to currently unavailable baseline data.
3. Data management systems for climatalogical data(hardware and software), including the establishment of properly managed databases.
4. Adoption and implementation of a coherent policy to support research, data management and data exchange (draft Environmental Research Policy)
5. Improvement of data analysis capability (though training of personnel and strengthening of key agencies)
6. Financial resources to support RSO activities.
7. Establishing an inter-agency body to guide national research efforts
8. Rescuing and archiving climate-relevant data in danger of being lost.

5.6 Climate Change Education, Training, and Public Awareness

This section examines the following:

1. Initiatives to increase awareness and understanding of climate change issues
2. Initiatives, projects and programmes for education, training and public awareness
3. Institutional framework for public participation in climate change activities
4. Cooperation to promote education, training and public awareness
5. Gaps, needs and priorities identified in climate change education, training and public awareness
6. Conclusions and recommendations

Initiatives to increase awareness and understanding of climate change issues and projects and programmes for education training and public awareness, are summarized in Table 5.4

Table 5.4 Initiatives for Public Awareness and Education

Approaches and Media	Programmes	Other Details
Radio and Television	*An Inconvenient Truth*[24]	*Sponsored under: UNFCCC New Delhi Work Programme on Article 6 on Education, Training and Public Awareness*
	Paradise at Risk? Facing up to Climate Change in Saint Lucia[25]	
	My Island- My Community	
Print Media	*Talking Sustainable Development* *SDED Newsletter (NEXUS)*	*Voice newspaper column (weekly articles by the SDED) established since 2002*
	World Environment Day Supplements	
The Internet	*Climate Change website*	*The climate change website will be enhanced and updated under the SPCR-PPCR*
Surveys / Assessments	*2005 KAP survey. Assessment included the level of awareness of climate change issues*	*Funded through MACC and VCA Projects. Survey Population: 500*
	2007 Environmental Awareness Survey was conducted. Also included information of awareness of climate change issues	*OECS Protected Areas and Associated Livelihoods (OPAAL) Project*
	2011 CC Survey. Completed under Phase 1 of the PPCR and informed the development of a Climate Change Environmental Education Strategy and the implementation of related activities to be undertaken under Phase 2 of the PPCR.	
Education and information Products	*Climate Change –themed desk calendars;* *Energy Efficiency Manual* *Climate Change Teacher's Toolkit (draft);* *Climate Change and You (Information brochure)*	*Produced since 2001* *In collaboration with: BIT, EU-SFA 2008, PPA Energy and AETS* *Sponsored under: UNFCCC New Delhi Work Programme on Article 6 on Education, Training and Public Awareness*

[24] A documentary featuring Al Gore

[25] A locally produced video by the SDED, in English and Creole

School-based awareness-building/summer camps	*SDED delivers talks and audio-visual presentations*	*Hosted by agencies such as the SLNT and others*
Exhibitions/open-air events	*Exhibit of posters; distribution of brochures and other informational material; reaching members of the public in small groups and on a one-on-one basis;*	*Events such as UN-designated, and other special days (e.g. World Health Day);*
Demonstration projects	*Critical Infrastructure Project (SPACC)* *Sustainability of Water Resources Project* *Installation of four photovoltaic systems on conspicuous public buildings*	

Other important initiatives included the use of meetings (including High-level briefings and presentations), workshops and symposia to increase climate change awareness. A summary of those undertaken in the last decade is provided in Table 2.5.

Table 5.5: Key Climate Change-Specific Meetings, Workshops And Symposia Within The Last Decade

Year	Event	Organiser	Audience	Details
2001	Climate Change Enabling Activity Project Institutional Data Needs Assessment (GOSL, 2005[26]) Workshop	SDED	Agencies with research needs and capabilities relevant to climate change	Identifying available data and key data gaps
2003	Climate Change and the Financial Sector Workshop	Insurance Council of Saint Lucia (ICSL)/SDED/ACCC Project	Insurance sector	Overview of climate change and its implications for the financial sector
2004	Climate Change and Health Seminar	SDED/CEHI	Participants from non-governmental and governmental organisations, particularly, but not exclusively related to the health sector	Increasing the level of awareness, especially of health practitioners on the relationship between climate change and climate-related diseases
2004	CDM Workshop	SDED	NCCC and other key stakeholders	Raising the level of awareness of the Kyoto Protocol, the CDM, and emissions trading in general among stakeholders with a view to stimulating interest in participating in emissions reduction ventures at the national and regional level.
2005	National Symposium on Climate Change and Food	SDED/ Inter-American Institute for Cooperation on Agriculture	Participants from non-governmental and governmental organisations,	Improving awareness of the relationship between climate change and agriculture/food production

[26] Government of Saint Lucia. 2005. Report for Climate Change Enabling Activity Project Phase II: Institutional Data Needs Assessment. Ministry of Ministry of Physical Development, Environment & Housing. Prepared by Susanna De Beauville-Scott.

Year	Event	Organiser	Audience	Details
	Production (GOSL, 2005)[27]	(IICA)	particularly, but not exclusively related to the agriculture sector	
2005 & 2006	Climate Change Vulnerability and Capacity Assessment Regional Workshop	MACC and UNDP-Caribbean Risk Management Initiative (CRMI), in collaboration with SDED and the Department of Forestry	Regional organisations involved in climate change in the Caribbean	Developing vulnerability assessment methodologies applicable to the Caribbean area
2006	KAP Survey Results Community Workshop	SDED	Community, governmental and non-governmental organisations	Sharing of project results with community and other stakeholder agencies
2007	Small Island Developing States (SIDS) Workshop on the Implementation of UNFCCC Article 6	UNFCCC, in collaboration with GOSL (specifically SDED)	Implementers on climate change from around the Caribbean	Implementing Article 6 of the UNFCCC on Education, Training and Public Awareness
2007	Annual General Meeting- Insurance Council of Saint Lucia	ICSL, in collaboration with Saint Lucia's climate change TFP	Insurance sector, finance, banking	Delivering a presentation on the implications of climate change for the insurance, and wider financial sectors
2007 & 2008	GHG Inventory Workshops (as part of the SNC Project)	Marbek Resource Consultants, Canada, in collaboration with SDED	NCCC	Training in the identification of sources of greenhouse gases on the island, an assessment of quantities of these gases discharged and the identification of sinks
2009	Symposium on the theme, *Dealing with Change:*	ICSL	Insurance sector	Improving awareness on the impact of climate change on insurance

[27] Government of Saint Lucia. 2005. Report on National Symposium on Climate Change and Food Production. Ministry of Physical Development, Environment and Housing, in collaboration with the Inter American Institute for Cooperation Agriculture

Year	Event	Organiser	Audience	Details
	Assessing Risks and Opportunities for Insurers			
2009	Student Symposium (as part of Energy Awareness Week (EAW) under the theme *Combating Climate Change through Renewable Energy and Energy Efficiency)*[28]	SDED, in collaboration with Caribbean Regional Agency Development Programme/ German Technical Assistance (CREDP/GTZ), Caribbean Electric Utility Services Corporation (CARILEC) and governmental and private sector agencies	25 schools from around the island	Exposing students to a range of sustainable energy options available to Saint Lucia, as well as energy efficient options
2009	Construction Symposia (as above, as part of EAW)	SDED, in collaboration with CREDP/GTZ, CARILEC and governmental and private sector agencies	Electricity generation, technical cooperation agencies, public utilities, transport, NCCC members	Improving awareness under the theme *Innovative Building Construction & Designs for Energy Efficiency*
2009	Workshop on *Climate Change and Water Use Efficiency in the Tourist Industry*	Global Water Partnership (GWP)-Caribbean, in collaboration with the Caribbean Basin Water Management Programme (CBWMP) Inc. and the Saint Lucia Hotel and Tourism Association (SLHTA)	Hotel managers and employees around the island	Improving awareness on the effects of the climate change on water and how to address this in the tourism sector

[28] All the themes for EAW are climate change-relevant; however, only 2009 is climate change specific.

Year	Event	Organiser	Audience	Details
2009	Regional Workshop on Training in Disaster Management and Mitigation for Teachers	Caribbean Union of Teachers and NEMO	Teachers from around the Caribbean	Exposing teachers to disaster management and mitigation, including climate change, to allow for incorporation into the school curriculum
2009	Vulnerability and Adaptation Climate Change Workshops (as part of the SNC Project)	Climate Studies Group of Mona Campus, Jamaica, in collaboration with SDED	NCCC and local consultants	Training and information about latest findings regarding global warming trends in the Caribbean in general and in Saint Lucia, in particular
2009	Mitigation Training Climate Change Workshops (two) (as part of the SNC Project	Marbek Resource Consultants, Canada, in collaboration with SDED	Local consultants and key stakeholders from various agencies that deal with energy, waste, land-use and land-use change and forestry	Training in generating and understanding baseline scenarios, towards enhancing national capacity to collect and analyse Saint Lucia's contribution to global greenhouse gas emissions
2009	Second Conference of the CCCCC on the MACC for Sustainable Development of the Caribbean	CCCCC, in collaboration with CARICOM	Participants from CARICOM involved in climate change and especially the MACC Project	Sharing of results of the MACC Project and determining the next steps
2009	Climate Change IFF Workshops under the theme, *Capacity development for policy makers of developing countries to address climate change concerns in key sectors*	UNDP, in collaboration with SDED		Assessing opportunities for improving investment and finance flows for climate change in key sectors and/or economic activities
2010	PPCR Joint Mission I: National Consultation	SDED and Ministry of Finance, in collaboration with the World Bank and the Inter-American	NCCC and other key agencies,	Finalising a proposal for Phase I of the PPCR and discussing ideas for implementation during Phase II of the PPCR; stocktaking on climate

Year	Event	Organiser	Audience	Details
		Development Bank (IDB)		change for the country
2010	Sensitisation Workshop in Energy Efficiency	SDED and Banana Industry Trust (BIT), in collaboration with Power Planning Associates (PPA) Energy and, Application Europeenne de Technologies et de Services (AETS) and with support from EU SFA 2008	Key agencies involved in energy	Held as part of a wider process to develop the following: A long term Sustainable Energy Strategy, which includes Electricity Sector Liberalisation, as it relates to renewable and alternative sources of energy, as well as a Transport Sector Strategy (inclusive of a Green Policy within the Transport sector), based on the NEP, approved by the GOSL; The revision and updating of the Electricity Supply Act (ESA) and other relevant concerns in accordance with the NEP- SEP A blueprint for the establishment of a regulatory authority and for inter-agency collaboration for energy sector improvements A Public Energy Education and Awareness Strategy and Plan to be developed for the short and long term
2010 & 2008	Engineering for Climate Change in Saint Lucia -The Hurricane Scenario**:** *Second Workshop on Designing and Constructing for Increased Hurricane Wind Speeds from Climate Change*	SDED, in collaboration with the CCCCC	Primarily for engineers, but also included architects, planners, building officers, contractors, technicians and others persons involved in construction	Process to be pursued for the adoption of the guidelines, as part of the DCA approval process for public and commercial buildings in Saint Lucia, in the first instance.

Year	Event	Organiser	Audience	Details
2010	Drought Management: *Issues, Challenges and Lessons for the Caribbean Water Utilities*	CBWMP Inc., in collaboration with the Caribbean Development Bank (CDB)	Persons involved in the water sector	Determining the way forward, based on the recent drought experienced in the Caribbean, including the link with climate change
2010	Energy Audit Seminar	OAS, in collaboration with SDED	Public and private sector agencies	Guidance and practice in conducting energy audits. Seminar was held over a five-day period.

Capacity constraints related to Education and Outreach are summarized in Table 5.6 below

Table 5.6 : Cross Cutting Capacity Constraints

Thematic Area	Cross-Cutting Capacity Constraints		
	Systematic	**Institutional**	**Individual**
Education and Outreach	▪ National Education Policy not reflective of importance of environmental issues ▪ Systemic resources not available and initiatives in this area are project-driven ▪ Initiatives are sporadic and project-driven ▪ Education and awareness is not sustained and does not always evolve from research and monitoring	▪ Initiatives generally under-funded and human resources not adequately deployed ▪ Limited involvement of civil society in environmental management	▪ Focus on relevant (applied) science generally lacking at all levels of education ▪ Access to necessary information limited. ▪ Limited sense of ownership and of responsibility for the environment by Saint Lucians

5.7 Measures to Promote Information Exchange and Networking

Actions have been taken, though in an uncoordinated manner, to promote information sharing and networking. There is scope for improving the level of collaboration between agencies and for strengthening the institutional and policy environment. There is also a need too to ensure that databases, compendia and electronic communication pathways are updated and maintained.

This section addresses:

1. Activities to promote information sharing; and,
2. Participation in and contribution to information networks.

Activities to promote information sharing include:

- Policy
- Legislation
- Institutional arrangements
- Forums: meetings, consultations and workshops
- Electronic communication
- Databases[29]

Policy instruments of relevance to climate change, and which address the issue of information exchange and networking include:

a. The St. George's Declaration (SGD)
b. National Environment Policy (NEP)/National Environment management Strategy (NEMS)
c. National Climate Change Policy and Adaptation Plan (NCCPAP)
d. Draft Environmental Research Policy
e. Draft National Environment Education Policy (NEEP)

Details of the proposed legislation are presented in Table: 5.7.

[29] Databases was addressed in Chapter 10, *Activities Related to Transfer of Environmentally Sustainable Technologies.*

Table 5.7: Legislative Measures

Legislation	Proposed Department	Functions
Draft Environmental Management Bill (currently under revision as part of Phase 1 of the PPCR)	Department of the Environment	Promote research and monitoring as well as the effective management and use of data and information with a view to supporting sound decision-making on environmental, social and economic development
		Maintain a register of all wastes, discharges, emissions, deposits or other sources of emission or substances which are of danger or potential danger to the environment
		Carry out such surveys and collect, collate and analyse such data and information as is necessary or expedient for environmental management purposes and establish and maintain a *National Environmental Information System.*
		Sets the stage for the continued publication of the *State of the Environment Report*

The institutional framework which exists at present includes the following:

- Climate Change Team within the SDED and the National Climate Change Committee (NCCC) – hub for climate change information and primary vehicle for information exchange and networking on climate change issues.
- National Environment Commission (NEC) – established in 2008, it fosters the exchange of information on subjects, which include climate change, at an advisory level.
- National Emergency Management Committees – part of the National Disaster Management System of Saint Lucia which operates in three tiers, viz: National: National Emergency Management Advisory Committee (NEMAC); Committees: National and District Disaster Committees; and, Coordinating Unit: NEMO Secretariat.
- Coastal Zone Management Advisory Committee (CZMAC)

Forums: meetings, consultations and workshops- many of these at the national regional and international levels have served as a medium for exchanging information and for strengthening inter-agency linkages.

