

# *The Power to Change*



## THE MONTSERRAT ENERGY POLICY 2016 – 2030

Prepared for:  
Ministry of Communications, Works, Energy & Labour

January 2016

## LIST OF ACRONYMS AND ABBREVIATIONS

B/C Ratio	Benefit to Cost Ratio
CARICOM	Caribbean Community
CARILEC	Association of Caribbean Electricity Utilities
CCCCC	Caribbean Community Climate Change Centre
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CCS	Caribbean Community Secretariat
CDB	Caribbean Development Bank
CEP	CARICOM Energy Policy
CREDP	Caribbean Renewable Energy Development Programme
CROSQ	Caribbean Regional Organization for Standards and Quality
C-SERMS	Caribbean Sustainable Energy Roadmap and Strategy
DFID	Department for International Development
DOE	Department of Environment
DRM	Disaster Risk Management
ECE	Energy Conservation and Efficiency
EEBC	Energy Efficiency Building Code
EIA	Environmental Impact Assessment
ESCO	Energy Service Company
ESIA	Environmental and Social Impact Assessment
EU	Energy Unit
FS	Feasibility Study
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GIZ	<i>Gesellschaft für Internationale Zusammenarbeit GmbH</i> , or German Agency for International Cooperation
GPS	Global Positioning System
GW	Giga watt = $10^9$ watt
GWh	Giga watt hours
HFO	Heavy Fuel Oil
HPP	Hydropower plant
HRIP	Heat Rate Improvement Plan
ICT	Information and Communications Technology
IPCC	Intergovernmental Panel on Climate Change
IRP	Integrated Resource Plan
IRR	Internal Rate of Return
kW	Kilo Watt = $10^3$ watt
kWh	Kilo Watt hours
LOCIMAP	Low Carbon Industrial Manufacturing Park
LPG	Liquefied petroleum gas
MEPS	Minimum Energy Performance Standards

MATHLE	Ministry of Agriculture, Trade, Housing, Land and the Environment
MCWEL	Ministry of Communications Works Energy and Labour
MUL	Montserrat Utilities Limited
MW	Mega Watt = 10 <sup>6</sup> Watt
MWh	Mega Watt hours
NAMA	Nationally Appropriate Mitigation Actions
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
OECS	Organisation of Eastern Caribbean States
OLADE	<i>Organización Latinoamericana de Energía</i> , or Latin American Energy Organization
OTEC	Ocean Thermal Energy Conversion
REETA	Renewable Energy and Energy Efficiency Technical Assistance
RESIM	Regional Energy Statistics and Information Management
SOC	Standard Offers Contract
SWAC	Seawater Air Conditioning
SWRO	Seawater Reverse Osmosis
UK	United Kingdom
UNDP	United Nations Development Programme
USD	US Dollar
WTE	Waste to Energy
XCD	Eastern Caribbean Dollar

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## MESSAGE FROM THE PREMIER



### *Hon. Donaldson Romeo*

Montserrat needs to provide reliable, low-cost, energy services and, at the same time, combat climate change. So we have formulated a revised robust Montserrat National Energy Policy. This Policy is timely as Montserrat prepares to travel the road towards self-sustainability. An energy generation mix dominated by indigenous energy sources, efficient use of energy in all sectors and a twenty-first century energy infrastructure, will all be needed. The Policy represents the desire of the Montserrat people to improve the country for this generation and future generations.

The Montserrat National Energy Policy is built on four primary objectives. These are; an energy knowledgeable population; a modern energy infrastructure; a world-class example for renewable energy in small island developing states; all supported by robust governance, institutional, legal and regulatory frameworks.

To meet the goals and objectives of the Montserrat National Energy Policy the government and people of Montserrat, along with our regional and international partners, will place great attention and effort in our energy initiatives. This is a Policy that is of prime importance to the country and will be delivered.

