



Republic of Mauritius

Draft Long-Term Energy Strategy

2009 – 2025



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**Ministry of Renewable Energy
&
Public Utilities**

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1.0 Framework of the Long-Term Energy Strategy and Action Plan

1.1 Background

- 1.1.1 A series of economic reforms were introduced in 2005 with the aim of democratising the economy, empowering all categories of citizens and widening opportunities for citizens in order to promote a fairer and more equitable society.
- 1.1.2 On the environmental front, there has been a general recognition that man is impacting on the planet in an unprecedented manner. The main cause has been the indiscriminate use of fossil fuels, causing climatic change, global warming and rise in sea level. Furthermore, the high degree of volatility in oil markets has increased awareness amongst policymakers of the need to decrease dependence on fossil fuels by increasing use of sustainable energies. This calls for a general shift in the energy policies and strategies in both developed and developing countries.
- 1.1.3 Government's energy strategy is underpinned by the Energy Policy framework, adopted in December 2009. The framework is based on the emerging economic model, with the main pillars of the Mauritian economy being tourism, with a target of two million tourist arrivals by year 2015, information technology, seafood hub, manufacturing and a restructured cane industry.
- 1.1.4 It is imperative that the environmental dimension be integrated in the energy strategy of our country in view of its vulnerability as a Small Island Developing State. Energy accounts generally for about 80% of all greenhouse gas emissions, which are at the root of climate change and air pollution. Energy strategies in Mauritius, has until recently been demand driven without any incentive to reduce demand and can no longer be sustainable.
- 1.1.5 Environmental issues are at the forefront of any energy strategy. It is therefore the duty and responsibility of Government to work towards decreasing carbon dioxide emissions. Though a signatory of the Kyoto Protocol, Mauritius as a developing country has no obligation to reduce its greenhouse gas emission. However, it has taken the firm commitment to implement mitigation and adaption measures in view of its vulnerability as a Small Island Developing State.
- 1.1.6 In terms of energy supply, Mauritius is reliant on imported sources to more than 90%. From a broader perspective, the consumption of fossil fuels by the emerging giants China and India over the past few years have pushed energy prices to higher levels, while the geopolitical situation in the Gulf States have had significant impacts on the price of oil, causing significant

volatility. The price of oil reached a peak of USD 147 in July 2008 followed by a drastic fall to about USD 60. Coupled with the financial crisis in the USA and Europe, a global economic downturn is currently being experienced. Some experts predict that the price will soar again. The high reliance on fossil fuels, therefore, bears economic risks for Mauritius.

1.1.7 The viability of the sugar industry is posing daunting challenges with the phased reduction in the price of sugar, cumulating to 36% this year following the changes in the sugar regime in the European Union. It is, therefore, essential that the sugar industry adapts to the new context and it is aiming to do so with the assistance of Government and through accompanying measures in the context of the European Union support to ACP sugar producing countries. The accompanying measures are tied to certain pre-conditions, including amongst others, the submission of a long-term energy strategy and action plan.

1.2 “Maurice Ile Durable” Vision

1.2.1 Electricity generation is characterized by a number of historical players. The dominance of sugar cane in agriculture has had a positive impact on the use of bagasse for electricity generation, allowing the country to have a relatively good proportion of renewable energy in its energy mix. However, there are a number of challenges lying ahead in the design and implementation of key strategies to achieve the desired strategic aims and objectives of making Mauritius a sustainable island in line with the concept of “Maurice Ile Durable (MID)”. This will require, amongst others, the operationalisation of a utility regulatory body to increase further the contribution of renewable energy in the electricity sector, the introduction of biofuels in the transportation sector and the implementation of energy efficiency and conservation measures in all economic sectors, particularly where energy usage is intensive.

1.2.2 In this context, the Prime Minister enunciated his clear vision, which led to the creation of the Maurice Ile Durable (MID) Fund under the aegis of the Ministry of Renewable Energy and Public Utilities in July 2008 for supporting efforts to promote more efficient use of energy and increase the use of renewable energy. To kick start the Fund, Rs 1.3 billion was provided by Government for the financial year 2008-2009, derived from a levy on fossil fuel.

1.3 Objectives of Energy Strategy

1.3.1 In keeping with the Maurice Ile Durable vision, energy strategies have been designed to achieve the following key objectives in the long-term:

- reduce our vulnerability with regard to imported fossil fuels and their volatile prices;
- promote economic growth and job creation;
- democratize energy supply;
- secure affordable energy to consumers;
- ensure the financial sustainability of the electricity utility; and
- promote long-term sustainable development in line with the concept of “Maurice Ile Durable”.

1.3.2 These objectives are underpinned by targets in terms of improvement of efficiency in the use of energy and reduction in the use of fossil fuels and in the emission of green house gases arising from energy use. Given the uncertainty about the ready availability of oil beyond the next five decades or so, it is important to chart out an energy strategy for the long-term that would reduce as far as possible the reliance of the country on oil for electricity production and transportation. In this regard, the strategy is multi-pronged, in keeping with the constraints of the country in terms of its geographical location, availability of other less volatile and better distributed reserves of fossil fuel such as coal, energy resources available locally and the availability and competitiveness of technologies in the marketplace for their conversion into electricity and for use in transportation and industry.

1.3.3 In addition, in formulating the energy strategy, the following essential criteria have been taken into account:-

- (i) demand for energy;
- (ii) economic reforms;
- (iii) the need to attract foreign direct investment in the energy sector;
- (iv) environmental considerations;
- (v) sugar sector reforms and linkage to electricity generation; and
- (vi) transportation and industrial development policies links to energy use.

1.4 Share of Renewables in Electricity Mix

1.4.1 In line with the MID vision, the target is to achieve by 2025 about 35% self-sufficiency in terms of electricity supply through a progressive increase in the use of renewable energies, depending on breakthrough in technologies such as sea-wave energy, geothermal, OTEC and others. The above targets are ambitious and will pose a number of challenges to decision makers in their

future strategic choices.

1.5 Security of Energy Supply

- 1.5.1 As a small island state with no indigenous reserves of fossils fuels, and no electricity interconnection, the country is exposed to the risks of being without power and transport as a result of geopolitical, economic or natural crises. The strategy to ensure security of energy supply involves diversification of energy base and the creation of adequate stocks to the extent it is financially viable.

1.6 Security of Electricity Supply

- 1.6.1 In terms of electricity, the strategy is also to meet demand in a consistent manner, assuring security and reliability of supply at affordable prices. The key economic pillars, in particular the ICT and tourism sectors would require a constant and high quality supply of electricity.

1.7 The Energy Balance

- 1.7.1 The energy balance in the table as at the close of this chapter shows the supply and final uses of energy and the different types of fuel. Total primary energy requirement, also known as Total Primary Energy Supply, is obtained as the sum of indigenous production (fuelwood, hydro, wind and bagasse) and imports (fossil fuel) less re-exports and bunkering, after stock adjustments. Final energy consumption is the total amount of energy required by end users as a final product. End-users are mainly categorised into five sectors, namely manufacturing, transport, commercial and distributive trade, households and agriculture.

In order to compare the energy content of the different fuels, a common accounting unit, namely tonne of oil equivalent (toe) is used.

1.8 Total primary energy requirement

- 1.8.1 The total primary energy requirement of the country increased slightly by 1.6%, from 1,382 ktoe in 2007 to 1,404 ktoe in 2008. In 2008, imported fuels (petroleum products and coal) accounted for 81.2% (1,140 ktoe) while locally available renewable, supplied the remaining 18.8% (264 ktoe). In 2008, petroleum products which amounted to 736 ktoe comprised mainly fuel oil (28.9%), diesel (27.8%), aviation fuel (18.5%) and gasolene (14.8%).

- 1.8.2 In 2008, coal inputs reached 404 ktoe, which showed a 13.8% increase over 2007. This increase of coal in the primary energy requirement was partly due to the coming into full operation of the 'Compagnie Thermique de Savannah Limitee' (CTSav), an Independent Power Producer which has a coal and bagasse co-generation plant.
- 1.8.3 The local production (264 ktoe) comprised renewables including bagasse (93.2%), hydro electricity (3.5%), fuelwood (2.9%) and wind energy (0.4%)
- 1.8.4 The total primary energy requirement index, with 1990 as base year (1990 = 100), witnessed a change, moving from 184.1 in 2007 to 192.1 in 2008 while the per capita primary energy requirement increased by nearly 2.0%, up from 1.09 toe to 1.11 toe.
- 1.8.5 Energy intensity defined as total primary energy requirement (toe) per Rs 100,000 of GDP (in 1990 rupees) provides a measure of the efficiency with which energy is being used in production. Energy intensity, which stood at 1.58 in 2007, slightly went down to 1.54 in 2008. A lower ratio usually reflects a more efficient use of energy.

1.9 Local production

- 1.9.1 Total energy production from local renewable sources rose by 7.3% from 246 ktoe in 2007 to 264 ktoe in 2008. This was primarily due to a higher production of bagasse. Thus generation from bagasse increased from 230 ktoe to 246 ktoe. Moreover, production of hydroelectricity increased from 7.2 ktoe to 9.3 ktoe.