Electronic communication includes: Electronic Mailing list for Environmental Education (EMLEE) established by the SDED; NEMO News, a newsgroup operated by NEMO; Climate change Website (established in 2000); and the SDED Ozone website (which provides information on actions taken to phase out ozone depleting substances and on the effects of ozone depletion on the climate system).

Although an official climate change data base has not been established, the SDED is a repository for a significant amount of climate relevant data and information in electronic form.

Participation in and contribution to information networks

Saint Lucia participates and contributes to the following networks:

- Caribbean Energy Information System (CEIS) – an energy information system of the Caribbean;
- Caribbean Information Platform on Renewable Energy (CIPORE) – created to provide information on renewable energy in the region;
- UNDP National Communications Support Programme (NCSP)[30] and the UNDP Climate Community;
- The Women's Environment and Development Organisation (WEDO)[31] – mobilizes women's participation to advance women's perspectives at the UN and other forums;
- Global Observing System (GOS) of the World Meteorological Organization (WMO)
- Regional Network of Ozone Officers for the English Speaking Caribbean and Regional Network of Ozone Officers for Latin America
- Caribbean Community Climate Change Centre (CCCCC) – the agency responsible for coordinating the response of the Caribbean Community to climate change

As a member if the Alliance of Small Island Developing States (AOSIS) Saint Lucia also participates in information exchange for the formulation negotiating positions. Finally, and of less direct relevance to climate change, the SDED collaborates with the Caribbean Council for Science and Technology (CCST), under whose umbrella efforts are underway to establish a true science and technology network to serve the Caribbean region.

5.8 Gender, Youth, Children and Poverty

Recognition is given to the fact that certain groups or sections in society are likely to be particularly affected by climate change and its impacts. Although Gender, Youth, Children and Poverty are addressed in various policy and legislative instruments, a strong linkage has not to date, been forged between these issues and the issue of climate change.

Gender

The term ***Gender*** *refers to the "differences in socially constructed roles and opportunities associated with being a man or a woman and the interactions and social relations between men and women. Gender determines what is expected, permitted and valued in a woman or a man in a determined context" (*UNDP, 2009[32]).

[30] United Nations Development Programme National Communications Support Programme: http://ncsp.undp.org/

[31] Women's Environment and Development Organisation: http://www.wedo.org/

[32] United Nations Development Programme and the International Union for the Conservation of Nature. 2009. Training Manual on Gender and Climate. In collaboration with Gender and Water Alliance, ENERGIA International Network on Gender and Sustainable Energy, United Nations Educational, Scientific and Cultural Organisation (UNESCO), Food and Agriculture Organisation (FAO) and the Women's Environment and Development Organisation (WEDO) as part of the Global Gender and Climate Alliance (GGCA).

Gender equality *refers to the:" equal rights, responsibilities and opportunities of women and men and girls and boys. Equality between men and women is seen both as a human rights issue and as a precondition for, and indicator of, sustainable people-centered development" (*UNDP, 2009[33]*).*

Climate change will affect women and men differently, depending on their respective status and roles in society. However, most of the national climate change initiatives undertaken to date have focused largely at the policy and institutional level and have not included the implementation of *concrete* adaptation or mitigation measures at the community level that would directly impact day-to-day life and that would necessitate the in-depth consideration of gender issues.

Activities undertaken have been coordinated by public sector agencies, and in most cases, by the SDED. In this regard, there has been significant participation by women as follows:

Table 2.7: Gender Distribution in the Area of Climate Change

Sectors	Sex of Consultant	
	Male	Female
Public Sector		
SDED (responsible for climate change coordination)	**2**	**12**
Climate Change Team (within SDED)	**1**	**5**
SNC Coordinator		**1**
SPACC Coordinator		**1**
PPCR Coordinator (Regional and National)		**2**
Private Sector (V&A Component: consultancies)	**5**	**7**
PPCRFinance	1√	**7**
SPACC Forestry and Biodiversity	2√	**1**
GIS		√
Health	√	
Housing		√
Critical Infrastructure		√
Tourism		√
Water		√
Disaster Management		√
V&A Team Leader	√	

[33] Ibid.

To date, climate change initiatives undertaken in Saint Lucia, based on the gender distribution on climate change work, have been both gender-inclusive and gender-equitable. An assessment of how proposed or ongoing climate change measures andimpacts on or benefits women has not been undertaken. At present, given the significant and growing role that they play in society, there appears to be scant reason for concern that women, in particular, will be unable to participate fully in future climate change activities at the policy-making, technical or community level. Nevertheless, as measures to address climate change continue to be planned and implemented, there will be a need to ensure that all sectors of society are considered, both in terms of how they are affected by climate change and in terms of how they can participate meaningfully in designing and implementing the necessary response measures. In this context, every effort must be made to ensure that both genders can participate equitably.

Youth

Official and statistical definitions of youth vary. The National Youth Policy[34] of Saint Lucia defines youth as "*young men and women between the ages of 15 and 35*". However, the United Nations defines youth as "*persons between the ages of fifteen and twenty-four*"[35].
Activities undertaken which have targeted young people, include:

- Conducting lectures and presentations for primary, secondary and post-secondary on climate change or related areas such as energy (Draft Climate Change Tool kit developed for senior primary to secondary level).
- Youth components for events such as Energy Awareness Week (EAW) and World Environment Day (WED);
- Youth Environment Forum (undertaken by the Saint Lucia national Trust)
- Climate Change Workshops (also I day consultation and Youth Exchange)– organized by the Caribbean Youth Environment Network (CYEN)
- Airing of Public Service Announcement (prepared by CYEN Saint Lucia) in commemoration of Caribbean Climate Change Day of Action
- Participation at the COP – 15 in Copenhagen, and 16 in Mexico

Children

A child is defined under the Convention on the Rights of the Child (United Nations, 1990[36], Article 1) as "*every human being below the age of 18 years unless under the law applicable to the*

[34] Government of Saint Lucia. 2000. National Youth Policy: Saint Lucia. Ministry of Education, Human Resource Development, Youth and Sports

[35] Youth and the United Nations: http://www.un.org/esa/socdev/unyin/qanda.htm#1

[36] United Nations. 1990. Convention on the Rights of the Child. Adopted and opened for signature, ratification and accession by General Assembly resolution 44/25 of 20 November 1989. Entry into force 2 September 1990, in accordance with article 49.

child, majority is attained earlier". According to organisation, *Save the Children* (2008), "*climate change, and the severe natural disasters associated with it, is already affecting the spread and intensity of disease, especially those diseases that affect children*". Around the world, children are usually the most severely affected by natural disasters due to their small size and relative inability to take care of themselves (UNICEF, 2007).

In the first instance, climate change is expected to result in the increased occurrence of a number of diseases. As early as 2000, climate change was estimated by the World Health Organisation (WHO) to be responsible for approximately 2.4 percent of worldwide diarrhoea and six percent of malaria in some middle-income countries – diseases that disproportionately affect young children in developing countries (UNICEF, 2007).

Climate change is also expected to result in more intense droughts and disruptions in water supply. Water shortages often lead to poorer hygiene, which in turn leads to the increased occurrence of gastro-intestinal diseases, to which children are particularly susceptible. Children are also most affected by malnutrition, brought about by the reduced food availability. Therefore, any negative impacts of climate change on food production could adversely affect the health of children.

Initiatives within the Education system to target children have been captured within the section on Youth. In addition to this, the health sector has been a primary target. Attempts have been made to sensitise health and medical practitioners to the effects of climate change on human health. In the V&A assessment being undertaken for the SNC, great emphasis has been placed on the health sector (for example in 2004, the GOSL convened a Climate change and Health Seminar). The draft report for that sector presents many findings pertaining specifically to children (Vitalis and Ragunanan 2010[37]).

Poverty

The poor are likely to be disproportionately affected by climate change. "*For the poorest and most vulnerable people in today's world, climate change is a 'triple whammy': they didn't cause it, they are most affected by it, and they are least able to afford even simple measures that could help protect them from those damaging impacts that are already unavoidable*" (Oxfam International , 2008[38]).

To date, there have been few initiatives aimed specifically at merging the poverty and climate change agendas. However, there is a growing recognition of the nexus between poverty and the environment in general, and poverty and climate change in particular. This nexus has been identified in a report entitled *Identification and Analysis of the Linkages between Poverty and the*

[37] Vitalis, E and M. Ragunanan. 2010. Vulnerability & Adaptation Assessment: Health Sector. Second National Communication Project of Saint Lucia.

[38] Oxfam International. 2008. Climate, Poverty, and Justice: What the Poznań UN climate conference needs to deliver for a fair and effective global climate regime. Oxfam Briefing Paper 124, December 2008.

Environment in the OECS. Case Study: Saint Lucia (Ramjattan. 2008[39]). This suggests the need for further research and analysis in this regard, and this is discussed further in the SNC chapter on Gaps and Constraints. Future climate change initiatives will, as necessary, more specifically address poverty considerations.

5.9 Capacity Building Activities, Options and Priorities

Actions taken with respect to capacity building in the national context include:

1. *Identification of specific needs, options and priorities for capacity building to address climate change issues* – Included in reports such as the Initial National Communication (INC), the National Capacity Self Assessment (NCSA), the Climate Change Technology Needs Assessment (CCTNA).

Table 5.8 extracted from the *National Climate Change Policy and Adaptation Plan* presents a summary of the capacity building needs in key areas.

Table 5.8: Capacity Building Needs In Key Areas Related To Climate Change

Key Area	• Required Strategies and Actions
Climate change education and awareness	• Development and implementation of an integrated, coordinated and sustained climate change education and awareness programme targeting all sectors and relevant interest groups • Establishment of a climate change information storage and exchange mechanism
Incorporation of climate change issues into the development planning process	• Undertaking of training activities in areas relating to planning and data processing • Establishment of a National Climate Change Unit • Development of a national climate change framework in the context of a larger national planning framework
Implementation of Saint Lucia's Sustainable Energy Plan	• Building institutional capacity for energy sector planning and evaluation of renewable energy technologies (RETs.) • Development appropriate regulatory framework for the successful implementation of the SEP • Development and implementation of education and awareness programme to support SEP • Conduct of research into RET potential and energy efficiency measures
• **Sectoral and Resource Management Options**	
Coastal and marine resources	• Undertaking review of existing coastal monitoring and data collection systems

[39] Ramjattan, D. 2008. Identification and Analysis of the Linkages between Poverty and the Environment in the OECS. Case Study: Saint Lucia.

Key Area	• Required Strategies and Actions
	• Implementation of integrated coastal zone management plans
Human settlements	• Development of adaptation plan for human settlements including zoning, defences, building codes, etc.
Terrestrial resources, terrestrial biodiversity and agriculture	• Establishment of a system for improved monitoring and research of key terrestrial and agricultural processes and resources.
Freshwater resources	• Undertaking inventory of freshwater resources and develop and implement a National Water Resources Management Plan
Tourism	• Improvement/ development of a regulatory framework with emphasis on enforcement
Regional initiatives	• Establishment of a Caribbean Climate Change Centre to coordinate Caribbean response to climate change
National communication process and follow-up activities	• Building capacity to resolve issues regarding emissions factors and to better address LULUCF computations • Enhancing data collection, management and processing • Identification and implementation of country-specific Stage II and III adaptation[40] measures • Developing national capacity for water resource planning and management • Establishing systems for enhanced exchange of information and experiences within the region, as well as between regions • Developing and implementing integrated resource/spatial management plans Implementing energy conservation and renewable energy pilot projects • Enhancing capacity for disaster planning and management • Enhancing early warning systems for extreme weather events • Enhancing capacity to participate in international climate change initiatives and negotiations

[40] Decision 11/CP.1 of the Conference of the Parties divides adaptation activities into three stages, as follows:
Stage I Adaptation: "*Planning, which includes studies of possible impacts of climate change, to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building*";
Stage II Adaptation: "Measures, including further capacity building, which may be taken to prepare for adaptation as envisaged in Article 4.1 (e)" Stage III Adaptation: "Measures to facilitate adequate adaptation, including insurance, and other adaptation measures as envisaged in Articles 4.1 (b) and 4.4". (UNFCCC, 1995).

2. *Participation of wide range of stakeholders in issues related to climate change* – The Climate Change Team liaises with the following, on a day to day basis:
    i. Representatives of agencies represented on the NCCC
    ii. Consultants from the public and private sectors
    iii. Teachers
    iv. Students
    v. Researchers
    vi. Youth organisations, such as the CYEN
    vii. The Office of the Prime Minister
    viii. NGOs such as the SLNT
    ix. Community groups
    x. Performing arts groups
    xi. Media practitioners (electronic and print)
    xii. Development partner agencies
    xiii. Regional and international donor organisations
    xiv. Regional and international technical support organisations

    In addition, through organs such as the National Climate Change Committee (NCCC), the National Environmental Commission (NEC), the CYEN and the SLNT a wide spectrum of stakeholders are accessed.
3. *Activities related to co-ordination and sustainability of capacity-building*
    The SDED works with national, regional and international partners to identify capacity-building needs. These include:
    - **CCCCC** – collaborates on a number of initiatives, in particular the SPACC Project;
    - **GEF-Small Grants Project (SGP)** - provides funding opportunities for NGOs and community groups to implement project under a number of GEF Focal Areas, including climate change. However, to date, Saint Lucian CBOs and NGOs have taken little advantage of the SGP and have submitted few projects for consideration. Further, very few, if any, projects have been submitted under the climate change focal area (Crispin d'Auvergne, pers. comm.[41])
    - **SNC Project** - steps were taken to ensure that training was provided in various areas and that the skills acquired, both by public and private sector individuals, would actually be used within the SNC process
    - **PPCR Project** – proposes the establishment and maintenance of in-house climate, climate-relevant databases; all the project submitted under this initiative, have incorporated capacity building components.

