PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

GREEN ECONOMY ASSESSMENT MAURITIUS

UNEP United Nations Environment Programme

ILO International Labour Organization

UNDP Empowered lives. Resilient nations.

UNIDO United Nations Industrial Development Organization

unitar United Nations Institute for Training and Research

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Citation

PAGE (2015), Green Economy Assessment Mauritius.

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GREEN ECONOMY ASSESSMENT MAURITIUS

University of Mauritius

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Africa Caribbean Pacific
ADB	African Development Bank
AFD	Agence Française de Développement
BAU	Business-as-usual
BOI	Board of Investment
CAGR	Compound Annual Growth Rate
CEB	Central Electricity Board
CFL	Compact Fluorescent Lamp
CO_2	Carbon Dioxide
COMESA	Common Market for Southern and Eastern Arica
CSR	Corporate Social Responsibility
CWA	Central Water Authority
DSM	Demand-side management
EE	Energy Efficiency
EEMO	Energy Efficiency Management Office
EFR	Environmental Fiscal Reform
EIA	Environmental Impact Assessment
EM	Enterprise Mauritius
EPA	Environment Protection Act
EPR	Extended Producer Responsibility
ESG	Environmental, Social and Corporate Governance
EU	European Union
FAO	Food and Agriculture Organisation
FiT	Feed in Tariff
GDP	Gross Domestic Product
GE	Green Economy
GEM	Green Economy Model
GHG	Greenhouse Gases
GoM	Government of Mauritius
GPS	Global Positioning System
GRI	Global Reporting Initiative
Ha	Hectares
HDI	Human Development Index
HoV	High-Occupancy Vehicle
ICZM	Integrated Coastal Zone Management
ILO	International Labour Organization
IPP	Independent Power Producers
IRS	Integrated Resort Scheme
ISO	International Organization for Standardization
ISWM	Integrated Solid Waste Management
IWRM	Integrated Water Resources Management
JEC	Joint Economic Council
LPG	Liquid Petroleum Gas
M-GEM	Mauritius Green Economy Model
MEPU	Ministry of Energy and Public Utilities'
MEXA	Mauritius Export Association
MID	Maurice Ile Durable

MIDPSAP	Maurice Ile Durable Policy, Strategy and Action Plan
MOESD	Ministry of Environment, Sustainable Development, and Disaster and Beach Management
MOFED	Ministry of Finance and Economic Development
MPI	Ministry of Public Infrastructure and Land Transport
MRF	Material Recovery Facilities
MSB	Mauritius Standards Board
MSW	Municipal Solid Waste
MUR	Mauritian Rupees
MW	Megawatt
MWh	Megawatt hours
NAMA	Nationally Appropriate Mitigation Action
NCCAP	National Climate Change Action Plan
NTC	National Transport Corporation
OECD	Organisation for Economic Cooperation and Development
OFSED	Office of Sustainable Energy Development
PAGE	Partnership for Action on Green Economy
PPP	Public-Private Partnerships
RECP	Resource Efficient and Cleaner Production Programme
REDD	Reducing Emissions from Deforestation and Forest Degradation
Rs	Mauritian Rupees
R&D	Research and Development
RWHS	Rain Water Harvesting Systems
SADC	Southern African Developing Community
SCP	Sustainable Consumption and Production
SIDS	Small Islands Developing States
SM	Statistics Mauritius
SME	Small and Medium-sized Enterprises
SMEDA	Small and Medium Enterprises Development Authority
SPP	Sustainable Public Procurement
Toe	Tons of oil equivalent
SE4ALL	Sustainable Energy for All
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
UNITAR	United Nations Institute for Training and Research
UNRC	United Nations Resident Coordinator
URA	Utility Regulatory Authority
VAT	Value Added Tax
WB	World Bank
WTO	World Trade Organization


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ACKNOWLEDGEMENTS

This study was commissioned by the United Nations Environment Programme (UNEP) at the request of the Government of Mauritius. The study is the fruit of two programmes:

- The "Green Economy and Social and Environmental Entrepreneurship Development in Africa" Project funded by the European Union

- The Partnership for Action on Green Economy (PAGE), a UN initiative which combines the collective expertise of 5 UN agencies, UNEP, International Labour Organisation (ILO), United Nations Industrial Development Organisation (UNIDO), United Nations Development Programme (UNDP) and the United Nations Institute for Training and Research.

The report was produced under the overall guidance of Steven Stone, Chief of the Economy and Trade Branch, and Patrick Mwesigye, Regional Office for Africa. Richard Scotney managed this study under the supervision of Asad Naqvi with valuable support from Meriem Ait-Ali Slimane, William Scott, Alexandra Galef, Silvi Llosa and Hameedullah Jamali.

The Green Economy Assessment was conducted by a team from the University of Mauritius led by Professor Toolseeram Ramjeawon with the support of an international consultant in Systems Dynamics Modelling, Dr Andrea M. Bassi. The latter built the Mauritius-Green Economy Model (M-GEM) and provided initial scenario analysis. Each sector chapter was led by a national expert, namely Roshini Brizmohun-Gopaul (agriculture); Dr Robin Sunnassee (tourism); Dr Boopen Seetanah (transport); Prof Sanjeev Sobhee (economics); Dr Viren Proag (water); Prof Toolseeram Ramjeawon (energy, manufacturing and waste).

UNEP and the partners of the PAGE initiative would like to thank the Government of Mauritius for its cooperation. In particular, representatives from the Ministry of Environment and Sustainable Development, most notably Sarita Meeheelaul, Nazia Outim, Neermala Seenarain and Prakash Kowlesser for their comments and suggestions. The former officials of the Maurice Ile Durable Commission also provided guidance in the initial stages of the document, including Osman Mahomed, Sunil Dowakarsing, Rubyna Boodhoo and Afzal Mohamed.

The paper benefited from suggestions from a wide range of ministries including the Ministry of Finance and Economic Development (R Sultoo), the Strategic Policy Unit (Hemelata Boolell, Nunramsing Baichoo, Fazana Juman), the Ministry of Energy and Public Utilities (Dr. P.M.K. Soonarane), the Ministry of Public Infrastructure and Land Transport (D. Romooah), the Ministry of Tourism and External Communications (Rishi Purusram), the Ministry of Business, Enterprise and Cooperatives, the Ministry of Industry, Commerce and Consumer Protection, the Ministry of Agro-Industry (Dr. K. Chikhuri, Dr Nitin Chikhuri) and with special thanks to Ms. Indoomatee Ramma of the Food and Agricultural Research and Extension Institute (FAREI).

The United Nations Resident Coordinator (UNRC), Simon Springett provided guidance and support throughout the process as well as members of his office. In particular, the Green Economy Focal Point in the UNRC office Dr. Asha Poonyth-Seewooram provided technical guidance to the document as well as ensuring smooth interaction with the Government at all stages. Doorgawatee Ram-Gopal also provided first-class support. Cindy Armance was instrumental in organizing the stakeholder consultations.

Administrative support was provided by Désirée Leon, Fatma Pandey and Rahila Somra. The report was edited by Edward Girardet. The layout design was carried out by Nathalie Loriot.

The PAGE agencies gratefully acknowledge the financial support of the European Union for the preparation of this study, as well as further support from the governments of Finland, Norway, South Korea, Sweden, Switzerland and the United Arab Emirates.

EXECUTIVE SUMMARY

Mauritius has made significant steps towards a greener economy with the new government agenda aiming to further drive this transition. Mauritius has been a beacon for other Small Island Developing States (SIDS) in terms of sustainable development. In the last decade, Mauritius has been investing in renewable energy, clean waste management technologies and in public transport infrastructure. The new government programme, 'Achieving Meaningful Change', has ambitious targets in the area of green economy (GE) - from generating 35 per cent of electricity from renewable energy to large increases in recycling rates (GoM, 2015).

The GE assessment demonstrates that a green economy transition offers Mauritius further opportunities for sustained economic growth, energy and water savings, increased agricultural productivity and green jobs. According to the analysis in this report, green economy investments are expected to generate better economic outcomes than a business-as-usual (BAU) investment allocation, with GDP 6 per cent higher in the GE case relative to BAU, by 2035. The cost of such public and private investment will be approximately 0.9 per cent of GDP per year between 2014 and 2035. However, this will generate annual savings of around 3 per cent of GDP. The report examines greening initiatives and opportunities in seven key sectors of the Mauritian economy and the impacts of implementing various policies against a business-as-usual scenario.

Agriculture: The new government programme for the Republic of Mauritius (2015-2019) commits to promoting natural farming and organic production (GoM, 2015), as well as increasing food self-sufficiency. According to the modelling analysis for this report, an increase of 10 per cent of the area under sustainable food crop production would result in an increase in crop yields of 11.2 per cent per year by 2025, compared to BAU.

Energy: The new government programme reaffirms Mauritius' commitment to achieving at least 35 per cent of electricity sourced from renewable energy by 2025, from today's level of less than 15 per cent (GoM, 2015). In recent years, renewable energy as a percentage of total energy use has fallen, primarily due to increased overall electricity demand, and low renewable energy growth. However, the Government is committed to reversing this trend. According to the modelling analysis, achieving 35 per cent of energy from renewable energy, combined with efforts to improve energy efficiency, is expected to result in savings on fuel imports of Rs4.5 billion per year between 2014 and 2025.

Manufacturing: Manufacturing is a major component of the Mauritian economy. In terms of green economy, energy and water efficiency improvements are a central priority for the manufacturing sector. According to the modelling analysis, the improvement of energy efficiency in manufacturing is projected to generate savings on electricity consumption between 2015 and 2020 of about Rs1.3 billion, reaching Rs6.5 billion by 2030. Added economic benefits are also projected to result from investments in industrial water efficiency. In particular, water savings would amount to about Rs101 million and Rs322 million by 2020 and 2030, respectively, corresponding to an annual average of about Rs20 million by 2030.

Tourism: This sector has been one of the key drivers of diversification for the Mauritian economy. In recent years, tourism has become increasingly energy efficient, with energy intensity reducing by 53 per cent between 2002 and 2009. The results of the modelling exercise demonstrate that further investments in energy efficiency would reduce water costs by 20 per cent by 2030. Actions on energy efficiency would also generate economic savings for the industry. Finally, increased green tourism actions can attract visitors who value such measures.

Transport: Green economy interventions, such as the promotion of the use of mass transport systems, the introduction of low-carbon vehicles on the market, use of biofuels, congestion charges and land use planning policies are needed for sustainable mobility on the island. Due to a lack of data, the modelling was not carried out for this sector. However, the assessment recommends a series of interventions in terms of smart mobility, including on the introduction of congestion pricing, and increasing teleworking.

Water: Improvements in water efficiency are needed in order to deal with increasing demand. The report outlines several options that the Government could pursue in this sector, including increasing investment in the pipe network, meter renewal, rain water harvesting systems, micro-irrigation systems, a new water tariff policy for cost recovery, and sustained water conservation awareness campaigns. Such efforts to tackle water use, if successful, would reduce consumption by 16.7 per cent compared to the business-as-

usualscenario. It is estimated that avoided water losses would generate savings of around Rs858 million between 2014 and 2030.

Waste: Greening the waste sector refers to a shift from landfilling towards the "three Rs": Reduce, Reuse and Recycle. The Government of Mauritius has stated their intention to direct an increasing amount of waste to recycling. If Mauritius was to increase recycling levels to 50 per cent, the stock of landfilled waste would be 8.4 per cent and 16.3 per cent lower than BAU in 2025 and 2035 respectively. Projections show that the cumulative costs of waste collection and disposal between 2014 and 2025 would decrease by Rs3.9 billion, as compared to BAU.

The report makes a series of recommendations in each sector. These focus on the following areas:

Fiscal policy instruments: Fiscal tools such as taxation, pollution charges, public expenditure on infrastructure, and market mechanisms, are powerful instruments for a transition to a green economy. Across the different sectors analysed, the main opportunities for intervention in Mauritius are: (i) investments in infrastructure to support a GE transition such as through improved public transport systems, renewable energy or smart grids; (ii) Sustainable Public Procurement with the government leading by example by purchasing more environmentally-friendly products; (iii) Environmental Fiscal Reform (EFR) to create the fiscal space to support environmental protection and conservation; and (iv) tariffs and trade policy for sustainably produced goods.

Financing: Significant resources can be mobilized by smart public policy and innovative financing mechanisms. The growing green orientation of capital markets and the evolution of emerging market instruments are opening the space for larger-scale financing into the green economy. The potential key sources of funding include: (i) the Government's budget; (ii) earmarked funds from various sources; (iii) funds generated by the economy; and (iv) donor programmes of assistance and loans from international financial institutions. The country should also continue participating in international climate finance mechanisms and facilitate access to emerging climate finance.

Regulations and standards: Across the sectors, the issue of regulation and voluntary standards was highlighted in this report as a prerequisite for a green economy transition. Broadly, the report recommends two improvements: (i) improve regulatory compliance; and (ii) develop a robust harmonized system of environmental standards benchmarked against various international norms with support to help producers meet these goals.

Institutional and policy processes to support reform: Central to an integrated approach to the green economy is the role of governance and the effectiveness of the supporting institutional framework. Policies will need to be complemented by a strengthening of institutions and integrated into any future national development strategy or vision. An array of government processes and initiatives will be required to facilitate the success of the initiatives outlined in the seven sectors.

Education, training and capacity enhancement: Institutional capacity-building, training and education are vital to the emergence of a green economy. Key capacity building issues include policy impact analysis, the need for integrated planning as well as adequate enforcement of policy requirements and laws. Enhancement of the vocational and technical training capacities is necessary to provide the workforce with the capacity and skill to deliver the commodity or service. The challenge for education is to empower people of all ages to be responsible for creating a sustainable future.

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1.0 INTRODUCTION

1.1 A GREEN ECONOMY TRANSITION FOR MAURITIUS

Mauritius faces the inherent vulnerabilities associated with a Small Island Developing State (SIDS). The country suffers from geographical isolation, scarce natural resources, sensitive ecosystems, limited human and institutional capacity, and is highly susceptible to natural disasters. As a result of its economic success, the standard of living on Mauritius has increased with significant changes in consumption patterns. These new demands placed on an insufficient natural resource base are resulting in increased environmental problems.

A green economy transition for Mauritius implies more investment shifted into sectors such as renewable energy, low-carbon transport and improved water management. UNEP defines a green economy as one that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2011c). For Mauritius, this would mean an economy whose growth in income and employment is driven by public and private investments that reduce carbon emissions and pollution and enhance energy and resources efficiency and prevent the loss of biodiversity and ecosystem services.

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The transition to a greener economy implies the formulation of an overarching integrated approach that links social, economic, and environmental policies and actions. The new government programme (2015-2019) outlines a series of green economy actions ranging from increased investment in renewable energy to expanding organic agriculture. To achieve this, the Government should consider establishing a cross-ministerial body to ensure the successful implementation of these initiatives.

This study is an analysis of key opportunities for a green economy transition in Mauritius. The overall aim is to provide decision makers with reliable data and policy recommendations to support green policies and investments in high-impact sectors of the economy. A macroeconomic modelling exercise was carried out to understand how government policies coupled with both public and private investments can help achieve the objectives of income growth, economic diversification and job creation, while also contributing to social equity and environmental improvement.

The basis of this Green Economy Assessment report is the work undertaken by the University of Mauritius in partnership with UNEP. Through a multi-stakeholder consultation workshop, local actors identified seven sectors for transitioning towards a green economy, namely: agriculture, energy, waste, water, tourism, manufacturing and transport. These consultations led to the modelling exercise with the methodology described in the next section. Following the publication of the first draft, a further multi-stakeholder consultation took place to validate the report. Stakeholders provided a wide range of comments and the document was finalised.

1.2 THE MAURITIUS GREEN ECONOMY MODEL (M-GEM)

1.2.1 Overview of the M-GEM

The Mauritius Green Economy Model (M-GEM) is a quantitative simulation model, customized to the national context of Mauritius. The M-GEM was produced by Dr. Andrea Bassi in conjunction with the University of Mauritius. The national team identified four priority sectors as key drivers of a green economy transition in Mauritius, which are covered in the model. These are: (i) agriculture; (ii) energy; (iii) waste; (iv) water. In addition, sectoral impacts of energy and water green economy interventions are estimated on (1) tourism, and (2) manufacturing. The transport sector was not covered due to a lack of data.

An integrated model is used as green economy interventions are cross-sectoral in nature and thus

need to be analysed with a dynamic and long-term perspective. Being systemic and dynamic, the M-GEM highlights feedback relations within and across sectors and helps to identify possible synergies and unintended consequences of policy implementation.

1.2.2 Technical specifications

The approach proposed uses the System Dynamics methodology. The M-GEM was designed to analyse green economy scenarios. As a result, it includes several sectors across social, economic and environmental dimensions. Figure 1 presents the generalized underlying structure of M-GEM. This diagram shows how the key capitals are interconnected, and contribute to shaping future trends across social, economic and environmental indicators. Policies can be implemented to promote sustainable consumption and production by decoupling economic growth from resource use (also through education and behavioural change) to mitigate the exploitation of natural capital and to generate stronger and more resilient green growth.

The M-GEM can be used to:

(1) Test the effectiveness of individual policies and investments (by assessing their impact within and across sectors as well as for social, economic and environmental indicators);

(2) Inform budgetary planning by assessing the effectiveness of annual plans in delivering green and inclusive growth; and

(3) Support the formulation and analysis of development plans that span across sectors and target medium-to-longer term goals.

Further details on the technological specifications can be found in Annex II.

1.2.3 Scenario setup

The simulation of M-GEM scenarios starts in the year 1980 and ends in 2030. This allows for historical behavioural validation to assess the impacts of policy interventions throughout the lifecycle of investments. Two main scenarios are simulated and analysed in this report, as presented in Chapter 2.

Figure 1: Causal Loop Diagram (CLD) representing the main variables and feedback loops of GEM applications

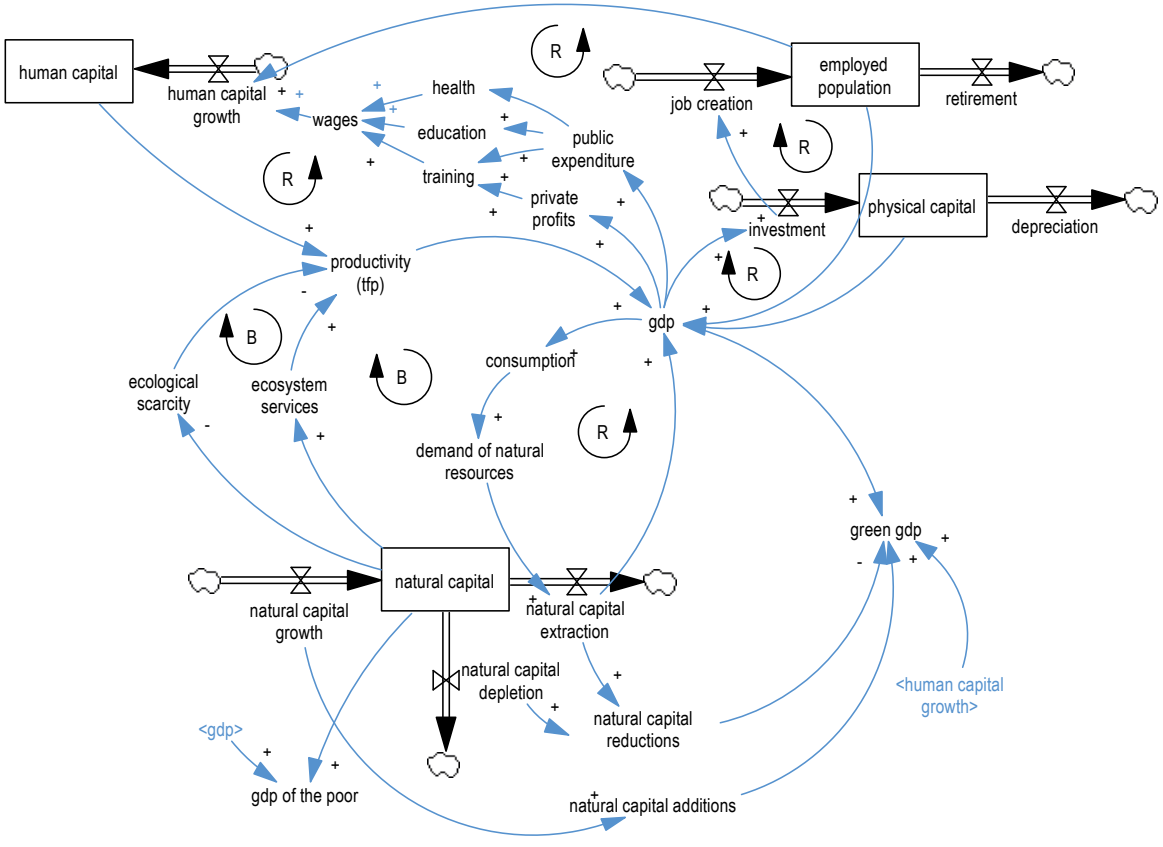


Table 1: Sectoral targets for green economy interventions under the green economy scenarios

Sector	GE interventions
Agriculture	• Increase **self-sufficiency** levels in strategic commodities targeted under the Food Security Fund from 56 per cent in 2012 to 90 per cent in 2025. • Convert 10 per cent of agriculture arable land **to ecological agriculture** (organic fertilizers and certifications) by 2025.
Energy	• Increase **renewable energy** penetration up to 35 per cent by 2025. • Increase **energy efficiency** by 10 per cent in 2020 and 20 per cent in 2030.
Waste	• Increase **recycling** from 12 per cent in 2012 to 50 per cent by 2025.
Water	• Increase economy-wide **water use efficiency** by 20 per cent by 2030.