My government and the people of Montserrat express our sincere thanks and gratitude to all who have played a role in the development of the Montserrat National Energy Policy. This includes the United Kingdom Department for International Development (DFID), the European Union (EU), the Caribbean Community and Common Market (CARICOM), the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Carbon War Room – Rocky Mountain Institute (CWR-RMI), the Clinton Climate Initiative (CCI) and Montserrat Utilities Limited (MUL). I commend the Hon. Minister Paul Lewis for his leadership in advancing this ambitious Policy.

Hon Donaldson Romeo  
Premier, and Minister of Finance,  
Economic Development and Tourism

## MESSAGE FROM THE MINISTER OF COMMUNICATIONS, WORKS, ENERGY & LABOUR



### *Hon. Paul Lewis*

As the Hon. Premier of the Government of Montserrat has indicated, we are exploring ways to develop renewable energy resources, and improved energy efficiency for our island nation. My target is to have a 100% renewable electricity generating capacity by 2020. Currently we are receiving assistance from both the Caribbean Development Bank and the UK's Department for International Development to provide reliable energy to help boost business and tourism. But this is only the first step in the transformation process.

Recent discussions in the Legislative Assembly explored the topic of 'Securing Montserrat's Energy needs both present and future'. This was of interest to the members of the Assembly, and also to the listening public, and allowed me, as Minister with responsibility for energy, to secure a number of energy initiatives.

The Premier has confirmed this Government's interest in working in a collaborative approach with local, regional and international donor and technical partners as we journey on Montserrat's energy transition pathway. Together our ambition is to deliver on our target to turn our country around from 100% fossil fuel dependency to 100% renewable energy generating capacity.

Although we are only small, we want to benefit from the bigger ideas and new technologies that have worked elsewhere. Our regional and international partner's networks and access to knowledge will help deliver cost effective business solutions that will remove our reliance on fossil fuels and build technology with low carbon options. Cheap, available, reliable, renewable energy will help boost business and tourism, driving our economy forward.

Montserrat is a small island and a big-hearted nation. I look forward to achieving our goals in the context of a meaningful and effective responses to reduce our carbon emissions; develop indigenous, renewable energies; and use our energy efficiently and effectively.

Yours sincerely,

Hon Paul Lewis  
Minster of Communication, Works,  
Energy and Labour

## 1. RATIONALE FOR THE NATIONAL ENERGY POLICY

This document presents the Montserrat Energy Policy for 2016-2030, which is structured and designed to ensure that by 2030, Montserrat has:

***“Reliable, low-cost, sustainable provision of energy services matched to the societal and development needs of Montserrat over time, equitably provided to all sectors of the society, and based on robust, diverse energy sources and distribution systems that utilize appropriate generation technologies.”***

The Montserrat Energy Policy 2016 – 2030 is built on a number of fundamental elements

- An energy sector that contributes to the international competitiveness of the productive sectors of the economy
- An energy sector that provides reliable, affordable energy supplies to all consumers with the capacity to meet long-term growth in demand. An energy sector that is environmentally sustainable and built on the complete use of cost-effective renewable energy sources. An energy sector that is supported by high levels of awareness among Montserratians of the importance of energy and its use in their daily lives and the contribution that each individual can make towards energy conservation efforts, thereby supporting the sustainable energy goals of Montserrat
- An energy sector in which there is reduced energy intensity through the efficient production, delivery and use of energy, supported by increasing application of appropriate energy efficiency technologies and better energy management practices.
- An energy sector that is based on comprehensive, planning-based and research driven approaches to energy transition, including implementation of pilot and demonstration projects, based on successful models so that individual clean energy projects are part of a fully integrated, climate-resilient energy transition toward clean sustainable energy for all. An energy sector with an appropriate institutional framework to support and facilitate the effective implementation of the policy supported by all relevant stakeholders, including the public and private sectors, educational institutions and non-governmental and community based organizations.

The implementation of the Power to Change, the Montserrat Energy Policy 2016 – 2030, will help the Montserrat economy become more productive, competitive and resilient.