4. *Dissemination and sharing of information on capacity-building activities*
    Modes of transmission of information:
    - **NCCC Meetings** - provide a forum to discuss all climate-change related activities, including capacity-building activities;

[41] Member, Barbados and OECS SGP Sub-regional Steering Committee (SRSC) and Saint Lucia's climate change TFP

- **MPDE** - often through the SDED, is usually the primary recipient of notifications from regional and international development partners on capacity-building opportunities in climate change. These notifications are disseminated to relevant stakeholders
- **SDED** - circulates, electronically, or in hard copy, reports of capacity-building activities and about funding opportunities for climate change and related areas, including those for capacity-building (NCCC, CZMAC, NEC, and 5C's also disseminate information of Capacity building opportunities through this medium)
- **Documents such as the INC (GOSL, 2001[42]), and the NCSA Report (GOSL, 2007[43])** - compile information on a range of climate change activities, including those aimed at building capacity.

5. *Capacity-building activities aimed at integrating adaptation and mitigation into medium- and long-term planning*
   Numerous persons in Saint Lucia, largely through the support of the SDED, have benefitted from national, regional and international training exercises and programmes. Some of these are detailed in Table 5.9.

[42] Ibid.

[43] Ibid.

Table 5.9: Medium And Long-Term Planning Considerations (for traing undertaken) For Specific Capacity-Building Activities

Capacity-Building Activity	Anticipated/Actual Medium and Long-Term Benefits	Comments
Training in V&A assessments	Trained persons available to conduct subsequent V&A Assessments.	Of four persons trained for the INC, two of the three currently in Saint Lucia also took part in the SNC V&A Assessment. The SNC team and members of the NCCC have also participated in specific workshops at the regional and international level to build capacity to execute the SNC Project and conduct V&A assessments, including, but not limited to training on:. Scenario generation; Conducting national vulnerability and adaptation assessments; Interpreting the output of regional models for assessing climate change; Biophysical models and climate change impact assessment on agriculture; Climate change risks and opportunities for the finance sector; and Climate change and water.
Training in mitigation and specifically, greenhouse gas inventory	Trained persons available for future GHG inventories	A number of local persons trained for the INC GHG Inventory were part of the SNC GHG Inventory process In addition, persons form the SDED, Saint Lucia Bureau of Standards and Department of Forestry participated in overseas sessions in 2009 and 2010 on greenhouse gas schemes addressing climate change and how ISO standards help; climate change and trade in a development perspective and greenhouse gas quantification, reporting and verification

Capacity-Building Activity	Anticipated/Actual Medium and Long-Term Benefits	Comments
Acquisition of data on coastal resources	Baseline data available to support decision-making as well as to determine changes in resource base over medium and long term	Data acquired in 2008/9 already being used as a basis for subsequent studies
Training in web site design	Ongoing maintenance of climate Change Website	Website operational since 2000
Acquisition of additional stations and sensors by MSD for systematic observation	Data to support detection and attribution of climate change over medium and long term and for generation of scenarios	
Training of Surveyors from the Physical Planning Section	Building national capacity to incorporate climate change elements into maps, models, etc	
Training in assessment of IFF	Building national capability to project future adaptation and mitigation needs and thus, to facilitate their inclusion into the budgetary/development process	
Conduct of KAP study	Generation of baseline data on awareness levels to assist in determining impact of future measures. Identification of pathways for future initiatives to reach target audiences and achieve desired attitudinal and behavioural changes.	
Training of engineers, architects, planning and building officers and contractors in new engineering guidelines pertaining to hurricane wind speed designs	Building national capacity to retrofit and construct structures that are better able to withstand the anticipated Category IV and V hurricanes in the Atlantic Basin up to 2025, as a result of climate change.	One such workshop was held in 2008 and another in 2010, as part of the SPACC Project. Trained persons were involved in the designing, construction and planning and supervision aspects of buildings. Process to be pursued for the

Capacity-Building Activity	Anticipated/Actual Medium and Long-Term Benefits	Comments
		implementation of the hurricane wind speed guidelines generated under the SPACC Project, as part of the DCA approval process for public and commercial buildings in Saint Lucia, in the first instance
Training of technical personnel from LUCELEC, Ministry of Communication Works, Transport and Public Utilities, Castries City Council, SLNT and Sir Arthur Lewis Community College, in PV installation	Trained personnel will be equipped to undertake future PV installations while trainees from the community college will be better empowered to impart knowledge to students	Training held in 2009
Training and certification of technicians in Good Refrigeration Management Practices, Recovery and Recycling, Retrofitting and Alternative Technologies; training of Customs and Marine Police Officers in the Monitoring and Control of Trade in ODS	In addition to depleting the ozone layer, most ODS covered by the Montreal Protocol are also potent GHGs. Saint Lucia successfully phased out the use of CFCs and put in place a trial ban in 2009. Since HCFCs also have a high GWP, Parties made a decision to accelerate the phase out of HCFCs from a target date of 2040 to 2030. Saint Lucia is currently preparing to embark upon the phasing out of HCFCs.	
Training and practice in conducting energy audits	Trained personnel will be equipped to undertake future energy audits within their organisations. This will lead to improved energy efficiency in the public and private sector, with concomitant cost savings and environmental benefits.	Seminar was held over a period of five days. Hands- on training was provided and participants are expected o report back with findings.

6. *Promotion of synergy in implementation of the Rio Conventions*
   The three Rio Conventions bear many aspects in common. For SIDS such as Saint Lucia, with limited human, financial and institutional capacity, and vulnerable ecosystems on which it depends, there is merit in seeking to implement these Conventions in an integrated and synergistic way[44]. Table 2.11 shows the overlapping requirements of the Parties to the Rio Conventions.

Table 2.11: Overlapping requirements of the Parties to the Rio Conventions

	Biodiversity	*Climate Change*	*Desertification/Land Degradation*
National inventories		Article 4 (b)	
National and regional action plans	"strategies" Article 6 (a), (b)	Article 4 (b)	Articles 9, 10
Identification and monitoring	Article 8		Article 16
Develop protected areas	Article 8		
Legislation	Article 8 (k)	Preamble	Article 5 (e)
Research	Article 12 (b)	Article 5	Articles 17, 19 (b)
Public education	Article 13	Article 6	Articles 5 (d), 19, 6
Environmental impact assessment	Article 14	Article 4 (i) (d)	
Clearing house for technical information	Article 18		Article 18
Public participation	Article 9	Article 6 (i) (a) (iii)	Article 19 (4)
Information exchange	Article 17	Article 7	Article 16
Training	Article 12 (a)	Articles 6	Article 19
Reports	Article 26	Article 12	
Data collection			Article 16
Examine obligations - assess implementation	Article 23	Article 7 (e)	
Report steps to COP	Article 26	Articles 12	Article 26

Source: GOSL, 2007[45].

[44] The respective Focal Points for the Rio Conventions lie within the MALFF (CBD and UNCCD) and the MPDE (UNFCCC).

[45] Ibid.

The National Capacity Self Assessment (NCSA) exercise, by way of providing a situational analysis and then identifying capacity constraints, needs and priorities, has assisted in laying the foundation for the promotion of synergy in implementing the Rio Conventions. To date, however, efforts to build on the findings of the NCSA and to achieve the required synergy remain sporadic and inadequate. A number of steps towards the achievement of synergies have been undertaken prior to and after the NCSA. These are as follows:

- Conventions Advisory Committee - In the late 1990s to early 2000s, the MALFF established an internal Conventions Advisory Committee (CAC). The purpose of the CAC was to ensure collaboration and coordination between the organs of the Ministry responsible for national implementation of the various Multilateral Environmental Agreements (MEAs) falling under the purview of the Ministry and to promote synergy with regard to actions taken to implement these agreements. At that time the MALFF was responsible for all three Rio Conventions.

- National policies and projects - Policy instruments highlight the need for coordination between the conventions. There are a number of national entities, programmes and initiatives which point to a recognition of the need for a coordinated approach to the implementation of the conventions. These include:
  - The National Environmental Commission (NEC)
  - SPACC
  - GEF support programmes

5.10 Recommendations: Way Forward

A summary of the recommendations are as follows:

1. ***Institutional strengthening and capacity building***
   a) Revitalising, strengthening, and supporting the work of entities such as the SDED Climate Change Team, the NCCC, the CAC, the NCSTD and the NEC.
   b) Strengthening GIS capability within agencies and establishing a coordinated interagency GIS network.
   c) Identifying and targeting capacity needs with respect to gender, youth, children, the poor and the elderly
   d) Activating the DNA.

2. ***Inter-agency collaboration and coordination***
   a) Continuing to work with the CCCCC and other regional entities to develop knowledge and skills.
   b) Fostering closer collaboration between the lead agencies on climate change and those responsible for women's issues, health, youth, the poor, children and the elderly.

3. ***Policy and legislation***
   a) Ensuring that the youth continue to play a meaningful role in climate change activities.

b) Ensuring that future national communications more adequately address issues relating to gender, youth, children, poverty and the elderly.
c) Finalising draft policy instruments such as the Building Code, and the Environmental Management Act.
d) Systematically implementing the recommendations of the TNA and NCSA.
e) Ensuring that future policy instruments, where feasible, address climate change issues.
f) Mainstreaming climate change into agency work programmes.

4. Databases and networks

a) Establishing a repository of all relevant policy documents.
b) Establishing properly managed databases including for ESTs.
c) Ensuring that the SDED is provided with the resources required to establish, maintain and regularly update required information networks and databases.

5. Support for non-governmental entities

a) Supporting the work of non-governmental entities on gender, youth, poverty, children and the elderly.
b) Taking all practicable steps to encourage civil society and other entities to participate in climate change education and awareness activities.

6. Monitoring and evaluation

a) Regularly monitoring and reviewing activities pertaining to capacity building needs and making the necessary improvements.
b) Reviewing the success of the SNC process.
c) Regularly reviewing and updating the TNA and other relevant documents, policies and strategies.
d) Strengthening the existing Climate Change Team to take the lead in monitoring of policy implementation.
e) Undertaking periodic surveys to determine changes in knowledge, attitudes and practices and to identify emerging needs.

7. Research, systematic observation and data management

a) Deployment of monitoring stations on a scientifically representative basis to address monitoring gaps.
b) Collecting currently unavailable baseline data.
c) Strengthening the MSD and other key agencies to address logistical and equipment issues.
d) Providing training in research and data management technologies.
e) Establishing an inter-agency body to guide national research efforts.
f) Rescuing and archiving data in danger of being lost.

8. Environmental education and awareness

a) Developing and applying communication strategies, methods and tools to/for gender poverty, children's, youth and the elderly issues.

b) Developing and implementing inter-agency climate change education and awareness programmes.
c) Training personnel in appropriate education and awareness and social marketing methodologies.
d) Establishing an Environmental Education Unit within the SDED.
e) Ensuring that all key agencies possess personnel dedicated to environmental education and awareness work.
f) Re-establishing the Education and Awareness sub-committee of the NCCC.

9. *Technology Transfer*

a) Ensuring the replication of viable pilot projects.
b) Encouraging and supporting South-South cooperation.
c) Encouraging the efforts of innovators.
d) Encouraging the establishment of EST enterprises.

10. *Financing*

a) Ensuring availability of adequate financial resources for climate change activities.

Given that climate change will be a part of the global and national reality for decades, if not centuries, and because it is projected to profoundly impact every facet of human existence, especially in SIDS like Saint Lucia, there will be a constant need to factor it into every aspect of development planning and to do so in an integrated, holistic fashion. For this to happen, however, climate change "thinking" must be infused into the Saint Lucian "psyche" at all levels, from the policy level to the level of the so-called "person-on-the street. The perception of, and response to, a "*genuinely existential threat* (United Nations in Indonesia website)[46]" and the "*most serious problem we are facing today*[47]" must pervade the national planning process, the operations of government agencies, the practices of the commercial/private sector and the actions of all citizens, from where and how they choose to build their homes to how they utilise water.

This suggests the need for, among others, ongoing awareness-building and education to positively influence practice; and research and systematic observation, supported by information dissemination, to guide decision-making. For these desired results to be achieved, financial, human and technological resources must become available at levels that will allow the necessary changes in knowledge and attitude to occur and the improved actions to be undertaken, on an ongoing basis. These resources must also be complemented by a supportive policy, legislative and institutional environment as well as by the requisite political will. There have been advances in all these areas and there are opportunities to make further progress if available funding channels can be tapped and if new and additional financial resources become available.

[46] United Nations in Indonesia: *2008 End-of-Year Quotes by UN Secretary-General Ban Ki-Moon on the United Nations and Selected International Issues*: http://www.un.or.id/page/2008-end-year-quotes-un-secretary-general-ban-ki-moon-united-nations-and-selected-international

[47] British Government Chief Scientist, Sir David King (quoted) in: Held, D, and Anthony G. McGrew. 2007. Globalization Theory: Approaches and Controversies. Polity Press, UK.

Chapter 6:
Gaps, Constraints and Related Financial, Technical and Capacity Needs

Constraints, Gaps and Related Financial, Technical and Capacity Needs

6.1 SECTION OVERVIEW

The Second National Communication (SNC) Report consists of six thematic areas which includes:

1. *National Circumstances;*
2. *Green House Gas Inventory;*
3. *Programmes Containing Measures to Facilitate Adequate Adaptation to Climate Change (V&A Assessment);*
4. *Programmes Containing Measures to Mitigate Climate Change;*
5. *Other Information Relevant to the Achievement of the Objective of the Convention;*
6. ***Constraints, Gaps and Related Financial, Technical and Capacity Needs.***

This final chapter highlights the Gaps and Constraints and associated Financial, Technical and Capacity Needs. For a small island developing state (SIDS) like Saint Lucia, a thorough understanding and response to climate change is critical, especially in light of the limited resources. Although the country's contribution to the source of this anthropogenic change is minimal, due to characteristics such as geographic location and small land mass with significant proportion of low lying coastal area, the country becomes vulnerable to the anticipated impacts of climate change.

Climate Change considerations have not to date been mainstreamed into the country's development agenda and is therefore not reflected in national sector considerations. In an effort to identify gaps and constraints, financial and technical needs to implement mitigation and adaptation measures in response to climate change, the country context as it relates to the current development agenda must be the starting point. This is a necessary backdrop against which the country's ability to implement mitigation and adaptation measures in response to climate change concerns must be assessed.