1.10 Imports of energy sources

- 1.10.1 Data on total imports of energy sources show that some 1,451 ktoe of petroleum products and coal were imported in 2008 compared with 1,482 ktoe in 2007, representing a decrease of 2.1%. Petroleum products went down from 1,080 ktoe to 1,075 ktoe (-0.5%) and coal decreased from 402 ktoe to 376 ktoe (-6.9%).
- 1.10.2 Due to increases in the prices of petroleum products and coal, the import bill went up by 28.0% to reach Rs 27,635 million in 2008 from Rs 21,639 million in the preceding year.

1.11 Re-exports and bunkering

1.11.1 Of the 1,451 ktoe of imported energy sources in 2008, about 341 ktoe (23.5%) were supplied to foreign marine vessels and aircraft, showing an increase of 8.8% over 2007 figures. Re-exports consisted of 131 ktoe of aviation fuel (38.2%), 119 ktoe of diesel oil (34.7%), and 92 ktoe of fuel oil (27.1%). The following changes were noted as compared over the previous year: Aviation fuel +7.5%, Fuel Oil +27.1%, Diesel -0.8%, overall +8.8%.

1.12 Electricity generation

1.12.1 Some 2,557 GWh (220 ktoe) of electricity was generated in 2008 as compared with 2,465 GWh (212 ktoe) in 2007, representing an increase of 3.7 %. The Independent Power Producers (IPPs) supplied 63.2% of the total electricity generated, and the Central Electricity Board (CEB), 36.8%. Thermal energy represented 96% and hydro 4%. The peak demand in 2008 reached 378 MW (+3.0%) in the Island of Mauritius as compared with 368 MW in 2007.

1.13 Fuel input for electricity generation

1.13.1 Fuel input increased by 6.2%, from 707 ktoe in 2007 to 751 ktoe in 2008. The major components of the fuel input were coal, the dominant fuel, (50.4%), bagasse (27.7%) and fuel oil (21.4%).

1.14 Electricity sales and consumption

1.14.1 Electricity sales increased by 4% from 1,975 GWh in 2007 to 2,054 GWh in 2008. The average sales price of electricity went up by 26.9%, from Rs 3.79 per kWh to Rs 4.81 per kWh, during the same period.

The per capita consumption of electricity sold per annum stood at 1,619 kWh in 2008 compared with 1,567 kWh in 2007.

1.15 Final energy consumption

1.15.1 Final energy consumption fell by 2.0% from 858 ktoe in 2007 to 841 ktoe in 2008. "Transport" and "Manufacturing" were the two largest energy-consuming sectors accounting for 48.3% and 29.4% of energy consumed respectively. They were followed by "Household" (13.1%), "Commercial and Distributive Trade" (8.2%) and Agriculture (0.5%).

1.16 Transport

1.16.1 In 2008, some 406 ktoe of energy were used for transportation, representing a decrease of 1.2% over last year's figure of 411 ktoe. Consumption of gasoline increased from 107 ktoe to 110 ktoe (+2.8%) and that of diesel oil from 153 ktoe to 154 ktoe (+0.7%). Consumption of aviation fuel decreased from 144 ktoe in 2007 to 137 ktoe in 2008 (-4.9%) and the use of LPG in the transport sector decreased from 7.2 ktoe in 2007 to 5.6 ktoe in 2008 (-22.0%).

1.17 Manufacturing

1.17.1 Energy used for manufacturing processes decreased by 6.1% from 264 ktoe in 2007 to 248 ktoe in 2008. The contribution of electricity was 79 ktoe (9.3%), fuel oil, 53 ktoe (6.2%), diesel oil, 47 ktoe (5.6%) and bagasse, 38 ktoe (4.6%).

1.18 Household

1.18.1 Energy consumed by households (excluding transport) increased slightly from 109 ktoe in 2007 to 110 ktoe in 2008. The two main sources of energy for households were electricity and LPG, representing 51% and 42% respectively of total energy consumed by households. Consumption of electricity increased by 1.4% and that of LPG by 0.7%.

1.19 Commercial and Distributive Trade

1.19.1 Total energy consumption by "Commercial and Distributive Trade" sector rose by 6.0%, from 65.2 ktoe in 2007 to 69.1 ktoe in 2008. This sector witnessed an increase of electricity consumption from 53 ktoe to 58 ktoe (+9.4%) and a decrease of LPG consumption from 11.8 ktoe to 10.9 ktoe (-7.6%).

1.20 Agriculture

1.20.1 Energy consumption in 'Agriculture' went down from 4.9 ktoe in 2007 to 4.5 ktoe in 2008 (-8.2%). Electricity and diesel were the only two sources of energy used in this sector. In 2008, about 2.2 ktoe of electricity were used mainly for irrigation while 2.3 ktoe of diesel oil were used for mechanical operations in fields.

Note – The statistics are from Central Statistics Office

Table - Energy Balance 2008

Source Flow	Coal	Petroleum products							Renewables					Electricity	Total	
		Gasolene	Diesel	Aviation Fuel	Kerosene	Fuel Oil	LPG	Total Petroleum products	Fuelwood	Charcoal	Hydro	Wind	Bagasse			Total Renewables
Local production	-	-	-	-	-	-	-	-	7,720	-	9,291	32	246,434	263,477	-	263,477
Imports	376,050	117,190	331,738	272,694	6,146	279,404	68,159	1,075,331	-	-	-	-	-	-	-	1,451,381
Re-exports and bunkering	-	-	(118,454)	(130,543)	-	(92,347)	-	(341,344)	-	-	-	-	-	-	-	(341,344)
Stock change / Statistical error	27,829	(7,671)	(8,221)	(5,644)	(2,124)	26,241	(240)	2,340	-	-	-	-	-	-	-	30,169
Total Primary Energy Requirement	403,879	109,518	205,062	136,507	4,022	213,298	67,919	736,327	7,720	-	9,291	32	246,434	263,477	-	1,403,682
Public electricity generation plant	-	-	(1,596)	-	(2,179)	(160,845)	-	(164,619)	-	-	(9,291)	(32)	-	(9,323)	81,021	(92,921)
Autoproducer plants	(378,042)	-	-	-	-	-	-	-	-	-	-	-	(208,150)	(208,150)	138,902	(447,291)
Other transformation	-	-	-	-	-	-	-	-	(822)	400	-	-	-	(422)	-	(422)
Own use	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(3,543)	(3,543)
Losses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(18,345)	(18,345)
Total Final Consumption	25,837	109,518	203,467	136,507	1,843	52,453	67,919	571,708	6,897	400	-	-	38,284	45,582	198,035	841,161
Manufacturing sector	25,837	-	46,764	-	-	52,453	5,314	104,531	542	-	-	-	38,284	38,826	78,511	247,704
Transport sector	-	109,518	154,439	136,507	-	-	5,599	406,064	-	-	-	-	-	-	-	406,064
Commercial and distributive trade sector	-	-	-	-	-	-	10,902	10,902	-	312	-	-	-	312	57,853	69,066
Household	-	-	-	-	1,843	-	45,786	47,628	6,356	88	-	-	-	6,444	56,087	110,159
Agriculture	-	-	2,263	-	-	-	-	2,263	-	-	-	-	-	-	2,222	4,485
Other	-	-	-	-	-	-	320	320	-	-	-	-	-	-	3,363	3,683

Note: figures in brackets represent negative quantities

2.0 Institutional and Regulatory Framework

2.1 A Holistic Approach for Sustainable Development

2.1.1 Energy is the key driver for economic growth and, therefore, energy strategies should promote sectoral economic growth. The energy strategy of Government forms part of an integrated multi-sectoral programme with regard to:-

- Energy supply - use of fossil fuels such as such as oil, coal and LPG, as well as renewable energy sources such as bagasse, wind and solar energy;
- Energy conversion- technologies and fuels for electricity generation;
- Energy demand - promotion of energy efficiency at all levels including design of buildings and public awareness campaign; and
- Energy security - ensuring essential storage facilities to prevent shortages for all services at all times.

2.1.2 National responsibility for energy currently rests with the Ministry of Renewable Energy and Public Utilities, which is also the parent Ministry for the electricity utility. Other stakeholders include the Ministry of Finance and Economic Empowerment, the Ministry of Public Infrastructure, Land Transport and Shipping, the Ministry of Environment and National Development Unit, the Ministry of Agro-Industry and Fisheries, the Ministry of Industry, Science and Research, the Ministry of Local Government, Outer Islands and Rodrigues, the Central Electricity Board, the Maurice Ile Durable Fund and the Mauritius Sugar Authority.

2.1.3 In the context of a globalised economy, Mauritius has to encourage greater competition in the energy sector. Government strategy is to avoid any monopolistic situation, be in public or private. To encourage competitiveness in the energy sector, Government will put in place appropriate market regulations for the utility sector with a view to enhancing operational efficiency. To that effect, Government has proclaimed the Utility Regulatory Act in September 2008 and the Regulatory Authority would be operational by the end of 2009.