## 2. OBJECTIVES OF THE NATIONAL ENERGY POLICY

The Policy represents the desire of the Montserratian people to improve the country for this generation and future generations.

There are four primary objectives of the Montserrat Energy Policy

1. Montserratians are well aware of the importance of energy conservation, use energy wisely and continuously pursue opportunities for improving their use of energy, with key economic sectors embracing eco-efficiency.
2. Montserrat has a modern energy infrastructure with clean and secure generation capacity, ensuring that energy supplies are reliably and affordably available in homes, communities and the productive sectors on a sustainable basis.
3. Montserrat is a world-class example for renewable energy use, providing secure energy supplies at internationally competitive prices and a small carbon footprint, capable of supporting medium- and long-term economic growth, social development and environmental sustainability.
4. Montserrat has a well-defined and established governance, institutional, legal and regulatory framework to support the future developments in the energy sector, underpinned by high levels of consultation and citizen participation in this sector that is the “cornerstone” of the plans to restore prosperity and sustainability to the island.

The primary objectives are supported by supplemental objective components:

***Increase energy efficiency and conservation:*** The Government will increase energy efficiency and conservation where economically viable leading to a reduction in fossil fuel import and ensuring energy access to all citizens.

***Improve domestic energy supply:*** The Government will secure efficient energy, including electricity supply, integrating renewable energy where practical and economically feasible.

***Improve end use sectors:*** The Government will take action to utilize and encourage sustainable energy practices within the individual economic sectors of Montserrat. This entails a reduction in energy consumption per unit of economic output in all sectors of the economy.

***Foster institutional strengthening:*** The Government will take the necessary actions to restructure administrative sectors and ensure the institutional requirements to enable an energy transition. This includes the use of regulatory and fiscal measures to encourage renewable energy generation and energy efficiency measures. Lowering the cost to the citizens will require the structural reformation of government’s administrative apparatus and procedures.

## SPECIFIC POLICIES FOR ENERGY TRANSITION AND USE

Sections 3, 4, 5 and 6 set out how the Government of Montserrat (GOM) will pursue the objectives of the policy in the areas of fossil fuel management, electricity supply and energy efficiency throughout all sectors of the island's economy.

### 3. POLICIES FOR ENERGY EFFICIENCY AND CONSERVATION

The Government of Montserrat's policy is to encourage and direct more efficient use of energy in all sectors of the economy through conservation, the use of energy efficiency technologies and better demand-side management and energy use in buildings. GOM will collaborate with the Montserrat Utilities Limited (MUL) to implement its policy by:

- Creating public education programs aimed at the improvement of energy consumption patterns of all consumer classes in end-use sectors
- Researching the consumption patterns of all sectors to improve conservation and energy efficiency practices
- Creating energy performance standards and energy labels to encourage the use of energy efficient appliances and technology by all consumers and sectors of the economy
- Requiring retailers to inform customers on energy efficiency appliances and provide energy labels
- Collaborating with the Ministry of Agriculture, Trade, Housing, Land and the Environment (MATHLE) to assess the short, medium, and long term impacts of energy efficiency and conservation efforts
- Developing and improving energy building standards to be enforced through the establishment of Energy Efficient Building Codes (EEBC)
- Incentivizing and conducting energy audits for existing private and public sector buildings
- Providing fiscal incentives for individuals and businesses to conduct energy audits and utilize energy efficiency products
- Restructuring the portfolio of energy services offered by MUL to operate as an Energy Service Company (ESCO)
- Reporting energy efficiency progress in yearly national economic reports and statistics to establish national benchmarks for energy use
- Reducing carbon dioxide emissions associated with electricity production and consumption in all sectors of the economy
- Working with Latin America Energy Organization (OLADE) to collect data and manage information on energy efficiency gains from various stakeholders, including MCWEL and MUL and publish reports including indicators of successful energy efficiency implementation