6.2 FINANCIAL, TECHNICAL AND CAPACITY NEEDS

6.2.1 Overview of Constraints and Gaps and Capacity Needs

The UNFCCC recognizes the challenge to Small Island Developing States (SIDS) as it relates to the integration of climate change concerns due to lack of financial and human resources and institutional capacities. Also critical is the issue of technological constraints. Climate Change concerns have not to date been mainstreamed into Saint Lucia's development agenda and integrated into national planning and therefore not reflected significantly in sectoral development plans as well as the overall development agenda for the country.

The following sections attempt to identify gaps and constraints, financial and technical needs required to implement mitigation and adaptation measures in response to climate change. This will be viewed on a sectoral basis as well as in general and as such the sectors under review will be the sectors which were the focus of the relevant assessments for the Second National Communication (SNC). The following highlights gaps and constraints and capacity needs as articulated in the relevant SNC Sector Reports, 2010.

1. *Agriculture Sector [SNC V&A Assessment – Agriculture, 2010]*

This Sector assessment recognised that there were a number of challenges to this sector. In this regard, the critical capacity needs identified for effective implementation of adaption options included:

- **a.** Development and strengthening of institutional capacity for research and systematic observation (RSO), including data collection, management, analysis and processing into outputs to guide decision-making;
- **b.** Enhanced capacity to evaluate suitable adaptation and mitigation technologies;
- **c.** Enhanced capacity to participate in relevant international negotiations;
- **d.** Increased sensitivity and awareness of the need to promote and finance no-regrets options that support climate change response efforts;
- **e.** Promotion of a mode of integrated development planning that incorporates environmental, economic and social considerations in a holistic, coordinated manner;
- **f.** Increasing public awareness of the options that individuals and communities can play in responding to climate change;
- **g.** Proper documentation of lessons learnt, best practices and historical / traditional knowledge.

2. *Coastal Zone Sector [SNC V&A Assessment – Coastal Sector, 2010]*

The Sector assessment highlights a number of constraints which impact on the sector's ability to integrate climate change concerns as follows:

- **a. Inadequate institutional capacity** of the following agencies to allow for an increased ability to support law enforcement in relation to the protection of coastal resources :
  - **i.** Department of Fisheries
  - **ii.** Department of Forestry
  - **iii.** Customs Departments
  - **iv.** Saint Lucia National Trust
  - **v.** Royal Saint Lucia Police Force
- **b. Inadequate prioritization of land use.** There is a need for adequate management of these resources and by extension this requires the requisite human and financial resources.
- **c. Inadequate availability of data** to allow cost analyses associated with adaptation measures. In cases where data is available there are significant gaps and this limited data has not been adequately disseminated for allow Government to make management decisions.
- **d. Inadequate financial resources** to facilitate implementation of adaptation measures.

3. *Critical Infrastructure Sector [SNC V&A Assessment – Critical Infrastructure, 2010]*

The Sector assessment highlights a number of constraints and key issues which require attention which impact on the sector's ability to integrate climate change concerns as follows:

a. **Lack of Involvement and collaboration of critical public and other agencies:** Most climate change issues are currently introduced and dealt with only by the Sustainable Development and Environment Division (SDED) as the national focal point for the United Nations Framework Convention on Climate Change (UNFCCC). *These other critical agencies include: Ministry of Communications Works, Transport and Public Utilities (MCWTPU), St. Lucia Air and Sea Port Authority (SLASPA), National Emergency Management Organisation (NEMO), Meteorology Office, Ministry of Physical Development and Environment (MOPDE), Coastal Zone Management Unit (CZMU), Ministry of Finance, Economic Affairs & National Development, Ministry of Agriculture (including Departments of Forestry and Fisheries), Attorney General Office, Ministry of Health (MOH), Utility companies (WASCO, LUCELEC, LIME, Digicel and Karib Kable), St. Lucia Bureau of Standards, Ministry of Education. Other important stakeholders: Chamber of Commerce, St. Lucia Hotel and Tourism Association (SLHTA), Insurers, Financiers/ Lending Institutions, Cooperatives and other Farmer associations, Designers, Developers and Builders, Non-Governmental Organizations (NGOs) and Community Based Organisations (CBOs).*

b. Lack of Awareness and Education: Sensitization levels as it relates to the implications of climate change are very low, even among key stakeholders. There is a need for increased public awareness and environmental education which targets policy makers, educators and educational institutions, environmental, planning and development control agencies, developers and other persons involved in the construction industry and the public in general.

c. Inadequate Information Availability and Management: There is a need for national site specific modelling and hazard risk assessment in vulnerable areas. This should included assessments relating to flooding, landslide, sea level rise, and flooding combined with sea level rise in certain low lying coastal areas. Also important is a policy on the availability of information to the public and other interests. Regional agreements on the collection and sharing of data is also a critical step.

d. Inadequate Collaboration and Planning: Cross-sectoral collaboration is important and this must be improved at all levels from the data generation and analysis through to national and sectoral planning that facilitate climate change resilience.

e. Inadequate Capacity and Tools for implementation of Proposed Measures

- Need to improve capacity of institutions to improve research, data collection, management and analysis. This can be achieved through the provision of adequate staffing, equipment, effective training and budget. This should also include the communities and resource users.
- Need to improve training to facilitate research, data analysis including risk assessment, and application of findings to design of engineering and non-engineering adaptation measures.

- Need to improve capacity to implement GIS instruments and techniques. A National Geographic Information System is required to facilitate the development, maintenance and management of data sets.
- Need to improve capacity to enforce existing and new regulations.

4. *Disaster Management Sector [SNC V&A Assessment – Disaster Management, 2010]*

The Sector assessment highlights a number of constraints and key issues which require attention which impact on the country's ability where disaster management is concerned to integrate climate change concerns as follows:

a. **Inadequate agency collaboration:** This is critical to ensure a co-ordinated approach to disaster management and more importantly disaster risk reduction. In this regard the mandate of the agency should reflect areas of inter agency collaboration.
b. **Inadequate resources:** Due to the need for implementation of critical measures there is a greater need for the requisite human, material and financial resources to achieve required goals and objectives.
c. **Inadequate Information and Communications Technology Management:** ICT Management on the part of NEMO is hampered by an absence of the requisite trained staff as well as associated resources. This is currently supported by other agencies on an ad hoc basis.
d. **Inadequate Public Sensitization & Education:** This is an ongoing multi sectoral issues which is cross cutting. In an effort to move forward there is a need to bring on board all persons and to educate them on all potential climate change issues but more importantly to identify their role in mitigation and adaptation towards resilience.

5. *Financial Services Sector [SNC V&A Assessment – Financial Services, 2010]*

This Sector report has highlighted the following constraints and associated requirements for all the sectors as it relates to financial considerations:

a. ***Inadequate extensive insurance coverage for agricultural sector:*** This would include crops as well as equipment. This is critical in light of the projects of increased weather systems resulting in both excessive rainfall and droughts. This would cover damage due to diseases.

b. ***Inadequate financing for agricultural research:*** There is a need for greater support of agricultural research. Government has a pivotal role to play in this area especially with respect to Research and Development (R&D) which would facilitate solutions such as drought-resistant crops for emerging needs of the sector.

c. ***Inadequate development, implementation and enforcement of climate change sensitive building guidelines:*** There is a need for the implementation of relevant approved guidelines to ensure the construction of climate resilient structures. As well insurance companies need to streamline approved building guidelines which promote climate resilience into their approval processes.

d. ***Lack of consideration of risk- based pricing:*** *This allows developments to be constructed in any areas and therefore there is no incentive for developers to do the right thing and incorporate climate change concerns.*
e. ***Inadequate education and sensitization:*** There is a need to sensitize the citizenry on all aspects of climate change which is likely to impact on the development of the country as well as impact on basic livelihoods. This should include individuals as well as sector groups.
f. ***Lack of a co-ordinated approach to responses for adaptation to, and mitigation of climate change***: This includes improved financial considerations for climate change friendly technologies and measures. This includes the use of solar photovoltaic systems, solar hot water systems and solar cooling systems, wind technologies, for example.
g. ***Inadequate health coverage finance:*** It is important to provide adequate financial resources to deal with increased health cases resulting from climate change impacts.

6. *Forest Biodiversity Sector [SNC V&A Assessment – Forest Biodiversity, 2010]*

The Sector Assessment highlights key constraints which impact on the sector's ability to integrate climate changes concerns as follows:

a. Inadequate financial resources to implement adaptation measures.
b. Inadequate technical resources to implement adaptation measures.
c. Inadequate human resources to implement adaptation measures.
d. Inadequate institutional co-ordination to implement adaptation measures.
e. Absence of an integrated development planning approach which adequately deals with land management.

7. *Health Sector [SNC V&A Assessment – Health, 2010]*

The Sector Assessment highlights impediments which impact on the sector's ability to integrate climate changes concerns as follows:

a. Inadequate numbers of health care professionals and allied health care workers with requisite skills mix for the delivery of health care services. There is the need to ensure greater accountability from all levels of staff in the execution of their duties. Inadequate surveillance systems in order to monitor disease trends.
b. Poorly sustained national public health programmes.
c. Weak public health responses to disease outbreaks and emergency events.
d. Inadequate capacity of National Health Services Lab to conduct rapid testing.
e. Lack of funds for awareness campaigns specifically on climate health.
f. Poor links with other government ministries to develop national programmes that incur co-incidental health benefits.
g. Lack of quality assurance systems within the health sector.
h. Ineffective system for the management and analysis of data and dissemination of information.
i. Ineffective national emergency medical system that will ensure appropriate and timely dispatch, effective stabilisation and transfer of patients and is integrated with hospital emergency rooms during a disaster.

8. *Human Settlement Sector [SNC V&A Assessment – Agriculture, 2010]*

The SNC report highlights many multi-sectoral issues which affect the ability of the sector to adequately deal with key issues especially in light of potential climate change impacts. The following are major constraints and capacity needs which need to be given urgent attention as follows:

- **a.** Adequate availability of financial resources.
- **b.** Adequate availability of human resources especially skilled technical personnel.
- **c.** Inadequate institutional co-ordination to facilitate the multiplicity of issues which impact on the sector.
- **d.** Lack of an integrated approach to development.

9. *Marine Biodiversity Sector [SNC V&A Assessment – Marine Biodiversity, 2010]*

The Sector Assessment refers to the following as constraints and require intervention to effectively implement relevant climate change related measures:

- **a.** Inadequate capacity for enforcement of legislation related to the protection of marine biodiversity. Relevant agencies include:
  - **i.** Department of Fisheries
  - **ii.** Department of Forestry
  - **iii.** Customs Departments
  - **iv.** Saint Lucia National Trust
  - **v.** Royal Saint Lucia Police Force
- **b.** Inadequate maintenance and need to restore the biodiversity and ecosystems that underpin the sector's resilience and ability to mitigate and adapt to climate change.
- **c.** Inadequate policy framework that recognises the interdependence of climate change, biodiversity and ecosystem services; It is necessary for this framework to facilitate cross-sectoral interaction, incorporating areas of agriculture, forestry and business, including areas of research.
- **d.** Inadequate Coastal Infrastructure. There is a need to design and implement ecosystem-based actions which includes soft coastal defences as well as the maintenance and restoration of vegetation and green infrastructure.

10. *Tourism Sector [SNC V&A Assessment – Tourism, 2010]*

- **a.** ***Inadequate Human Resources:*** There is a need for climate change exposure or expertise in the sector to handle potential impacts.
- ***b.*** ***Inadequate Institutional Co-ordination:*** There is a need for an effective coordinating mechanism among agencies or across ministries to ensure adequate monitoring and enforcement of tourism projects to facilitate compliance with regulations and other environmental issues.

- **c.** ***Inadequate Financial Resources:*** A lack of adequate funding coupled with difficulty in accessing funds is an issue affects the sector's ability to address climate change effectively.
- ***d.*** ***Inadequate Policy and Legal Instruments:*** The absence of supportive policies, standards, regulations to effect adaptation is of major concern.

e. ***Inadequate Technological Solution:*** *Absence of cost effective technological solutions make adaptation less attractive to major players in the sector.*
f. ***Inadequate Data and Information:*** This includes sector data for example on hotel consumption patterns for energy, water and solid waste disposal practices as well as other tourism impacting information such as land use maps, GIS information and climate data relevant to the tourism sector.

11. *Water Sector [SNC V&A Assessment – Water, 2010]*

The Sector Assessment highlights a number of constraints in this sector which are critical to the adequate management of water resources in Saint Lucia as follows:

a. **Data availability** – there is a paucity of data. It is necessary to have well established records of Current & Historical Rainfall, Stream Flow, Runoff, Water Demand & Supply. The data available is insufficient to facilitate proper planning and as such the establishment of a system of continuous collection of data is important. (Legal Responsibility of the Water Resources Management Agency (WRMA).
b. **Inadequate Water Supply Infrastructure** – the infrastructure is over 50 years old and is in dire need of replacement. (Legal Responsibility of the Water Company (WASCO/ the new water company).
c. **Absence of implemented water & land use policy** as it relates to water resource management and inadequate natural and water resource management. (Legal Responsibility of the Water Resource Management Agency (WRMA)).
d. **Inadequate Institutional and Regulatory Capacity** – absence of a functional Water Resources Management Agency and National Water and Sewerage Commission as mandate by law.

12. *Mitigation Thematic Area [SNC Mitigation Assessment, 2010]*

In the SNC review of the potential for implementation of mitigation measures the following key barriers were identified which require attention:

a. **Technical barriers:** Despite the availability of options for GHG emission reduction, it is clear that there is still a need to explore other options as well as to augment existing potential options. The key objective is to identify and to make available appropriate technology.
b. **Economic and financial barriers:** The lack of adequate resources to implement the required measure is a significant issue which needs to be addressed and as such makes such options impossible to implement with existing government or private sector resources.
c. **Institutional barriers:** The effectiveness of the recommendations for mitigation is dependent on strong institutional support. This capacity required includes technical, financial, and managerial capabilities. Any institutional weakness in these areas would undermine the attempt to implement mitigation measures effectively.