2.1.4 Once the multi-sectoral Regulatory Authority is operational, Government will proclaim the Electricity Act 2005 to regulate, in the first instance, electricity services. The latter Act provides, inter-alia, for reform of the electricity sector, including improvements in the standards of customer service and consumer protection.

2.2 Energy Efficiency and Development of Renewable Energy

2.2.1 Government priority is to move the country towards an energy efficient economy. In this context, a new legal framework will be set-up with the enactment of the Energy Efficiency Act to promote energy efficiency programme at the levels. An Energy Efficiency Unit will be set up as a nodal agency for a systematic and comprehensive development and implementation of energy efficiency measures including assessment of energy consumption, formulation of strategy and enforcement of regulations for product labeling and new building codes.

2.2.2 With a view further promoting the development of renewable sources of energy, including small decentralized systems, Government will introduce appropriate feed-in tariffs and incentive schemes for sale of surplus electricity to the national grid.

2.3 Power Sector Reform

2.3.1 The long-term strategies for the power sector are to create:-

- a financially sound and self-sustainable electricity sector
- a transparent and fair regulatory environment that appropriately balances the interests of consumers, shareholders and suppliers
- conditions that provide efficient supply of electricity to consumers and improvement in customer services
- a modern power sector with up-to-date organisational and management practices

2.3.2 However, given the small size of the electricity market, complete unbundling of the power system is not envisaged at this stage. The long-term objective is to encourage further private sector participation in the generation side within the framework of a single buyer model. The new Electricity 2005 sets the path for the implementation of the long-term power sector reform strategies.

3.0 Energy Efficiency

3.1 Energy Efficiency Act

3.1.1 Government recognises the potential for energy efficiency in all sectors of the economy. In order to promote energy efficiency in the country, Government strategy is to remove all current barriers, namely, institutional, technical, economic and financial, so as to allow for the transformation of the economy into an energy efficient one.

3.1.2 To implement its strategy, Government will put in place an Energy Efficiency Act with the objective of reducing energy use and costs, protecting the environment, improving productivity and contributing to the mitigation of the effects of climate change.

3.1.3 With a view to implementing the provisions of the new Law, an Energy Efficiency Unit would be created within the Ministry of Renewable Energy and Public Utilities. In addition, the specialized Energy Efficiency Unit will become a centre of excellence in the fields of:

- Creation of a national data base on energy usage
- Renewable energy technologies and techniques
- Tapping carbon-clean development mechanisms with regard to renewable and energy conservation
- Energy efficiency program management
- Promotion and awareness-raising on energy supply/demand

3.2 Energy Audits

3.2.1 The new Energy Efficiency Legislation will, *inter alia*, make energy auditing for designated consumers/sectors mandatory, regulate the standards of energy auditing, allow for the imports of energy efficient appliances, improve standards of energy utilization in buildings and promote awareness and education of the public.

3.2.2 In order to pursue its energy efficiency and conservation strategy, Government will also create a pool of qualified and certified energy auditors in the country. To ensure that the auditors are of required standard, Government will also develop an appropriate Energy Auditor Certification Scheme.

3.3 Education and Training

- 3.3.1 The development of a sustainable energy economy affects the way that people live, so it is important to develop not only a broad appreciation of sustainable energy and the resulting environmental benefits, but also to transfer know how and skills, including practical engineering skill in areas such as energy efficiency and renewable energy technologies.
- 3.3.2 Relevant educational materials on sustainable energy will be developed by the Energy Efficiency Unit for use at all levels in schools. The target groups would include primary and pre-primary children.
- 3.3.3 Moreover in the context of MID concept, emphasis will be laid on appropriate training to build capacity to develop a culture of sustainable development including energy efficiency and energy conservation.

3.4 Demand Side Management

- 3.4.1 On the demand management front, Government has, with the collaboration of the electricity utility, implemented a Compact Fluorescent Lamps (CFL) project whereby one million lamps have been sold at a concessionary price. The main objective of the project was to promote the use of CFLs in households and to lower the evening peak demand comprising a significant component of domestic load.
- 3.4.2 The technical and economic potential for lowering energy intensity of the industrial sectors, through energy efficiency, measures will also be addressed. Demand Side Management strategy will target the largest energy intensive industries, which will be required to hire a Certified Energy Auditor and to develop energy management plans. On the other hand, the smaller industries will be required to carry out energy audits at prescribed interval. In this respect, a classification of companies by their energy consumption will be carried out and the EEU will be responsible to prepare and monitor realistic targets for energy savings in the sector.
- 3.4.3 It is reckoned that there is presently an absence/shortage of energy service companies and energy efficiency specialists in the country. Accordingly, industries will be given a reasonable moratorium to comply with the above policies. Meanwhile, Government will continue to encourage industries to carry out energy audits and implement such measures as may be required for efficient energy use.

3.4.4 As part of the demand side management strategy, efficient street lighting system using CFL and traffic lighting using LED would be promoted with a view to reducing Government energy bills.

3.5 Sustainable Buildings

3.5.1 Government is committed to the "Public Sector Leading the Way" in energy efficiency. This will be the fundamental sustainable energy principle for the public sector institutions, and will be reflected in highest standards of sustainable energy and energy efficiency being applied in all public sector activities. The aim of Government is to maintain energy expenditure at a reasonable level.

3.5.2 Energy efficiency will, henceforth, be one of the main criteria that will be considered in the design of public and in rental of private buildings. This will act as an incentive for individuals in designing energy efficient buildings to the benefit of the lessee.

3.5.3 Government is committed to retrofitting existing state-owned public buildings, if financially attractive, to bring their energy performance up to best practice standards for such buildings.

3.5.4 A new Building Control Act will be passed to improve building design and choice of building equipment to attain high efficiency in term of energy use.

3.5.5 New buildings, both public and private, will have to be energy efficient in terms of the building envelope and equipment to be used as per the provisions of the new Act.

3.5.6 Government will also introduce best working practices and engineering based solutions to address public sector energy efficiency. In this respect, the EEU will launch appropriate campaigns with the objective of changing behaviour at work and promoting practices aimed at rationalization of energy use in all big buildings. Necessary technical support and guidance will be provided by the EEU for the implementation of energy saving measures in all Ministries and parastatals.

3.5.7 The public sector will also play its part in demand management. In hospitals, the demand for hot water is very high and this is generally met from electric and gas water heaters, though there is good potential for the use of solar water heaters. To ensure optimal use of renewable sources of energy, solar water heaters will be used for water heating in all Government buildings, except where it is not practical to do so.

3.5.8 The overall strategy of Government is to reduce energy consumption of public sector to half the current level by the year 2015 and to continue to aggressively target energy efficiency opportunities through to 2025, as and when new technologies enter the marketplace.

3.6 Energy Efficiency in the Tourism Industry

3.6.1 Tourism, third pillar of the economy after the E.P.Z. manufacturing sector and Agriculture, contributes significantly to economic growth and has been a key factor in the overall development of Mauritius. In the past two decades tourist arrivals increased at an average annual rate of 9% with a corresponding increase of about 21% in tourism receipts. In 2008, gross tourism receipts were 14.2 billion rupees (508.3 million US \$) and contributed to about 11% of our GDP. Tourism may be called to play an even more important role in the wake of the After-GATT Agreements.

3.6.2 Worldwide developments in the energy sector are likely to adversely impact the tourism sector of Mauritius. Higher fuel oil prices and a growing awareness of the negative environmental impacts of long distance air travel have the potential to put Mauritius at a competitive disadvantage to other tourist destinations which may be closer to these markets.

The strategy to raise tourist numbers to two million will be supplemented with specific measures for ensuring sustainability of energy use in the sector. Energy efficiency and renewable energy solutions that would allow the hosting of more tourists in the country would be put in place. For that purpose a well-defined energy strategy for the tourism sector is being put in place.

3.6.3 The energy strategy for the tourism sector will focus on the following:

- retrofitting of existing hotel with the latest energy efficient technologies
- mandatory use of solar hot water systems in hotels
- mandatory low-energy lighting/appliances/air-conditioning and cooling devices throughout the hotel industry
- mandatory introduction of low-energy airport transfer policies
- mandatory provision by businesses of optional facilities to allow tourists, who choose to do so, to offset the carbon impact of their flights by investing in sustainable energy schemes in Mauritius

3.6.4 In the long-term, the strategic objective is to offer zero-carbon-footprint holidays, thereby mitigating the risk of losing market share to other countries for environmental reasons.

3.7 Product Labeling & Efficiency Standards

3.7.1 At present, price has been the main decisive factor in the purchase of equipment in the public sector. But as far as electrical appliances are concerned, such a criterion may ultimately prove to be costly to Government, especially when such equipment are not energy efficient and do not provide for stand-by or energy saving modes. Henceforth, besides the price element, energy efficiency will be a key determinant in the selection of electrical equipment including lamps, computers, scanners, printers, photocopying machines, air-conditioners, refrigerators and freezers.