#### 4. POLICIES FOR ELECTRICITY SUPPLY

Currently, Montserrat's electricity supply is 100 percent diesel based and the price of electricity averaged EC\$ 1.30 /kWh (US\$ 0.49/kWh) in 2014. The Government of Montserrat's policy is to provide reliable, low-cost sustainable energy services through energy efficiency, and the strategic substitution of imported fossil fuels with domestic renewable energy sources. A top priority for the government is to minimize the total system costs of electricity throughout the island's transition to 100 percent renewable energy. Montserrat has a total peak demand of 2.1 MW on a grid with a capacity of 5.4 MW. GOM will collaborate with the Montserrat Utilities Limited (MUL) to implement its policy to:

- Encourage the increased efficiency in power transmission and distribution to lower operating costs for the utility and ensure no losses are passed onto the customer base
- Establish line loss targets and regional utility benchmarking system in coordination with the Association of Caribbean Electric Utilities (CARILEC)
- Establish heat rate improvement program (HRIP) to sustain efficient operation of thermal generation throughout the transition to 100 percent renewable energy based supply. This will include the development of dispatch protocol based on discovered and utilized energy resources
- Establish an Integrated Resource Plan (IRP) for the next 20 years of electricity production to identify least cost pathways and optimize resource utilization
- Work in collaboration with Caribbean regional programmes for energy planning to ensure advanced energy system models are utilized to provide decision making analysis
- If appropriate, establish a task force and protocols for the selection of distributed renewable energy generation through Standard Offers Contracts (SOCs) for self-generation. This task force will oversee tariffs, integration impact assessment, and approvals of any distributed generation. Distributed generation and prosumers will be at the discretion of the Montserrat Energy Unit after an island wide distributed energy grid stability study
- Research the impacts of demand side management and self-generation on the business model of the utility

#### Public Awareness

- Collaborate with Regional and International partners and governments to develop an energy curricula for the local school system
- Develop renewable energy awareness programmes, knowledge workshops and seminars for Government employees via the Montserrat Energy Unit and MUL
- Develop energy awareness and capacity building campaigns via social media, newspapers, radio and television broadcasting

#### Solar Energy

- Collaborate with the CARICOM Secretariat as well as development partners to identify technical requirements for integrating grid-tied solar power into the conventional diesel power system
- Catalogue government owned facilities and institutions with critical loads to be met by solar energy pilot projects such as hospitals, schools, the local abattoir
- Identify any potential off-grid opportunities for government owned or local businesses
- Identify the opportunity for solar thermal energy technologies and create fiscal incentives to promote their disbursement in the residential, commercial and industrial sectors of the island and public buildings



**Picture 1: Photovoltaics and Crown Land Earmarked for Solar Development**

### Wind

- Collaborate with development partners to conduct wind resource assessments of the island and document the island's wind regime
- Create and maintain a database for wind maps and wind data to be periodically updated

### Geothermal

- Collaborate with development partners to continue the development of the geothermal potential of the island
- Work with the United Kingdom Department for International Development (DFID) to complete the drilling of three geothermal wells and identify a reinjection site
- Review current legislation and establish new legislation for the definition of the resource and the ownership and use of that geothermal resource.
- Establish a complete legislative framework for geothermal energy use over the next 40 years
- Collaborate with development partners to procure geothermal expertise for all phases of the procurement process
- Conduct techno-economic feasibility studies to evaluate parameters for commercial geothermal development, plant sizing, grid integration and optimization within Montserrat's establish electricity system
- Facilitate the design, construction and operation of plant that meets country's demand
- Build national human capacity to support the plant
- Develop a roadmap for geothermal expansion and low carbon technology and product exportation



*Picture 2: Geothermal Well (MON1) in Montserrat and Geothermal Plant (Philippines)*

### Waste to Energy

- Identify the potential waste-based technologies to utilize for Montserrat’s waste
- Conduct studies on the island’s waste stream and characterization.
- Develop an integrated resource management program for waste
- Create public awareness programs to promote better waste practices
- Conduct feasibility studies on the use of organic waste, agricultural residues, liquid effluents and municipal waste for power generation