- **A business-as-usual (BAU)** case that assumes the continuation of historical and present trends. This includes all policies and interventions currently active and enforced. However, it excludes policies planned but not yet implemented.

- **A set of green economy (GE)** scenarios that simulate green economy policies in key sectors, including agriculture, energy, industry, tourism, waste and water. The sectoral policies simulated under the green economy scenarios are listed in Table 1. These interventions can be tested and analysed in isolation (e.g. one by one) or simultaneously, to assess their short, medium and long-term impacts across social, economic and environmental indicators. These targets were agreed on with local stakeholders.

2.0 MACROECONOMIC PROFILE AND IDENTIFICATION OF PRIORITIES

2.1 MACROECONOMIC PROFILE

Strong economic growth driven by diversification has increased per capita income from $200 in 1968 to $8,500 in 2013. Agriculture as a share of GDP has shrunk from 23.1 per cent in 1968 to 3.5 per cent in 2012, whilst the services and manufacturing sector has risen. Employment sources also have changed with agricultural employment falling from 27 per cent in the mid 1970's to 8 per cent in 2012 (SM, 2013e). Financial intermediation, tourism and the real estate sector remain the main drivers of the service sector today. By contrast, the sugar sector's contribution to GDP has fallen from 17.8 per cent to 1.2 per cent over the same period. Figure 2 describes the main components of Mauritius's GDP, demonstrating the high level of diversification of the economy.

In recent years, economic growth has slowed, particularly during the financial crisis. Between 1980 and 2007, average growth of the economy was around 5 per cent. Growth beyond 2012 has remained relatively slow and has not exceeded 4 per cent, in part due to the global economic crisis (SM, 2013e). The government is committed to increase growth in order to achieve a 'second economic miracle', which aims to re-create the high levels of growth seen in Mauritius in the 1980s.

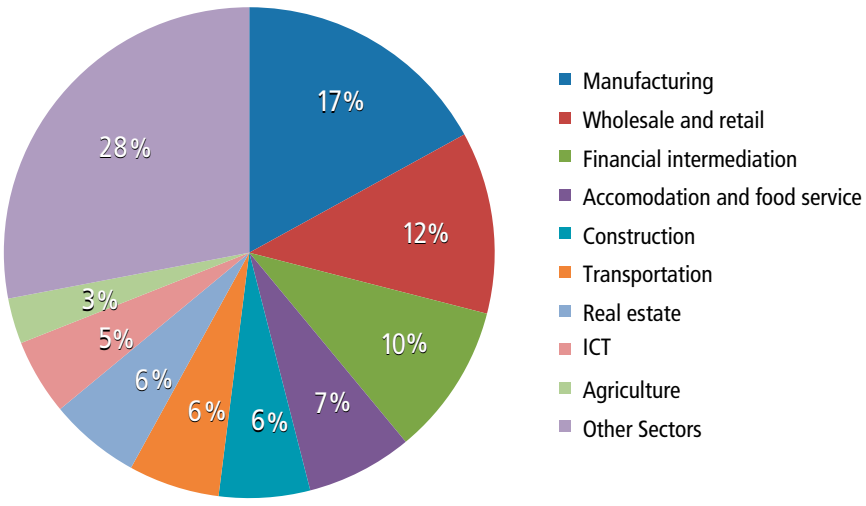
Mauritius's economic priority is to create employment through private-led investment. In August 2015, the Prime Minister outlined the government's new economic Mission Statement. The Government committed to a Public Sector Investment Programme for 2016-2020 of Rs75 billion. These investments will target the water sector, electricity, waste management, wastewater management, transport infrastructure and other sectors. In addition, 40 major private sector investment projects worth Rs183 billion are being launched to create 100,000 jobs (GoM, 2015b).

2.2 ENVIRONMENT PROFILE

The Mauritian economy relies greatly on its limited natural resources. Mauritius has no major reserves of minerals or fossil fuels, or large amounts of arable land or forest. However, the island depends heavily on its beaches, marine and coastal environment for tourism, seafood production, real estate and port services. Land is used in the agricultural sector for sugar, cut-flowers, fruits and vegetables.

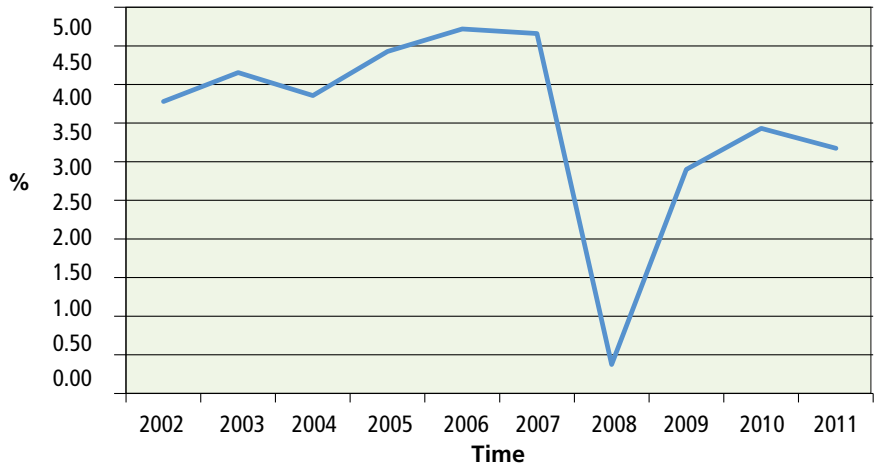
The Mauritian Government spent approximately 3.5 per cent of public expenditure on environmental protection, or 1.04 per cent of GDP in 2012. Public sector expenditure amounted to 27.8 per cent of GDP in 2012 (SM, 2013f). A Public Environment Expenditure Review is currently underway led by the Ministry of Finance and Economic Development.

Figure 2: Sectoral contribution to GDP in 2012



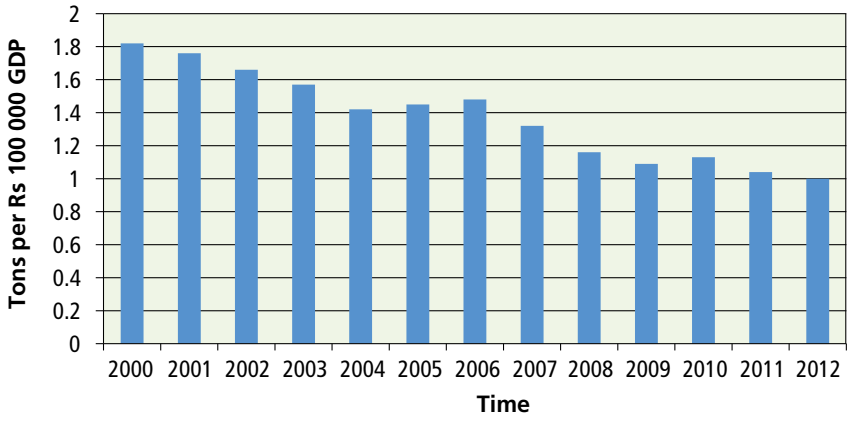
Source: Statistics Mauritius, 2013e

Figure 3: Share of government environmental protection expenditure to the total government expenditure (%) 2002 – 2011



Source: Statistics Mauritius, 2013f

Figure 4: Carbon dioxide emissions (metric tons) per Rs100,000 GDP, 2000 – 2012



Source: Statistics Mauritius, 2013c

Mauritius's ecological footprint is higher than the global average at 4.3 hectares per person compared to the global average biocapacity of 1.8 hectares per person. A country's ecological footprint is the area of productive land and aquatic ecosystems required to produce resources and assimilate waste (GFN, 2010). Over the next ten years at least 12,200 additional hectares of land will be needed for urban, business, and infrastructural development (MOESD, 2011), further putting pressure on Mauritius's ecosystems.

Mauritius has the third most endangered terrestrial flora in the world according to the International Union for Conservation of Nature (IUCN). 88 per cent of plant species are threatened, while 89 per cent of animal species are also under threat (SM, 2013c).

Mauritius's carbon dioxide emissions per capita have increased, but carbon intensity of GDP has fallen. Figure 4, demonstrates the fall in CO_2 emissions per unit of GDP in recent years in Mauritius, as the country has shifted to less-carbon intensive activities such as financial services. However, increased demand for energy means overall greenhouse gas emissions have increased (SM, 2013c).

The Environment Protection Act of 2002 and the National Environmental Policy of 2007 provide the main framework for environmental protection in Mauritius. The latter outlines a series of thematic policy objectives and strategies to address environmental challenges. Sectoral policies have also been developed on land, biodiversity, forests, water and wastewater, solid waste, coastal zone management, tourism and energy. The institutional framework for climate change is in place with a National Climate Change Committee and a Climate Change Division at the Ministry of Environment, Sustainable Development, and Disaster and Beach Management. A National Climate Change Adaptation Policy Framework has also been developed.

Table 2: Status of amenities of households and fuel consumption by type in 2012

Amenities		*Fuel for Cooking*	
Nature of Amenities	Percentage of Acquisition	Type of Fuel Used	Percentage Used
Piped water	99.5%	Wood & charcoal	1.9%
Electricity	99.5%	Kerosene	0.1%
Toilet	99.8%	Electricity	0.3%
Flush Toilet	96.4%	Gas	97.6%

Source: Statistics Mauritius, 2013c

Table 3: Social sector performance 1970-2012

Item	1970–74	1980–84	1990	1995	2000	2012
Illiteracy rate (%)	N/a	24.5	20.2	17.7	16.0	12.9
Infant mortality per 1000	45.2	29	21.3	18.6	16.3	12.0
Female as a % of economically active population	N/a	26.7	30.3	31.6	32.8	37.6

Source: UNDP, 2013b

At the international level, the Government of Mauritius has shown commitment to implement international recommendations on sustainable development. These include the 1992 Agenda 21, the 1994 Barbados Programme of Action for SIDS, the 2002 Johannesburg Plan of implementation (JPOI), the 2005 Mauritius Strategy for SIDS and the 2012 Rio+20 outcome document "*The Future We Want*", as well as the Samoa Pathway for SIDS in 2014. Under the guidance of UNEP, Mauritius was the first country in Africa to develop its National Programme on Sustainable Consumption and Production (SCP), which aspires to decouple economic growth from use of natural resources, bring about change in consumption patterns, promote technological shifts and encourage the adoption of more sustainable lifestyles.

2.3 SOCIAL PROFILE

Mauritius has achieved progress in providing its population with basic amenities. Table 2 demonstrates the high level of progress in the coverage of piped water, electricity and advanced sanitation. In addition, the table demonstrates the widespread use of to modern forms of cooking fuel that has been achieved in Mauritius – this is in comparison to other African countries where biomass represents 80 per cent of the fuel used for cooking (IEA, 2014). Furthermore, the number of housing units increased from 229,000 in 2000 to 264,100 in 2011 resulting in greater living space for the average Mauritian (SM, 2011).

Progress has been made on a wide range of social indicators. Illiteracy has fallen fast in the last 40 years. In terms of health, infant mortality has fallen dramatically. In addition, female participation in the labour market has increased, even if their involvement remains lower than males. Table 3 describes some of the major social trends in Mauritius.

However, economic growth has not always been inclusive. Inequality has risen in recent years and women remain significantly less active in the labour market. Despite the low rates of absolute poverty in Mauritius, the rate of relative poverty has increased. The Gini Coefficient, measuring income inequality, rose from 0.371 to 0.412 between 2000 and 2012. Over the period 2000-2012, the Human Development Index (HDI) dropped from 0.78 to 0.74 (UNDP, 2013b). In addition, while unemployment stood at 8.1 per cent in 2012, it exceeded 25 per cent among youth plus a rate among women that is three times higher than men.

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3.0 SECTORAL ANALYSIS

During stakeholder consultations, the agriculture, energy, transport, manufacturing, tourism, waste and water sectors were identified as having significant potential for greening the economy in Mauritius. These areas were chosen because of their contribution to GDP, employment creation, global competitiveness and environmental impact. Not only are these sectors interrelated, but they reflect the country's challenges on food and water security, dependence on imported energy and high energy costs, traffic congestion, impacts related to waste management, and the vulnerability and fragility of the tourism sector.

Each of the sectors is discussed below, examining the current development context, policy landscape and potential green economy interventions.

3.1 AGRICULTURE SECTOR

3.1.1 Overview

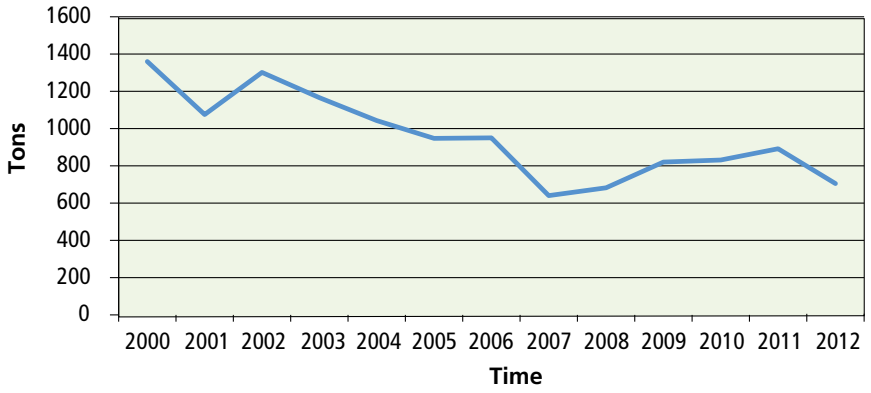
Agriculture remains a key sector to ensure food security, rural employment and economic growth in Mauritius. In 2012, the contribution of agriculture to the GDP was estimated at 3.4 per cent, while the share of agriculture in total employment in Mauritius stood at 8.3 per cent (SM, 2012a). Moreover, the island's agriculture is inextricably linked to the health of ecosystems through soil formation, water regulation and carbon sequestration.

Mauritius is no longer a predominantly agriculture-based economy and increasingly relies on imports. Domestic food crop production has risen by only 1.3 per cent between 2001 and 2011, compared to a population growth of 8.4 per cent over the same period. Though productivity has increased, agricultural land is being increasingly converted to residential and industrial use leading to a reduction in crop production and consequent need for increasing food imports. Food import costs have increased from Rs7.7 billion to Rs31.4 billion between 2000 and 2011 (SM, 2012a). The dependence on food imports makes Mauritius vulnerable to external food price dynamics. As a result, the country is aiming to improve food security.

Agriculture faces significant challenges, particularly in fishing. The competing demands on limited land resources, decreasing soil fertility, water scarcity, and insufficient interest of the young generation in agricultural activities poses challenges to the sector (MOESD, 2013). The fishing industry also has declined in recent years as demonstrated in Figure 5.

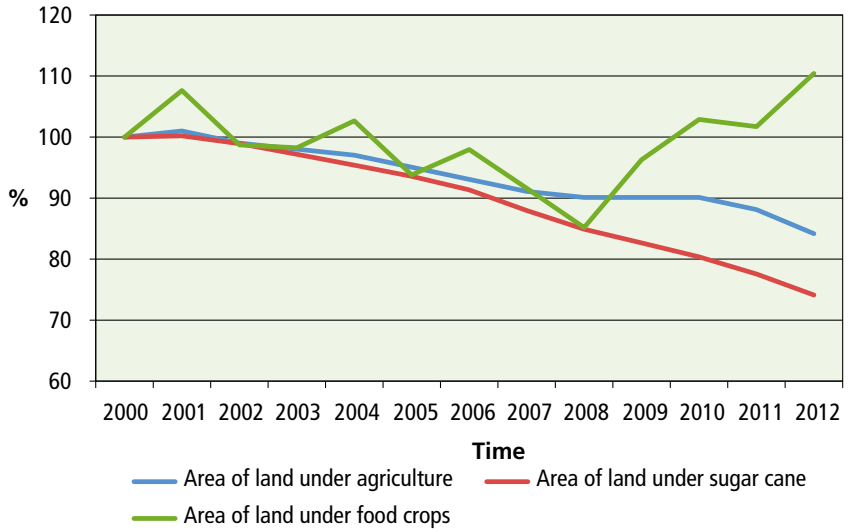
Sugar production has been slowing due to the end of the ACP-EU (Africa, Caribbean, and Pacific – European Union) sugar protocol. The reforms of the ACP-EU protocol led to a 36 per cent decrease of the price of sugar exported to the EU (WTO, 2008). This sector is also undergoing profound structural changes, moving from solely raw sugar production to a diversified sector producing refined and special sugars, as well as through using bagasse to supply energy to the grid. Between 1993 and 2013, the area under sugar cane cultivation decreased from 74,000 ha to 54,000 ha, a drop of 27 per cent (SM, 2012a). Figure 6 demonstrates the downward trend in agricultural and sugar cane land use, while also showing that land for food crops has increased

Figure 5: Annual fish catch of coastal fishery (tons), 2000 – 2012



Source: Statistics Mauritius, 2013c

Figure 6: Trend in agricultural, sugar cane and food crops land use



Source: Statistics Mauritius, 2012a

since 2008. Prices are further set to reduce in 2017 when the EU sugar-import quota is fully abolished.

The agricultural sector often has negative environmental impacts, particularly for water use. The sector is a relatively intensive user of water. In 2012, out of a total of approximately 800 Million cubic meters of water used, the agricultural sector consumed 50 per cent (SM, 2012b).

Intensive use of agro-chemicals for increased agricultural productivity has been common practice. Statistics show that the amount of fertilizer imported over the years has been more or less constant but the amount of pesticides brought in has increased (MOESD, 2011). Shifting to agro-ecological practices through the expanding use of compost, improving water consumption efficiency, and implementing integrated pest management programmes should increase long-term agricultural productivity.

3.1.2 Major policies

The Government has implemented a series of policies to re-dynamise the agricultural sector. These polices aim to (i) address land abandonment; (ii) improve productivity; and (iii) support access to finance, modern technology and markets. For example, the Field Operations, Regrouping, and Irrigation Project (FORIP) commits public investment to de-rocking land of small planters to halt land abandonment and to improve productivity. A compost subsidy scheme for planters has been introduced to improve land productivity. In addition, a biomass scheme is being developed to encourage the plantation of energy crops on marginal lands. Additionally, a full VAT refund scheme exists for agricultural machinery, equipment and tools.

A series of initiatives are in place to increase food security in Mauritius. The Food Security Fund Strategic Plan 2013-2015 proposed to improve food self-sufficiency to 33 per cent. This would imply an increase in food crop production of 130,000 tons annually, as well as increased investment of Rs 400m (GOM, 2013a). This includes investment in land preparation, post-harvest facilities, onion curing units, and advances on seeds for potatoes, onions and garlic. To further tackle food security, the following plans also are being implemented: Multiannual Adaptation Strategy – Sugar Sector Action Plan (2006 – 2015); Blueprint for a Diversified Agri-Food Strategy for Mauritius (2008 – 2015).