3.7.2 With the introduction of energy efficiency product labeling under the Energy Efficiency Act, customers' rights would be safeguarded in terms of:

- (i) awareness on the importance of using energy-efficient products;
- (ii) access to readily available pre-purchase information on product rating, efficiency data and energy consumption so as to enable them to purchase more energy-efficient products; and
- (iii) from the supply side, manufacturers and distributors would have to develop and provide products that meet or exceed designated minimum energy efficiency standards.

3.7.3 Government strategy is also to set the minimum energy performance standards for household and non-household electrical energy-consuming appliances/equipment in addition to labeling of such appliances/equipment according to their energy efficiency levels. The appliances/equipment targeted for energy efficiency product labeling and minimum standards will, in the first instance, be limited to:

- (i) room air conditioners;
- (ii) dishwashers;
- (iii) refrigerators, freezers and their combinations;
- (iv) ovens, microwaves and their combinations
- (v) washing machines, dryers and their combinations;
- (vi) instantaneous electric water heaters and electric storage water heaters; and
- (vii) compact fluorescent lamps (both ballasts integrated and ballasts separated).

3.8 Targets for Efficiency in the Electricity Sector

The Table below indicates the cumulative targets for energy efficiency gains over the period 2010-2025 as compared to the electricity consumption of 2008.

Year	2010	2015	2020	2025
Target in %	2	4	6	10

4.0 Renewable Energy Development Strategy

4.1 Bagasse Energy Strategy

- 4.1.1 Mauritius has long recognized the need to diversify its energy mix in the electricity sector away from fossil fuels as far as possible. To date, Mauritius produces about 22% of its electricity from renewable resources namely hydro and sugar cane bagasse, and as such is among one of the world leaders in renewable energy use.
- 4.1.2 Mauritius has a very valuable asset in the form of cane biomass. Of all cash crops, sugar cane best absorbs solar energy with 55 tonnes of carbon dioxide fixed per 100 tonnes of cane produced per hectare. In this way, each year 5 million tons of environment friendly biomass are produced in the form of sugar cane. Cane tops and leaves can add another 20% of biomass to that amount.
- 4.1.3 The biomass from sugarcane used for generating electricity consists essentially of bagasse. The latter is the most plentiful primary energy resource used by the sugar industry to meet all its energy requirements in terms of heat and electricity generation. In addition, surplus power from bagasse is fed into the national grid.
- 4.1.4 Besides sugar production, energy generation from bagasse complemented by coal has been a major activity of the sugar industry since the mid-1980's. About 50% of investments in a typical sugar factory are linked to the boiler and the turbo-alternator. The IPPs in the industry have been making such investments through power generation projects for supply of electricity into the national grid. Such IPPs include Central Thermique de Belle Vue (CTBV), Flacq United Estates Ltd (FUEL), Consolidated Energy Ltd (CEL) and Central Thermique de Savannah (CTSav).
- 4.1.5 In such an arrangement, the sugar factory obtains steam and electricity required for its operation, and in return the power plant obtains the bagasse produced after the milling of canes free of charge. This has been the strategy of the sugar industry to optimize the use of bagasse for power generation complemented with coal in line with the Bagasse Energy Development Programme initiated in 1991. At the same time, the sugar factories had the opportunity to modernize their milling infrastructure, in addition to diversifying their revenue from the sale of electricity to the CEB for onward sale to consumers. In environmental terms, it may be noted that another key positive aspect of bagasse is that its ash content is less than that of coal.

- 4.1.6 Government strategy is to use bagasse more efficiently with a view to increasing the contribution of bagasse based electricity in the medium-term from the present level of 350 GWh to 600 GWh annually. However, benefits from the use of additional bagasse should be reaped by all stakeholders of the sugar industry, particularly the corporate sector, employees and small and medium planters, but equally for the country in terms of avoidance of the use of fossil fuels.
- 4.1.7 While the strategy for more efficient use of bagasse for power generation is essential from the sugar sector standpoint, it is important that the use of coal in future power plants from the sugar industry be minimized given that bagasse-coal plants, by virtue of their technology and design, have low efficiency when using coal as compared to dedicated higher capacity coal plants. Hence, in new bagasse-coal power generation configurations, Government strategy is to maximize the amount of energy generated from available bagasse, while minimizing the use of coal. Within this framework, the target of 600 GWh of electricity from bagasse will be achieved in medium term.
- 4.1.8 It is to be noted that research and development in the sector is being accelerated at ACP level where Mauritius is playing a leading role to develop new varieties of sugar cane with higher biomass production. A new variety of sugar cane which can produce between 15-25% more fibre than current ones was developed by the Mauritius Sugar Industry Research Institute in 2007. Development and use of such variety of sugarcane can help to increase the amount of electricity produced from bagasse. The long-term strategy of Government is to encourage the use of new varieties of sugar cane with higher biomass content and any other technology that would be commercialised so as to increase the amount of energy generated from bagasse.

4.2 Master Plan for Renewable Energy

- 4.2.1 A Master Plan for Renewable Energy will be prepared with the aim of establishing our long term objectives. With the assistance of the World Bank, a consultant is being hired to develop the Master Plan in consultation with all the stakeholders.

4.3 Solar Energy Strategy

- 4.3.1 Mauritius is situated in the tropics and as such benefits from more than 2900 hours of sunlight per year. Yet, the present cost of generating PV electricity is still unfavourable when compared to other conventional and renewable sources, despite the progressive reduction in the cost of the technology in the last decade. In order to encourage use of solar energy, whether for water

heating or electricity production, incentive schemes would be implemented to enable long-term strategic goals to be achieved.

4.4 Solar Water Heating

4.4.1 Solar water heating is the most common form of solar energy conversion, used in Mauritius. However, it is not sufficiently tapped, though the potential is very high.

4.4.2 Since 1992, the Development Bank of Mauritius has been providing a concessionary rate of interest on loans for the purchase of solar water heaters. However, it was estimated in 2008 that only some 25,000 households, out of a total of about 330,000, used solar water heaters for domestic water heating.

4.4.3 With the setting up of the MID Fund in July 2008, the solar water heater loan scheme operated by the Development Bank of Mauritius has been revisited with an outright grant of Rs 10,000 from the MID Fund given for every solar water heater purchased so as to double the number of solar water for domestic use by end 2009. Loan facilities are also provided by the Development Bank of Mauritius, but the grant is not contingent to a loan being taken from the Bank.

4.4.4 The outcome of the new scheme has been beyond expectations with some forty thousand applications received by the Bank. Given the budgetary ceiling of Rs 290 million from the MID fund, only some 29,000 households would benefit from the grant scheme. Based on the positive experience, Government is proposing to design and implement another scheme in furtherance of its strategy to promote wider use to use solar energy for water heating in household and other sectors of the economy. However, Government will also ensure that customers receive good quality products by prescribing standards for solar water heaters and providing the necessary testing facilities at the Mauritius Standards Bureau for implementation of the standards.

4.5 Solar Photovoltaic

4.5.1 The photovoltaic technology is fast evolving and it will have an impact on the country's energy mix in the long-term. In 2008, the world production of photovoltaic modules increased to some 170 MW as compared to some 100 MW ten years earlier. Over the same period, the average module price has decreased from **5 €/Watt** to **3€/ Watt**. With new technological advancement, the price of PV modules are expected to drop in the long-term making PV a viable option. The average daily sunshine intensity of Mauritius adds to this advantage.

4.5.2 Government strategy is to adopt the technology when the costs are reasonably competitive with other technologies. Moreover, Government will design appropriate schemes to allow for the progressive market penetration of photovoltaic systems in terms of:

- Investment subsidies, whereby part of the cost of installation of PV systems could be refunded; and
- Feed-in Tariffs/net metering, whereby the CEB would purchase PV electricity from the producer at a guaranteed rate.

4.6 Wind Energy Strategy

4.6.1 Wind is the most commercially viable renewable source of energy for electricity generation. Technological progress in the wind energy technology has enabled a hundred fold increase in unit capacity of wind turbines from 50 kW to above 5 MW units in 20 years with reduction in costs by some 50%. With the adoption of worldwide green policy in energy production, major technological breakthroughs in wind energy with greater cost reductions are expected in the coming years.

4.6.2 The main islands of Mauritius and Rodrigues are for the major part of the year exposed to the South East Trade Winds and which are, therefore, conducive for wind energy exploitation. A Wind Energy Resource Assessment Study financed by the UNDP was carried out in the mid 1980s. The study confirmed that there are potential sites on the two islands for the setting up of wind farms, with some areas having an annual average speed of 8.0 m/s at 30 m above ground level.

4.6.3 However, pilot projects in Mauritius and Rodrigues in the mid 1980's were not successful as the wind turbines were damaged by cyclones after about two years of operation. As gust of 280 km/hr can occur during the passage of cyclones, the wind turbine technology to be used should be able to withstand such severe cyclonic conditions.

4.6.4 In the quest to substitute as far as possible imported oil for power generation, the strategy is to implement wind power projects to the extent that it is technically feasible and suits the local cyclonic conditions.

4.6.5 The Wind Farm implemented at Trèfles, in Rodrigues, comprising three wind turbines 60 kW each and the two additional units of 275 kW each at Grenade have successfully contributed in the global electricity generation in Rodrigues with plant load factor above 30%. The wind turbines, being of the tilted type, can be protected during cyclonic periods. Three additional units of 275 kW will be installed at Grenade so that by 2010, wind energy contribution in Rodrigues would be raised to above 10%.