13. ***General Summary***

In general in Saint Lucia there are constraints to economic growth and development of all sectors. The previous sections highlight sector specific gaps, constraints and capacity needs. In general however it is clear that there are common threads between sectors, suggesting that a national approach can be utilised to provide the required solutions. Some of the overarching issues are as follows:

- **a.** *Limited availability of financial resources.*
- **b.** *Inadequate availability of human resources. This includes inadequate availability of specialist skilled resources.*
- **c.** *Loss of institutional / sector memory with change in the Human Resource composition.*
- **d.** *Inadequate availability of data to facilitate information for management decisions. Inadequate emphasis on research in all sectors.*
- **e.** *Ineffective high level co-ordination of major development sectors/ issues such as: Development Control & Land Management, Water Sector Development, Strategic Tourism Development.*
- **f.** *Inadequate infrastructure development to meet the development needs of the country.*
- **g.** *Ineffective public sensitization and public education programmes to educate the populace on key issues as it relates to the development of the country.*
- **h.** *Inadequate Institutional co-ordination.*
- **i.** *Lack of an integrated development planning approach to sector development.*

As a result of the constraints highlighted in the various sectors above in combination with the limited financial resources and the poor co-ordination of an overall development strategy for the country, it is difficult to accurately quantify all areas of vulnerability and potential impacts of climate change on the sectors. It is necessary in the Third National Communication for more thorough analysis of the sectors be done especially to determine geographic areas of vulnerability which may be possible impediments to development growth in the country. Also in tandem, the TNC needs to be the platform for the implementation of strategic measures for address the country's climate resilience.

6.2.2 Proposed Initiatives

The reality of Climate Change has not been integrated into the planning regime of the country and as such development initiatives, still simply reflect the development needs of the sector. Nonetheless there is a growing recognition of the importance of climate change or rather the impacts of extreme weather events due to climate change. The ongoing preparation of national communications supports the planning process by providing valuable data and information to facilitate management decisions especially as a result of the multi-sectoral reporting mechanism.

The recent impacts on the water sector as a result of Hurricane Tomas which struck on Oct 31, highlight the potential impacts of such weather systems which may increase in intensity with climate change. This hurricane was a Category 2 system resulting in wind and rainfall over a 21-hour period. This hurricane caused extensive land slippage island-wide resulting in the disruption of all sectors island-wide especially the water sector which took a longer period to recover as every source on the island was affected.

There is a need for a more thorough analysis through the Third National Communication of the impacts of climate change on the sectors. Hurricane Tomas has brought to the fore a significant amount of attention to the issues and has created a platform for one to build upon. This event sought to justify and support the many issues raised in the Second National Communication and by extension underscore the need to incorporate climate change issues into the normal planning and development agenda. There is need for integrated development planning, marrying the various needs of the many sectors and also charting a course which allows for the realization of the country's development goals in a climate resilient manner.

As a result of Hurricane Tomas, the Government of Saint Lucia has embarked on a national restoration effort with the aim of rebuilding the nation but at the same time facilitating an improvement in the resilience of the country to withstand such extreme weather events in the future. A special unit, the National Reconstruction and Development Unit has been established in the Ministry of Finance to provide a coordinating role for the reconstruction efforts. This Unit is the result of the merger between the Special National Projects Unit which previous spearheaded the development and implementation of the National Vision Plan and the Unit developed to co-ordinate the reconstruction efforts. Through the reconstruction efforts a number of issues are being addressed in an effort to facilitate the development of climate resilience.

The SNC review which included a compilation of all other climate change and other relevant information highlighted a number of key areas where attention was required in building national capacity and improving the institutional and technical framework to facilitate cross sectoral solutions for climate change impacts. The table below highlights these multi-sectoral issues and associated strategies and actions. It should be noted that although the initiatives are required and recommended, in most cases, they have not been integrated into work programmes or projects as yet.

Table 6.1: Capacity building needs in key areas related to climate change [SNC, Other Relevant Information, 2010]

Key Area	*Required Strategies and Actions*
Climate change education and awareness	▪ *Development and implementation of an integrated, coordinated and sustained climate change education and awareness programme targeting all sectors and relevant interest groups* ▪ *Establishment of a climate change information storage and exchange mechanism*
Incorporation of climate change issues into the development planning process	▪ *Undertaking of training activities in areas relating to planning and data processing* ▪ *Establishment of a National Climate Change Unit* ▪ *Development of a national climate change framework in the context of a larger national planning framework*
Implementation of Saint Lucia's Sustainable Energy Plan	▪ *Building institutional capacity for energy sector planning and evaluation of renewable energy technologies (RETs.)* ▪ *Development appropriate regulatory framework for the successful implementation of the SEP* ▪ *Development and implementation of education and awareness programme to support SEP* ▪ *Conduct of research into RET potential and energy efficiency measures*
Sectoral and Resource Management Options	
Coastal and marine resources	▪ *Undertaking review of existing coastal monitoring and data collection systems* ▪ *Implementation of integrated coastal zone management plans*
Human settlements	▪ *Development of adaptation plan for human settlements including zoning, defences, building codes, etc.*
Terrestrial resources, terrestrial biodiversity and agriculture	▪ *Establishment of a system for improved monitoring and research of key terrestrial and agricultural processes and resources.*

Key Area	*Required Strategies and Actions*
Freshwater resources	▪ *Undertaking inventory of freshwater resources and develop and implement a National Water Resources Management Plan*
Tourism	▪ *Improvement/ development of a regulatory framework with emphasis on enforcement*
Regional initiatives	▪ *Establishment of a Caribbean Climate Change Centre to coordinate Caribbean response to climate change*
National communication process and follow-up activities	▪ *Building capacity to resolve issues regarding emissions factors and to better address LULUCF computations* ▪ *Enhancing data collection, management and processing* ▪ *Identification and implementation of country-specific Stage II and III adaptation measures* ▪ *Developing national capacity for water resource planning and management* ▪ *Establishing systems for enhanced exchange of information and experiences within the region, as well as between regions* ▪ *Developing and implementing integrated resource/spatial management plans Implementing energy conservation and renewable energy pilot projects* ▪ *Enhancing capacity for disaster planning and management* ▪ *Enhancing early warning systems for extreme weather events* ▪ *Enhancing capacity to participate in international climate change initiatives and negotiations*

Table 6.2 Capacity needs and Recommended Initiatives for priority areas
[SNC, Other Relevant Information, 2010]

Priority Area	**Capacity Needs:**		
	Systemic	**Institutional**	**Individual**
Organisational Performance and Functioning: ***Needs:***	▪ Harmonised policies and legislative frameworks for collaboration and cooperation ▪ Mechanism for integrated planning to effectively mainstream Convention objectives into the national sustainable development agenda ▪ Adequate human resource pool both in terms of actual numbers and skills/expertise and technically trained personnel	▪ Mechanism for developing and maintaining effective coordinated networks for a more comprehensive approach to implementation of Conventions within the context of an overall national sustainable development strategy ▪ Requisite administrative and operational systems that facilitate collaboration and mainstreaming climate change, biodiversity, land degradation and drought issues across and within sectors ▪ Adequate financing for programmes and projects	▪ Acquisition and/or development of specialised skills ▪ Networking
Proposed Interventions:	▪ .Implementation of NEP/NEMS to drive harmonisation of policy, legal and regulatory framework for mainstreaming Conventions' objectives within the country's sustainable development goals and ensuring full integration of convention issues at the macro and micro	▪ Adoption of proposals for redistribution of roles and responsibilities within the framework for environmental management as outlined in the NEP/NEMS ▪ Strengthening and equipping designated National Coordinating Agency or body ▪ Institutions/Agencies	▪ Assessment of job requirements and skills levels ▪ Employ and/or Train in specialised areas ▪ Encourage peer and professional networking among policy, technical, research, community, and other private sector personnel

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	level ▪ Full implementation of existing integrated development planning (IDP) concept to facilitate the creation of a suitable inter-agency mechanism for collaboration and coordination (including joint programming) among agencies ▪ Designation of a lead agency in the inter-agency collaborative mechanism as proposed in the NEMS ▪ Ongoing public sector reform must clearly define institutional roles and responsibilities to ensure more ordered functioning and that institutions are held publicly accountable ▪ Requisite system resources given prominence to ensure the systematic integration of environmental considerations into the national budgeting process ▪ Poverty Reduction and Environmental Strategies need to be harmonised so as to be more	effectively structured and management equipped with relevant competencies based on regular capacity needs assessment ▪ Pursue the various actions proposed in the NEMs for the establishment of appropriate institutional arrangements for environmental management to enable more equitable sharing of rights and responsibilities among public sector, private sector, communities and grass roots resource users ▪ Knowledge and expertise in key areas such as environmental, social sciences and economics to facilitate inter-agency collaboration ▪ Clear definition of organizational missions and mandates ▪ System of accountability in Public sector to ensure that the country meets its obligations of UNCCD. ▪ Capacity to report effectively in fulfillment of obligations under the Convention. ▪ Human capacity to be knowledgeable of, and	

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	effective and efficient.	effectively participate in, the international cooperation process. ▪ Specific allocation of financial resources	
Research and Systematic Observation ***Needs:***	▪ Research infrastructure and systematic observation framework to support decision making and planning ▪ Inadequate systems levels resources for research and systematic observation	▪ Abundance and accessibility to scientific data	
Proposed Interventions:	▪ Pursue recommendations in NCSTD Study "Strengthening Science and Technology Capabilities in St. Lucia" and OECS "Legal and Institutional Review of Environmental Management" to create an appropriate policy, legal and institutional framework for and Technology (research and systematic observation) to promote a knowledge base approach to planning and decision-making ▪ Systematic integration of Science and Technology needs in	▪ Data resources and facilities for environmental assessments, audits actual and current trends in land degradation and drought ▪ Data capture systems ▪ Data management, including analysis, systems ▪ Clearing House Mechanism for information sharing	▪ Skills in V&A, mitigation inventories and Convention methodologies ▪ Training in research techniques and analysis ▪ Persons trained in research, analysis, monitoring and evaluation techniques

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	budgeting process ▪ Strategies need to be developed for integration of traditional knowledge		
Education and Outreach ***Needs:***	▪ Adequate human resource pool both in terms of actual numbers and skills/expertise and technically trained personnel ▪ Increased level of awareness on climate change, biodiversity land degradation and drought issues to permit participatory involvement of resource users in the decision making process and the implementation of "safeguarding" activities	▪ New approach to public sensitisation – focusing on behavioural change ▪ KAP assessments to determine impact of PEO strategies	▪ Enlightened self interest for ownership and engagement of community and grass roots users in environmental management
Proposed Interventions:	▪ Development of Education Policy to address problem of low prominence given to Science and Technology to develop an orientation and appreciation of Science and technology ▪ Specific financial allocations for requisite human, technical and financial resources to increase level of awareness on UNCCD	▪ Support from other public sector education and awareness mechanisms (Ministry of Education, Government Information Service, etc.) ▪ Review and implementation of appropriate PEO strategies	▪ Appropriately public sensitization techniques that promote "call to action"/behavioural change ▪ Reward systems to encourage stewardship/ownership of environmental management

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	issues among key Agencies, Ministries of Government and public		
Communication and Information Exchange ***Needs:***	▪ Mechanism for harmonisation of guidelines for reporting, and outreach) at the national level (	▪ Suitable information management systems and protocols for information sharing with emphasis on environmental management	▪ Identify communication and information exchange as an area requiring specialised skills ▪ Appropriate guidelines for accessing information – particularly for community based organisations and grass roots resource users
Proposed Interventions:	▪ Policy integration for cooperation between national focal points, ministries and agencies and community based organisations/grass roots users	▪ Pattern management information systems similar to Clearing House Mechanism for information sharing to facilitate inter-agency collaboration ▪ Access to Manuals, handbooks, and other relevant material and equipment	▪ Participatory approach to skills development ▪ Peer and professional networking among policy, technical, research, community, and other private sector personnel
Technology Development and Transfer ***Needs:***	▪ Policy, legal and regulatory framework for promoting inter-agency collaboration technology use and collaboration ▪ Adequate systems levels resources for accessing and evaluation	▪ Clearing house mechanism for identification, evaluation/adaptation and acquisition	▪ Enabling environment to support career progression or minimize the loss of technical expertise

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	technologies		
Proposed Interventions:	▪ Pursue proposals in NCSTD study to attain inter-agency collaboration for technology ▪ Systematic integration of environmental and technology needs in the budgeting process	▪ Technology Needs Assessments and Technology Assessments for acquisition of appropriate technology which will allow more effective management and distribution of the country's water resources	▪ Mechanisms to promote career progression within the technological field
Conservation, Adaptation and other Measures **Needs:**	▪ Response mechanisms for land degradation and drought mitigation ▪ Incentives for ecosystem services to promote sustainable investment in SLM at community level	▪ Baseline studies and Vulnerability Assessments ▪ Establish benchmarks and indicators for M&E ▪ Explore market based incentives (trade-related) for ecosystem services to promote sustainable investment in SLM at community level	
Proposed Interventions:	▪ System resources including Human capacity within focal agency to effectively coordinate conservation, adaptation and mitigation efforts ▪ Comprehensive assessment of the root causes of land degradation,	▪ Data capture systems ▪ Data management, including analysis, systems ▪ Development of early warning and forecasting systems to include drought indices and other relevant data;	▪ Appropriately trained persons in meteorology, climatology, etc. with understanding of convention issues ▪ Natural resource, sociological, economic and health and other sectoral personnel trained in: assessment, conservation adaptation

Priority Area	Capacity Needs:		
	Systemic	**Institutional**	**Individual**
	biodiversity loss and climate change and causal factors; vulnerability and mapping/ of degraded and drought - prone areas; ▪ Incentives for good agricultural and other land use practices; to prevent the conversion of agricultural lands to commercial and residential use. ▪ Adequate human and financial resources for implementation of incentive programmes		and mitigation measures ▪ GIS skills ▪ Training/expertise in forecasting systems and relevant models ▪ Peer and professional networking among technical, research and community/NGO personnel

6.2.3 Resource Requirements for preparation of national communications

The assessments and reports prepared through the National Communications for the country are aimed at assessing the impacts of Climate Change on various productive sectors in the country and on life in general. These assessments allow the collection of data to produce information to facilitate management decisions.

Traditionally these assessments and reports have been prepared by a wide cadre of professional both local and external. Over the years many local experts have been utilized to assist with the development of sector assessments. In most cases these persons are government personnel as well as local private sector consultants.

The following table highlights the technical support utilized for the Second National Communications as well as the associated financial resources required. Also captured are the anticipated arrangements and financial resources to execute the Third National Communication.

Although an amount has been given for the Third National Communication, it should be noted that this is only based on the use of local consultants to augment public sector expertise. The use of external support would require a complete revision in the proposed budget as the associated costs are much higher. Also there is a need to review the availability of resources to ensure project co-ordination support throughout the preparation of the national communication.