### Promoting Hydrogen and other Fuel Production

- Utilize excess geothermal energy to produce hydrogen and other global commodities such as methanol
- Conduct feasibility studies to assess Montserrat’s potential to be a net exporter of hydrogen to the fuel cell industry

### Other technologies

The GOM intends to explore other opportunities for renewable energy and their suitability for the island’s context. These include marine technologies such as desalination, Sea Water Air Cooling (SWAC) and Ocean Thermal Energy Conversion (OTEC). The GOM will continue to follow international developments and progression in global technologies. The GOM also sees the opportunity to establish the island as an area for research and design into new technologies. In addition, the experience of Montserrat and volcanology presents a unique opportunity for regional and global learning. The GOM intends to establish a Center for Excellence and educational opportunities for renewable energy, energy efficiency, building community resilience and effective disaster risk management (DRM).

The GOM will work to develop and incorporate information and communications technologies into the energy transition. This requires working closely with development partners and regional organizations such as the Association of Caribbean Electric Utilities (CARILEC) to communicate energy best practice throughout the region.

The GOM will work to replace all streetlights on island with solar and Light Emitting Diodes (LED). This initiative will allow the GOM to illuminate areas along the road system thus increasing safety and reducing consumption of energy.

Smart Grid development will be a priority for the GOM, As such, the government will work with regional development partners to develop regional and national roadmaps for the implementation of smart grids. This will depend on the development of energy regulation to foster smart grid development, public awareness campaigns and establish Montserrat within as a center for excellence where regional skills can be developed. Smart Grids and renewables may also play a key role in emergency response mechanisms for the island.



*Picture 3: LED Retrofit and Solar Street Lighting*



*Picture 4: Volcanic Activity Monitor Siren Powered by Photovoltaics on the outskirts of Plymouth and the No Entry Zone*

## 5. POLICIES FOR END USE SECTORS

The Montserratian economy has a variety of economic sectors with their own needs as end users of indigenous energy. These sectors are: Transport, Agriculture, Industrial and Commercial, Domestic, Tourism and Hospitality. Sector-specific provisions will help the Government of Montserrat to refine efforts for a national transition.

### Transport Sector



*Picture 5: Solar Car Port and Electric Vehicle Charging Stations*

The Government of Montserrat (GOM) will identify policy opportunities and strategies for sustainable transportation practices. The government will collaborate with all ministries on refining their initiatives. The GOM will collaborate with all stakeholders to implement its policy to:

- Develop a robust and integrated transportation sector
- Improve the efficiency with which fuel is utilized through conservation and demand management programs
- Establish energy baseline for vehicle stock in Montserrat
- Promote the development of electric, hybrid electric, and advanced vehicle technologies
- Conduct studies on the regulatory changes, infrastructure development, and potential incentives for green transport
- Conduct feasibility and cost benefit analysis and implementation scenarios for effective public transport
- Procure private partners to implement business plan for public transportation through Public Private Partnership (PPP)
- Establish transportation emission standards for vehicles imported to the islands
- Amend legislation and implement tariffs for fuel efficient vehicles
- Improve the efficiency cost-effectiveness of the public transport system
- Implement strategic plan for integrated transport planning, route selection and decision support
- Utilize Information and Communications Technology (ICT) tools such as Geographic Information Systems (GIS) and Geographic Positioning Systems (GPS) to make transportation routes more energy efficient
- Facilitate public awareness campaigns and stakeholder dialogues to promote efficient transportation
- Investigate the potential for using renewable energy in the ferry system to Montserrat