3.1.3 Economic modelling of a green economy transition in agriculture

On the basis of national data on crop production and productivity, fertilizer consumption, water use for irrigation purposes and other relevant indicators, different scenarios were simulated with the Mauritius Green Economy Model (M-GEM) to analyse potential future developments of the agriculture sector, and to explore costs and benefits of green economy investments and policies. The scenarios analysed include:

- A **business-as-usual (BAU)** case, assuming the continuation of historical and present trends.
- A **green economy (GE)** scenario that simulates additional interventions for the greening of the agriculture sector. The objective under the GE scenario is to:

Table 4: Main assumptions used for model development and scenario simulation for the agriculture sector

Metric	Assumption	Source
Investment in sustainable agriculture land conversion	Rs 7,450 per hectare	Based on Pretty et al, 2006 and adjusted based on national consultations.
Market price of organic crops	0 per cent-30 per cent higher than conventional crops	Organic Monitor, 2010.
Employment in ecological agriculture	30 per cent higher than conventional agriculture	Herren, H. R. et al. (2012).
Sustainable agriculture crop yield	0 per cent-40 per cent higher than conventional agriculture	Pretty et al, 2006.

1. Increase the land area under sustainable cultivation by 10 per cent by 2025
2. Reach self-sufficiency of 90 per cent by 2025 in certain strategic crops.

Table 4 summarizes the assumptions for the simulation of the BAU and GE scenario for agriculture sector.

Main results

Sustainable agriculture land

Only a very small share of the total agriculture area is currently under sustainable cultivation. Given that the climate and soil in Mauritius are particularly suitable for more environmentally-friendly production practices, the conditions exist for a considerable increase in sustainable agriculture area. Two different scenarios were simulated:

Processing of sugar cane
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Scenario 1 (GE-1): expansion of sustainable agriculture land up to 10 per cent of total agriculture land used for food crop production.

The simulation of the GE-1 scenario assumes an average yearly increase of 432 hectares of sustainable agriculture area between 2014 and 2025. Under this assumption, the land under sustainable agriculture practices would reach 9,000 hectares by 2025, corresponding to 10 per cent of total agriculture land, as indicated in the sectoral target. This expansion would take place at the expense of conventional agriculture land.

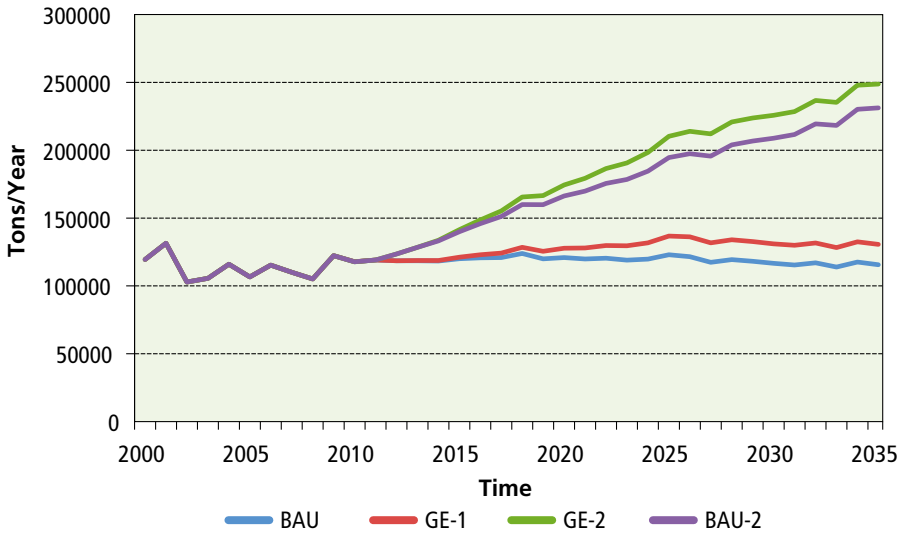
Projections for total agriculture production based on observed average crop yields (SM, 2012a) show an increase by 11.2 per cent in 2025, compared to BAU. Higher production under the GE scenario is attributable to the increase in land productivity deriving from reduced soil depletion under sustainable farming practices. As a consequence, crop self-sufficiency under the GE-1 scenario is expected to increase from 54 per cent in 2014 to 57 per cent in 2025, while it would drop from 54 per cent to 51 per cent under the BAU scenario, as depicted in Figure 7.

Scenario 2 (GE-2): Achieve the self-sufficiency target of 90 per cent in strategic food crops by 2025.

In this case, the share of total agriculture land dedicated to food crop production is assumed to increase from nine per cent in 2014 to 14 per cent in 2025, and up to 18 per cent in 2035, both under green economy (GE-2) and BAU-2 scenarios (BAU-2 assumes the continuation of historical and present trends to self-sufficiency).[1] Figure 7 shows that total agriculture production in 2025 would be 8 per cent higher under the GE-2 than BAU-2 (attributable to higher sustainable agriculture production compared to GE-1), while crop self-sufficiency would reach 88 per cent in 2025 and 100 per cent in 2035, compared to 81 per cent and 94 per cent under BAU, respectively.

[1] BAU assumes the continuation of historical and present trends in expansion of agricultural land).

Figure 7: Food crop production under BAU and GE scenarios (in tons)



As a result, in order to reach the target of 90 per cent of food self-sufficiency for strategic crops, a combination of land expansion and adoption of sustainable agriculture practices would be required, with the latter also providing economic incentives due to the price premium generally associated with sustainable production.

The expansion to increased land under sustainable agriculture will require investment of approximately Rs6.5 million per year between 2014 and 2025. This investment estimate is obtained by multiplying the assumed expansion of sustainable farming by the cost of transforming such land. It is estimated that the cumulative investment needed to support the expansion of sustainable farming land area to 10 per cent of the available land would reach approximately Rs74.48 million by 2025 with an annual average investment of approximately Rs6.5 million between 2014 and 2025. Importantly, this analysis does not assume that the cost of expanding sustainable production needs to be entirely borne by the public sector. This cost, in fact, could be shared with farmers through the use of incentives, thus reducing the financial burden to the public sector.

While the total investment in sustainable agriculture would remain unchanged under GE-2 compared to GE-1 scenario, additional outlays may be required to convert non-food crop agriculture land to food crop land. Moreover, such a shift in land uses may lead to reduced value added in non-food agriculture production.

(i) Avoided costs and added benefits

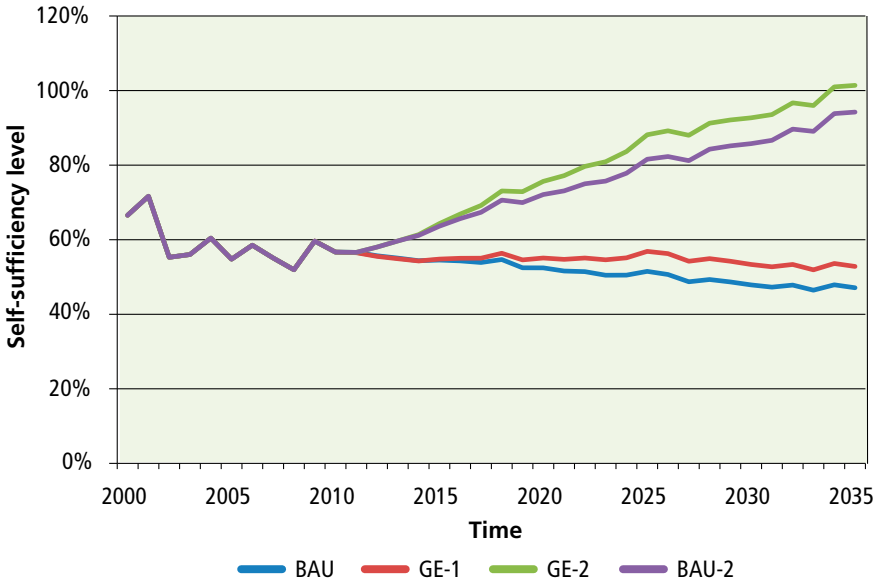
The expansion of agricultural production, sustainable or conventional, is likely to generate positive economic impacts. In the specific case of sustainable agriculture, it is reasonable to expect an increase in yields and higher market prices. Premium market prices would be justified by a rising demand for organic products in the global market (Organic Monitor, 2010), and several studies confirm the higher productivity of ecological agriculture, becoming evident in the medium-term (Pretty et al., 2006). Further, sustainable farming practices would generate a variety of environmental benefits ranging from soil preservation (e.g., avoided soil erosion) to water purification (e.g., avoided water contamination), and higher carbon sequestration. Based on these considerations, it is assumed that the market price of ecological agriculture crops would be 30 per cent higher than conventional crops.

Under the GE-1 scenario, the total value added would be higher than in the business-as-usual scenario. Value added is expected to reach Rs3.9 billion in 2025, compared to Rs3.2 billion in the business-as-usual scenario**.** The economic performance of the sector would be 21.2 per cent and 27.6 per cent higher than BAU in 2025 and 2035, respectively. As a result, investments under the GE-1 scenario would bring cumulative net returns of Rs4.19 billion by 2025 and Rs12.1 billion by 2035 against a cost of Rs74.8 million.

Under the GE-2 scenario, a further expansion of total food crop land would generate cumulative net returns amounting to Rs4.9 billion in 2025 and Rs13.9 billion in 2035.

According to developing country studies, sustainable agriculture has the potential to increase jobs by 30 per cent compared to traditional agriculture methods (FAO, 2012). Therefore, it is possible that the expansion of sustainable farming in Mauritius will create additional employment. However, total agriculture employment under the

Figure 8: Crop self-sufficiency under different scenarios



GE-1 scenario would be lower than BAU in 2025. This is because of the simultaneous reduction in conventional agriculture land driven by higher productivity under sustainable agriculture practices as shown in Figure 8.

In particular, total employment would be 1 per cent and 3.6 per cent lower than BAU in 2025 and 2035, respectively. On the other hand, with the expansion of total food crop land under the GE-2 scenario, total employment is projected to be consistently above the BAU case.

3.1.4 Suggested actions for a green economy transition in agriculture

The overall objective is to increase the land area under sustainable cultivation by 10 per cent by 2025 in order to improve agricultural sustainability and to increase production, productivity and employment. In addition, the government aims to reach a share of self-sufficiency of 90 per cent in certain strategic crops by 2025. This will entail investment in a certification system, capacity-building, awareness raising and subsidies on organic inputs (including fertilizers, compost, bio-pesticides, etc.). Some examples of such policy measures are listed below:

- **Develop incentives for conversion of land from conventional to sustainable agriculture.** Shifting from conventional to sustainable agriculture requires increased investment at the farm level. The measures needed to achieve smart agriculture include rainwater harvesting schemes, compost subsidy schemes as well as new approaches for supporting small smart agribusinesses through grants and subsidies. Often, extended transition time may be required to obtain the benefits of smart agriculture practices. During these periods, agricultural returns may prove negative or low, hence the need to develop appropriate incentives through some form of financing to support the conversion to smart agriculture.
- **Linking sustainable agricultural producers to the market.** Agricultural producers will invest in sustainable agriculture only if they are guaranteed a market for their products, hence the need to link sustainable

Tea cultivation in Mauritius
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agricultural producers to the market. In order to create demand for such products consumers should be sensitized on the benefits of smart agricultural products. This could entail having a green agricultural certification scheme.

- **Investment in research and extension for smart agriculture.** Developing sustainable agriculture practices in Mauritius requires support through strong research and extension services. Therefore the establishment of a dedicated Sustainable Agriculture Unit within the Food Agriculture Research and Extension Institute will contribute to the coordination of research and extension projects, such as soil conservation, integrated pest management, water conservation and organic fertilisers. The farming community must be provided with the necessary support to move towards sustainable agriculture through appropriate training. Capacity-building of farmers should be enhanced by disseminating information on the appropriate agro-ecological practices.

3.2 ENERGY SECTOR

3.2.1 Overview

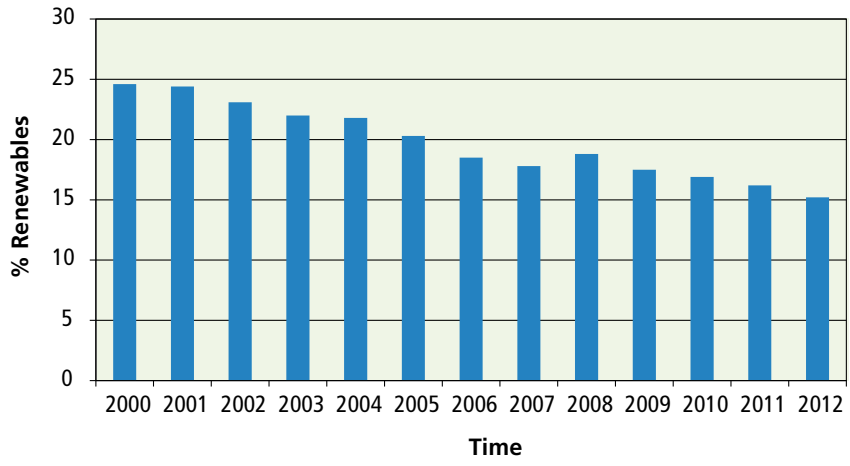
During the last decade, Mauritius's energy requirement has grown at an annual rate of 5 per cent and has become increasingly reliant on the use of fossil fuels. Around 85 per cent of the total primary energy requirement was met by imported fossil fuels. The fossil fuel mix for electricity generation has been changing over time with a shift from oil to coal. Around 15 per cent of electricity was generated from local renewable sources with bagasse (biomass from sugar cane production), contributing 92 per cent. This share has fallen over the last decade, as shown in Figure 9. In 2012, Independent Power Producers (IPPs) produced 59 per cent of the total electricity generated while the Central Electricity Board (CEB) produced the remaining 41 per cent (SM, 2013b).

Fossil fuels must be imported, meaning Mauritius faces energy security concerns. In 2013, the import bill of petroleum products and coal accounted for 21 per cent of total imports (SM, 2014a). Such energy dependence means Mauritius suffers from price volatility of imported fossil fuels. This has a negative impact on the country's balance of payments prompting growing concern about energy security. These problems provide a strong motivation for Mauritius to increase investment in low-carbon technologies.

Dependence on fossil fuels poses environmental problems. Following a 2007 study, it was estimated that power plants generated 105,000 tons of coal ash. This ash contains varying levels of heavy metals and was being disposed of in sugar cane fields (MOESD, 2011). In terms of greenhouse gases, the energy industry was the main source of CO_2 emissions, contributing 61 per cent of the country's total emissions (SM, 2013c). Figure 10 depicts the trend of CO_2 emissions, fossil energy use and renewable energy share in electricity generation.

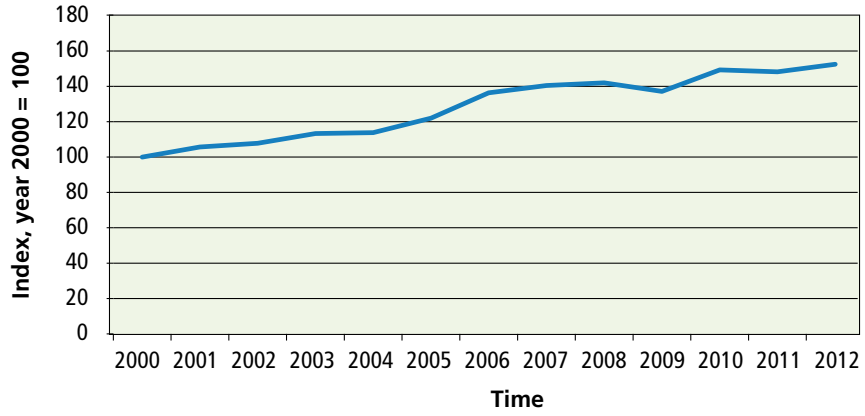
The two main energy-consuming sectors were transport (50.4 per cent) and manufacturing (24.4 per cent), and energy intensity has been falling, albeit at a slow rate. For Mauritius, the energy intensity decreased at a compound annual growth rate (CAGR) of –0.79 per cent per year in 2000–2010. An indicator for measuring future progress in global energy efficiency under the Sustainable Energy for All initiative (SE4ALL) has been set at a CAGR in energy intensity of –2.6 per cent for the period 2010–2030 (SE4ALL, 2013). Mauritius is therefore behind the SE4ALLbenchmark.

Figure 9: Share of renewable energy in the energy supply



Source: Statistics Mauritius, 2013b

Figure 10: Trend of CO_2 emissions in electricity generation, 2000 – 2012



Source: Statistics Mauritius, 2013c

Energy efficiency measures in large industries and buildings can lead to saving an estimated Rs1.1 billion per year (JEC, 2012). The total potential in electricity savings for these large consumers over the long-term is in the range of 150-200 GWh/year. This would lead to a reduction in required power capacity of around 40 MW.

3.2.2 Major policies

A Long-Term Energy Strategy for 2009-2025 and an Energy Strategy Action Plan 2011-2025 have been adopted by the Government of Mauritius. The main targets addressed in this strategy are:

- Increase the share of renewable sources of energy in electricity supply (from about 14.2 presently to 35 per cent in 2025);
- Improve energy efficiency and conservation in all sectors through demand-side management measures (with targeted energy efficiency gains of 10 per cent by 2025 over the 2008 baseline); and
- Create a financially-sound and self-sustaining modern electricity sector within a transparent and fair regulatory environment.

Other regulatory measures are in place. Legislation to regulate the electricity sector was introduced in 2008 with the proclamation of the Utility Regulatory Authority (URA) Act. This now needs to be consolidated through the setting up of the URA. An Integrated Electricity Plan 2013-2022 has been prepared by the Central Electricity Board to address the energy challenges of Mauritius. Action is ongoing for the preparation of the Renewable Energy Master Plan for 2015-2025.

The Government passed the Energy Efficiency Act 2011 and established an Energy Efficiency Management Office (EEMO) to promote energy efficiency and conservation. Minimum energy performance standards for some domestic appliances and a comprehensive framework to promote sustainable buildings have been developed. The new Energy Efficiency Management Office offers potential, but the training of energy auditors needs to be enhanced and the country's capacity in energy efficiency has to be significantly upgraded. The practice of Demand-Side Management is still at its infancy. An Energy Inefficient Products Charge of 25 per cent on energy inefficient household appliances was introduced in 2013, whilst the Maurice Ile Durable (MID) fund subsidizes compact fluorescent lamps. A National Energy Efficiency Programme is currently being implemented. It is a joint initiative of the Joint Economic Council (JEC) and the Ministry of Energy & Public Utilities with the support of the Agence Française de Développement (AFD).

The Government is also encouraging households and businesses to produce electricity using renewable energy technologies through Feed-in-Tariffs (FiT) and tax breaks. The FiT programme provides a tariff to wind, hydropower and solar PV installations under 50kw. To further support renewable energy, there is no Value Added Tax (VAT) on photovoltaic panels. There is also an exemption in the land conversion tax for abandoned agricultural land being converted to renewable energy production.

These policies have led to 60 MW of renewable energy projects currently in the pipeline with a gross private investment of Rs5 billion. The government is providing Rs235 million annually over the next 20 years (MOESD, 2013), which has spurred this large pipeline. In addition, a solar water heater grant scheme has provided subsidies totalling Rs600 million over three phases and about 20 per cent of households in Mauritius are now equipped with solar equipment (MOESD, 2013).

Table 5: Main assumptions used for model development and scenario simulation for the energy sector

Metric	Assumption	Source
Renewable energy solar subsidy	Rs250 million per year between 2015 and 2025	MID Policy, Strategy and Action Plan
Renewable energy wind subsidy	Rs1.2 billion between 2015 and 2025	MID Policy, Strategy and Action Plan

There is potential to increase the efficient use of bagasse and use of sugar cane tops for energy production. The total estimated potential of the sugar mills' power plants from bagasse is estimated at 750 GWh per year, compared to 473 GWh produced today (BOI, 2014). In addition, cogeneration of the total sugar cane biomass including tops and leaves can further increase electricity generation potential through collecting cane trash from the fields.

The Ministry of Public Infrastructure has reviewed the Building Act to incorporate the concept of energy efficiency and green the building codes. UNDP is presently funding an important project entitled "Removal of Barriers to Energy Efficiency and Energy Conservation in Buildings" to further reduce energy consumption in buildings.