4.7 Wind Farm in Mauritius

4.7.1 Wind power, being an intermittent source of supply, cannot be relied on for ensuring security, stability and reliability of supply. Moreover, power system impact studies have revealed that the total wind power capacity that may be accommodated in the national grid is limited to 30% of the night load. In view of this constraint, wind generation capacity can be limited to some 60 MW at current level of night load. Taking due consideration of the future growth in the night load demand, some 2-3 MW of wind power may be accommodated annually.

4.7.2 The strategy of Government is to resort to the Build Operate Own (BOO) model for the implementation of any future wind farm in Mauritius. Moreover, the wind farm would comprise wind turbines which have established record to resist cyclonic gusts of the order of 280 km/hr.

4.7.3 In line with this strategy for wind energy development, a wind farm of 25-40 MW will be set-up at Curepipe Point on a BOO scheme. The wind farm is expected to be operational by end 2010.

4.7.4 Besides the PPP Project, Government is encouraging private sector initiatives at Plaine des Roches and Britannia for setting up of wind farms with a minimum of 10 MW installed capacity.

4.8 Hydro Power Strategy

4.8.1 CEB operates eight hydroelectric stations having a total installed capacity of 59 MW. The full installed capacity can only be exploited in wet periods with heavy rainfall. The power stations at Champagne, Tamarind, Magenta, and Le Val are run with dam storage facilities. The remaining stations at Ferney, Réduit, Cascade Cécile, and La Ferme are of the run-of-river type. The amount of energy that can be generated from the hydro power stations varies significantly over the year, from less than 5 GWh in the driest month to some 20 GWh in the wet season. For an average year, some 100 GWh is generated from the eight hydro power plants.

4.8.2 The hydropower potential in the country has been almost fully tapped with the eight hydro power plants, and there are very competitive uses of the existing water resources. Nevertheless,

Government strategy is to encourage the setting up of mini and micro hydro plants, at potential sites wherever economically viable.

- 4.8.3 In this respect, a 375 kW micro hydro power plant will be commissioned in early 2010 on La Nicolière Feeder Canal, at Trente Chutes. The plant is expected to generate some 2 GWh/year. Other potentials sites, such as Midlands dam, where the basic infrastructure was already provided when the dam was constructed will also be considered if found to be economically viable.

4.9 Waste-to-Energy Strategy

- 4.9.1 Waste-to-energy generation is part of the solid waste management strategy of Government to relieve the existing landfill site at Mare Chicose. The solid waste management policy has been designed on the basis of a feasibility study prepared in 2005.

- 4.9.2 The strategy of Government is to incinerate waste that allows for the generation of electricity as a useful output from the process. The electricity from such facilities will be supplied to the national grid at rates which are competitive and comparable to other sources so as not to adversely impact on the financial sustainability of the CEB while providing some bonus to cater for the potential environmental benefits that waste incineration entails as opposed to waste disposal in a landfill site.

- 4.9.3 A 20MW waste-to-energy plant at La Chaumiere, in the West of the island, will be implemented on a BOO scheme. While the cost of producing electricity from waste may be high, it has to be noted that such costs take into account externalities in waste management and treatment, such as environmental costs, which are not accounted for in landfills. Government, through the MID Fund, will financially support efforts to protect the environment through the incineration and recycling of waste.

4.10 Other Technologies

- 4.10.1 Other energy technologies that have potential application in Mauritius are geothermal and Ocean Thermal Energy Countries (OTEC). While the former technology is well established and commercially available, its application is site dependent. As Mauritius is of volcanic origin, there is the probability that geothermal sites are available. However, exploration costs could be exorbitant if deep drilling is required to access the thermal source in the earth crust. The strategy of Government is to allow private operators to take the risks of any exploration costs

and the electricity utility would examine the advisability of entering into contracts for such power on a needs and cost effectiveness basis.

4.10.2 As regards the OTEC technology, it has not yet been commercialised and Government strategy for its application will depend on its adoption by other countries, which is unlikely to happen before 2025, given the current state of development of the technology.

4.10.3 Government will also encourage innovative strategies for technology transfer through reliance on special programmes under global funds, such as the Global Environmental Facility (GEF) and funds from other bilateral and multi-lateral cooperation agencies. Technologies such as hydrogen-based electricity, gasification and fuel cells could be explored on pilot basis subject to appropriate funding from donor agencies.

4.10.4 A Land Based Oceanic Industry is one of the innovative projects which will be developed with the participation of private sector operators for the exploitation of very deep ocean water currents for air conditioning and setting up a green data centre.

4.11 Targets for Renewable Energy over period 2010-2025

4.11.1 On the basis of Government overall energy policy and strategy, the targets in terms of percentage of total electricity generation over the period 2010 – 2025 on the basis of renewable and non-renewable sources of energy are given in the Table below.

Fuel Source		Percentage of Total Electricity Generation			
		2010	2015	2020	2025
Renewable	Bagasse	16%	13%	14%	17%
	Hydro	4%	3%	3%	2%
	Waste to energy	0	5%	4%	4%
	Wind	0	2%	6%	8%
	Solar PV	0	1%	1%	2%
	Geothermal	0	0	0	2%
	Sub-total	20%	24%	28%	35%
Non-Renewable	Fuel Oil	37%	31%	28%	25%
	Coal	43%	45%	44%	40%
	Sub-total	80%	76%	72%	65%
	Total	100%	100%	100%	100%

Assumptions

The above targeted energy mix is based on the assumptions that the coal and waste energy projects approved by Government would be operational by 2013 and new and more affordable PV technology would be available. Moreover, the above table would be subject to regular review and update depending on changes and development in technology, including outcomes of local energy resource assessment and affordability.

5.0 Strategy for the Electricity Sector

5.1 Strategic Objectives

- 5.1.1 In the Presidential Address of 29 July 2005, it is ,*inter-alia*, stated that “in view of the constantly growing needs of the country, Government will take action for the timely commissioning of additional power generating plants. The CEB would be encouraged to increase its own production capacity and to ensure security and reliability of supply, at the lowest possible costs”.
- 5.1.2 Three key principles underpin Government strategy in electricity generation and supply. Firstly, availability, security and diversity of supply with particular focus on renewable energy; secondly, affordability with a view to ensuring socio-economic development of the country taking into account the financial sustainability of the utility and thirdly, energy efficiency and conservation, given the high volatility of the prices of fossil fuels, in particular oil. Thus, the triple targets are the financial, environmental and social sustainability of the sector within which framework the strategic objectives will have to be achieved.
- 5.1.3 Over the next 25 years Mauritius will need massive investment in new electricity generation plants. Government priority will be to secure adequate investment by putting in place the proper market conditions for such investment. Demand and supply balance will be closely monitored to allow for timely implementation of power sector projects.
- 5.1.4 To meet the growing electricity demand, Government will encourage the emergence of new producers/suppliers while fully integrating the role of the sugar sector on the basis of economic, financial and environmental analyses. Moreover, Government will provide the necessary incentives for the development of the renewable energy sector and will promote energy savings and energy efficiency at all levels in the country.

5.2 Electricity Market Share

- 5.2.1 CEB currently produces around **40%** of the country's total power requirements, the remaining **60%** being purchased from Independent Power Producers (IPP). Presently, the CEB is solely responsible for the transmission, distribution and supply of electricity in Mauritius and Rodrigues. Whilst IPPs would continue to be accommodated, the CEB would be allowed to also participate in providing new generation capacity. Accordingly, for strategic reasons, the CEB will continue to generate electricity in line with the policy outlined in the 2005 Presidential Address. However, the Regulator will have to ensure level playing in relation to electricity

generation.

5.3 Small Scale Distributed Generators/SIPPs

- 5.3.1 A comprehensive Renewable Energy Master Plan will be prepared to sustain and further promote the use of renewable energy in the country while allowing IPPs to be a major player in electricity generation. Government strategy is to allow consumers from the domestic, industrial and commercial sectors to also join the electricity supply market by the setting-up of small renewable generating units, mainly using wind and photovoltaic systems.
- 5.3.2 A grid code has been developed to provide the technical framework for Small Independent Power Producers (SIPPs) with capacity below 50 kW to generate electricity for their own purpose and feed any surplus into the national grid. Accordingly, the CEB will 'buy back' power from the SIPP's on the basis of net metering. In order to encourage the SIPP's to enter the decentralized electricity market, a feed-in tariff combined with an appropriate incentive scheme will be designed and implemented.
- 5.3.3 SIPPs exceeding 50 kW and up to threshold to be determined based on technical and legal parameters, will be considered under a separate grid code and pricing policy.