Table 6.3: Breakdown of Technical & Financial Resources [SDED, 2011]

Second National Communication				
Financial Resources		**Technical Support**		
Local **US$0**	**External** **US$420,000**	**Local : Government**	**Local : Private**	**External Private**
Source: N/A	**Source: GEF**	**Government Personnel**	**Consultant**	**Consultant**
Sectors Covered: Water, Agriculture, Tourism, Human Settlements & Livelihoods, Critical Infrastructure, Finance, Health, Biodiversity, Coastal Zone, Disaster Management; Areas of Interest: Mitigation & Green House Gas Inventory				
Third National Communication				
Financial Resources		**Technical Support**		
Local **US$0**	**External** **US$500,000**	**Local : Government**	**Local : Private**	**External Private**
Source: N/A	**Source: GEF**	**Government Personnel**	**Consultant**	**Consultant**
Sectors to be Covered: To be Determined				

6.3 PROPOSED PROJECTS FOR FUNDING

6.3.1 Overview of Proposed Projects

There are a number of projects being proposed in various sectors and through various agencies. Some of these projects are likely to be funded however in some cases the funding mechanism is still uncertain but is expected to be confirm within the next few months.

1. Pilot Project for Climate Resilience (PPCR):

Through the Sustainable Development and Environment Department a number of climate change related projects are being planned for implementation with the more recent being the Pilot Project for Climate Resilience. The projects being proposed are detailed in SNC Report on Constraints, Gaps and Related Financial, Technical and Capacity Needs are summarised as follows:

Health Sector

1. Effective Surveillance and Control of Schistosomiasis in Saint Lucia: Duration 10 weeks: US$50,000.
2. Enhancing the Water Quality Surveillance Programme of the Department of Environmental Health: US$16,000.
3. Mitigating The Mental Health Impacts Of Climate Change and Climate Variability In Saint Lucia: Duration : 3 years. (Cost to be determined).
4. Short-Term Rodent Control Project: Duration 6 months: US$81,038.
5. Mainstreaming the Lessons of Hurricane Tomas and Other Recent Climate Events : Cost & Duration to be determined.

Coastal Zone Management

6. Coastal Stabilization of Pigeon Island to Prevent and Mitigate Coastal Erosion Caused by Climate Change : US$1,718,963.
7. Climate Change & Ports: US$15,380,000.

Data Management

8. Events Mapping – Hurricane Tomas : Duration 9 months: US$150,000
9. Enhanced capacity of the Physical Planning and Survey and Mapping Departments in the management of digital geo data: Duration 1 year: US$200,000.
10. Enhancing the capacity of The Ministry of Agriculture – Pest Control and Surveillance Services: Duration 3 months: US$100,000.
11. Enhancing the capacity of WASCO in the use of GIS technology: Duration 18 months: US$260,000.

Other

12. Development of Landslide Hazard Maps based on newer comprehensive Hazard Models: duration 3 years: US$1 million.
13. Rehabilitation of Main Landslides resulting from Hurricane Tomas: Duration 3 years: US$5million.

14. Enhancing the capacity of the Fire Department to address climate-induced fires : Duration 1 year: US$100,000.
15. Climate Proofing the Laborie Community: Duration 3 years: US$245,000.
16. Building Climate Resilience through Sustainable Land Management: Duration 3 years: Cost to be determined.
17. Increased Climate Resilience through Improved Food Provisioning and Food Security: Duration 3 years: Cost to be determined.

See section 6.4.1 for further details on the PPCR/ SPCR.

2. Water Sector Proposed Projects:

The water sector has been going through a reform process for a while with many challenges in both the Management of the Water Resource and Management of the Water Supply and Sewerage Services. There are a number of critical interventions being proposed in the short to medium term. However a more strategic approach to the development of the sector is expected to be outlined soon.

Out of a myriad of critical interventions required in this sector a few priority projects have be selected and submitted to the Japanese Government for consideration under the Climate Change Fund. Projects in the amount US$7 million have been identified and proposed for implementation. These projects cover critical interventions as it relates to water resources management as well as critical improvements in the water supply infrastructure.

Water Resources Management Project

The planned activities for this component totalling approximately US$1 million are as follows:

1. ***Conduct of an island wide comprehensive Integrated Water Resources Assessment (IWRA). This must include: surface water, groundwater (river groundwater, deep groundwater).***
2. ***Conduct water demand assessments for various user groups for the future (2011, 2015, 2020, 2025) based on country's development plan.***
3. ***Conduct assessment to quantify the impact of climate change on the water resources. This should include cost of implementation of adaptation measures.***
4. ***Conduct an assessment for the development of a water augmentation plan as a climate change adaptation measure. Based on the outcome, water augmentation options need to be assessed i.e. desalination, rainwater harvesting, wastewater re-use, storm water use etc.***
5. ***Establish appropriate monitoring systems for fresh and coastal water quality.***
6. ***Conduct an assessment of the adequacy of the institutional and legal framework to deal with IWRM issues.***
7. ***Development of an IWRM Master Plan.***
8. ***Development of Implementation Strategy for the National Water Policy, Coastal Zone Management Policy and Operationalization of the Water and Sewerage Act.***

9. ***Assessment of national water human resource requirements.***
10. ***Review and Upgrade of existing IWRM information System.***
11. ***Development and Implementation of a Public Sensitization Plan to cover the National Water Policy, the Coastal Zone Management Policy and IWRM.***
12. ***Implementation of a Short to Medium Term investment Programme for the Water & Sewerage Co*. This will include critical infrastructure upgrades.**

Water Supply Infrastructure Improvement Project

The planned activities for this component totalling US$6 million are:

1. Upgrade of the Water Supply System in an effort to improve the reliability especially in extreme situations of drought and heavy rainfall. The areas under consideration in this project component are :

   a. ***Roseau Dam Water Supply System***
   b. ***Hill 20 Water Supply System***
   c. ***Micoud Water Supply System***
   d. ***Desruisseaux Water Supply System***
   e. ***Vieux Fort Water Supply System***
   f. ***Anse La Raye Water Supply System***
   g. ***Canaries Water Supply System***
   h. ***Delcer Water Supply System***
   i. ***Soufriere Water Supply System***

3. Coastal Zone Management Project

In an effort to continue the work already initiated, a second phase has been approved for mainstreaming Saint Lucia's national plan of action through a North West Coast Water Quality Demonstration Project. This phase is funded by the United Nations Environment Programme – Global Programme for Action (UNEP-GPA) and the National Oceanic and Atmospheric Administration (NOAA).

The overall project objective is to improve Recreational Water Quality along the North-West Coast of Saint Lucia through the implementation and demonstration of best practices for pollutant discharge reduction. This project component is expected to cost US$35,000.

6.3.2 Proposed Projects – Mitigation Initiatives:

The following projects as detailed in Chapter 3 have been proposed as specific mitigation interventions both by reducing emissions or enhancing removal by sinks [SNC Measures to Mitigate Climate Change, 2011]:

1. **Waste Reduction across sectors:** the reduction of waste sent to the landfill through a Reduce, Reuse, Recycle programme and introduction of composting incentives for households (kitchen gardens).
2. **Refrigerants phase out:** the establishment of an accelerated programme to phase out refrigerants that deplete the ozone layer and contribute to global warming. This measure applies to refrigerants that are not currently subject to accelerated phase out under the Montreal Protocol.
3. **Fiscal measures for industrial energy efficiency:** the provision of fiscal incentives for energy efficiency measures in industry. This measure includes incentives for energy audits, efficiency improvements, and related R&D.
4. **Reforestation program for marginally used agricultural lands: the** implementation of a programme to support reforestation of marginally used agricultural lands and to sustain the existing forest, including coastal dry forest habitats and mangroves.
5. **Reforestation of marginally used agricultural lands** and to sustain the existing forest, including coastal dry forest habitats and mangroves. This includes the implementation a programme to encourage the use of **alternative energy** sources where feasible, such as the use of solar energy for drying of crops and substitution of fossil fuels with less carbon-intensive bio-fuels. This measure includes incentives to encourage farmers to use biomass residues for energy, including production of biogas.
6. **Regulation for purchase of higher efficiency vehicles:** the establishment of regulations establishing minimum fuel efficiency levels for light duty vehicles (cars, vans and light duty trucks) imported into Saint Lucia, including vehicles used for public transportation.
7. **Transportation demand management, including a range of initiatives:** the implementation of a transportation demand management (TDM) programme including a range of initiatives such as promotion of greater use of low cost public transport, tele-work, car pooling and other elements. The TDM programme would include a social marketing component.
8. **Auto-generation and co-generation:** the encouragement of auto-generation and co-generation by passing legislation to allow entities to generate electricity for their own use using renewable energy or co-generation plants with a maximum capacity of 500 kW and located at the site of energy consumption. Self-generators would have the right to sell excess electricity to the grid operator and be reimbursed for such supply.
9. **Wind farm:** Acquire the necessary land and establish a wind farm providing power to the local grid.
10. **Improved energy efficient appliances and lighting through the use of standards:** the introduction of minimum energy efficiency standards for selected types of appliances used in the residential and commercial sectors. These standards would apply to new appliances sold in Saint Lucia, and (2) Introduce regulations or standards to accelerate the adoption of energy efficient lighting. These standards would apply to the lighting products sold in Saint Lucia.

11. **EE Building Code (strengthen energy efficiency in the Building Code):** the development of an Energy Efficiency Building Code (EEBC) for new construction and retrofits in commercial, institutional and residential buildings. The EEBC would strengthen the energy-related requirements in the new building code (soon to be adopted). The EEBC would be mandatory for both public and private sector buildings. The code would address some or all of insulation, passive shading, water heating, air conditioning, ventilation, and lighting ("green building").
12. **Auditing for small hotels:** the implementation of an audit programme for small hotels, addressing their use of energy and water and generation of waste.
13. **Solar water heating:** the encouragement greater use of residential solar water heaters by maintaining or expanding fiscal incentives for the purchase of solar water heaters, supported by promotion activities. Electric water heaters would not be eligible for fiscal incentives.
14. **Landfill gas capture with energy generation:** the implementation of a landfill gas capture initiative, and generation of electricity using the captured gas for sale to the grid.
15. **Demand-side management (DSM) programme for electricity:** the implementation of a comprehensive programme encompassing and adding to certain Scenario #1 measures (Measures #3, 5, 11, 12, and 13), in an effort to increase the uptake of energy efficiency and on-site renewables in the commercial, residential, industrial, and agricultural sectors.

Refer to Chapter 3: Measures to Mitigate Climate Change, Table 3.1 and Table 3.2 for further detail.

6.4 OPPORTUNITIES FOR IMPLEMENTATION OF ADAPTATION MEASURES

The National Climate Change Policy and Adaptation Plan underscores the Government's commitment to address the issues of reducing emissions, and Saint Lucia's vulnerability to the effects of climate change. This plan has three key objectives, which were to foster the development: of processes, plans, strategies and approaches to avoid, minimize or adapt to the negative impacts of climate change; and application of appropriate legal and institutional systems and management mechanisms for planning for and responding to climate change; and of appropriate economic incentives to encourage public and private sector adaptation measures. The Plan identified the following priority activities for immediate implementation [SNC V&A Synthesis Report 2011]:

Table 6.4: Sector Strategies Recommended for Adaptation Initiatives

SECTOR	ACTIVITY/STRATEGY
Coastal & Marine Resources	Undertake review of existing coastal monitoring and data collection systems
Human Settlements	Develop adaptation plan for human settlements including zoning, defences, building codes etc.
Terrestrial Resources, Terrestrial Biodiversity& Agriculture	Establish a system for improved monitoring and research of key terrestrial and agricultural processes and resources.
Freshwater resources	Undertake inventory of freshwater resources and develop and implement a National Water Resources Management Plan
Tourism	Improve/ develop regulatory framework with emphasis on enforcement.
Cross-cutting	Development and implementation of an integrated, coordinated and sustained climate change awareness programme targeting all sectors and relevant interest groups

Table 6.5 below further outlines opportunities for implementation of adaptation measures as identified in the various sector analyses.

Table 6.5: Summarised Adaptation Initiatives and Measures [SNC V&A Synthesis Report, 2011]

CC Impact	Sea Level Rise		Precipitation Changes		Temperature Changes		Extreme Events	
Determinant	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**
Economic Resources	Funding for relocation	Funds procurement Financing mechanisms	Financing infrastructure and technologies	Funds procurement Financing mechanisms	Financing technologies	Funds procurement Financing mechanisms	Resources for disaster response and recovery	Funds procurement Financing mechanisms
Technology	Alternative technologies - Setbacks - Sea defenses - Natural defenses - Alternative fisheries – aqua culture	Research	Soil conservation Alternative Desalination/ ground water/ rain water harvesting Restoration of riverbanks, wetlands	Research re exploitation of alternative water sources	Alternative drought resistant crops Water storage	Research	Drainage and soil conservation Infrastructure design Sea /natural defenses Early warning systems	Systematic observation
Information and Skills	Education and information Data and information management GIS decision support tool	Public Awareness Strategy RSO	Education and information Data and information management	Public Awareness Strategy RSO	Education and information Data and information management	Public Awareness Strategy RSO	Education and information Data and information management Early Warning Systems GIS decision support tool – mapping extreme events Coastal / construction engineering	Public Awareness Strategy RSO

CC Impact	Sea Level Rise		Precipitation Changes		Temperature Changes		Extreme Events	
Determinant	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**	**Measures**	**Strategies**
Infrastructure	Coastal Setbacks Sea defense infrastructure Natural defenses	Strengthening port infrastructure	Drainage infrastructure Alternative water sources – Desalination, groundwater, rain water harvesting		Water conservation Design standards/ building codes		Design standards/ building codes Early Warning Systems Water Storage and distribution	
Institutions (Policy/legal)	Enforcement of appropriate /revised coastal setback policies	Incentives Framework Integrated Watershed Management Planning	Incentives to encourage building away from flood /landslide prone areas Incentives to promote alternative water sources	Integrated Watershed Management Planning Water rates to reflect costs of water supply – prevent wastage	Incentives to promote CC resilient cooling systems	Building codes/ standards	Incentives to encourage building away from flood /landslide prone areas	Integrated Watershed Management Planning
Equity	Relocation of individuals/communities Safeguarding of livelihoods	Land use Plan	Habitat protection and rehabilitation measures	Land Use Plan	Water conservation		Rehabilitation measures- Restoration of riverbanks, wetlands	

6.4.1 Existing / Proposed Pilot / Demonstration Projects

Further to the identification of numerous adaptation measures for all the sectors reviewed, a number of funding opportunities have been forthcoming. In this regard a number of projects have been developed to facilitate initiation and implementation of adaptation and mitigation measures in the various sectors. The projects initiated to date as indicated below and some of the opportunities available adaptation implementation.