3.2.3 Economic modelling of a green economy transition in energy

The assessment of green economy options in the energy sector aims to quantify the investments needed to expand renewable energy capacity. Based on national data regarding power demand and supply, greenhouse gas (GHG) emissions and the energy mix, different scenarios were simulated with M-GEM to estimate the impacts of renewable energy investments on the Mauritian economy, society and environment as well as to explore costs and benefits of green economy investments and policies.

Solar panel installations in Mauritius
©UNEP

The scenarios analysed were:

- A **business-as-usual (BAU)** case, assuming the continuation of historical and present trends).
- A **green economy (GE)** scenario that simulates an increase of renewable energy penetration of up to 35 per cent of the electricity grid by 2025. In addition to renewable energy expansion, energy efficiency improvements are simulated in residential, industrial and domestic sectors (10 per cent by 2020 and 20 per cent by 2030).

Table 5 summarizes the underlying assumptions for the simulation of the BAU and GE scenario for the energy sector.

Main results

Electricity demand and supply

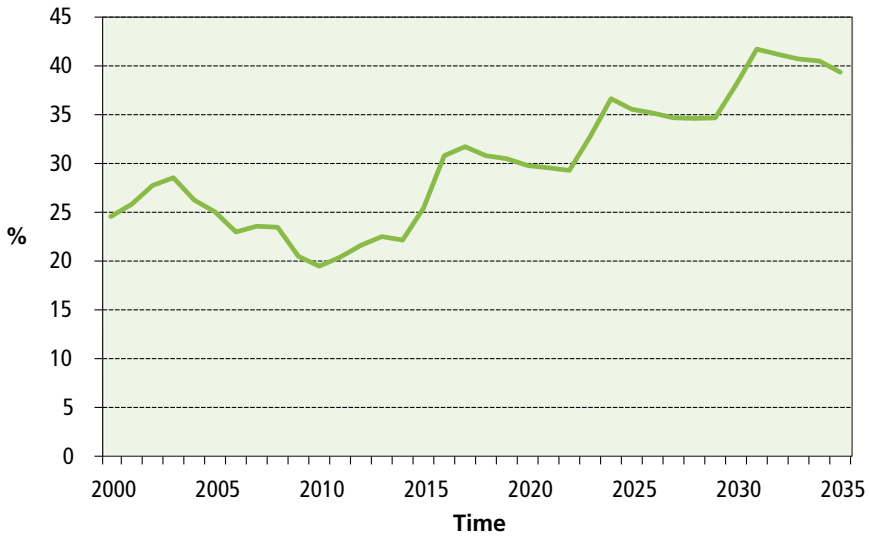
Under the GE scenario, the share of renewable energy over total electricity generation would reach 36 per cent in 2025, as shown in Figure 11. The main goal of green economy interventions on energy supply is to increase renewable energy penetration up to 35 per cent by 2025. Investments are timed according to the Long-Term Energy Strategy document (GoM, 2009), and to ensure proper integration with the national grid.

As result of efficiency improvements, total power demand would be 6.9 per cent lower than BAU in 2020, and 12.7 per cent lower in 2030. Energy efficiency policies are implemented under the GE scenario in all the sectors. This is smaller than the target improvement in energy efficiency due to the growth of population and GDP.

It is estimated that the cumulative additional investment needed to achieve the renewable energy penetration target of 35 per cent would need to reach approximately Rs14.2 billion by 2025. This implies an annual average investment of Rs1.2 billion between 2014 and 2025.

The savings on fuel imports originating from investments in renewable energy and energy efficiency are projected to be Rs4.5 billion per year

Figure 11: Renewable energy share of total electricity generation (%), under the GE scenario



Box 1: Alternative renewable energy development scenarios

The expansion of renewable energy capacity planned in the Long-Term Energy Strategy 2009-2025 would increase renewable energy penetration up to 35 per cent by 2025. However, this best-case scenario would require significant investment in the coming years, for which the government budget might not be readily available and the electrical grid may not be able to accommodate. Based on this consideration, two alternative scenarios were simulated in order to project more realistic renewable energy development paths, namely:

1) Scenario RE-1 that simulates a slower expansion of renewable energy capacity in the coming years, followed by higher investments and capacity improvements, eventually leading to the achievement of the penetration target of 35 per cent by 2025; and

2) Scenario RE-2, under which energy investments would be directed to both renewable energy and coal/oil capacity expansion. More precisely, 50 per cent more renewable energy and 50 per cent more coal capacity would be created by 2025, thereby meeting the projected additional power needs, but reaching a lower share of renewable energy penetration by 2025 (about 26 per cent). The results of these two alternative scenarios are shown in Figure 12. Importantly, total cumulative energy investment would amount to Rs40.4 billion and Rs35.6 billion in 2025 under the RE-1 and RE-2 scenarios, respectively.

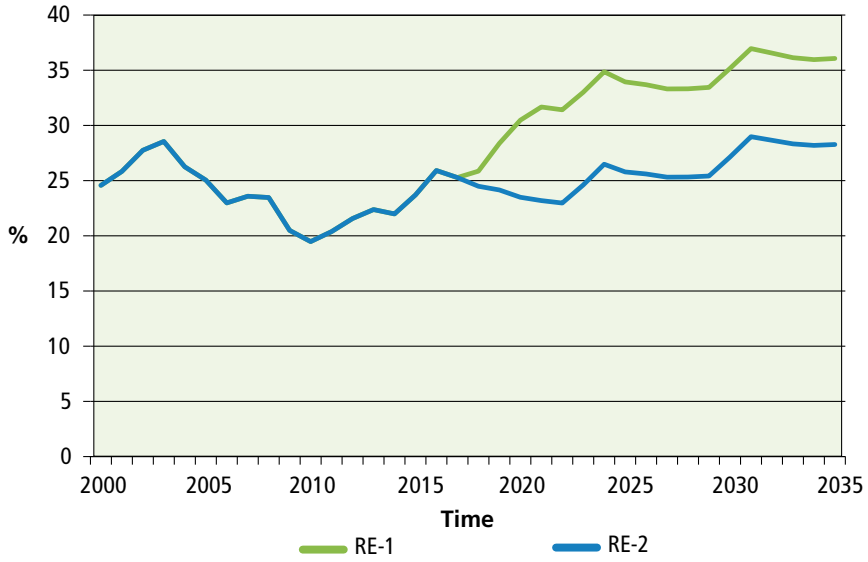
between 2014 and 2025. When compared to the total investments in the expansion of renewable energy capacity, the cumulative net return will amount to Rs31.2 billion by 2025 and Rs111 billion by 2035. The expansion of renewable energy capacity will also create additional jobs in the energy sector. For example, in the green economy scenario, jobs in the energy sector are projected to increase by 240 per cent by 2025.

As a result of investment in renewable energy, fossil fuel emissions under the green economy scenario are projected to be 20 per cent lower than in the business-as-usual scenario by 2035. However, emissions would still be 29.2 per cent and 50.4 per cent higher than in 2008. Per capita emissions are also projected to increase in both scenarios, indicating that CO_2 emissions will grow faster than the population. Per capita emissions were about 2.9 tons per person per year in 2008 (SM, 2013g) and are projected to reach 3.5 tons per person per year in 2025 and 4 tons in 2035 under the green economy scenario, against 4.3 and 5 tons per person per year respectively under the business-as-usual scenario.

3.2.4 Suggested actions for a green economy transition in energy

Mauritius can derive significant benefits from the development of renewable energy resources and the implementation of energy efficiency and conservation programmes. Mutually reinforcing measures are required to address market failures and barriers as well as to create the enabling policy conditions for public and private sector investment. These include:

Figure 12: Renewable energy penetration under alternative scenarios



Potential actions on energy supply:

- **Reinforce the Ministry of Energy and Public Utilities' (MEPU) planning capacity and conduct a multi-criteria assessment of different energy pathways to achieve the 35 per cent target**. This could include a multi-criteria assessment of energy pathways and the economic, environmental and social implications of these choices. The energy future of Mauritius is to be worked out with precision through appropriate modelling exercises and detailed feasibility studies, particularly on the question of ensuring steady power supply with the rise of intermittent sources such as solar and wind.

- **Operationalize the Utility Regulatory Authority (URA) and set up an Office of Sustainable Energy Development (OFSED).** OFSED would advise in the formulation of policies and strategies to achieve sustainability in the energy sector. These will seek to promote the effective implementation of the renewable energy programmes and to assess and advise on the sustainability of project proposals in the sector.

- **Elaboration of a Renewable Energy Master Plan.** This Master Plan would explore the feasibility of a renewable portfolio standard for CEB that encourages increased renewable energy development. This will specify a minimum amount of energy that the utility must generate from renewable sources. The Master Plan, once completed, would undergo a sustainability and strategic environment assessment.

- **Set up a Biomass and Renewable Energy Development Programme.** This programme will devise a package of measures for the promotion of bagasse and other forms of biomass, biogas, solar and wind electricity generation. The task of setting up such a programme could be left to the proposed OFSED. The price of bagasse will be reviewed so that it encourages sugar cane production.

- **Increase levies on fossil fuels in order to establish a Sustainable Energy Innovation and Development Fund.** The levy system on fossil fuels needs to be reviewed to take into account the carbon content of fuels. The mechanism for this new levy should encourage a shift from coal towards biomass in IPPs. The fund will strictly finance only renewable energy, EE and DSM projects to facilitate the transition to a sustainable energy future.

Sugar cane for Biomass production
©Shutterstock.com

- **Research on the integration of renewable energy in the grid, as well as capacity-building**. Many aspects regarding the integration of renewables in the island system (e.g. reliability, variability, forecast accuracy, etc.) must be investigated comprehensively. This action will develop a coordinated strategic research agenda for a smart grid. In addition, learning institutions will need to develop graduates, postgraduates and researchers with appropriate skills to meet the needs of industry and to ensure that a critical mass of researchers is in place to deliver the vision of a smart grid.

Actions on energy efficiency:

- **Develop a Long-Term Energy Efficiency and Demand-Side Management Master Plan, complementary to the Renewable Energy Master Plan.** This master plan will look into the feasibility of setting a mandatory annual demand reduction target for the CEB and EEMO. It will study the possibility of incentivising this measure by providing funding grants to CEB and EEMO for each additional MWh saved beyond the mandatory target.

- **Implementation of Energy Efficiency and Demand-Side Management measures.** These projects can be implemented with a potential cumulative saving of at least 30 MW at peak hours by using new low-energy lighting (CFL lamps), replacing old refrigerators, introducing time-of-use (ToU) tariffs in industries, reducing air-conditioning demand during peak times and sensitizing people on peak demand reduction.

- **Implement energy efficiency in industry and the service sector with technical assistance and green loans**. The main barriers to EE are insufficient expertise and consultancy services, limited financing capacity and an unfavourable policy framework and commitment from authorities. Burden sharing has to be clearly defined between the Government and private sector, such as the energy audit cost. Incentives for energy audits should be given by government through a matching grant, while funding partners can help in bringing in the required expertise. Green loan schemes for industries are to be enhanced through development finance institutions or the Government. This project will include a capacity-building component.

- **Review of electricity tariffs, including concessionary electricity tariffs, to industry to encourage energy efficiency**. Concessionary electricity tariffs to industry should be linked to energy efficiency. A threshold needs to be defined for each electricity purchaser, above which they would be paying at the commercial rate. Differentiated electricity tariffs will be investigated that promote off-peak use. All large beneficiaries of concessionary electricity tariffs will be required to conduct an energy audit if they are to preserve this benefit and to implement all commercially-viable recommendations.

3.3 MANUFACTURING SECTOR

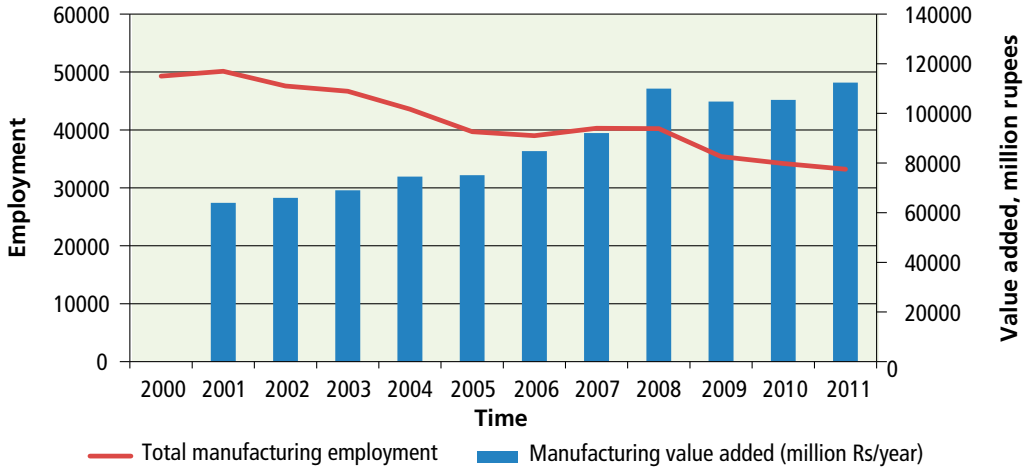
3.3.1 Overview

Over the years, manufacturing has played an important role in the structural transformation of the economy. Manufacturing accounts for 16.9 per cent of GDP (SM, 2014b) - the highest of any sector. Aggregate employment in the sector is estimated at 115,000 persons, 19 per cent of the total labour market. Textiles and apparel contributed to nearly 30 per cent of the manufacturing GDP, while the food and beverage sector accounts for 32 per cent (SM, 2014b). Fish and fish preparation are an increasingly important part of this sector, with 25 per cent of exports.

In recent years, manufacturing value added has increased, but overall growth is slowing. A few high technology enterprises have been engaged in the production of sophisticated medical devices and high precision plastic products. The growth rate of the manufacturing sector averaged 2.1 per cent from 2008 to 2012 compared to 6 per cent during the nineties. Employment levels have also fallen, as can be shown in Figure 13 (SM, 2014b).

Textile manufacturing
©Flickr

Figure 13: Trend of value added and employment in the manufacturing sector, 2000 – 2011



Source: Statistics Mauritius, 2014b

Manufacturing is one of the main energy-consuming sectors, accounting for 24 per cent of energy consumed in 2013. Although energy productivity has increased by 5.7 per cent between 2011 and 2012, additional improvements could be made to reduce energy waste in industrial processes. A recent Joint Economic Council and Association for Industrial Development study states that there is a potential through short-term actions at no to low-cost of more than Rs400 million/year in energy savings in large industries and buildings. The total saving, including higher cost activities, is Rs1.1 billion per year (JEC, 2012).

Mauritian enterprises have a strong understanding and awareness of sustainability. According to a survey conducted by the International Labour Organization (ILO) in 2012, Mauritian enterprises are conscious of the need to improve the sustainability of their production processes. In particular, business managers are aware of the economic, social and environmental importance of sustainable practices such as energy saving, more efficient use of materials, reduction of wastewater and adoption of pollution control and cleaner production methods (ILO, 2013).

3.3.2 Major policies and initiatives

A sophisticated policy framework for the environment is in place to control pollution from manufacturing. The National Environment Policy of 2007 adopted the polluter pays principle. The Environment Protection Act (EPA), amended in 2008, then established comprehensive enforcement procedures as well as regulations and standards for environmental protection. As of April 1st 2009, the Environment Protection (Industrial Waste Audit) Regulations entered into force to prompt industries to optimise resource use, develop waste management systems and comply with prescribed discharge and emission regulations.

Buyers of manufactured goods are increasingly incorporating environmental considerations in their terms of engagement with manufacturers. These agreements include standards for water treatment, waste disposal and recovery, transporting hazardous material and promoting energy efficiency to ensure lower carbon dioxide emission. Movement toward green production methods helps producers to meet international buyers' environmental and social compliance requirements.

Several domestic and international initiatives exist to improve the resource efficiency of the manufacturing sector. The Blue Carbon Award from the Mauritius Export Association (MEXA) acknowledges companies for achievements in reducing their carbon footprint. Enterprise Mauritius (EM) has funded consultancies for energy audits of manufacturing companies. The Agence Française de Développement (AFD) has partnered with four commercial banks to build on their capacity to drive and catalyse green investment decisions. These include customized loans, advisory services for clients and a grant (equal to 12 per cent of the loan). UNEP, with financial

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support from the European Commission, is also implementing the Switch Africa Green Project to support the development of green businesses, eco-entrepreneurship and implementation of SCP practices.

Only a small number of firms have implemented formal environment management systems, such as ISO 14000. About 10 enterprises in Mauritius are certified ISO 14001 (Industrial Observatory, 2015). More advanced sustainable production concepts, such as Life Cycle Assessments and Eco-design, are not yet applied.

3.3.3 Modelling energy and water efficiency measures in manufacturing

Overview

The M-GEM model studied the impact of energy and water efficiency interventions on the manufacturing sector. The economy-wide green interventions on water and energy efficiency simulated in this study would bring benefits to the manufacturing sector by reducing production costs, creating new employment opportunities and mitigating the impact of production processes on the environment. In line with the analysis in other sectors, the goal of green interventions is to increase energy efficiency by 10 per cent in 2020 and by 20 per cent in 2030, plus improving water efficiency by 20 per cent in 2030, compared to the baseline scenario.

Investment

Electricity: Under the GE scenario, industrial electricity demand is projected to decline by about 6.8 per cent in 2020, and by 12.7 per cent in 2030, relative to the BAU case. The total investment required to reach this goal amounts to Rs88.2 million every year between 2014 and 2030, less than 0.05 per cent of GDP. Depending on the policies utilized to reach this target, the investment allocated will be across the main actors of the economy: public, private, domestic and foreign investment.

Water: The cumulative investment required to achieve the water efficiency 2030 target would be Rs853,375 per year between 2015 and 2030.

Avoided costs and added benefits

Investments in EE lead to energy and emissions savings, avoiding costs for the industrial sector, as well as reducing costs for power supply expansion. More specifically, according to the model, the improvement of EE is projected to generate savings of approximately Rs406 million per year. These avoided costs can be directly compared with the EE investment (Rs88.2 million per year on average between 2015 and 2030), indicating that this intervention is very likely to generate consistent positive economic returns.

Energy efficiency improvements in industrial buildings will also create additional jobs. This was calculated based on the study by Wei et al, which studied the potential for job creation in the energy efficiency industry (Wei et al, 2010). As a result, it is estimated that under the GE scenario, a total of 62 full time jobs would be created by 2020, and 195 jobs by 2030 for energy efficiency auditing and installation in the industrial sector.

3.3.4 Suggested actions for a green economy transition in manufacturing

As demonstrated above, investing in cleaner manufacturing has positive environmental, economic and social benefits. Following stakeholder consultations, the potential actions to green the industrial sector in Mauritius are listed below:

Development of a National Eco-labelling Framework and incentives for green certifications. Eco-labelling of sustainably produced products and services provides a market-based instrument to enhance access to international markets for Mauritian businesses. In turn, this provides an additional incentive for these businesses to adopt GE strategies. Currently the Mauritius Standards Board (MSB) is developing an eco-labelling scheme with limited scope. This action is expected to lead to a comprehensive National Eco-labelling Framework to cover numerous industries and supporting campaigns to increase customer recognition of the label. The Eco-labelling Framework will establish standards for the agriculture, manufacturing and tourism sectors as well as a recognition system for other sustainability standards. A sustainability index also has been proposed to reflect the performance of the most sustainable companies trading on the Stock Exchange of Mauritius.

Establish new financial tools to invest in energy efficiency action, as well as reforming the current electricity tariff regime. Green loan facilities such as the one set up by the Agence Française de Développement, allowing commercial banks to offer preferential credit facilities to companies investing in green industries, need to be enhanced. Capital allowances and soft loans could be used to encourage the construction of eco-friendly buildings. Additionally, the concessionary electricity

tariff for export-oriented enterprises needs to be reviewed so as to encourage investments in energy efficiency measures.

Use of international standards on business environmental reporting. Companies increasingly demand participation in ISO standards within their supply chains. Firms that position themselves accordingly are expected to have a competitive advantage for export opportunities. Mauritian companies should also work to achieve other standards, notably the EU's REACH standard on chemicals. The Global Reporting Initiative (GRI) reporting framework is a tool that sets out sustainability indicators for organisations to develop and improve on. There should be a gradual step towards the adoption of Level C of the GRI, for entry-level reporting organizations, and businesses should make moving further up in the reporting level a priority.