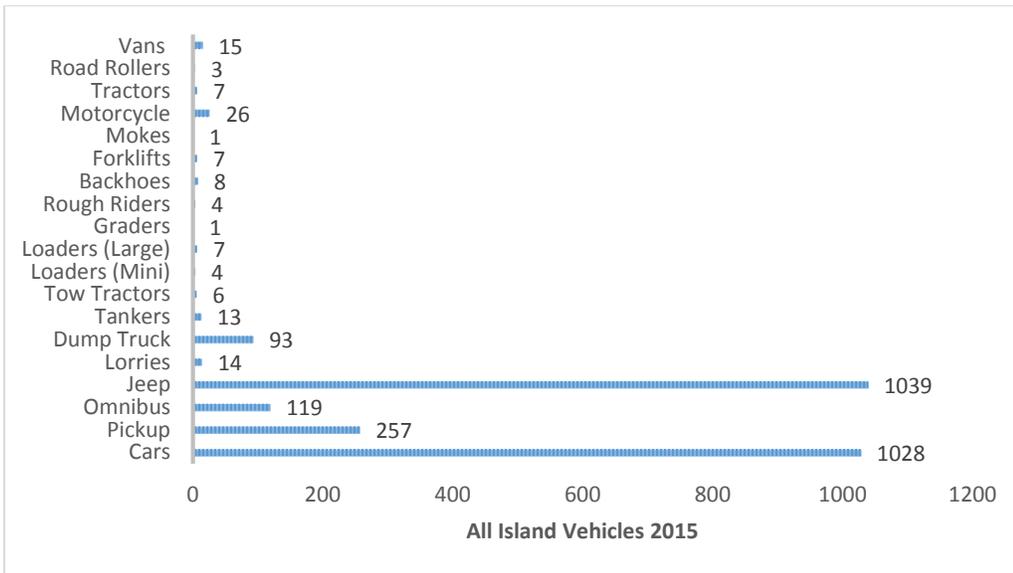


Figure 1: Breakdown of all vehicles in Montserrat by type for 2015. Prepared by: Statistics Department, Ministry of Finance and Economic Management (MoFEM).

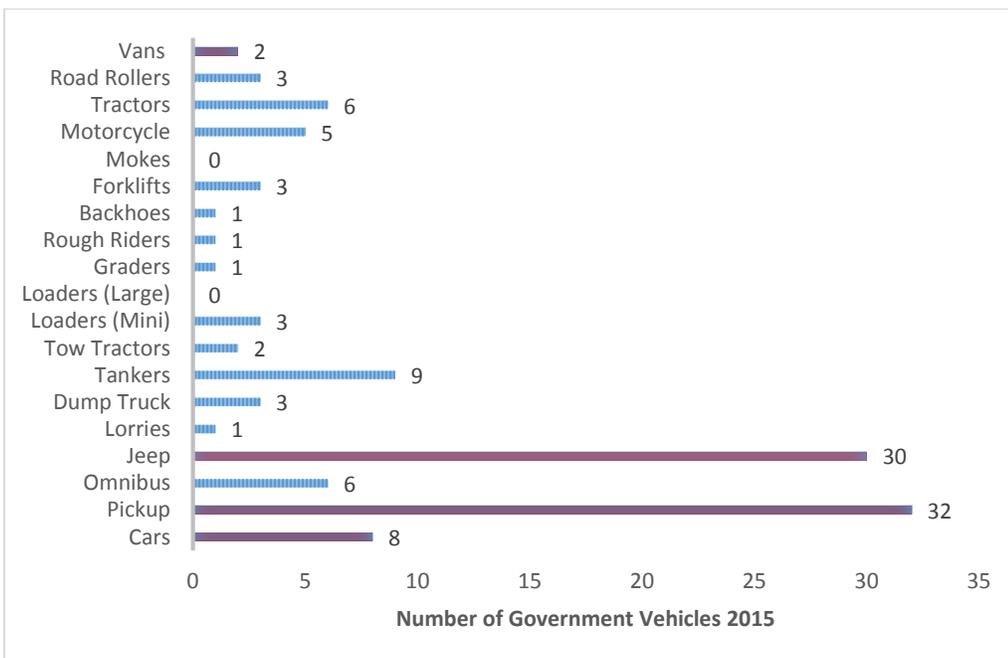


Figure 2: Breakdown of all Government Owned Vehicles in 2015 by type. Prepared by: Statistics Department, Ministry of Finance and Economic Management (MoFEM). The highlighted vehicles will be the first select group to be replaced depending on technologies.