1. Special Program on Adaptation to Climate Change (SPACC) Project – This project has to date been successfully implemented. This includes two components:

1. Northern Component – Strengthening of the Marchand Community Centre to withstand a Category 4 and higher Hurricane.
2. Southern Component – Design and Installation of a Rainwater Harvesting System at Coconut Bay Hotel, Vieux Fort.

2. Pilot Programme for Climate Resilience (PPCR)

The latest initiative with respect to building resilience to Climate Change was the development of a Pilot Programme for Climate Resilience. This will include a Strategic Programme for Climate Resilience. The interventions expected through the Strategic Programme for Climate Resilience (SPCR) are implemented in five strategic programme areas, namely [PPCR, 2011]:

1. ***Human Welfare and Livelihood Protection.***
2. ***Integrated Natural Resource Protection, Conservation and Management to Promote Sustainable Development.***
3. ***Building Resilience through Business Development, Innovation and Productivity Enhancement.***
4. ***Capacity Development/Building and Institutional/ Organisational Strengthening.***
5. ***Reducing Risk to Climate Related Disasters.***

These strategic programme areas dovetail with the intent of disaster risk reduction (DRR). For reasons of synergy, therefore, the SPCR activities are being blended with those to be implemented under the Disaster Vulnerability Reduction Programme (DVRP).

Given the cross-cutting nature of many of the interventions to be undertaken, the activities under the strategic programme areas will be implemented under the following three components: Adaptation Facilitation, Adaptation Implementation and Adaptation Financing as indicated below:

Component 1: Adaptation Facilitation [PPCR, 2011]

Component 1 aims to create an enabling environment for building climate resilience at all levels, by strengthening the existing policy, legislative institutional and fiscal framework. This entails the review and enhancement of relevant legislation, policies, guidelines, strategies, plans and incentives regimes. This will also include a review of the

methodologies used to guide coastal planning and development in the context of sea level rise and storm surge.

Measures will be implemented to build on existing institutional capacity for research and systematic observation and for data and information acquisition, management, sharing and analysis. Special emphasis will be placed on Public Education and Outreach (PEO), with the objective of making the general public and specific groups, including the vulnerable, more knowledgeable about climate change and, importantly, empowering them (through knowledge and mechanisms) to take meaningful action to build resilience at all levels.

Component 2: Adaptation Implementation [PPCR, 2011]

Component 2 focuses on the implementation of tangible resilience-building measures at the community and national level. This component will promote and utilise investment in proven and innovative measures to demonstrate results in the catalytic and replication dimension of the PPCR.

One sub-component will entail the retrofitting of public and key community buildings for climate change resilience and for demonstration and replication of climate-appropriate design. Another sub-component will involve the re-design and modification of critical infrastructure, such as ports, to adapt to storm surge, coastal flooding and sea level rise, following assessment of existing coastal engineering structures and formulation of design guidelines/standards in the context of storm surge, coastal flooding and sea level rise. The final sub-component will involve pilot or supporting water conservation and interventions. These could include measures such as communal rainwater harvesting and the construction of micro-dams.

Component 3: Adaptation Financing [PPCR, 2011]

Climate resilience building is the business of the entire citizenry of a country. In order to become climate resilient, the private sector, civil society and individuals will require access to funds, with affordable interest rates. The scale and/or efficiency of many adaptation interventions typically undertaken by the Government of Saint Lucia (GOSL) could also be enhanced through engagement with the private sector. Given the high level of investment required for adaptation, and the limited resources of the GOSL, the country will be pursuing all opportunities for public-private partnerships, as well as other private sector partnerships with communities and vulnerable groups.

Overall, Component 3 will focus on developing modalities for securing more sustainable financing for climate resilience-building measures. In this respect, modalities will be developed for a Climate Adaptation Trust (CAT) Fund. In addition, using concessional financing, a Climate Adaptation Loan Facility (CALF) will be established to allow the private sector and civil society to undertake resilience-building measures.

Table 6.6 provides a summary for the Strategic Programme for Climate Resilience (SPCR).

Table 6.6 : Summary Of Strategic Programme For Climate Resilience [PPCR, 2011]

Saint Lucia Pilot Programme For Climate Resilience		
1. Country/Region:	*Saint Lucia, Caribbean Region*	
2. PPCR Funding Request (in US$ Million)::	*Grant:US$7.0 Million*	*Loan/Concessional:US$10.0 Million*
3. National Implementing Agency (Coordination of Strategic Programme)**:**	• *Sustainable Development & Environment Division in the Ministry of Physical Development & the Environment in collaboration with the Project Coordination Unit of the Ministry of Finance, Economic Affairs and National Development*	

4. Description of SPCR:

(a) Key challenges related to vulnerability to climate change/variability:

- Vulnerability of economic systems, social processes and ecosystems to climate change/variability singly and collectively compromise the attainment of sustainable development goals
- The existence of demographic groups and areas considered to be particularly threatened by climate change, but not adequately defined in geographical extent, or analysed
- Policy, legislative and fiscal instruments, and institutional framework for climate change resilience-building inadequate and fragmented
- Various publics not sufficiently aware of potential impacts of climate change and the measures that they can take to build climate resilience, nor are they provided with the enabling environment/mechanisms to effect the necessary change
- Business and other economic sectors challenged to maintain productivity and continuity of operations
- Inadequate capacity at the community and sectoral level to respond to climate change.
- Climate-relevant data and information inadequate, often discontinuous or sporadic, fragmented among agencies, poorly managed and inadequately shared or exchanged
- Critical buildings and other structures, as well as water infrastructure, vulnerable to extreme weather events such as floods, droughts and hurricanes
- Coastal management capacity inadequate and coastal management planning and development does not properly take into account climate-related risks
- Climate financing generally inadequate and project-driven, and thus, discontinuous

(b) Areas of Intervention – sectors and themes

THEME: BUILDING NATIONAL CLIMATE RESILIENCE, ONE PERSON, ONE HOUSEHOLD, ONE ENTERPRISE, ONE COMMUNITY, ONE SECTOR AT A TIME

STRATEGIC PROGRAMME AREAS

1. Human Welfare and Livelihood Protection
2. Integrated Natural Resource Protection, Conservation and Management to Promote Sustainable Development
3. Building Resilience through Business Development, Innovation and Productivity Enhancement
4. Capacity Development/Building and Institutional/ Organisational Strengthening
5. Reducing Risk to Climate Related Disasters

Component 1:Adaptation Facilitation	**Component 2:Adaptation Implementation**	**Component 3: Adaptation Financing**
Strengthening National Level Policy, Legislative and Institutional Framework for Climate Resilience and Enhancing PPCR Implementation	Implementation of Climate Resilience Measures in Critical Buildings	Climate Change Adaptation Financing Facility
Public Education and Outreach for Climate Change Resilience Building	Coastal Zone Management for Climate Resilience	
Research and Systematic Observation and Data and Information Acquisition and Management for Climate Change Adaptation	Supporting Community-Level Interventions in Water Resource Conservation and Management	
Research and Systematic Observation and Data and Information Acquisition and Management for Climate Change Adaptation		

(c) Expected Outcomes from the Implementation of the SPCR:

- A robust and effective policy, legislative and fiscal framework for the building of climate resilience established
- Public, private and civil society actors more informed, educated, empowered and engaged to contribute to national climate resilience-building
- National capacity for climate-relevant research and systematic observation, data acquisition, management, analysis and sharing enhanced
- Coastal management capacity enhanced and coastal planning guided by, and demonstrates, incorporation of climate change considerations
- Critical buildings and community-level water supply systems made more climate-resilient

• Blueprint for Sustainable Climate Change Financing facility developed • Public- Private Partnerships for investments increased and enhanced in climate adaptation interventions • A gender disaggregated information source on specific aspects of vulnerable groups developed • Targeted programming for different types of vulnerable groups established • Best practices and lessons learned shared nationally and regionally.

5. Expected Key Results from the Implementation of the Investment Strategy:

Result	**Success Indicator(s)**
1. *Strengthened Climate Resilience of Communities and Critical Infrastructure*	• Reduced incidence of loss of buildings, communities and livelihoods located in coastal and other vulnerable areas • Reduced economic costs of coastal, critical and community infrastructure • Reduced downtime in economic activities in vulnerable sectors, e.g. tourism • Fewer number of lives lost/injuries annually from climate extreme and variability events (as % of population) • Fewer number of private/public buildings damaged in extreme weather events • Fewer number of critical buildings retrofitted or climate-improved • Decrease in the number of days without access to water
2. *Improved Public Sector Capacity*	▪ Climate-resilient policy, legal, fiscal measures adopted and implemented/enforced • National budgetary processes and allocations reflect capital costs for climate change adaptation ▪ Functioning institutional mechanism for collaboration and coordination of climate resilience building ▪ Increased integration of climate change considerations in sectoral work programmes and plans ▪ Increased data and information management systems and expertise in government ministries/departments and agencies ▪ Increased retrieval and use of climate related data in decision making

3. *Strengthened Knowledge, Awareness and Application of Climate Risk Management*	• Increased use of climate resilient technologies by households, communities, businesses and the public sector • Number of private sector enterprises undertaking vulnerability assessment to prepare adaptation plans • Number of communities trained in and using vulnerability assessments to reduce climate related risks
4. *Enhanced Integration of Learning and Knowledge Management in Climate Resilience Building*	• Meetings/workshops, shared databases and electronic documentation, and other information sharing mechanisms
5. *Increased Civil Society and Private Sector Participation*	• Number of Public Private Partnerships in climate adaptation investments • Climate Adaptation Loan Facility created and capitalised • Uptake of concessional loan funding 25% of which should be by vulnerable groups
6. *Increased Integration of Social Vulnerability*	• Risk maps and profiles of vulnerable groups • Increased number of targeted programmes

3. Mainstreaming Saint Lucia's National Plan of Action through a North West Coast Water Quality Demonstration Project Phase 2

The project objective is to improve Recreational Water Quality along the North-West Coast of Saint Lucia through the implementation and demonstration of best practices for pollutant discharge reduction. This project component is expected to cost **US$35,000**.

The project consists of four specific components which include [CZMU, 2011]:

1. Characterize hot spots of pollution and environmental degradation that can have impacts on the coast environment.
2. Establish spatial guidelines for recreational water quality standards
3. Establish pollution control strategies for prevention, remediation and control and prioritize solutions within the demonstration site
4. Promote public awareness and sensitization of the issue of recreational water quality

The purpose of the overall project is as follows [CZMU2011]:

- To reduce the threat of pollution from land-based activities on coastal ecosystems in the study are by use of interventions that could be duplicated elsewhere in Saint Lucia and other Small Island Developing States.
- To develop and test a methodology for undertaking an assessment of hotspots within the project site.
- To undertake an assessment of identified hot spots within the four watersheds, located within the project site and establish prevention, remediation and control options.

- To develop and prioritize policy recommendations and management strategies to address land-based pollution to the coastal environment.

4. Hurricane Tomas Emergency Recovery Project

The Hurricane Tomas Emergency Recovery Project (ERP) is a US$15 million project and is expected to be to be implemented over the period March 2011 – March 2014. This project financed through an IDA Loan is expected to support the recovery and reconstruction of the country following the impacts of Hurricane Tomas. The objective of the project is to support post-hurricane Tomas reconstruction and recovery in the transportation, health, and education sectors, throughout the island and strengthen disaster risk management capacity to lay the foundation for the longer-term sustainable strategy to improve the resilience, preparedness and response capacity of Saint Lucia to natural hazards [PPCR Report 2011].

The project is expected to finance the following activities:

1. Support the early recovery of the country's key economic sectors from the impact of Hurricane Tomas through the provision of goods, technical advisory services and emergency operating costs;
2. Technical assistance and purchase of equipment to improve national capacity to evaluate and integrate natural hazard and climate change risk reduction into national development policy and decision-making processes;
3. Reconstruction and rehabilitation of selected education, health and transportation facilities and services damaged by the Hurricane; and
4. Strengthening and developing the institutional capacity of the PCU for project management and execution.

4. Other Hurricane Tomas Reconstruction Activities:

The following includes other projects geared at reconstruction post Hurricane Tomas. All of these initiatives are executed against the back drop of building climate resilience and by extension ensuring disaster risk reduction.

- **a.** Hurricane Tomas Recovery: Duration 3 years: EC$54 million: Reconstruction and Repairs to Roads, Bridges & Schools. This project is funded by the Caribbean Development Bank with grant and loan funds.
- **b.** Emergency Housing Programme: Duration 2 years : EC$14,518,025.70
- **c.** Upgrading of the Geographic Information Systems: Duration 3 years: EC$3,920,000.
- **d.** Residential Land Development Programme: Duration 2 years: EC$9,334,690.37.
- **e.** Rehabilitation of Major Drains: EC$6,500,000.

Barriers / Constraints Regarding Implementation

Institutional Framework

There are a number of challenges which need to be overcome in an effort to successfully implement the required adaptation measures. This includes many institutional changes. The following tables provide examples of the Public Sector, Private Sector and Public/Private Sector Partnerships required for adaptation to the effects of Climate Change. There is a need for a central agency to co-ordinate and facilitate these required changes to ensure effective implementation.