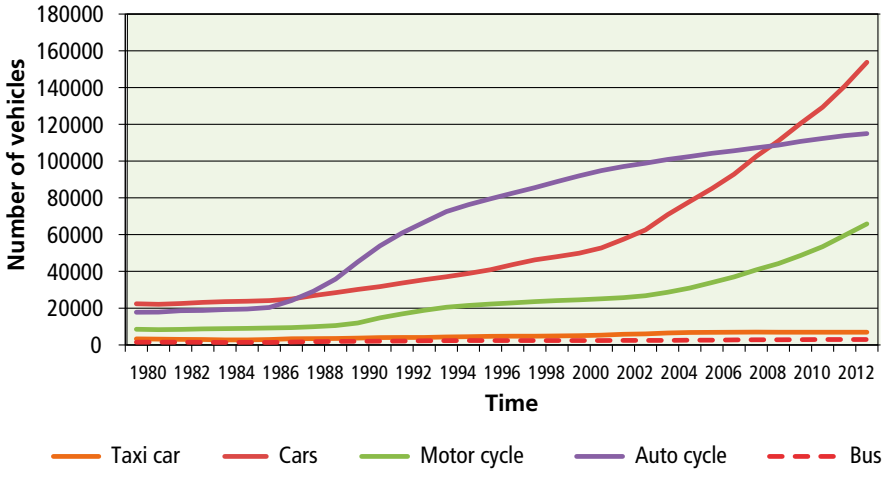
Promoting green technologies and technology transfer. Technology transfer is crucial to low-carbon industrial growth. Important opportunities exist for technology transfer, including power generation technology, energy and water efficient technology, waste recycling and soil management. Experiences from emerging economies imply that most benefits are yielded from a two-pronged strategy in which technological transfers are complemented by localized innovation to help with adaptation and diffusion. The Small and Medium Enterprises Development Authority (SMEDA) and industry association also can promote green technology industries by establishing SME and private sector support programmes for technology awareness. Furthermore, an industrial symbiosis programme could be envisaged through building clean tech parks, where businesses use the waste of other enterprises as production inputs.

3.4 TRANSPORT SECTOR

3.4.1 Overview

Road transport is currently the only form of inland transport in Mauritius, and is constantly expanding. The number of vehicles per km of road increased from 39 in 1981 to 188 in 2013. The fleet of vehicles has increased from some 190,000 in the 1990s to 443,495 vehicles in 2013 (SM, 2013d). Figure 14 below shows the major increase in car registration in Mauritius.

Figure 14: Vehicles registered in Mauritius, 1980 – 2012



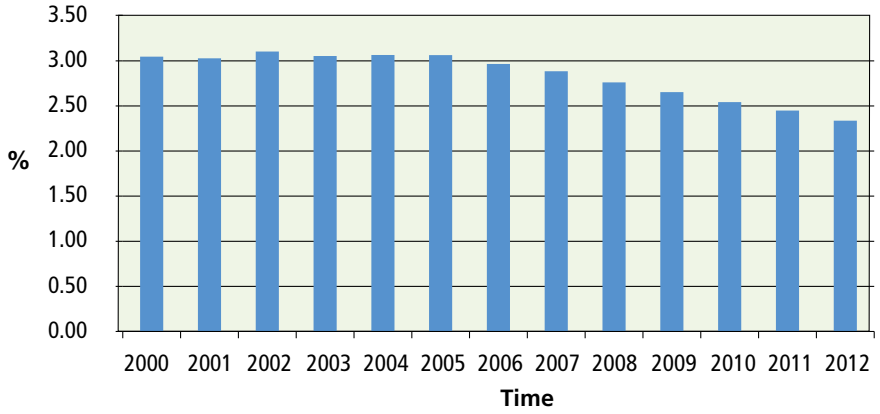
Source: Statistics Mauritius, 2013d, 2015

Congestion has become a major challenge for the country, and also contributes to road deterioration. Much of the road network was constructed in the pre-independence period and was not designed to support the current traffic load. Today, 15-20 km journeys by car typically take over one hour during peak periods. Furthermore, a greater number of heavy vehicles are using the road network as a result of increased economic and consumer activities. With the combined effect of rising traffic, overloading of vehicles and the constant changes in climatic conditions, the road structure in several areas is fast deteriorating despite routine and periodic maintenance.

The Government, through the National Development Strategy, has emphasized the need to develop a modern transport system. The major recommendations of the NDS were as follows: major new land uses and transport facilities need to be more integrated through the preparation of nation-wide action plans; greater reliance to be placed on public transport, walking and cycling for local journeys; a proposal for a strategic road network with more north-south and east-west roads.

This notwithstanding, the share of public transport has decreased in recent years. Figure 15 depicts the share of public transport.

Figure 15: Public transport share (%) bus and taxi, 2000 – 2012



Source: Statistics Mauritius, 2013g

The transport sector uses approximately 50 per cent of the imported fossil fuels, and is contributing significantly to environmental problems. It also emits 25 per cent of CO_2 in the country. This figure is expected to continue rising (SM, 2013c). In addition, heavy vehicular traffic is a cause of pollution, costing the economy an estimated Rs3 billion per year. In a 2013 budget speech, it was disclosed that severe traffic congestion costs around Rs4 billion annually.

3.4.2 Major policies

The Mauritian Government has been adopting various measures to improve the transport sector and its greening. These include the following.

A series of fiscal measures are in place to incentivise the use of efficient vehicles. In 2011, the motor vehicle taxation system was modified to reflect this polluter pays principle. The ceiling on CO_2 emissions is set at 150 grams per kilometre. The measurement of carbon emissions is modelled on existing European standards. Electric cars are categorised as zero-emission and thus pay lower taxes. The Minister of Finance and Economic Development previously introduced a 50 per cent reduction in taxes on hybrid vehicles, but this was replaced by a CO_2 levy rebate system.

Traffic in Mauritius
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The Government is trying to decrease the use of private transportation modes, whilst encouraging the greater use of public transport. A fee of Rs0.3/L on all petroleum products, Rs0.3/kg on LPG and Rs0.3/kg of coal has been introduced. This levy replenishes a fund (previously the MID fund) for the financing of sustainable development projects. In addition, the Government has introduced revisions in vehicle taxation systems and measures to improve fuel efficiency.

Fiscal mechanisms are encouraging the purchase of new buses by the National Transport Corporation. The 2013 budget laid the foundation for a Comprehensive Bus Replacement Mechanism to enable the acquisition of up to 200 modern and more comfortable semi-low floor buses annually, with low CO_2 emissions. In addition, the National Transport Corporation (NTC) has embarked on a restructuring plan to purchase 65 new buses, plus a further 100 buses. The above replacement mechanism was funded by a subsidy of Rs1 million per bus to operators. These subsidies are financed through a levy of one rupee per litre on petroleum products. In addition, the Government has announced the removal of VAT on this type of bus. The combined effect of these two measures should help reduce the acquisition cost of each semi-low floor bus by some Rs1.6 million, thus providing a greater incentive to proceed with more environmentally-friendly public transport (GoM, 2014).

The Government is tackling the increasing congestion through the Road Decongestion Programme with projects at an estimated total cost of Rs15.5 billion in the pipeline. The Government will also increase road capacity by constructing additional lanes in towns to ease congestion and bottlenecks (GoM, 2015c). In 2008, the Government embarked on an 'Additional Stimulus Package' in which approximately Rs2 billion were earmarked for road investment. Through this programme, a number of projects, mainly to address congestion along the motorway as well as in major villages, have been implemented.

3.4.3 Suggested actions for a green economy transition in transport

As demonstrated above, the government is already taking major efforts to reform the transport sector. In addition, following stakeholder consultation, the following actions are recommended for consideration.

Master plan for the refurbishment of town centres. Many neighbourhood and town centres need to be upgraded and reconfigured in ways which enable citizens and the economy to prosper. For example, this can be achieved by creating infrastructure for pedestrian paths and non-motorized mobility to reduce vehicle dependence while increasing social interaction. This urban design-led project using architectural and sustainability principles will create incentives for planners, engineers and designers to redesign and revitalize town centres.

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Bicycle transportation plan around the Ebene area. Communities that are bicycle-friendly are seen as enjoying a high quality of life. They also can have higher property values, business growth and increased tourism. The objective of such a pilot project would be to create a bicycle-friendly area in the region of Reduit-Ebene-Rose Hill-Quatre Bornes though development and investment in a Bicycle Transport Plan.

Introduction of Teleworking. A research study will identify jobs where teleworking can be introduced in the public and private sector. It will also explore the barriers to telework adoption, the benefits of teleworking for employees and society as a whole as well as the conditions of service that need to be modified in the public sector. There can be a target for having 10 per cent of the public sector regularly working from home using high-speed broadband by 2020. Teleworking is underpinned by the rollout of the national broadband network. The US and Australian Governments recently mandated that their workforces adopt teleworking as part of their usual method of functioning. In the US, the Obama administration passed an Act in 2010 that requires federal US government agencies to offer teleworking to all employees who work in a job that can make more efficient use of broadband activities.

Improved public transport information system. In addition to the hard systems, soft systems aimed at improving the public transport experience through mobile and other applications are being developed. There is a need to identify opportunities for systems applications and to create platforms for the ICT sector to engage with the transport industry by making better use of these opportunities. The project in this action plan will involve public transport operators and authorities, who will facilitate the provision of travel information through different media, such as GPS automatic vehicle location of public buses, strict time tabling of buses for enhanced reliability and live bus tracking.

Introduction of smart routes and rapid bus transit. In line with the modernization of the public transport system, consideration is being given for the creation of smart routes which would include modern and more comfortable low floor buses with electric ticketing, new bus shelters and a reliable passenger information system. Such routes would move private cars owners away from their own vehicles. This would include the introduction of a mass transit system (BRT) between Rose Belle (South East) and Riche Terre (North West), which would make use of the motorway as well as transforming part of the link between Curepipe and Phoenix into a bus lane.

Box 2: Congestion pricing

A 2004 report (MPI, 2004), studied the introduction of a congestion charge in Mauritius. It posited that the fee should not be too low so as to be ineffective in discouraging vehicle entry, or too high so that the city roads become under-utilised. It suggested a range from Rs40 to Rs60. Carpools (3 passengers + 1 driver) were recommended to be exempt from this congestion toll. The report concluded that it would be difficult to predict accurately the extent of the drop in traffic volumes entering the city from 7 a.m.-10 a.m. but that in Singapore the volumes dropped by 44 per cent and in London by 16 per cent. A conservative estimate by the analyst pointed to a drop of 10-15 per cent in traffic volumes during the periods of operation. This would prove sufficient to bring off-peak traffic conditions to the city roads and to all entry points leading into Port Louis.

Improve efficiency of vehicles. The local development and adoption of cleaner energy for motor vehicles is another area of opportunity that needs to be incentivized. This includes facilitating the use of biofuel and liquefied natural gas in public transport and supporting the use of hybrid and electric vehicles. This can be stimulated by requiring the next generation of public transport vehicles to use cleaner fuels. A further reduction of duty and registration fees would act as incentives for private car users to switch to cleaner fuel and efficient vehicles. In addition, outlets for electricity for private vehicles need to be integrated into transport infrastructure to encourage the use of electric vehicles.

Examine feasibility of converting the third lane on the M1 highway as a High-Occupancy Vehicle lane (or HOV lane) to encourage car-pooling and mass transport. Given the success witnessed in other countries of reducing traffic congestion, the Government needs to incentivize car-pooling and public transit through reduced commute times enabling drivers to avoid regular traffic congestion.

Establishment of congestion pricing, parking fees and introduction of 'park and ride' locations to discourage the use of private vehicles: These actions are meant to increase cost of travel in congested cities thus discouraging use of private vehicles in favour of public transport. The creation of 'park and rides' at Rose Belle, Curepipe, Vacoas and Riche Terre would enable the retaining of some 4,000 private cars with passengers changing to public buses. This would have direct impact on fuel usage and carbon dioxide emissions.

3.5 TOURISM SECTOR

3.5.1 Overview

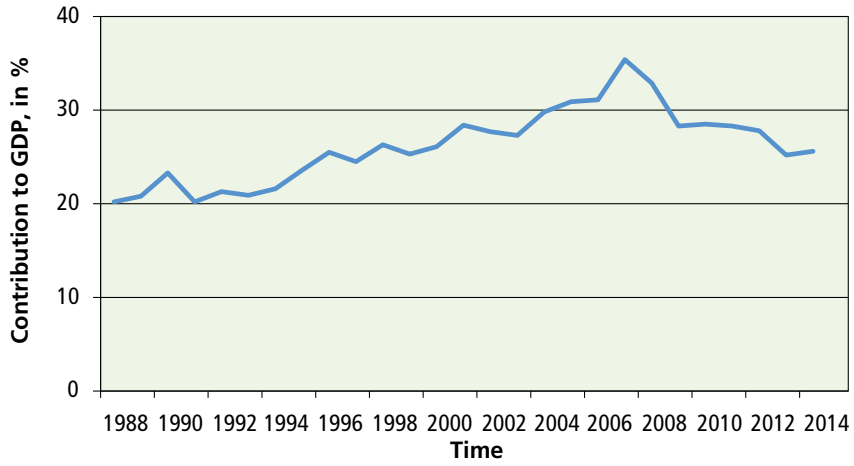
Today the tourism industry contributes significantly to the GDP of Mauritius (refer to Figure 16). The Government has been able to take advantage of the tropical island appeal, beautiful beaches, security and absence of tropical disease to promote Mauritius as an attractive tourist destination (BoM, 2012).

The number of tourist arrivals since 1974 has increased more than ten-fold with numbers reaching nearly 1 million in 2013 (SM, 2014d). Tourism facilities also have expanded considerably over the same period, with a 28 per cent increase in hotel capacity; 4.7 per cent of the total labour force is employed directly in tourism (SM 2014c). Figure 17 demonstrates this trend.

Vulnerability to the effects of climate change was taken into account in the Mauritius Sector Strategy Plan on Tourism (2008-2015). Potential threats include tidal waves and surges as well as the deterioration of the coral reef through changes in sea temperature (Landell Mills, 2009). Approximately 23 per cent of the island's beaches are considered at risk of disappearing as a result of climate change.

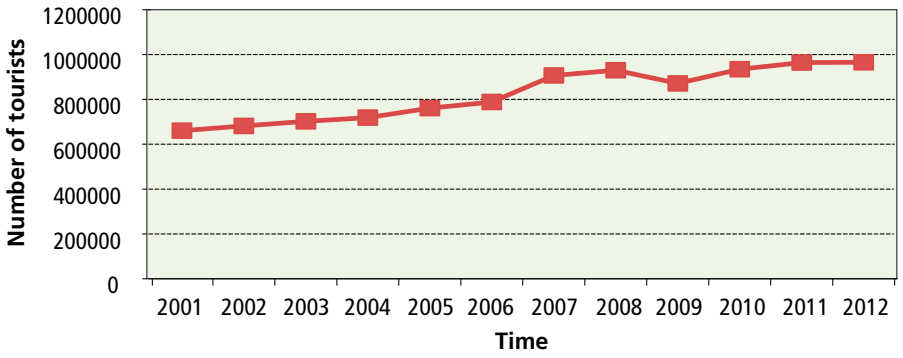
Tourism, industrial and domestic sectors accounted for 29 per cent of total water withdrawal in 2011 (SM 2013c). Total demand for water by hotels increased 53.6 per cent between 2000 and 2011. This is expected to increase further with the construction of new hotels and the development of Integrated Resort Schemes (IRS) and Residential

Figure 16: Travel & tourism contribution to GDP (1988 – 2014)



Source: Bank of Mauritius (2012)

Figure 17: Trend of tourist arrivals, 2000 – 2012



Source: Statistics Mauritius, 2014

Estate Schemes projects. Severe water shortages arise during periods of drought (September-December). Increased occurrence of water shortages is foreseen in the future. In addition, there has been an expanding use of desalination plants for hotels and resorts, given the relatively high cost of fresh water. However, the current constraints for establishing a desalination plant may not be the capital costs, but rather the operational burden.

Total energy consumption in hotels and resorts has decreased dramatically in recent years, from 53.13 tons of oil equivalent in 2002 to 32.3 in 2009. Energy intensity also dropped by 53 per cent between 2002 and 2009 from 3.58 to 1.64 toe/Rs (SM 2014b). Both the government and the private sector have been implementing policies and measures to encourage the adoption of energy-saving devices and eco-friendly practices. This includes the use of renewable energy and particularly solar power generation when designing new hotel and bungalow projects. A proposal for these renewable energy measures is now one of the conditions of the Environmental Impact Assessment (EIA) License.

The increase in awareness amongst tourists worldwide of environmental issues can increase the attractiveness of Mauritius as a tourism destination. If hotels and resorts adopt more energy efficiency measures and invest in renewable energy technologies, Mauritius can improve its brand as a green tourist destination, thereby attracting new visitors. Key priorities identified for improving the sustainability of the hotels include: retrofitting of existing hotels; mandatory use of solar hot water systems; and mandatory low-energy lighting, appliances, air-conditioning and cooling devices.

The Government has earmarked funds which will be geared at obtaining Blue Flag status for its beaches. Blue Flag status is awarded to those beaches that achieve excellence in water quality, environmental education and information, plus adhere to international safety standards. Spatial planning of the lagoons also has become of prime importance. The Government already has achieved improved zoning and sustainable management of the lagoon.

3.5.2 Major policies

The Tourism Authority Act is the main policy framework for the industry. The act was completed in 2006, and further amended in 2008 to make better provisions for regulating the operation of tourist enterprises and pleasure crafts (boats used for fishing, water sports, etc.). In addition, the Act urged hotel developers to install eco-friendly and energy-saving practices, such as recycling plants. Additionally, the Environment Protection Act (2002) requires hotel developers to submit Environmental Impact Assessment results with their application for hotel development. The Tourism Sector Strategy Plan (2009-2015) made recommendations to achieve environmentally sound, socially equitable and economically viable tourism development.

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In 2008, the Government revised the Hotel Development Strategy, requiring hoteliers to strictly follow the recommendations of the Planning Policy Guidance for coastal development. The document offers guidelines on land management, architectural design and eco-friendly practices, amongst others. Other areas of intervention include tourism-related development control through EIA mechanisms, control of recreational activities in the lagoon and the promotion of energy efficient and environmentally-friendly technology in hotels.

As of 2007, one hotel, the Labourdonnais Waterfront Hotel, has been certified to the ISO 14000 series. Interestingly, Green Globe certification is also possible. The Ministry of Tourism and Leisure, in collaboration with the Mauritius Standards Bureau (MSB) and other key tourism stakeholders have developed eco-label standards for the industry. These standards will be applicable to accommodation, restaurants and tour operators as well as tourist and pleasure craft. Fiscal incentives need to be given to businesses for achieving such certifications (e.g. tax incentives such as reduction of the Environmental Protection Fee for Hotels). There is also a lack of capacity to undertake energy audits for hotels which are undoubtedly large energy consumers.

3.5.3 Economic modelling of a green economy transition in tourism

Overview

The energy and water efficiency interventions simulated in this study are expected to produce positive impacts on the tourism sector. In particular, an energy efficiency improvement of 10 per cent by 2020 and of 20 per cent by 2030 would contribute to reducing energy intensity in the sector. Similarly, the projected improvement in water efficiency by 20 per cent by 2030 would reduce the high water costs sustained by tourism facilities.

Investment

The total cumulative investment required for water efficiency improvements would amount to Rs13.6 million by 2030, or Rs0.8 million per year on average between 2014 and 2030. Such an investment needs to be compared with avoided water costs in order to fully appreciate the economic returns of the green economy intervention.

Avoided costs and added benefits

Under the green economy scenario, efficiency interventions would reduce water costs by 20 per cent in 2030, corresponding to total cumulative savings of Rs12.2 million per year between 2014 and 2030, as compared to BAU. When comparing these savings with water efficiency investments, its net returns would amount Rs11.5 million per year on average between 2014 and 2035.

Energy efficiency improvements will also bring savings in the sector. More precisely, total cumulative savings are projected to reach Rs1.3 million by 2020 and Rs4.5 million by 2030, as compared to BAU. The implementation of green economy policies would contribute to the profitability of tourism, especially in the face of rising energy costs.

3.5.4 Suggested actions for a green economy transition in tourism

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Implement the Blue Flag Programme for sustainable development of beaches. Blue Flag status is awarded to those beaches that achieve excellence in water quality, environmental education and information, and adhere to international safety standards. An application for Blue Flag Status will be made for one beach per annum over the medium-term. The main objective in that endeavour is to promote inter alia the sustainable use of the coastal resources and sound national policies on lagoon water quality, reefs, protection of the beaches and safety.