### Agricultural Sector

The Government of Montserrat (GOM) will identify policy opportunities and strategies for sustainable agricultural practices. The government will collaborate with the Ministry of Agriculture, Trade, Housing, Land and the Environment (MATHLE) on such initiatives. The objective is to promote energy efficiency in agricultural methods and utilize renewable energy where possible within the sector. MCWEL will collaborate with the MATHLE to implement its policy to:

- Conduct studies on agricultural best practice and energy efficiency practices
- Identify energy efficient methods of irrigation and water storage
- Implement food storage methods that are energy efficient
- Design and recommend a strategy for Efficient Energy Use in Agriculture
- Develop targeted educational campaigns and training for farmers around best practice
- Utilize renewable energy for farming practices where possible
- Identify the potential for equipping the local abattoir with renewable energy
- Create incentive program for farmers to use energy efficiency and renewable energy in their operations

### Industrial and Commercial Sector

Since the volcanic disaster started in 1995, Montserrat's economy has been limited with few exports. The Government of Montserrat (GOM) plans to expand and diversify the economy utilizing renewable energy as an indicator of a progressive energy system to attract foreign investors. The objective is to market the island as a green economy to promote commerce and industry. The GOM will collaborate with development partners and the Office of the Premier to:

- Encourage sustainable methods of operation like waste reduction, material re-use and recycling
- Incorporate energy best practice into all aspects of business
- Design and implement targeted education programs to disseminate knowledge on the benefits offered under a new Energy Conservation and Efficiency Policy (ECEP) and Action Plan (ECEAP) with a focus on commercial buildings
- Conduct demand analysis for future and current scenarios of industrial and commercial activities
- Implement voluntary industrial and commercial energy efficiency standards
- Support and develop a Low Carbon Industrial Strategy
- Develop Low Carbon Industrial Manufacturing Parks (LOCIMAP)
- Utilize regional models to develop tax incentives for attracting future development

### Tourism and Hospitality Sector

The government plans to make the tourism and hospitality sector a low carbon footprint sector and demonstration to the rest of the world. A strong focus will be on making buildings energy efficient with minimum energy performance standards and certification for the industry. GOM intends to market the island as an eco-friendly tourism destination, and will:

- Conduct energy audits of accommodation stock
- Create business plans for hospitality and tourism establishments
- Create programs for employee energy awareness
- Revise tax legislation to provide incentives for energy efficiency and renewable energy
- Implement a retrofitting program for guest houses and hotels
- Incentivize for energy using tariff modifications
- Develop a certification and recognition program for efficient resource use in the sector
- Identify ways for tourism establishments to implement renewable energy into business

### Domestic Sector

The domestic sector is responsible for 53% of electricity consumption in Montserrat. The Government of Montserrat (GOM) will work households to ensure they have access to diversified supply of energy efficiency appliances. Campaigns to promote responsible energy use will be at the forefront of GOM's policy. The GOM will collaborate with MUL and development partners to:

- Conduct demand side analysis to understand consumption patterns within the sector
- Catalogue energy efficient appliances suitable for Montserrat's energy system
- Establish an energy baseline for the sector to measure improvements against
- Offer home energy audits
- Collaborate with stakeholders to design and implement energy awareness campaigns to promote energy efficient products, best practice and the progress of the renewable energy transition
- Adopt standards for the promotion and use of efficient lighting, refrigeration, air conditioning
- Adopt the framework for regional energy performance standards
- Collaborate with regional and international partners to develop the standard for solar water heater use in Montserrat
- Identify and implement fiscal incentives for energy efficient products, passive solar thermal systems and public buy in
- Establish the regulatory and legislative framework to support energy efficiency, conservation and renewable energy within the domestic sector