5.4 Strategy for Electricity from Coal

- 5.4.1 It is well established that coal is the only other fossil fuel available with proven reserves that can last much longer than oil, in addition to its even distribution around the globe, making it less prone to geopolitical and other associated risks and therefore less volatile in terms of prices.
- 5.4.2 To further diversify the country's electricity production and given that there is a range of technologies already available in the marketplace for the efficient conversion of coal into electricity, the preferred strategy is to increase the share of clean coal in the country's energy mix.
- 5.4.3 However, to limit carbon dioxide emissions, modern coal power plants using the clean coal would be encouraged at improved efficiency of 40 to 45%. This option would substitute oil to the extent possible in the country's energy mix to ensure security and diversity of supply. Moreover, the higher efficiency of dedicated clean coal plants would also allow the cost of electricity generation to be less than from bagasse-coal plants. However, the issue of ash disposal is pertinent and would be addressed in an integrated environment strategy.

5.4.4 In the context of the above strategy, a coal plant of 110 MW with all the mandatory environmental safeguards will be implemented at Pointe aux Caves, the site identified for a coal fired power plant in the west of the country. An appropriately designed ash pond would cater for ash disposal from the plant. As regards particulate emissions, the project will include an electrostatic precipitator which is known for its high performance efficiency in terms of pollution control.

5.5 Replacement of Old Diesel Engines

5.5.1 In the short-term, there is a need to replace many of the diesel engines at the St Louis and Fort Victoria Power Stations for semi-base load generation. Such a replacement is warranted to achieve energy efficiency, as the old engines are fuel inefficient, and minimize environmental impacts in terms of emissions and noise. In the context of this replacement policy, two new engines, each of 15 MW capacity, are currently being commissioned at Fort Victoria. In addition, because of complaints of noise from inhabitants at St Louis Power Station, six old engines have to be de-commissioned and would be replaced by four new ones at Fort Victoria. The new engines are expected to go on stream in 2011 and simultaneously the four relevant engines at St Louis would be decoupled from the grid.

6.0 Energy Strategy for Transport Sector

6.1 Background

6.1.1 The transport sector is one of the heaviest energy consumer in Mauritius, accounting for 48% of total energy imports. The situation has worsened over the years with the significant increase in the number of vehicles on our roads. During the past years, the fleet of vehicle has increased from some 190,000 in the 1990's to around 351,406 vehicles in 2008. At the end of December 2007, 39% were less than 5 years, 25% between 5 and 9 years and the remaining 36% were 10 years and above. 37% of the buses were under 5 years, 23% between 5 and 9 years and 40%, between 10 and 18 years. Heavy vehicular traffic is one of the causes of pollution problems, in terms of vehicular emission whereas traffic congestion which entails heavy costs for businesses, has also a negative impact on the economy and on the health and productivity of the nation.

6.1.2 In its programme for 2005 – 2010, Government took the firm commitment to adopt appropriate short, medium and long-term policy measures to address the long standing problem of road congestion. In 2006, Government decided to undertake a review of the Urban Transport Strategy to find affordable solutions that could be quickly implemented. The strategy was

formulated after taking into consideration all the previous studies and reports and it is based on the premises that –

- (i) investment in infrastructure specially roads do not necessarily reduce congestion ;
- (ii) traffic congestion can be managed by making public transport more reliable, faster and more comfortable ;
- (iii) managing congestion will involve both increasing the speed of public transport and control the access of private cars particularly with single occupancy to Port Louis during peak hours.

6.2 Main Elements of Strategy

The main elements of the strategy are -

Institutional Measures

6.2.1 Setting up of a new Land Transport Authority with the mandate to plan, implement and manage the nation's land transport with improved coordination and efficiency. It will take over the activities of the Road Development Authority, the National Transport Authority and the Traffic Management and Road Safety Unit. It will primarily remove duplication and bureaucracy and improve cost efficiency through capacity building specially transport and management professional skills and competencies.

Public Transport Development

6.2.2 Government has embarked on a Bus Modernisation Programme. At the heart of the programme is the implementation of a 25 km busway using a disused rail right of way and 12 km bus-only lane to be placed along an existing motorway and to be operated together as an integrated Bus Rapid Transit System. The programme will also include a route restructuring and review of the regulatory and fare regimes to bring them in line with the needs of the new express bus facilities and the general interests of bus modernization system.

6.2.3 The project includes a Bus Replacement Programme that will permit the replacement of the Mauritius bus fleet with modern, speedy, comfortable, and environmentally-friendly vehicles. Government has also introduced customs rebates on hybrid and electric vehicles.

Road Construction and Management

6.2.4 Government is implementing a major infrastructure development programme which includes:

- (i) resurfacing of Motorways M1 and M2
- (ii) construction of a new access to the Réduit Triangle and Tianli Development
- (iii) construction of the:
 - Terre Rouge-Verdun-Trianon Link Road,
 - Port Louis Ring Road,
 - Harbour Bridge,
 - Phoenix-Beaux Songes Link Road,
- (iv) implementation of a major Bus Modernisation project, including a 25 km bus-way corridor between Curepipe and Port Louis and 12 km bus lane along Motorway M1.

6.2.5 The Port Louis Ring Road and Harbour Bridge will not only relieve congestion at Port Louis but also facilitate entry into Port Louis and the Terre Rouge Verdun road will deviate 15% to 25% of traffic from the motorway and through the city. The road will also provide the link with the Administrative City in Highlands as well as connect the North to the Central part of Mauritius and the East. Government has also decided that the new roads will include a congestion pricing element.

6.2.6 Other projects to address traffic congestion problem are the construction of the administrative city in Highlands in order to decentralize services from Port Louis, a review of the parking policy and integrated land planning with transport strategies.

6.3 Strategic Objective of the Transport Sector

6.3.1 In the Transport Sector, the energy strategies are to –

- (i) encourage the use of more efficient and lower emission vehicles and fuels;
- (ii) encourage the use of biofuels;
- (iii) reduce the level and types of vehicle and fuel supply chain emissions;
- (iv) improve the efficiency of transport provision and use; and
- (v) provide a degree of security against supply discontinuities.

6.3.2 Government will take the following short and medium term measures –

- (i) Promote the use of more efficient and lower emission vehicles and fuels;
- (ii) Enforce standards to reduce the level and types of vehicle and supply chain emissions. As a first step, the national standard for the sulphur content of automotive and industrial diesel oil would be lowered to 500ppm as from August 2010, making a substantial immediate and noticeable improvement to air quality;
- (iii) Diversify fuel supplies with biodiesel manufacture or import while recognizing that local manufacture will be a long term project as presently the volume of waste is insufficient for that purpose;
- (iv) Introduce the mix of ethanol –gasolene at the pump by using E10 and moving to E20 at a later stage;
- (v) set up strategic reserves of transport fuels to be in line with oil consumption and demand patterns. The State Trading Corporation should ensure storage capacity of at least 30 days on arrival of vessels as compared to the existing 5-10 days storage;
- (vi) promote fuel saving techniques in -driving through education and information programme and including such techniques into the driving test ;
- (vii) carry out campaigns to encourage car owners to make more efficient use of fuel ;
- (viii) conduct fleet reviews in companies, government and parastatal bodies having over 50 vehicles, and advising them on cutting fuel costs and emissions;
- (ix) encourage the use of information technology to avoid traveling by the public for different services and payments;
- (x) integrate long term transport planning with land development and in infrastructure investment decisions;
- (xi) restructure operations within organizations and decentralize services from the city to other locations in order to avoid congestion;
- (xii) introduce congestion pricing in order to reduce demand and alleviate traffic congestion.
- (xiii) promote the use of hybrid vehicles through fiscal incentives and concessions and introduce fiscal policies to encourage transport fuel efficiency technologies;
- (xiv) encourage vehicle users to reduce the distance travelled by single occupancy vehicles in urban areas during peak hours by 10 per cent;
- (xv) encourage private and public sector organizations to improve energy efficiency of heavy duty vehicles with energy efficiency technologies and to improve tyre standards.

7.0 Financial Incentives and Tax Regime for Long-Term Energy Strategy

7.1 Background

- 7.1.1 The financial, incentive and tax regime with respect to the long-term energy strategy is to allow for sustainable energy financing so that there is a shift in energy usage pattern that would favour efficiency at the sectoral level, which would be mirrored at the macro-economic level. This would require a paradigm shift from the traditional practice of putting in place measures on the supply side to having a functional fiscal framework that promotes efficient energy use, affordability and opportunity to lower the cost of energy to the user through the use of sustainable energy techniques.
- 7.1.2 The long-term fiscal framework would aim at helping the population at large to use energy efficiently and generate their own energy using renewables. For that purpose, existing subsidy to households would be revisited in the medium-to-long term. The current regime is undermining to some extent the incentive to invest in energy efficiency and household renewables. For vulnerable households, targeted low-income subsidies, energy efficiency schemes and household renewable schemes to lower the energy need would be designed and implemented in the medium-to-long term.
- 7.1.3 With respect to the industrial sector, the fiscal framework would be designed such that affordability of energy is enhanced that would allow the local industry to remain or become more competitive. Furthermore, programmes will be designed to help industries identify and act upon energy efficiency investment opportunities.