Introduce an Ecological Fee. A fee of $1 per head of tourists arriving in Mauritius could be used to create an Ecological Fund earmarked for coastal zone management, overcoming coral bleaching and damage from eco-tourism. This fee can, for example, be collected through a charge on each air ticket arriving into Mauritius.

3.6 WATER SECTOR

3.6.1 Overview

Municipal water demand, increased by 18.3 per cent between 2000 and 2011 (CWA, 2013). Moreover, the expected increase in population and GDP will put further pressure on available surface

and ground water resources. By 2040, total water demand is projected to reach 1,200 Mm^3 per year, which is close to the usable renewable potential of 1,233 Mm3 per year (MOESD, 2013). For this reason, Mauritius must increase water efficiency and minimise losses to strengthen water security.

Losses are estimated at about between 48 and 60 per cent of total water supply, emphasizing the need for investment in the distribution network. Though there has been a gradual, but steady investment in new networks, this figure remains high. There is thought to be significant water pilferage, and that meters show incorrect readings. It is important that the Anti-Fraud Unit of the Central Water Authority (CWA) - involved in the detection of illegal connections, under-billing and illegal withdrawals of water from boreholes that take place all around the island – be reinforced.

Rising average temperatures and fluctuating rainfall patterns due to climate change may further exacerbate water scarcity. Water scarcity is greatly felt during some seasons where there is lack of rainfall. 2012 saw the lowest rainfall in over a decade, and the level of water abstraction (extraction) has decreased by 14.5 per cent from 2000-2012 (SM, 2013c). Climate change has been seen as a contributor to the gradual decrease of rainfall as well as irregular rainfall extremes. This means less water is stored in the surface reservoirs and aquifers. Figure 18 shows the variability in annual rainfall and water abstractions.

3.6.2 Challenges in the water sector

Many meters in Mauritius are older than 10 years, after which point the meter functions sub-optimally. Currently, 15 per cent of meters in the water network are not working properly, while another 7 per cent cannot be read because of inaccessibility. This means that some 22 per cent of consumers are given a minimum charge or an average bill, thus distorting the non-revenue water figures. About 80,000 meters will thus need to be replaced in the short to medium term (CWA,2013). While old pipes need to be replaced, there should also be emphasis on regular meter renewal (for example, 14-15 per cent of meters per year) and correct installation.

The average cost of water to domestic consumers is less than the average cost of production which results in little incentive for consumers to reduce their water consumption. In addition, low prices result in little excess revenue available for investing in new projects or for important maintenance work, such as meter replacement.

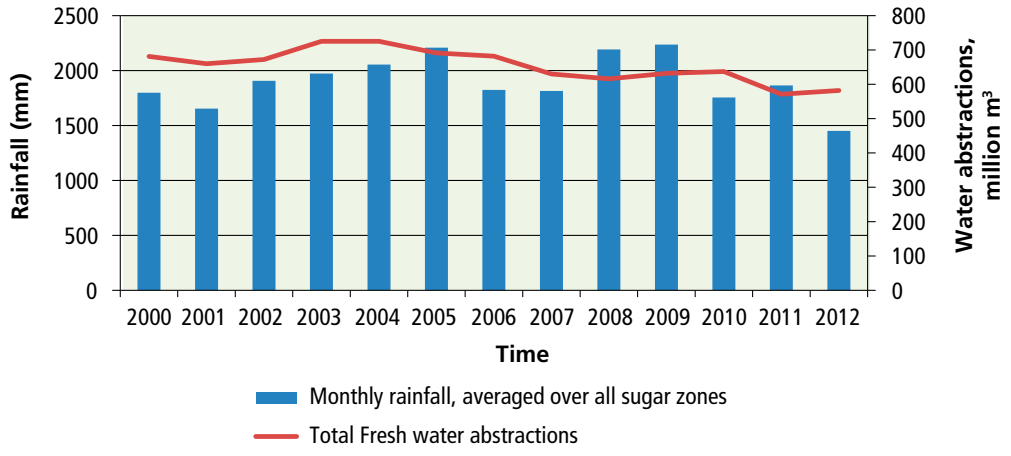
Inefficient use and abuse by water right holders leads to excess water being extracted from rivers. Owners of land adjoining a water course have the possibility of withdrawing water from the river (based on water rights) for purposes of irrigation, or non-consumptive use, so long as the original volume is returned to the water course downstream. Abuse of these water rights, such as selling land but illegally retaining the water rights, or irrigating during rainy periods, leads to an inefficient use of water in the country.

3.6.3 Economic modelling of a green economy transition in water

The analysis seeks to present possible alternative scenarios of water resources availability and use. The following scenarios were simulated and analysed:

- A **business-as-usual (BAU)** case that assumes the continuation of historical and present trends. This includes all policies and interventions currently active and enforced, but excludes policies planned but not yet implemented.

Figure 18: Annual rainfall and water abstractions, 2000-2012 (SM, 2013c)



Source: Statistics Mauritius, 2013c

Table 6: Main assumptions used for model development and scenario simulation for water sector

Metric	Assumption	Source
Domestic water price	Rs0.023 per litre	Board of Investment, 2014
Industrial water price	Rs0.018 per litre	Board of Investment, 2014
Agriculture water price	Rs0.011 per litre	Board of Investment, 2014
Annual water losses	50 per cent of total water consumption	% of Non-Revenue Water as per CWA, 2013
Cost of pipeline replacement	Rs7 million per km of pipe	Based on expert judgment and CWA, 2013
Water efficiency investment	Rs0.001 – 0.002 per litre of water	2030 Water Resources Group, 2009

- A **green economy (GE)** scenario simulates additional interventions to reduce water use through investments in efficiency. The goal under this scenario reflects the national objective of improving water efficiency in residential, industrial and agriculture sectors by 20 per cent by 2030. In particular, 1,040 km of pipelines are replaced between 2014 and 2030, thereby reducing water losses from 50 per cent to 25 per cent over the indicated period.

All the assumptions used for the purpose of this study are listed in Table 6.

Main results

Under the GE scenario, total water consumption is projected to be 16.7 per cent lower compared to BAU in 2030. The water stress index meanwhile would be 0.11 under the GE scenario, compared to 0.13 in the BAU case in 2030, meaning that 2 per cent of total available water resources would be saved under the GE scenario in 2030.

Total water consumption is calculated as the amount of water consumed by the residential, agriculture and industrial sectors. However, when adding the water lost (or unaccounted for) amounting to approximately 50 per cent of water consumption, the water stress considerably increases. In particular, with a 25 per cent reduction in annual water losses by 2030, the actual water stress index would be 0.44, compared to 0.53 under BAU (Figure 19).

(i) Investment

According to the Central Water Authority (CWA, 2013), the investment required for the replacement of old pipes is Rs7 million per km. Since 1,040 km of old pipes should be replaced in order to reduce water losses by 25 per cent by 2030, the total investment required for this intervention is Rs7.28 billion, or Rs455 million on average every year between 2014 and 2030.

The cost of water efficiency technology varies considerably depending on the sector addressed (e.g. residential water use, municipal water supply, irrigation, use of water in industrial processes), and the specific situation of the country. Based on existing literature and case studies on supply and demand interventions for the improvement of water efficiency, the range of costs is as low as Rs0.001 to Rs0.002 per litre of water is saved (2030 Water Resources Group, 2009). Under the GE scenario simulated in this study, a total of 217.2 Mm3 of water would be saved between 2014 and 2030 due to the introduction of water-saving practices and technologies, compared to BAU. Based on the cost assumptions mentioned above, the total cumulative investment needed to reach the goal of the GE scenario would amount to a value ranging between Rs217.2 million and Rs434.4 million, which would correspond to an average annual investment of Rs12.8 million to Rs25.5 million between 2014 and 2030.

(ii) Avoided costs and added benefits

The introduction of water efficiency technologies, simulated under the GE scenario, is expected to reduce total demand. As a consequence, the total water expenditure for residential, agricultural and

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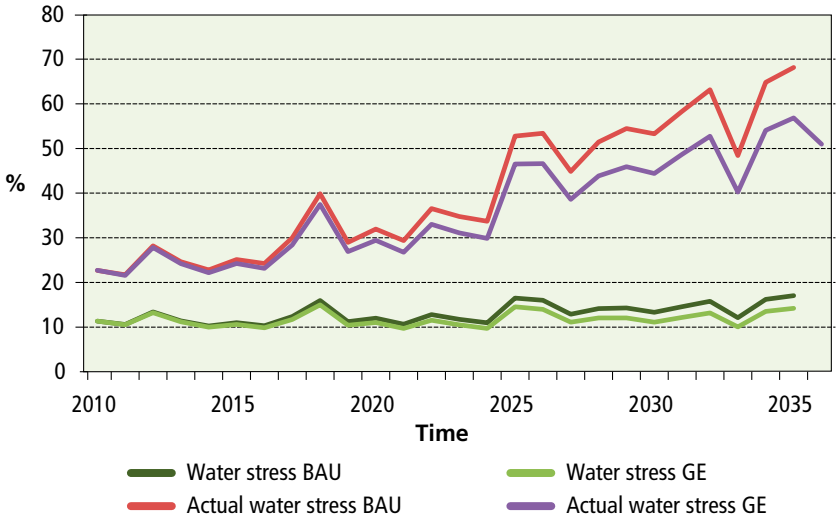
Figure 19: Water stress (without water losses) and actual water stress (with water losses), under GE and BAU Scenarios



industrial use would reduce, with positive effects on households and production. In particular, the average yearly water expenditure between 2014 and 2030 would be 11 per cent lower under the GE scenario, compared to BAU. Overall, approximately Rs285 million would be saved every year between 2014 and 2030. Such avoided costs are comparable to the projected investment in water efficiency previously mentioned, which is expected to reach Rs12.8 to Rs25.5 million every year. This, on the other hand, may translate into more income available for household expenditure, and therefore more water consumption, known as the "rebound effect".

3.6.4 Suggested actions for a green economy transition in water

As demonstrated above, increased investment into the water can have positive economic and environmental benefits. A series of actions are therefore recommended to ensure better water management.

- **Sustained awareness campaigns on water conservation**. It has been observed that most people are unaware of the costs of producing water. This false perception about the cost and value of water is caused by an ignorance of the basic factors involved in producing and distributing water from rainfall to the tap. It is proposed that the government introduce a sustained water awareness campaign with the help of communication professionals.

- **New tariff policy for the Central Water Authority (CWA) and creation of a Water Fund.** There is a need for a new water tariff policy which provides CWA with the possibility of generating funds for investment projects. This new tariff would include progressive tariffs for industrial and commercial customers to encourage water efficiency while maintaining competitiveness. Any profit from this new tariff would go into a Water Fund which would be available for investments in infrastructure and watershed protection. Hotels could also contribute to this water fund to improve the water network instead of investing in expensive desalination plants. New tariffs for irrigation should not be exorbitant and should still allow farmers to stay in agriculture.

- **Investments in Rain Water Harvesting Systems (RWHS)**. The lack of an adequate reserve of stored water in reservoirs during certain periods makes rainwater harvesting a sensible option for Mauritius. Incentives need to be given for larger investments in RWHS in all sectors of the economy. This action will encourage the installation of RWHS in households. Results of a feasibility study revealed that the collection of rainwater is favourable in certain areas, notably the North, South, East and Centre. When only the cost of water is considered, the payback periods for the optimum tanks range are relatively long, from 12 to 25 years, so some fiscal support may be required.

Tea production
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- **Incentives for investment in micro-irrigation systems in the agricultural sector**. Incentives for the purchase of simple drip irrigation equipment could be given along with training of planters in their use.

Reinforcement of Anti-Fraud Unit and purchase of new meters for CWA. The Anti-Fraud Unit of the CWA, which is involved in the detection of illegal connections, under-billing and illegal withdrawals of water, needs to be reinforced. While old pipes should be replaced, there must also be a greater emphasis on the regular and continuous renewal and correct installation of meters. A continuous meter renewal programme of some Rs75 million annually would ensure that correct readings are obtained for the bills, indefinitely. A corresponding exercise for the production side would lend a better estimate for water use figures and enable more effective planning (new pipes, curb water demand, etc.) for the water distribution sector.

- **Replacement of old pipes.** There is a need for continued public investment for the replacement of degraded water pipelines across the country. According to the modelling analysis, replacing 1,040 km of pipelines between 2014 and 2030, would reduce water losses from 50 per cent to 25 per cent.

- **Use of treated wastewater**. The estimated coverage of the sewerage system will reach 50 per cent of the population by 2025 and the potential amount of tertiary treated wastewater that can be used for irrigation is estimated at 68,000m3/day. A proper tariff is to be negotiated between irrigation water users and the Wastewater Management Authority.

- **Review of water rights for wise use of riparian water.** Water rights have been beneficial to the development of agriculture in Mauritius. Now that development priorities concerning water have evolved, it is important to examine what is a national asset rather than private property. In many countries, water rights may be purchased, transferred or taxed. This ensures that those involved make an optimum use of the water available. The legislation for water use by riparian owners needs to be reviewed.

- **Capacity-building in Integrated Water Resources Management (IWRM).** Training in IWRM for water sector professionals and policy makers in optimizing water resources will support better management practices and reduce water stress in Mauritius.

3.7 WASTE SECTOR

3.7.1 Overview

Waste management systems in Mauritius are coming under pressure because of increasing population, economic growth and changing consumption patterns. Waste management currently focuses on landfilling, which represents missed economic opportunities and is becoming challenging due to the limited availability of land. The total amount of waste landfilled annually increased by 56 per cent between 2000 and 2013 (MOESD, 2013). Most of this growth occurred between 2000 and 2005, when open dumps were closed and waste was moved to sanitary landfill. Moreover, it is expected that total waste generation may increase by another 50 per cent by 2030 if no additional measures are taken to recycle, reduce and reuse waste (GoM, 2013b).

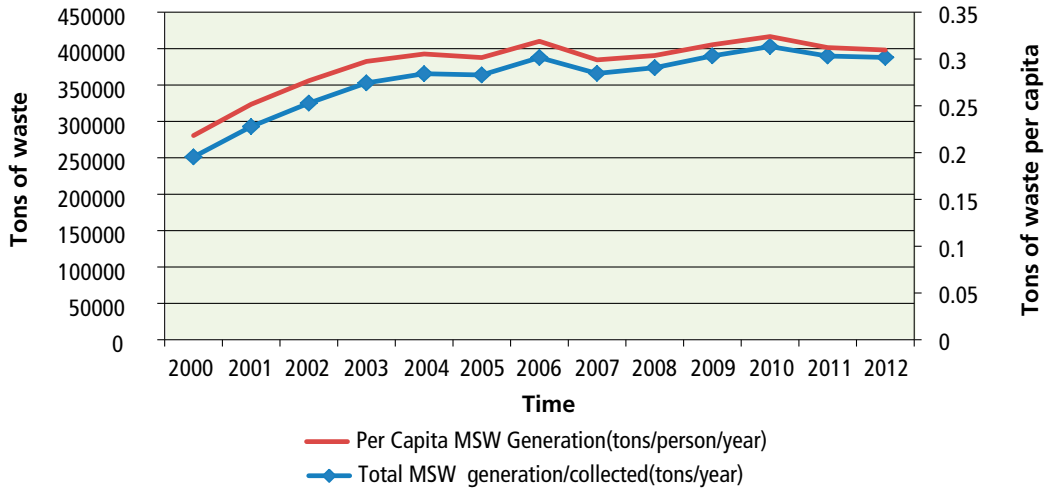
The cost of cleansing, collecting, transporting and disposing solid waste is $46.6 million US annually, or $36 per person. The Solid Waste Management Strategy 2011 - 2015 of the Ministry of Local Government clearly states that "the strategy *will be led by waste reduction, reuse, and recycling".* A new policy is being drafted for the period 2016-2020.

The new Government Programme (2015-2019) aims for a large increase in recycling. The Roche Bois transfer station is being re-designed to allow the recovery of waste for recycling. Incentives have been inserted in the contract to encourage the contractor to segregate wastes and support recycling. The target for waste recycling is an increase from 25 per cent in 2013 to 50 per cent of total waste by 2025.

In Mauritius, most municipal waste is transported to transfer stations and then deposited in the Mare Chicose sanitary landfill. Mare Chicose is a 225,000 m^2 landfill located in the southern part of the island. The gas generated from the landfill was captured and flared until October 2011. In November 2011, a 2 MW landfill gas to energy plant came into operation, supplying electricity to the Central Electricity Board. At current filling rates, however, the landfill will reach capacity before 2020.

In 2011, a compost facility was built at La Chaumiere. The compost facility, which has a processing capacity of 180,000 tons of municipal solid waste (MSW) every year (GoM, 2013b), received only 34,785 tons of waste in 2012, and 19,257 tons in 2013. In 2013, 9,729 home compost bins were distributed to householders in all local authorities by the Ministry of Environment, Sustainable Development, and Disaster and Beach Management (GOM, 2013b). This scheme may be further extended.

Figure 20: Trend of municipal solid waste collected (MSW, 2000 – 2012)



Source: MOESD, 2013

Hazardous waste generation is predicted to increase by 35 per cent between 2011 and 2015, if no action is taken. The road map for the sound management of hazardous waste in Mauritius comprises the setting up of an interim storage facility at La Chaumière, the strengthening of existing regulations for the sound hazardous waste management, better enforcement of regulations, capacity-building of the various actors along the value chain in hazardous waste management as well as mass sensitisation and education-campaigns for improved management in Mauritius.

It is estimated that only 2 per cent of the 9,000 tons of e-waste in Mauritius is collected. The EU is currently providing technical assistance to the Ministry of Local Government for the elaboration of policies, strategies and an action plan for e-waste management. At present, specific types of obsolete chemicals and other hazardous wastes are exported for treatment.

©The Solid Waste Division of the Ministry of Environment, Sustainable Development, Disaster and Beach Management

3.7.2 Challenges in the waste sector

According to stakeholders, there is a lack of sufficient public responsibility, civic sense and concern for a healthy environment related to waste. However, it must be recognized that there is also a shortage of information that hinders awareness of these issues and the development of a sense of civic pride regarding the environment.

The unwillingness of residents to accept new waste facilities near their homes combined with high land prices means finding appropriate sites for new waste facilities is challenging. In certain places, a "Not in my Backyard" (NIMBY) syndrome exists, meaning the local citizens will not accept construction of, for example, a composting site near their home. High land premium and labour costs also affect the economic viability of setting up local recycling facilities.

The present system lacks an explicit methodology for mobilizing necessary investment. The absence of a cost recovery mechanism renders the system unsustainable in the medium to long-term. The use of innovative financing measures such as Public-Private Partnerships (PPPs) can be looked into as they offer the potential for addressing the capital and expertise constraints that public service faces. The predominance of small and medium-sized recovery and recycling enterprises may discourage large-scale investments in waste recovery technologies.

Infrastructure will need to be constructed to meet the government target of an increase to 50 per cent of waste recycled by 2025. It is estimated that there will be a need for additional annual treatment capacity of 200,000 tons for materials recycling facilities, 5,000 tons for dismantling and treatment of e-wastes, and 175,000 tons for organic treatment (composting and anaerobic digestion) (GOM, 2013b).

3.7.3 Economic modelling of a green economy transition in waste

In this modelling exercise, following stakeholder consultation, a target of 50% of total waste recycled was chosen, an increase from 12% in 2013. Such a target can be considered achievable, particularly as 80 per cent of the waste generated has recycling potential (GoM, 2013b).

The following scenarios were simulated and analysed for the waste sector:

- **A business-as-usual (BAU)** case that assumes the continuation of historical and present trends in municipal and hazardous waste generation and landfilling.
- **A green economy (GE)** scenario that simulates additional interventions to encourage waste recycling in the residential, commercial and industrial sectors to achieve the target set by the new Government Programme (GoM, 2015b), namely a waste recycling share of 50 per cent by 2025.

Various parameters and assumptions from available studies are used for the simulation of the baseline and alternative scenarios. All the assumptions used for the purpose of this study are listed in the following table.