Table 6.7: Public Sector Mission and Roles in adaptation to Climate Change

Agency	Mandate	Mission and Roles in adaptation to Climate Change
All Ministries of Government	Varied	All of Government construction projects (roads to hospitals) should have a mitigative aspect to facilitate the "hardening" of Government property to the impacts of Climate Change.
All Ministries of Government	Varied	Imbed mitigation to disasters and adaptation to Climate Change in project proposals.
Inland Revenue Department	Collection of Taxes	Offer tax incentive to hotels (large and small) for water conservation e.g. use of grey water (of course this will have to be verified.)
Cultural Development Foundation	Cultural Activities	Use local entertainers in PSAs to bring home the need for conservation. (e.g. OECS use of Invader for their environmental Public Service Announcements)
Physical Planning and Cabinet	Strategic Planning	Adoption of the building code
Physical Planning and Cabinet	Strategic Planning	Sea level rise is forecasted and can already be seen in Anse la Raye: Government should consider a strategic shift from coastal development to inland development.
Physical Planning and Cabinet	Strategic Planning	Sea level rise is forecasted and can already be seen in Anse la Raye: Government should consider a long term programme of relocating existing public properties from the vulnerable coast to inland sites (e.g. Anse la Raye Primary School and the Village Council from the waterfront to Au Tabor)
Budget Department and Cabinet	Finance	Government should create a standing Mitigation Budget Head for all its Departments and Statutory Authorities. Such a budget line will allow Government to take measures to reduce the impacts of Climate Change as many of those impacts if left to manifest can create disasters.

Ministry of Agriculture, Ministry of Commerce, Ministry of Education, Ministry of Finance	Various	Agriculture needs to become "sexy" There is a need for a fundamental shift from Agriculture to Agri Business. Planting will ▪ increase food security ▪ stabilise areas prone to landslides ▪ reduce unemployment ▪ cushion external shocks ▪ reduce import bills ▪ feed the nation

Table 6.8: Private Sector Mission and Roles in adaptation to Climate Change

Agency	Mandate	Mission and Roles in adaptation to Climate Change
Hardware stores	Provision of equipment for construction industry and "weekend warriors"	Import and distribute environment friendly products e.g. low volatile organic compounds paint.
Media	News	Using Helen Television System "Historic Minute" as an example – media houses can feature a segment on environment stories – the successes and the failures and what the public can do to make a change.
Hotels	Accommodation	Reuse grey water in landscaping
WASCO	Distribution of potable water	Set a quota on hotels (large and small) once quota is exceeded the water rate changes. (e.g. if the formula states that Sandals Grande can safely use ½ million gallons of water a month and they use ¾ million. The excess of ¼ million will be charged at a higher rate)
Junior Achievers Clubs	Future Business people	Imbed environmental concerns into business plans
Financial Institutions (incl SLDB and Credit Unions)	Business Loans	▪ Imbed environmental concerns into business plans ▪ Imbed mitigation to disasters and adaptation to CC in business plans.

Table 6.9: Public/Private Sector Partnerships needed for Adaptation

Institution	Mission	Main role in climate adaptation
MET Saint Lucia Meteorological Services	Provide weather and climate information and services.	Produce scenarios of climate change and provide early warnings; improve communication of forecasts
Disaster Management National Emergency Management Organisation	Direct and coordinate disaster management activities.	Improve preparedness and response for expected changes in disaster profile
Ministry Agriculture Ministry of Agriculture	Accelerate broad-based agricultural and rural development.	Inform farmers about climate change; promote farm practices better suited for expected climate conditions
Ministry Agriculture Water Resources Management Agency	Ensure equitable access to water at all times for all.	Ensure reliability of water supply systems under different climate
Red Cross Saint Lucia Red Cross Society	Alleviate human suffering	Prepare for more frequent disasters; reduce vulnerability of those at risk
Co-ops Farmers' Cooperatives	Empower farmers through collective action	Promote adaptation practices among members; scale up risk sharing schemes

6.4.2 Resources : Financial & Human

The implementation of adaptation to Climate Change will require the management of human, material and financial resources to achieve the stated goals and objectives. At present there is very little consideration given disaster prevention, mitigation or preparedness when appraising projects or programmes financed by the Government. This suggests that costs for rehabilitation post disaster, simply recurs as opposed to the development of climate resilient projects. Little or no action is taken to ensure disaster risk reduction in the future.

There is little incentive for government agencies to spend money on effective risk reduction programmes and activities. There is no comprehensive monitoring and evaluation of mitigation and surveillance activities and there is little accountability for the success or failure of funded prevention programmes [SNC Disaster Management, 2010]. Disaster Management/Climate Change Adaptation requires a wide range of tools, equipment and supplies many of which must be held in readiness until required in emergency situations. Government usually ensures that there is an adequate stock of material resources available to mount an initial response to any emergency or disaster situation.

The approved country budget e.g. in 2011 was EC$3.14 billion with an amount of EC$442,425,300 being allocated for capital projects in various sectors. Although not identified and specifically geared at Climate resilience these sector projects aim to improve on the performance of the individual sectors and by extension present and opportunity for implementation of adaptation and mitigation initiatives for the relevant sectors.

There is a need for climate change adaptation to be streamlined into the country's development agenda and be the backdrop against which the country develops in a sustainable manner. In so doing the existing resources of the country could be utilised more effectively and also facilitate climate change adaptation. In many sector situations the existing human and financial resources can already facilitate adaptation through training and sensitization. The annual capital budget can be streamlined more effectively and facilitate quick wins where basic low cost adaptation initiatives are concerned. The success of this however relies heavily on the country's policy direction.

6.5 Technology Transfer

Activities related to transfer of environmentally sustainable technologies

According to reviews on technological advancements in SNC, Other Relevant Information 2010, in Saint Lucia, a number of steps have been taken with regard to the transfer of environmentally sustainable technologies. In 2003, a Climate Change Technology Needs Assessment (CCTNA) was conducted for Saint Lucia in order to determine the country's priority environmentally sustainable climate change technology needs.

With regard to adaptation, the CCTNA addresses a number of sectors, namely: coastal zone, freshwater resources, tourism, agriculture, health, human settlements and disaster response. For mitigation, the CCTNA addresses energy generation, road transport, new and renewable energy and land use, land use change and forestry (LULUCF) and wastes. The CCTNA identifies adaptation and mitigation options, development benefits, technology needs and barriers to the transfer or adoption of these technologies [SNC, ORI, 2010].

While Saint Lucia has yet to establish any database on environmentally sustainable technologies, the need for such a database, has, however, been recognised and it is anticipated that this will begin to be addressed under a newly launched initiative. Saint Lucia currently has no operational national networks for the sharing of information on technology. A National Council on Science and Technology for Development (NCSTD) was established in 1998, but has been inactive for a number of years.

Saint Lucia is affiliated with the Caribbean Council for Science and Technology (CCST). The mandate of the CCST includes the "*promotion of cooperation in the* mutual transfer of science and technology…". Significant effort has been directed into strengthening human, scientific, technical and institutional capacity. In this regard, a number of actions have been taken, including [SNC, ORI, 2010]:

1. Training in areas such as metadata, Geographic Information System (GIS) and maintenance and repair of remote weather stations
2. Procurement of a remote weather station and GIS software
3. Acquisition and installation of photovoltaic panels and a small wind turbine.

The pilot activities under the SPACC Project are examples of the application of environmentally sustainable technologies for adaptation, while the phasing out of ozone-depleting substances and the installation of net-metered photovoltaic systems demonstrate the use of mitigation technologies. With regard to innovation, efforts are currently being made to assist a Saint Lucian scientist in establishing a bio-ethanol plant that will use a proprietary process.

The Cabinet of Ministers has approved the establishment of a Designated National Authority (DNA) to address matters pertaining to the Clean Development Mechanism (CDM). The SDED, which has overall responsibility for science and technology issues within the GOSL system, is to serve as the secretariat to the DNA.
Barriers to the transfer of environmentally sound technologies include: the costs associated with purchase and maintenance of these technologies; the financial feasibility of these options (especially at the scale required in Saint Lucia); inadequate awareness of the possible impacts of climate change and of the technological and other options available for responding to these changes and limited access to financial resources, especially in lower-income communities.

Measures for enhancing the transfer or environmentally sound technologies are wide and varied and include: introduction and enforcement of technology standards that will ensure introduction of these technologies; tax and fiscal incentives for persons and enterprises engaging in an identified set of adaptive actions; and, use of energy efficiency standards to promote use of mitigation-oriented *energy technologies*.

General recommendations to enhance the transfer of environmentally sound technologies include:
1. Systematically implementing the recommendations of the TNA
2. Activating the DNA
3. Encouraging the efforts of innovators through grants, fiscal incentives and competitions, for example
4. Revitalising and strengthening the NCSTD.

Table 6.12 highlights measures to improve on the rate of adaptation of ESTs in Saint Lucia.

Table 6.10 : Measures to improve on the rate of adaptation of ESTs

Adaptation	Mitigation
Policy Measures for Financing: ▪ Introduction and enforcement of technology standards (e.g. for low water use flush toilets, and rainwater harvesting) that will ensure introduction of these technologies ▪ Direct government spending, through integrating climate change concerns into existing recurrent expenditure programmes and projects ▪ Tax and fiscal incentives for persons and enterprises engaging in an identified set of adaptive actions (e.g. coastal or watershed protection) ▪ International and regional financing sources (Caribbean Development Bank, World Bank, Inter-American Development Bank), by integrating climate change adaptation concerns into bilateral and multilateral loans and assistance ▪ Support for indigenous research and development activities utilizing available educational and technical facilities ▪ International assistance from the Global Environmental Fund ▪ International assistance through the Climate Change Adaptation Fund to be established under the Clean Development Mechanism of the Kyoto Protocol[1].	***Measures for Energy Conservation:*** ▪ Use of energy efficiency standards to promote use of mitigation oriented energy technologies. This involves regulating public use of particular technologies and thereby enforcing their use ▪ Voluntary standards (e.g. among hoteliers) to advance introduction of agreed environmental standards ▪ Regional and international development agencies (e.g. CDB, World Bank, GEF) can provide financing and technical assistance for mitigation related projects ▪ The CDM of the Kyoto Protocol which allows developed countries to invest in and gain international emission credits, from GHG mitigation projects in developing countries
Cross-cutting measures to overcome barriers to awareness: ▪ Improving awareness of potential implications of climate change among decision-makers at all levels (from grass-roots to national level policy makers) ▪ Increasing knowledge of climate change and climate variability, including through	*LULUCF and Wastes:* ▪ Expansion of credit and savings schemes ▪ Improvement of disaster warning systems ▪ Strengthening research and development into impacts of climate on tropical agriculture and forestry

[1] The coming into effect of the Kyoto Protocol will trigger the implementation of the CDM designed to encourage, *inter alia*, the transfer of environmentally sustainable technologies to developing countries. A proportion of funds generated from the CDM are to be applied to implementation of adaptation projects in developing countries.

improved understanding of long-term weather and of short-term weather forecasting ▪ Enhancing research, development, and demonstration efforts of climate change adaptation technologies	
	Road Transport: ▪ Traditional sources of financing for public sector investments in transport e.g. road taxes, and loans from various sources ▪ Introduction of mandatory and voluntary standards

6.6 Capacity Building Needs Other Than Those Identified

1. Information and Communications Technology Management in NEMO

According to [SNC V&A, Disaster Management, 2010] NEMO has no Information Technology specialists on staff. Information Technology support is provided on an "as-needed" basis by local service providers. The Secretariat also receives support from government Information and Communications Technology specialists (from the e-Government Unit and the Government Information Service), but that appears to be an informal rather than structured arrangement. There was no indication that either of the government departments offered any formal guidance to NEMO with regard to the implementation, support or use of Information and Communications Technology as it relates to disaster management.

Conclusion

Conclusion

Climate change impacts are cross-sectoral in nature and are usually manifested in effects on the country's natural resources and the population. Climate change impacts may however, be further exacerbated by the realities of indirect drivers of climate change such as socio-economic and ecological challenges, including trade regimes, demographics of people, poverty and unemployment. In responding to the impact of climate change, there is a need for a coordinated, broad-based, multi-sectoral response aimed at mainstreaming climate change issues into the planning and development process.

The perception of, and response to, a "genuinely existential threat (United Nations Secretary General, 2008)[1]" and the "most serious problem we are facing today[2]" must pervade the national planning process, the operations of government agencies, the practices of the commercial/private sector and the actions of all citizens, from where and how they choose to build their homes to how they utilise water. Responses to climate change and its impacts must seek to facilitate sustainable development, and must be coordinated and integrated with existing policies for socio-economic development and environmental conservation.

Against this backdrop, the preparation of the Second National Communication (SNC) for Saint Lucia as indicated previously is a continual step towards further implementation of the UNFCCC at national level and in compliance with Article 12 of the Convention.

Through the SNC, a viable institutional and procedural framework was established to ensure continuous reporting of national communications to the UNFCCC. The preparation of the SNC will further ensure that climate change issues are integrated into the national sustainable development framework and strategic planning processes of Saint Lucia.

The SNC was prepared according to guidelines set by the UNFCC Convention and the SNC Project Document. This allowed for the incorporation of previous work conducted under the Initial National Communication (INC), which defined the basis on which the country proposed to address climate change and its impacts. The analysis conducted within the Initial National Communication (INC) was upgraded and extended. Relevant information was extracted and summarised from the reports, chapters and other outputs from the SNC process to produce a synthesised advanced national report. The SNC built on activities under the CPACC, ACCC, MACC, and SPACC projects, led by the Caribbean Community Climate Change Centre (CCCCC).

[1] United Nations in Indonesia: *2008 End-of-Year Quotes by UN Secretary-General Ban Ki-Moon on the United Nations and Selected International Issues*: http://www.un.org.id/page/2008-end-year-quotes-un-secretary-general-ban-ki-moon-united-nations-and-selected-international

[2] British Government Chief Scientist, Sir David King (quoted) in: Held, D, and Anthony G. McGrew. 2007. Globalization Theory: Approaches and Controversies. Polity Press, UK.

The *main components of the SNC were:*

1. ***National Circumstances;***
2. ***Green House Gas Inventory;***
3. ***Programmes Containing Measures to Facilitate Adequate Adaptation to Climate Change (V&A Assessment);***
4. ***Programmes Containing Measures to Mitigate Climate Change;***
5. ***Other Information Relevant to the Achievement of the Objective of the Convention;***
6. ***Constraints, Gaps and Related Financial, Technical and Capacity Needs.***

The preparation of the SNC provided a good foundation for the thorough review of the relevant sectors. The sectoral analysis was based primarily on expert judgement and existing data. There was no primary data collection. The period of implementation and also available resources did not permit at this junction. However the SNC provide a solid base for the development of the Third National Communication (TNC). It is expected that the Third National Communication will facilitate data collection to fill in critical information gaps as well employ the use of appropriate models to generate the critical information on the impact of climate change of critical socio-economic sectors.

There is a need to ensure as well that the TNC is prepared in the context of the development objectives of the country and relate directly to existing government policies.