7.2 The Maurice Ile Durable Fund

- 7.2.1 With a view to implementing the energy strategy and associated institutional reforms to transform Mauritius into a sustainable energy economy, the Maurice Ile Durable Fund was created in July 2008 to provide the required financial resources. The fund receives direct provisions from the budget and a levy based on the volume of fuel-oil and coal used in the country. Currently the levy is Rs 0.15 per litre of fuel oil and Rs 0.15 per kg of coal used. In addition to these fiscal measures, an appropriate electricity feed-in tariff would be put in place to allow both households and industry to invest in small-to-medium renewable supply technologies.

7.3 Sources of Investment

7.3.1 The strategy underpinning the energy sector reform is a change from a small number of very large supply-side investments, public or private, generally with sovereign guarantees, to supply-side investments by households and a larger number of private sector investors, including large numbers of medium-sized demand-side investments by industry and commerce. Large numbers of small investments in simple energy efficient products will be promoted on the one hand. On the other hand, large-scale wind energy projects on PPP basis would be encouraged at sites that have good potential, while reckoning with the constraint of penetration of wind in the network, typically limited to about 30% of night load demand.

7.4 Framework for Banking Sector to support Energy Strategy Reform

7.4.1 In order to support the strategy of Government to promote a sustainable energy sector with a large number of small investments, the support of the banking sector is vital. To that effect, local banks would be encouraged to provide credit to industries which invest in energy efficiency and renewable technologies.

7.4.2 At present, the banking sector of Mauritius is not particularly attractive for small consumers. Interest rates are high, which makes a significant impact on the financial return of making an energy efficiency or renewable energy investment using borrowed funds. The ongoing economic and banking reforms would improve the availability of credit to small investors for energy efficiency and renewable energy investments.

7.5 Carbon Financing

7.5.1 As Mauritius is an Annex III Country under the Kyoto Treaty, the Clean Development Mechanism (CDM) is the main vehicle to attract carbon financing to the energy sector. While the selling price for the CO₂ credits is unknown and volatile, Mauritius can benefit from interesting annual cash flow if energy efficiency and renewable energy supply projects were implemented and carbon credits accordingly secured. In the same breath, carbon finance would be explored when putting up green buildings at the new city of Highlands.

7.5.2 The Energy Efficiency Unit (EEU) would develop expertise and run awareness programmes in carbon financing to help create as many CDM projects as possible in Mauritius. In addition, it is proposed to set up a system to allow international travelers to offset the carbon footprint of their flight to Mauritius with proceeds to be invested in highly visible, local sustainable energy

projects, which would allow passengers to see how their money is used. This project will be led by the EEU and would be carried out in the wider context of promoting sustainable tourism in Mauritius.

7.6 Energy Service Companies

7.6.1 Another strategy for financing the transition to a sustainable energy economy is the promotion of the establishment of Energy Service Companies (ESCOs), which are specialist energy efficiency companies investing in their clients' energy facilities to reduce costs, and share the resulting savings. This is a highly specialized field of business that has not yet developed in Mauritius. Use of ESCOs represents a 'win-win situation for the client, who achieves financial savings without making an investment, while the ESCO can reap dividends by investing in energy savings for third parties. The EEU would assess and propose the policy and legislation options to stimulate the emergence of this sector.

7.7 Environmental and Social Subsidies

7.7.1 The word 'subsidy', for the purpose of the long-term energy strategy refers to any Government financial support, including 'incentives', 'grants', 'breaks', 'benefits', 'special tariffs' and 'allocations'. The approach to subsidies in the energy sector would be reformed in the medium-to-long term. Targeted social and environmental subsidies would be introduced, with most of the subsidies going directly to deserving consumers, rather than utilities or consumers across the board, so as to help only those in real need who cannot afford to pay market prices.

7.7.2 A range of new subsidies in the following areas would be designed and put in place:

- Economic incentives for consumers who choose public transport over private transport
- Targeted subsidies to help low-income households and social institutions to afford energy, through assistance in developing ways of permanently lowering their energy bill, by promoting access to the use of compact fluorescent lamps, low-energy refrigerators and other household appliances, and the use of solar hot water systems
- Market incentives to promote the choice of sustainable energy products and services
- Introduction of fiscal incentives for energy suppliers to promote the choice of renewable and carbon-neutral options over fossil fuels

- Grants for targeted energy-efficiency or renewable energy initiatives through the MID fund based on well established criteria

7.7.3 Government strategy for any subsidy to the energy sector would be implemented through systems favouring energy efficiency and renewable energy supply investments. Government would also rely on the donor community to play an active role in facilitating environmental and social improvements, through programmes of technical assistance and the transfer of know-how to Mauritius.

7.7.4 In line with its long-term strategy to promote energy efficiency in all sectors of the economy, Government has already reduced as from July 2009 by half the excise duties, road tax and registration fees for electric cars and hybrid vehicles. Other such measures will be designed and implemented as and when technologies that favour energy efficiency and the use of renewable energy are available in the marketplace.

8.0 Energy Strategy and Gender Issues

8.1 Energy Use

- 8.1.1 Energy is critical for sustainable development and poverty reduction and is an essential element for the attainment of the Millennium Development Goals (MDGs). It has an important role in women's lives as regards their domestic responsibilities as well as their entrepreneurship, social and community activities. However, the gender aspect is often overlooked or inadequately addressed in designing energy policies and strategies.
- 8.1.2 For women, energy is a means of reducing their workload and their household expenditure and improving health and their quality of life. At the domestic level, women suffer heavy stress when there are increased fuel needs in households as they have to cope with less money for essential items. Exposure to smoke and particulates in households where women do not have access to electricity and use old cooking methods, affects women's health. Breakdown of electricity supply even for temporary periods means more work for women.
- 8.1.3 Women's empowerment and political development also depend on their mobility, access to evening study and attending community meetings or attending work. Lighting in public places benefit women by increasing their safety.
- 8.1.4 Women constitute the majority of operators in the informal sector focusing on activities such as textile, crafts, food processing, small scale farming and retail trading. Though these activities are small, they contribute to the household income and help to improve family life. Micro enterprises run by women are home based and their needs are often not taken into account in the overall energy policies. Energy costs represent a significant input for such enterprises, which may benefit from time and cost saving technologies and from mechanical applications to increase their profitability.
- 8.1.5 A study by the Institute of Development Studies of the University of Sussex has pointed out that "attempts to introduce ad-hoc energy services, such as photovoltaic home systems, have often failed. This is partly a function of remoteness, but more fundamentally because the delivery of spare parts and maintenance is not embedded in a proper system of 'intermediation'. Energy services have numerous indirect impacts on poverty and gender."
- 8.1.6 Women in vulnerable situation or living in poverty are most likely to be affected by disconnection of electricity for their incapacity to settle their electricity charges within the prescribed time.

8.2 Energy and Gender Equity

8.2.1 In Mauritius, as at end of 2008, the population stood at 1,272,040 comprising 628,105 males and 643,935 females. Housing, water, electricity, gas and other fuels' account for 9.8% of household expenditure. In 2007, the largest increases in CPI weights were registered in housing, water, electricity, gas and other fuels', up by 35 from 96 in 2001/02 to 131 in 2006/07. The two main sources of energy for households are electricity and LPG, representing 51% and 42% respectively of total energy consumed by households. A poverty analysis carried out by the Central Statistical Office in 2002 showed that poor households tend to use cheaper types of fuel such as wood and kerosene for cooking. It also showed that female headed households were more likely to be in poverty than male headed households.

8.2.2 Government acknowledges that energy should be a means for enhancing gender equity, because it affects livelihoods and makes a difference in life chances of men and women.

8.3 Gender and Energy Strategy

8.3.1 With a view to promoting the role of women in energy issues and energy use and to improve their general well being, the strategy of Government would focus on the following :-

- establishment of disaggregated data on impact of energy strategies on women needs energy usage and technologies which are reflected in the different energy needs;
- assessment of women access to energy through a comprehensive demand-side analysis on energy needs for the poor to support their livelihood, including the long-term basic energy needs of women;
- a proper assessment and integration of gender needs in the energy project cycle;
- capacity building programmes to enable women to participate in the energy sector through partnerships and networks among grassroots women, NGOs, and energy policymakers at the national and international levels;
- to stagger payment of electricity charges or to facilitate access to electricity for vulnerable groups;
- new policies for connecting and disconnecting electricity supply including the modalities for payments to take into account the needs of women from the vulnerable groups, who have irregular income flows;
- participation of women to contribute significantly in the adoption of less polluting fuels and technologies, particularly renewable energy resources such as wind and solar

power. Moreover, the decisive role of women in household and business, as consumers and energy entrepreneurs as well as managers, can to a greater extent achieve energy savings and energy efficiency objectives;

- electricity supply to public places to increase safety for women; and
- equal chances for women to participate actively in SIPP projects through information and awareness campaigns, access to technical information and incentive schemes.