Main results

(i) Waste recycling and electricity generation from waste

The simulation assumes that the annual share of recycled waste would increase from 12 per cent to 50 per cent of total waste generation by 2025 under the green economy scenario, while it would remain stable at 12 per cent in the BAU scenario. Consequently, the total amount of waste recycled in 2025 would be about three times higher under a green economy, as compared to BAU.

The stock of landfilled waste would be 8.4 per cent and 16.3 per cent lower than BAU in 2025 and 2035, respectively (Figure 20). The stock of compost waste is projected to increase by 74.5 per

Table 7: Main assumptions used for model development and scenario simulation for waste

Metric	Assumption	Source
Initial share of recycled waste	12 per cent of total waste generated	GoM (2011)
Capacity expansion needs	200,000 tons for material recycling facilities; 5,000 tons for dismantling and treatment of e-waste; 75,000 tons for organic treatment (composting and anaerobic digestion)	GoM (2011)
LFG produced per ton of waste	0.432 cubic feet	International Energy Agency (IEA), assumptions of the World Energy Outlook, and UNEP (2011)
Electricity produced from LFG	0.002 kWh per cubic foot of LFG	International Energy Agency (IEA), assumptions of the World Energy Outlook, and UNEP (2011)
Waste collection and disposal employment factor	0.00723 person per ton	GoM (2011)
Waste employment income	Rs120,000 per person per year	Expert judgment, based on national salaries as reported by the ILO and national statistics
Waste collection and disposal cost	Rs3,135 per ton	GoM (2011)
Treatment cost of recycling	Rs3,035 per ton	UNEP. (2011b)
Treatment and disposal cost per ton of compost	Progressively increasing from Rs6.5 per ton in 1990 to Rs32.5 per ton in 2010	UNEP. (2011b)
Emissions from waste	4.04 CO_2e per short ton of land filled waste	IPCC methodology, emissions multipliers

cent in 2025, and by more than three times in 2035, with respect to the baseline scenario (Figure 21).

(ii) Investment

In order to create the conditions for increasing the annual share of recycled waste, new investment would be required for the expansion of waste treatment facilities. The model assumes that capacity expansion costs about Rs3,035 per tonne of treated waste. Based on this assumption, the additional investment in waste recycling under a green economy would amount to a total of about Rs1.9 billion between 2014 and 2025. In addition, composting facilities will have to be upgraded in order to ensure the processing of a larger amount of compost waste, particularly through the introduction of composting facilities treating separated biodegradable waste. It is estimated that Rs534 million would be needed between 2014 and 2025 to fulfil composting capacity needs. This would be in order to both upgrade the current composting facility to treat separate bio-degradable waste, and potentially to fund anaerobic digestion of waste for biogas production.

Based on the above estimations, the total cumulative investment required for the waste sector would be Rs2.43 billion by 2025, or Rs202.8 million per year between 2014 and 2025. This investment should be compared with avoided costs of waste disposal, as discussed in the following section.

(iii) Avoided costs and added benefits

Projections show that the cumulative costs of waste collection and disposal between 2014 and 2025 would decrease by Rs3.9 billion, as compared

Figure 21: Stock of waste landfilled, under GE and BAU scenarios (in tons)

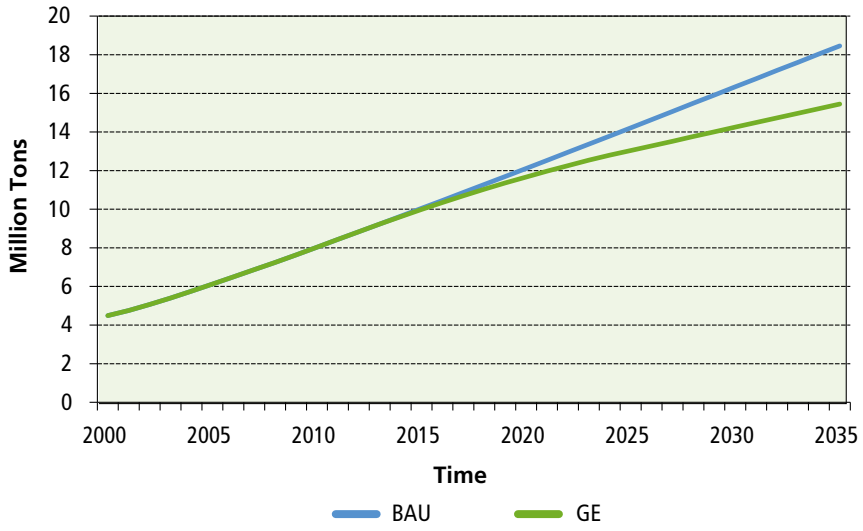
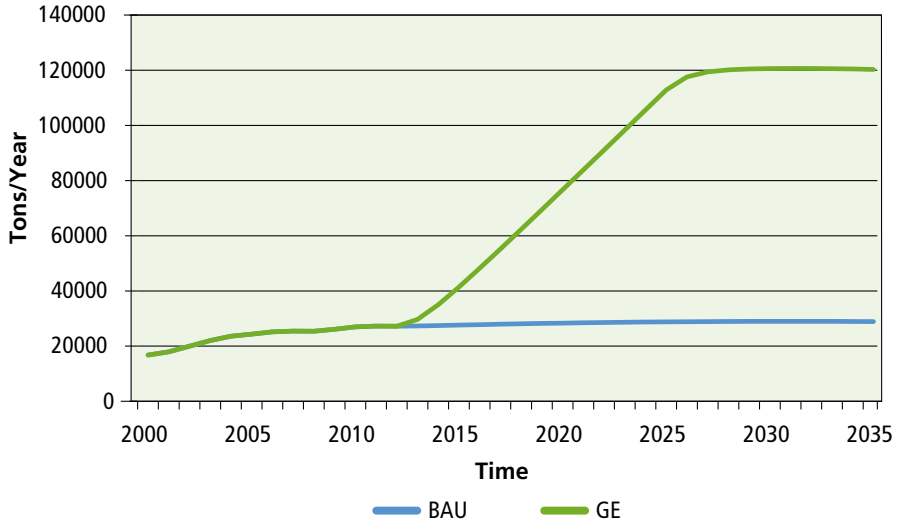


Figure 22: Stock of compost waste, under GE and BAU scenarios (in tons)



to BAU. It can be concluded that avoided waste management costs would be higher than investments in the expansion of recycling and composting capacity, thereby proving the economic feasibility of this intervention.

Overall, total waste employment under the green economy scenario would be 5.4 per cent higher in 2025, as compared to the baseline scenario, with job losses in the waste disposal offset by larger increases in the recycling sector.

Green economy interventions aimed at reducing the amount of waste landfilled would lead to a reduction of GHG emissions from waste disposal. Assuming that 4.04 tons of CO_2 equivalent are produced per short tons of waste landfilled, it is estimated that 2.25 million tons of CO2 emissions will be avoided every year between 2014 and 2025.

3.7.4 Suggested actions for a green economy transition in waste

The main objective will be to increase the recycling rate from 12 per cent in 2012 to 50 per cent by 2025. This could be achieved through five key actions:

Ensure an ambitious National Integrated Solid Waste Management (ISWM) strategy. The strategy should review policies and legislation to reduce waste landfilling and promote Extended Producer Responsibility (EPR) schemes. Banning the disposal of certain waste at landfills (such as food waste and construction debris) and the introduction of a disposal fee for selected wastes are to be considered. So will the promotion of composting and anaerobic digestion plants. All scenarios and technological options will be considered using multi-criteria and strategic environmental assessments. The strategy should include capacity-building for local authorities in ISWM.

Investment in waste infrastructure. Infrastructure to be considered includes organic waste treatment facilities, waste-to-energy MSW treatment facilities, landfill extensions, Material Recovery Facilities (MRF) for construction and demolition debris, e-waste and hazardous waste separation, collection and treatment facilities; plus the redesigning of transfer stations into MRF.

Sorting of wastes at household level and recycling. The success of any recycling programme is dependent on the quality of the segregated wastes and the recovery of recyclables from households and businesses. Necessary measures will be taken to decrease the quantity of biodegradable solid waste going to landfills through composting or anaerobic digestion plants. Separate collection may include the distribution of plastic bags or bins to households in pilot regions. This will require a public information and support campaign.

Development of a SME park to provide long-term land at affordable costs for the development of the recycling industry in Mauritius. Lots would be leased for recycling waste, cooking oil, waste metals, waste wood, waste electrical and electronic equipment, waste plastics, waste batteries, waste construction materials, waste glass, waste tires, food waste, etc.

Home composting scheme and provision of Ecopoints. To encourage composting of yard waste at the household level, a target of 25,000 households practicing composting is to be achieved in the medium-term. Ecopoints, places where residents can go to deposit recyclable goods, should also be installed at strategic points around the island over the next five years with a sustained awareness campaign.

Introduction of a hazardous waste disposal fee. There is currently no direct disposal fee for such wastes being landfilled. The introduction of a disposal fee for items such as sludge, poultry and abattoir waste as well as condemned goods could act as an incentive to finding ways of minimizing waste.

4.0 DISCUSSION OF POLICY ENABLING CONDITIONS

The right mix of enabling conditions can make green sectors attractive opportunities for investors and businesses. If the appropriate fiscal measures, laws, norms, know-how and infrastructure are in place, then the green economy should emerge. In addition to these policies, creating the right conditions in the investment environment requires a combination of capacity, information and awareness.

4.1 INSTITUTIONAL ARRANGEMENTS

To implement green economy, Mauritius needs an institutional arrangement that will facilitate the mainstreaming of the green economy in the medium-term development plan. This must incorporate national sector strategies and policies as well as budgeting and planning procedures with regard to political leadership and institutional arrangements that facilitate government engagement and linkages with the MOFED and the budgetary process.

A Technical GE Steering Committee should be established to lead the implementation of the actions described throughout this report. This will be a collaborative mechanism aimed at bringing responsible authorities and stakeholder groups together on a regular basis to discuss, develop and validate policy and strategies. This committee will report back to Ministers for approval on key decisions. It would comprise Permanent Secretaries and Department heads as well as representatives from civil society, academia, development partners and the private sector.

The Technical Steering Committee will identify entry-points and reinforce mainstreaming mechanisms to allow for the greatest impact of green economy activities. Some of the mainstreaming mechanisms include integrated planning, decision-making, resource management (EIA IWRM, ICZM) and Public Environmental Expenditure Review (PEER) that examines government resource allocations within and among sectors and assesses the efficiency and effectiveness of those allocations in the context of environmental priorities. The Technical GE Steering Committee can also oversee the Technical Committee for the Fund on Climate and Environment.

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4.2 ECONOMIC AND FISCAL POLICIES

Economic and fiscal policy instruments, including taxation, pollution charges, public expenditure on infrastructure, public procurement and market mechanisms can encourage the transition to a green economy. In the context of Mauritius, there are two broad recommendations:

1. **Environmental Fiscal Reform (EFR)**. To facilitate EFR, Mauritius should review the existing environmental tax landscape and identify areas where taxes or charges can be introduced or raised to create the fiscal space to support environmental protection and conservation. Environmentally-related taxes and charges currently provide revenue of about 2.6 per cent of the GDP, while environmentally relevant subsidies are 0.6 per cent of GDP. From a macroeconomic perspective, shifting taxes from labour to the use of natural resources can be expected to promote more job creation while encouraging investment in resource efficiency. Taxation may be particularly useful, as compared to regulations, price signals are effective at encouraging innovation across a range of activities

In Mauritius's context, some of the suggested enabling conditions for environmental fiscal reform include:

i. **The "polluter/user pays" principle**. Adherence to that principle can come in a number of ways, such as the Environment Protection Fee which includes taxes on mobile phones, batteries and tyres, as well as further environmental taxes on hotels. This fee can be increased and also target other products with negative environmental impacts, particularly hazardous ones such as lubricating oils and pesticides. Placing such a price on pollution creates opportunities for innovation as firms seek out cleaner alternatives.

ii. **Creation of a system of targeted subsidies.** The FiT policy needs to be reviewed regularly to enhance uptake of green energy such as from biomass. Concessionary electricity tariffs to industry must be linked to energy efficiency. There is an existing graduated refund scheme to encourage recycling of used PET bottles for export.

iii. **A strategy to phase out negative subsidies.** Subsidies (e.g. LPG subsidies) should be embedded in the policy framework. Aware of the multiple benefits from the removal of fossil fuel subsidies, the Government is reviewing the subsidies on LPG and seeking to replace it with incentives and support for low-income households.

iv. **Taxes are already applied on fossil fuels and can be placed on other pollutants (such as on coal ash or on effluent discharge from industry)**. The CO_2 levy/rebate scheme for vehicles provides an incentive to purchase low-emission cars. The levy provides funds to finance sustainable development projects. The excise duty on energy-inefficient household appliances, plastic products and metal cans discourages their use. Energy sector emissions are presently not directly taxed and are addressed indirectly through the levy. To incentivize the transition to renewable energy, some form of carbon taxation on power generation should be considered.

v. **Lower taxes on green energy programmes and products.** There is presently no VAT on photovoltaic cells and panels and no customs duty on solar water heaters and low energy lamps. Incentives could be developed to encourage the greater uptake of certification schemes, such as the ISO 14000 environmental management series. Use of lower discount rates when evaluating projects with an environmental dimension can help provide greater emphasis on the long-term sustainability of projects. There is already an accelerated annual allowance for depreciation granted in respect of capital expenditure on renewable energy, pollution control equipment and composting plants.

2. **Greening Public Expenditure through Sustainable Public Procurement**. Public investments typically focus on the provision of public goods such as energy and transport infrastructure that benefit society and would not be provided to their full extent by the free market. To enhance a green economy transition, these public investments should aim at ensuring more efficient use of the environment and natural resources. Investments that fall under this category are, for example, investments in infrastructure needed to support a green economy transition such as public transport systems, renewable energy or smart grids. Government procurement can set important market signals and provide incentives for the production and provision of environmental goods and services by its high volume of demand. The National Action Plan on Sustainable Public Procurement needs to be implemented.

4.3 FINANCING

A growing body of evidence has underlined the scale of the challenge in mobilising capital flows for the transition towards a green economy. As shown in the modelling analysis, significant investment will be required to finance a transition to a green economy. But this can be mobilised by smart public policy and innovative financing mechanisms. The potential key sources of funding include:

- Government expenditure;
- Earmarked funds from private sources;
- Funds generated by the economy; and
- Donor programmes of assistance and loans from international financial institutions.

1. **The Government can shift existing resources into green public investments and leverage new tax income for the provision of green public goods**. They can also use innovative fixed-income investment products, such as green bonds. Many of the economic and fiscal policy instruments mentioned earlier could serve as a key source of domestic financing for the green economic transition.
2. **Encourage greater participation of finance institutions, banks and investors in green investment initiatives, especially in infrastructure projects**. Long-term public and private institutional investors, banks and insurance companies are increasingly interested in acquiring portfolios that reduce environmental, social and governance risks, while investing in emerging green technologies.
3. **Promote the adoption of mandatory integrated frameworks to enable informed investment decision-making based on overall performance of companies, including environmental and social governance performance**. Governments should involve the private sector in establishing clear, stable and coherent policy and regulatory frameworks to facilitate the integration of environmental, social and corporate governance (ESG) issues into financial and investment decisions. Disclosure and sustainability reporting by the private sector should be encouraged. A sustainability index is being developed to reflect the performance of the most sustainable companies trading on the Stock Exchange of Mauritius.
4. **The Corporate Social Responsibility levy of 2 per cent on corporate profits currently funds projects that targets primarily social rather than environmental outcomes.** Companies could be encouraged to spend funds generated from the Corporate Social Responsibility (CSR) levy on projects that have significant social and environmental benefits.
5. **There are significant opportunities to access international funding sources for Mauritius's transition to a green economy.** The National Climate

Change Action Plan (NCCAP) has identified priority adaptation and mitigation actions that require international support, most of which can contribute to the transition to a green economy. Potential sources of international financing, technology transfer and capacity- building include bilateral and multilateral donors, the Green Climate Fund, Adaptation Fund, carbon markets, and the emerging NAMAs and REDD mechanisms. Bundling projects with other SIDS can overcome the barrier that the country's projects are too small to attract REDD and NAMA financing.

4.4 REGULATIONS, STANDARDS AND TARGETS

As the UNEP Green Economy Report outlines (UNEP, 2011b), robust regulatory frameworks coupled with effective enforcement reduce regulatory and business risks as well as increase the confidence of investors and markets. In the context of Mauritius, there are three broad recommendations:

1. **Improve regulatory compliance.** Mauritius has several laws and regulations that can assist in its transition to a green economy. These include the Environment Impact Assessment process, waste audit requirements, and regulations related to biodiversity, noise, water quality, waste management and physical planning. However, compliance with regulations and standards is often inadequate. Weak enforcement reduces long-term investor and market confidence. It also lends little incentive for most businesses to improve. More effective management and funding of enforcement functions are needed.
2. **Develop a robust system of environmental standards.** Authorities with mandates for setting standards, such as the Mauritius Standards Bureau, should facilitate the development of a robust and harmonized system of environmental standards benchmarked against various international standards. Support to help producers meet these standards will also be required.
3. **Negotiated and voluntary agreements and industry self-regulation**. These measures are established by the Government for negotiating with firms, or by one or more firms taking voluntary action themselves. These usually consist of non-binding commitments to certain standards or principles. Examples include Environmental Management Systems, Green Globe Certification and Sustainability Reporting.

4.5 INSTITUTIONAL AND POLICY PROCESSES TO SUPPORT REFORM

An array of government processes and policies will be required to facilitate the success of the initiatives outlined in the seven sectors. The following are some of the important overarching policy processes that the Government should engage in:

1. **Stakeholder Engagement.** A Council for Sustainable Development could provide a valuable mechanism for a coordinated and principled working relationship among government, business and civil society. It can facilitate the integration of the multiple dimensions of sustainable development into planning and strategy formulation, policy making, programme implementation, and monitoring and evaluation.
2. **Green Accounting.** Growth in GDP can be misleading if the capital base on which GDP growth depends is being undermined. Green accounting, such as natural accounting, refers to the integration of environmental and social information into systems of national economic accounts with the aim of giving a more accurate picture of the state and progress of the economy.
3. **Measuring progress towards a green economy.** An evidence-based approach to policy development and evaluation will require effective green economic, or sustainable development indicators built on reliable data, statistic and information systems. Implementation of policies should incorporate regular monitoring and review the effects of policy to assess progress towards the objectives over time. Policy should be robust but flexible to allow for any adjustments as new information becomes available.
4. **Research and Innovation.** Institutions need to adopt a consistent science-based approach to sustainable development. Research priorities need to be shifted to support the transition to a green economy. There is a need to focus the national public R&D efforts more on fostering green innovation, notably on local needs such as water scarcity, green agriculture, renewable energy, waste recycling, soil loss, etc., all of which are important for sustaining future economic growth as well as strengthening local capabilities to absorb technology from abroad and adapting it to local needs.

4.6 EDUCATION, TRAINING AND CAPACITY ENHANCEMENT

Strengthening the green economy requires the development of green skills within the employment market, as well as awareness-raising amongst those in primary, secondary and tertiary education. Proposed interventions are outlined below

1. **Vocational skills development.** Enhancement of the vocational and technical training capacities is necessary to provide the workforce with the capacity and skill to deliver the commodity or service. Studies have shown that a lack of the skills needed

to meet the requirements of changing and newly emerging occupations impedes green investment and hinders green economic development (ILO, 2011). The ILO Green Jobs study for Mauritius (ILO, 2013) has drawn two key conclusions. Firstly, green jobs already exist in a number of sectors of the Mauritian economy and are estimated at 6.3 per cent of the total number. Secondly, a green jobs investment strategy would have a higher multiplier effect in terms of output and employment throughout the economy in comparison to a BAU strategy.

2. **Education and awareness raising.** Through awareness campaigns, create the enabling conditions for behaviour change by framing the green economy as a social goal. The challenge for education is to empower people of all ages to be responsible for creating a sustainable future. A significant opportunity to boost the green economy agenda lies within the higher education system. Through the development of higher education courses which provide the necessary green skills, it is possible to supply emerging green markets with a highly-trained green workforce.

CONCLUSIONS AND KEY RECOMMENDATIONS

5.1 KEY FINDINGS

Green Economy investments stimulate GDP growth with total GDP 6 per cent higher in 2035 in the green economy scenario compared to BAU. The additional investments support economic growth by creating employment (e.g. in the waste and energy sector). The GE interventions are implemented to create a better balance between society, economy and environment, and will thus not only have positive impacts on GDP, but also on the environment and societal well-being. Furthermore, future costs are avoided (e.g. for the landfilling of waste and for fossil fuel imports).

The implementation of green economy interventions requires increased investment of 0.76 per cent of GDP, but results in annual savings of 2.6 per cent GDP. These are the average annual figures between 2014 and 2035, and demonstrate that green economy investments should lead to better economic outcomes than a BAU investment allocation.

5.2 POLICY ROADMAP

In order to realize the above potential, an enabling policy framework will be required with a mix of policy instruments, some of the key areas to be considered include regulations and standards, fiscal policies, financing as well as coherent and effective policy coordination.

Fiscal policies are perhaps the most powerful instruments that can be used to promote green economic activity. Environmental Fiscal Reform (EFR) will create the fiscal space that allows the Government to finance the green economy without an increase in the budget deficit. EFR can also drive private investment and consumer behaviour by affecting prices. Economic instruments are to be used to incentivize green investment, including low-interest loans, microfinance, and tax or tariff exemptions. Institutional capacity needs to be strengthened to implement more complex fiscal reforms and market-based instruments. A financial framework needs to be implemented as soon as

possible to allow climate finance to flow into the country. A National Fund could be established at MOFED which will seek to employ a wide range of public financing mechanisms, such as performance-based grants, loan guarantees, lines of credit and public venture capital to create an attractive investment environment for low-carbon activities.

There will be a need for policy coordination through various government agencies and levels. Coordination will allow green economy to be promoted and mainstreamed within national development plans and strategies with the active participation of all government agencies and levels. The National Action Plan on Sustainable Public Procurement should be considered an integral part of any Green Economy Action Plan. In addition, a new coordination mechanism may be necessary.

Capacity-building and skills to effectively implement policies. Institutional and technical capacity and knowledge needs to be improved, particularly in the areas of policy analysis, implementation, monitoring and financial management. Strategies are required to articulate clear quantitative targets and develop sets of indicators to measure progress and assess synergies and policy trade-offs. Investment in innovation (including R&D) needs to be increased. There is also a need to deepen the understanding of employment, competitiveness and equity dimensions of greening the economy. Detailed sector studies should be carried out to identify sector specific risks, challenges and opportunities.

Green economy strategies promise new tools and a fresh approach for overcoming the gaps and challenges experienced over the past decades in the implementation of sustainable development. By focusing on economic outcomes, a green economy approach will assist with integrating with national expenditure and fiscal priority setting, and the utilisation of economic instruments and fiscal reform to implement sustainable development. The preparation of Vision 2030 (GoM, 2015b) provides also a unique opportunity to mainstream green economy initiatives in development planning and to feed into the process to make Mauritius a high-income nation with a green economy.

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ANNEX 1: FURTHER DATA

Macroeconomic data

Table A.1 Trends in selected macroeconomic aggregates for Mauritius, 1980–2012

Item	1980	1985	1990	1995	2000	2005	2012
Population (million)	0.97	1.02	1.06	1.13	1.19	1.24	1.29
Population growth rate[2]	17.0	n/a	5.7	n/a	11.8	n/a	4.3
Urban population (%)	42.3	42.3	43.9	43.3	42.7	42.3	42.8
Economically active population (%)	35.5	38.1	40.9	42.2	43.7	44.4	46.4
Income per capita ($)	1,010	1,050	2,300	3,360	3,740	5,250	8,350
Real GDP growth (%)	4.5	6.9	7.2	4.3	9.0	1.2	2.7
Tax revenue as a % of GDP	21.1	22.9	23.2	18.9	20.7	19.9	20.1
Public expenditure as a % of GDP	31.6	28.2	25.3	22.4	24.0	24.9	23.8
Inflation rate	24.5	8.3	7.0	6.0	4.2	4.9	3.9
Unemployment rate	22.1	19.7	15.3	2.8	5.7	8.8	8.1

Source: ADB (2009); BOM (2012) & SM (2013e).

Table A.2 Sectoral contribution to Gross Domestic Product (%) 1976–2012

Sector of economic activity	1976	1980	1985	1990	1995	2000	2005	2010	2012
Agriculture, forestry and fishing	22.5	12.4	15.3	12.9	10.4	6.5	5.7	3.7	3.4
Sugar cane	17.8	8.1	11.1	8	5.7	3.3	3	1.2	1.2
Manufacturing	15.2	15.2	20.6	24.4	23	22.5	19.2	18	16.7
Sugar	5.5	2.4	3.2	3.4	1.6	0.8	0.8	0.3	0.3
Food		-	-	-	-	3.9	4.9	6.3	6.6
Textiles and Clothing	2.6	4.3	9.5	12	11.5	11.5	6.8	5.1	4.9
Construction	8	7.6	5.6	6.7	6.4	5.3	5.4	6.9	6.3
Wholesale and Retail	11.3	14.2	13.2	13	12.8	11.5	11.9	11.8	11.2
Hotels and restaurants	1.8	2.3	2.4	3.9	5.1	6	7.1	7	7
Transport, storage		11.3	10.9	10.4	11.4	12.7	11.9	9.5	5.9
Communications									
Financial intermediation	5.7	5	4.7	4.9	6.5	8.8	9.2	10	10.3
Insurance	4.2	3.3	2.9	1.5	2.1	2.3	2.8	2.9	3
Banks	1.5	1.7	1.8	3.5	4.4	5.7	5.1	5.7	6.1
Real estate, renting and business activities	10.2	12.7	11.1	8.9	8.5	8.4	9.8	12.3	13.4
Other activities	18.6	21.6	18.6	18.8	21	24.3	26.9	20.8	21.2

[2] The data on population growth relate to decade-wise census and relate to years 1983, 1990, 2000 and 2011.

Table A.3 Public sector expenditure on the environment

Sub-sector	Amount in MUR (million)	As a percentage of overall public expenditure
Agriculture, forestry, fishing & hunting	2440.9	2.9%
Fuel & energy	96.3	0.1%
Transport	6332.4	7.5%
Environmental protection	3146.2	3.7%
Water resource management	1974	2.3%
Real Estate	2333	2.8%

Source: Extracted from Public Finance Statistics, SM (2012)

Table A.4 Private investment on the environment

Sub-sector	Amount in MUR (million)	As a percentage of overall gross domestic fixed private capital formation
Agriculture, forestry, fishing & hunting	2012	3.3%
Mining & quarrying	375	0.1%
Fuel & energy	2020	3.4%
Water resources	254	0.4%
Construction	2403	4.0%
Transport	2333	3.9%
Accommodation & food service	7711	12.8%
Real estate	21843	36.3%

Source: Extracted from National Accounts, SM (2013e)

Table A.5 Employment level in the environment sector in 2012

Sub-sector	Male employ-ment	Female employ-ment	Total	As a percentage of overall employ-ment
Agriculture, forestry & fishing	29,200	18,200	47,400	8.3%
Mining & quarrying	2,100	200	2,300	0.4%
Energy	2,200	100	2,300	0.4%
Water & waste	3,400	200	3,600	0.6%
Construction	51,800	1,300	53,100	9.3%
Transport	28,000	5,500	33,500	5.95%
Accommodation & food services	25,900	14,400	40,300	7.1%
Real estate	700	200	900	0.15%

Source: Extracted and Computed from SM (2013b)

ANNEX 2: MODEL SPECIFICATIONS

The GEM model includes the following groups of sectors to ensure that green economy opportunities are effectively analysed:

- ***Industrial sectors:*** embedded in the conventional (carbon-intensive) structure that has contributed to modern life styles which is now being challenged by negative externalities. For a green economy transition, such sectors have to aim for a transition to energy efficient technologies, increased resource efficiency and lower environmental impact. Major steps are necessary to retrofit and replace old "brown" economic structures, to develop innovative regulations, and to introduce new green economic structures.

- ***Natural capital-based sectors:*** heavily relying on the availability of natural resources (stocks and flows), these sectors can thrive and be sustainable only if resource extraction is managed so as to maintain the ecosystem balance. Overexploitation of natural resources should be avoided to curb impacts on ecosystem services, which would ultimately undermine productivity and competitiveness.

The horizontal integration of several sectors having the potential to re-shape consumption and production, the GEM models are able to inform policy formulation and evaluation for *emerging economies* (those that find themselves increasingly locked into conventional energy and carbon intensive economic structures, but can more easily turn to greener paths than developed countries, as their economies are more flexible and adaptable) as well as *developing economies* (being less locked into carbon-intensive capital and thus having the unique opportunity to steer their development path towards the new greener economic development paradigm). In both contexts a green economy strategy is expected to be able to reduce poverty and generally improve living standards. The GEM models aim at quantifying and evaluating these impacts, assessing whether selected policies can deliver on the multiple goals of the green economy.

Finding that most currently available national planning models are either too detailed or narrowly focused (see UNEP, 2014), this study uses an approach that: a) extends and advances the policy analysis carried out with other tools by accounting for the dynamic complexity embedded in the systems studied; and b) facilitates the investigation and understanding of the relations existing between natural capital, society and the economy. The inclusion of cross-sectoral relations supports a wider analysis of the implication of alternative green economy policies, and the long-term perspective proposed allows for the identification of potential side-effects and sustainability of different strategies.

The approach proposed uses the System Dynamics methodology as its foundation, serving primarily as a knowledge integrator. System Dynamics allows explicit representation of stocks and flows of human, built and natural capital, and to create linkages among them through the use of feedbacks, delays and non-linearity. System Dynamics also allows simultaneous use of other modelling techniques, such as optimization and econometrics. In fact, Systems Dynamics has been successfully coupled, in the context of green economy work, with a CGE model in Mexico (Bassi et al., 2014), with InVEST for Borneo (Van Paddenburg et al., 2012) and in Thailand (Bassi et al; 2014), with energy sector optimization models for several countries, and in the global green economy modelling work of UNEP (Bassi et al., 2011).

GEM was designed explicitly to analyse green economy scenarios.[3] As a result, it includes several sectors across social, economic and environmental dimensions. Figure 1 (refer to chapter 1) presents the generalized underlying structure of GEM. This diagram shows how the key capitals are interconnected and contribute to shaping future trends across social, economic, and environmental indicators. Specifically, feedback loops can be identified that are reinforcing (R) in all areas pertaining economic growth and social development. These are enabled by the availability of natural capital, which, if not properly managed, can constrain economic growth (hence the balancing loops -(B)- identified in the diagram). Policies can be implemented to promote sustainable consumption and production, decoupling economic growth from resource use (also through education and behavioural change), to mitigate the exploitation of natural capital and generate stronger and more resilient green growth.

As a result, GEM applications can be used to:

(1) Test the effectiveness of individual policies and investments (by assessing their impact within and across sectors, and for social, economic, and environmental indicators);

[3] For more information see: www.ke-srl.com

(2) Inform budgetary planning, by assessing the effectiveness of annual plans in delivering green and inclusive growth;

(3) Support the formulation and analysis of development plans that span across sectors and target medium to longer term goals.

GEM complements existing tools (e.g. it does not substitute economic analysis performed with SAM and/or CGE models, or energy analysis carried out with MARKAL or LEAP), and can be used to inform both policy formulation and evaluation at the national, provincial and sectoral level.

The GEM Modelling Framework

The GEM is well suited to:

(i) Generate projections of future developments (though acknowledging that long-term accurate projection cannot easily be produced, even when simulating a large number of endogenous key variables (Sarewitz, 2000);

(ii) provide an integrated analysis and evaluation of policy choices; and

(iii) increase the understanding of the relations underlying the system analysed. The following paragraphs briefly describe the principal aspects of the GEM application customized to Mauritius.

Boundaries*:* Variables that are considered an essential part of relevant development mechanisms are endogenously calculated. For example, GDP and its main determinants, population and its main determinants, and the demand and supply of natural resources are endogenously determined. Variables that have an important influence on the issues analysed, but which are only weakly influenced by the issues analysed, are exogenously represented.

Time horizon*:* GEM applications are built to analyse medium- to long-term green economy scenarios. Also, simulations start in the past in order to allow validation against historical data. In M-GEM, the time horizon for simulation starts back in 1980 and extends up to 2030.

Structure*:* Despite the variety of green economy opportunities considered, GEM is a relatively small model. Its complexity lies in the high number of cross-sectoral linkages (dynamic complexity), but its vertical detail (within a sector, or detailed complexity) is far from overwhelming. This ensures that the model is fully-tailored to a green economy analysis based on stakeholder inputs, but does not compete with the models already being used by the Government and its partners. In fact, GEM is developed to fill a gap in the current modelling work in relation to the green economy and to identify research needs to be addressed with more detailed sectoral models.

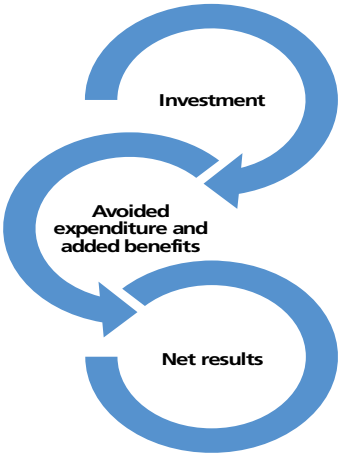
The main outputs of GEM and of the green economy analysis carried out with it include the investment required to implement the intervention desired, added benefits and avoided costs (Figure A-2). Among the benefits, indicators include sectoral value added (as driven by natural resources stocks and flows, e.g. sustainable agriculture yield and production), direct employment creation and relative income generated, (e.g. additional employment in public transport or energy efficiency sectors). Avoided costs include savings from lower consumption (e.g. water, through resource efficiency interventions), and potential avoided ecosystem restoration costs. These are compared with costs and potential damages created by the business-as-usual case and by the policies implemented. These are used to estimate the economy-wide annual cash flow, the break-even point and the return on investment (and, for instance, the return on employment, and emissions).

Figure A-1: Graphical overview of the GEM framework employed for this study. This analysis, spanning across social, economic and environmental dimensions and accounting for short, medium and longer-term impacts, is integrated and systemic

Social, economic and environmental modules are developed with the support of sectoral experts, testing the coherence of data and assumptions.

Social, economic and environmental impacts of green economy interventions are analyzed systemically

Figure A-2: Graphical representation of the main elements of the analysis carried out to evaluate the advantages and disadvantages of green economy interventions



By generating systemic, broad and cross-sectoral scenarios over time that address environmental, economic and social issues in a single coherent framework, the GEM simulates the main short, medium, and longer-term impacts of investing in a green economy. The most important contribution of this model is its systemic structure that includes endogenous links within and across the economic, social and environmental sectors through a variety of feedback loops[4]. Most existing models focus on one or two sectors and make exogenous assumptions about other sectors that affect, and are affected, by the sector under consideration. Using endogenous formulations instead improves consistency over time and across sectors, because changes in the main drivers of the system analysed are reflected throughout the model and analysis through feedback loops. While detailed sectoral analysis is very important, it is not adequate to demonstrate the whole set of relations and feedback loops that properly represent the functioning of the real world and that have to be taken into account in making the necessary transitions to greener economic and social structures.

Natural capital inclusion in GEM

The key drivers of a greener economy, as represented in the models customized for the analysis carried out in the green economy assessment, are stocks and flows. Stocks are accumulations of inflows and outflows (such as forests are the accumulation of reforestation and deforestation). In the economic sectors of the GEM, GDP is primarily influenced by stocks, such as capital and labour. Going beyond this simplistic view, we consider in the GEM that capital and labour are needed to develop and process natural resource stocks. As a consequence, three key factors often define the transformation of natural resources into economic value added: the availability of capital (which accumulates through investments and declines with depreciation), labour (which follows the demographic development of the planet, being driven by the population of labour age), and stocks of natural resources (which accumulate with natural growth, when renewable, and decline with harvest or extraction). Examples of the direct impact of natural resources on GDP are the availability of water and fertile land for agricultural production, as well as the availability of fossil fuels to power the capital needed to irrigate and harvest crops, among others. In this respect, the GEM accounts for both monetary and physical variables representing each sector in a coherent and consistent manner.

An overview of the sectoral and overall impacts of green economy investments is provided in Table A-6.

Box 3: Selected equations representing stocks

Economy (investment and depreciation):
Built capital = ∫real gross capital formation-depreciation dt + [initial capital]

Energy (construction and discard):
Thermal power generation capacity = ∫thermal capacity construction-thermal capacity discard dt + [initial thermal power generation capacity]

Land - agriculture (conversion from forest and losses due to degradation and settlement expansion):
Agriculture land = ∫deforestation for agriculture-agriculture land degradation dt + [initial agriculture land]

Infrastructure –hotel rooms:
Hotel rooms available = ∫hotel rooms completion – hotel rooms discard dt + [initial hotel rooms available]

[4] Feedback is a process whereby an initial cause ripples through a chain of causation ultimately to re-affect itself (Roberts et al., 1983).

Table A.6 Summary of green economy economic result, total and by sector

Sector	Category	Unit	2017	2020	2025	2030
Agriculture	**Investment**	Rs million	6.37	6.82	7.43	1.49
	Annual average (2014-2030)		5.20			
	Additional value added		228	453	828	902
	Annual average (2014-2030)		558.24			
	Value added % difference	*GE-BAU % difference*	*5.52%*	*10.07%*	*16.49%*	*16.54%*
	Annual average (2014-2030)		*11.34%*			
	Investment	Rs million	130.65	215.75	359.87	368.66
	Annual average (2014-2030)		250.96			
	Savings		67.67	109.7	180.56	181.46
	Annual average (2014-2030)		126.02			
Waste	*Waste mgmt cost % difference*	*GE-BAU % difference*	*-16.65%*	*-26.64%*	*-43.25%*	*-43.25%*
	Annual average (2014-2030)		*-30.35%*	*4.7*	*4.9*	*6.5*
	Additional labor costs	Rs million	7.20	11.63	19.31	19.36
	Annual average (2014-2030)		13.43			
	Labor cost % difference	*GE-BAU % difference*	*2.06%*	*3.29%*	*5.39%*	*5.38%*
	Annual average (2014-2030)		*3.77%*			
	Investment	Rs million	254	248	423	7656
	Annual average (2014-2030)		1636			
	Savings		3132	3891	6233	7463
	Annual average (2014-2030)		4829			
Energy	*Energy bill % difference*	*GE-BAU % difference*	*-8.03%*	*-9.25%*	*-13.21%*	*-14.41%*
	Annual average (2014-2030)		*-20.12%*			
	Investment in water efficiency	Rs million	9.82	15.18	24.61	34.65
	Annual average (2014-2030)		19.16			
	Savings from water efficiency		145	225	365	518
	Annual average (2014-2030)		285			
	Water bill % difference	*GE-BAU % difference*	*-5.5%*	*-8.3%*	*-12.5%*	*-17.4%*
Water	*Annual average (2014-2030)*		*-10.06%*			
	Investment in pipes replacement	Rs million	428	428	428	428
	Annual average (2014-2030)		428			
	Savings from pipes replacement*		332	565	1098	1930
	Annual average (2014-2030)		858.8			
	Investment	Rs million	829	914	1243	8489
	Annual average (2014-2030)		2339			
	Savings		3986	5373	8918	11208
	Annual average (2014-2030)		6805			
Total	*Costs (energy. Etc.) % difference*	*GE-BAU % difference*	*-8.57%*	*-10.74%*	*-15.95%*	*-18.38%*
	Annual average (2014-2030)		*-12.63%*			
	GDP differential	Rs million	8516	11463	18818	24778
	CO^2 emissions difference	GE-BAU % difference	-16.07%	-16.40%	-18.97%	-19.24%
	Annual average (2014-2030)		-16.17%			

PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

The Mauritius Green Economy Assessment, produced by the Partnership for Action on Green Economy (PAGE), studies the benefits of a green economy transition for Mauritius.

The study focuses on seven key sectors: Agriculture, Energy, Transport, Waste, Water, Tourism and Manufacturing. Firstly, the study provides an overview of the main policy framework related to each sector. Secondly, an economic modelling exercise analyses the quantitative implications of increased investment into these sectors. Finally, a series of recommended actions are made in each sector, as well as several cross-cutting recommendations.

The document underwent extensive consultation in Mauritius, and hopes to inform the government's long-term development planning process.

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Layout and Printing at United Nations, Geneva – 1524985 **(E)** – June 2016 – 50 – **UNEP/ETB/2015/25**