9.0 ACTION PLAN

9.1 Introduction to the Action Plan

9.1.1 This Action Plan proposes distinct steps to pave the way for the implementation of the strategies laid down in this document with a view to changing to an energy efficient economy in line with the Government declared vision to promote sustainable development. The actions are described as follows:

- **Category** – Actions are categorized, to the extent possible, as Regulatory, Institutional, Renewable Energy, Energy Efficiency, Transport, Power Sector, Fossil Fuels, Industry and Tourism, Public Sector and Gender.
- **Action.** A short title for the action.
- **Description.** A short description on the important features of each action.
- **Target.** The year by which Action should be taken. A number of the measures are scheduled to be implemented in the early years of the Action Plan - 2010 to 2015. In fact, many actions have already been enunciated in the 2008 – 2009 budget speech to move towards a sustainable energy economy. However, many of the required institutions and practices are yet to be put in place and there are several practices embedded into the economy that would be progressively reformed.

9.1.2 The Action Plan will be reviewed and updated every three years to take into account new developments (technological or otherwise) and the setting up of new deadlines for actions brought forward or postponed.

ENERGY SECTOR ACTION PLAN

A. Regulatory

Action	Description	Target
Sustainable energy legislation	Enact Energy Efficiency Act	2009
	Proclaim new Electricity Act	2009
	Enact Sustainable Development (MID) Act	2012

B. Institutional

Action	Description	Target
Energy Efficiency Unit	Establish the Energy Efficiency Unit as a specialised governmentally-funded Unit to become a centre of excellence in the fields of renewable energy, energy efficiency, clean energy financing, programme management, promotion and awareness raising. The overall task of the Unit should be to 'mainstream' sustainable energy.	2009
Utility Regulatory Authority	Operationalise the independent multi sectoral Utility Regulatory Authority. The regulator should curtail the ability of the utility to achieve 'monopoly prices'.	2009
Land Transport Authority	Set up a Land Transport Authority to implement reforms for the transport sector.	2009
Certify Energy Auditors	Develop a certification systems for Energy Auditors and Energy Managers	2011
Energy management education	Develop professional courses in Energy Auditing, Energy Management, Monitoring and Targeting and sustainable building design.	2010

C. Energy Efficiency

Action	Description	Target
Subsidy reform	Establish the principle that global energy subsidies shall be eliminated. Instead, subsidies shall be targeted to vulnerable households for assistance.	2010 - 2015
Sustainable energy budget	Establish appropriate budget for the setting up of the Energy Efficiency Unit to implement effective programmes to help building an energy efficient economy.	2010
Targeted, well-designed grants	Introduce a series of targeted grants for energy efficiency or renewable energy initiatives.	2010
Incentives for energy suppliers	Introduce fiscal incentives to encourage energy suppliers to use renewable and carbon-neutral energy sources in preference to fossil fuels.	2010
Incentives for product labeling	Introduce financial incentives such as low-interest loans for consumers to purchase sustainable energy products and services.	2009
ESCOs	Provide incentives to promote Energy Service Companies (ESCOs) to assist clients to save energy as an economically viable option.	2012
Clean Development Mechanism	Attract financing to Mauritius for Clean Development Mechanism (CDM) projects, to release a potential 1.8 million tons of CO ₂ emissions savings per year from waste incineration, landfill gas, transport projects, solar hot water heaters, photovoltaics, wind energy, bagasse, ethanol and energy efficient lighting and appliances.	2010

Action	Description	Target
Sustainable building design	Introduce mandatory sustainable energy design standards for new buildings, including housing, hotels and offices, including natural ventilation; day lighting; appropriate orientation; insulation; double glazed windows; solar hot water systems; time-of-day or smart metering; intelligent lighting systems that are suitable for low-energy lamps; and building energy management systems (BEMS).	2012
Low-energy consumption	Pass legislation so that existing hotels and rented spaces make use of solar water heating systems, low-energy lighting and appliances and rented houses/apartments to use low-energy lamps as well as appliances of the highest energy efficiency label be replaced gradually.	2010
Solar hot water promotion	Introduce a range of complementary policies, incentives and disincentive programmes to promote solar water heating systems to achieve in a short-to-medium term the target of 50% households and businesses, and in the longer term near-eliminating the use of LPG and electricity for water heating purpose.	2012
Sustainable energy education	Introduce sustainable energy topics into the curriculum and provided appropriate teaching materials for schools.	2011
Public awareness	Run programmes as a permanent activity to create awareness of the benefits of energy efficiency, renewable energy and sustainable living, including information on incentives/deterrents and rights/obligations for consumers.	2010
Energy efficient public lighting	Commission a specialised study on energy efficient, safe public lighting, leading to a short-term action programme to eliminate energy-inefficient lamps, reconfigure lighting patterns as appropriate and address issues such as over-lighting.	2009

D. Renewable Energy

Action	Description	Target
Renewable Energy Master Plan	Finalise Master Plan for Development of Renewable Energy.	2010
Wind Energy Projects	Construction of wind farms at Curepipe Point, Plaine des Roches and Britania Installation of new wind turbines in Rodrigues	2011 2009/10
Bagasse Based Power Plant	Increase bagasse based energy from 350 to 600 Gwh	2013
Waste Management	Construction of a 20 MW waste-to-energy plant at La Chaumière. Construction of a 5 MW plant at Mare Chicose using gas from land fill site to generate electricity.	2013 2013
Hydro Power	Construction of mini hydro power stations on La Nicoliere Feeder Canal	2010

E. Transport

Action	Description	Target
Lower average age of vehicles	Regularly review and implement measures to lower the age and improve the composition of vehicle fleets.	2010
Public transport incentives	Introduce economic incentives to choose public transport over private transport.	2012
Modernisation Programme	Create high safety, comfort and cleanliness standards for new buses, which should all be low floor, multiple-entrance, air conditioned models, with minimum fuel efficiency standards and maintenance, inspection and emissions standards. As the maximum age of buses shall be 10 years, all buses will meet these standards within 10 years.	2010
Public transport information	Enhance bus and taxi service information.	2012
Taxi regulation	Introduce a transparent, published, regulated tariff for taxis, to make them more attractive.	2010
Optimise traffic flow	Monitor traffic and travel demand patterns to improve traffic flow, which also lowers energy use.	2015
Congestion charge	Introduce congestion charges in Port Louis, to encourage the use of public transport, discourage the use of private cars and reduce congestion.	2012
Curepipe - Port Louis Busway	Construct of Bus way.	2010
Ethanol - E10	Introduce E10	2012
Ethanol - E20	Carry out studies to determine whether and when E20 should become mandatory, taking into account the experience of the introduction of E10.	2014

F. Power sector

Action	Description	Target
Electricity pricing	Set cost-reflective electricity prices by the URA. Costs may also include support schemes for energy savings, for Demand Side Management and for renewables.	2010
Feed-in tariffs and net metering	Introduce preferential feed-in tariffs for electricity generation from renewable energy sources. Introduce 'net metering' for SIPPs as an economic incentive to install solar photovoltaic panels or micro-wind turbines.	2010
Time-of-day metering	Introduce time-of-day metering and tariffs that provide an economic incentive for customers to move daytime electricity loads to night time, hence increasing the overall efficiency of the power system.	2015
Time-of-day metering awareness	<p>Create consumer awareness of day/night tariffs, for example, washing clothes at night represents a cheaper and more sustainable lifestyle option.</p> <p>Introduce sophisticated meters for larger customers to provide better information about electricity use and costs.</p>	2015

G. Fossil Fuels

Action	Description	Target
Minimum stocks of petroleum products and coal	Introduce minimum stocks for petroleum products and coal.	2011
Low-sulphur diesel fuel	Introduce a national standard of 500 ppm for the sulphur content automotive and industrial diesel oil, making a substantial, immediate and noticeable improvement to air quality, and allowing the latest generation of small-engine diesel vehicles to be used in Mauritius.	2010

H. Industry and Tourism

Action	Description	Target
Encourage sustainable programme for Industry and Tourism Sectors	Create energy efficiency programmes such as voluntary agreements with industries; sub-sector technology and know-how transfer projects; training in specialist sustainable energy topics; awareness building, promotion and transfer of know-how; proposals for new financial and fiscal tools.	2010
Mandatory energy audits	Carry out as a legal obligation Energy Audits by licensed Energy Auditors for the largest companies and develop energy management plans.	2010
Sustainable tourism	Develop close working relationships between the Tourism Industry, the Land Transport Authority and the Energy Efficiency Unit, in the context that fuel security, environmental sensitivity and tourism goals are mutually reinforcing.	2010
Carbon offsetting	Create a carbon offsetting scheme that is well-publicised and visible/verifiable by the airline travellers who pay for them.	2015

I. Public Sector

Action	Description	Target
The Public Sector Leads the Way	Introduce sustainable energy projects for public sector (ministries, local government, schools, hospitals, police, the state-owned bus company etc), adhering to the principle 'The Public Sector Leads the Way'.	2009
Sustainable procurement	Introduce sustainable procurement as a mandatory practice for all public services, for example - lamps, computers, air-conditioning and fans, freezers, vehicles etc are energy efficient and have energy saving/stand-by modes and that all photocopiers and printers are equipped with a duplex mode to use both sides of the paper. The Energy Efficiency Unit should develop expertise in these areas and advise all public sector institutions.	2010

J. Gender

Action	Description	Target
Gender and Energy Use	Study on needs/assessment/capacity building for women, especially for the vulnerable groups.	2012