*Picture 6: Montserrat Housing Community in Davy Hill*

## 6. POLICIES TO FOSTER INSTITUTIONAL STRENGTHENING

The Government of Montserrat (GOM) will build the necessary institutional framework to facilitate an energy transition to 100 per cent renewable energy. This tasks will require structural changes within the Government's framework of agencies coupled with the development of new regulations, legislation and policies. The GOM wants to build an adaptive model of governance that facilitates the energy needs of its citizens. The Ministry of Communications, Works, Energy and Labor (MCWEL) has the current portfolio responsible for energy developments within the country. However, the GOM will work to create the Montserrat Energy Unit (MEU) dedicated to all energy matters and implementation on island. This is one of the first tasks at hand for the GOM in moving towards 100 percent renewable energy. The GOM will collaborate with regional and international development partners to:

- Build an adequately staffed and empowered energy unit
- Facilitate training opportunities for officers within the energy unit
- Create a transparent legal framework to include the Montserrat Energy Unit (MEU)
- Provide the legislative, institutional and financial support for implementation of the Montserrat Energy Policy (MEP)
- Take administrative actions to prioritize the needs of the Montserrat Energy Unit
- Hire staff with the adequate skill sets for the implementation of renewable energy
- Collaborate with the CARICOM Secretariat to develop energy statistics and information management and create performance indicators for the MEU
- Build human capacity in coordination with other government agencies
- Form cohesive policies in collaboration with the policy agenda of other government agencies
- Support fiscal and economic measures to successfully implement the MEP
- Maintain an Expert's Database of external consultants capable of conducting implementation tasks and planning
- Create a dedicated desk for geothermal energy within the Montserrat Energy Unit
- Collaborate with the Ministry of Finance to conduct studies such as cost benefit analysis, tariff reviews and economic assessments
- Conduct due diligence on the ramifications of new energy tariffs and import tariffs
- Collaborate with MATHLE to assess best practice in Environmental and Social Impact Assessments (ESIA) for large scale energy projects
- Montserrat Energy Unit will monitor the planning, implementation and commissioning of energy projects on island
- Implement an Energy Efficient Building Code (EEBC) and Energy Standards and Labeling for appliances
- Promote regional coordination and workshops
- Align with the CARICOM Regional Organization for Standards and Quality (CROSQ) standards and create a national standard to be enforced through the Montserrat Energy Unit
- Secure the funding for implementation of the MEP
- Develop Nationally Appropriate Mitigation Actions (NAMA) and climate change strategy
- Design project documents, applications, terms of reference to procure international funding support
- Constantly engage with stakeholders to gain feedback on the performance and initiatives of the Montserrat Energy Unit

## APPENDICES

### Appendix A: Country Profile

Montserrat is a small island developing state of 102.6 square kilometers situated in the Leeward Island chain of the Eastern Caribbean. Montserrat lies between 16°40' and 16°50' North Latitude and 62°9' and 62°15' West Latitude between Antigua and Guadeloupe. Montserrat is one of fourteen territories described as British Overseas Territories. This means the island is dependent on the United Kingdom and does not possess full political independence. Such territories receive economic aid from the United Kingdom's Department of International Development (DFID).

Montserrat has a population of approximately 5215 people<sup>1</sup>. In 1995, the Soufriere Volcano which is located in the Southern part of Montserrat erupted after a long period of silence. This catastrophe resulted in the destruction of the southern part of the island including the capital Plymouth. This period of volcanic activities lasted until about 2003. More than half of the former population left the island to other countries as a result of this series of eruptions. Currently, the population growth in the last 5 years averages 0.2 % per annum<sup>2</sup>.



*Picture 7: The Soufriere Hills Volcano and No Entry Zone*

Montserrat became a full member of CARICOM since the 1<sup>st</sup> May 1974 and continued to become a member of the OECS. As such, the island has received technical and financial assistance in areas such as education, health care, technology, disaster management and law.

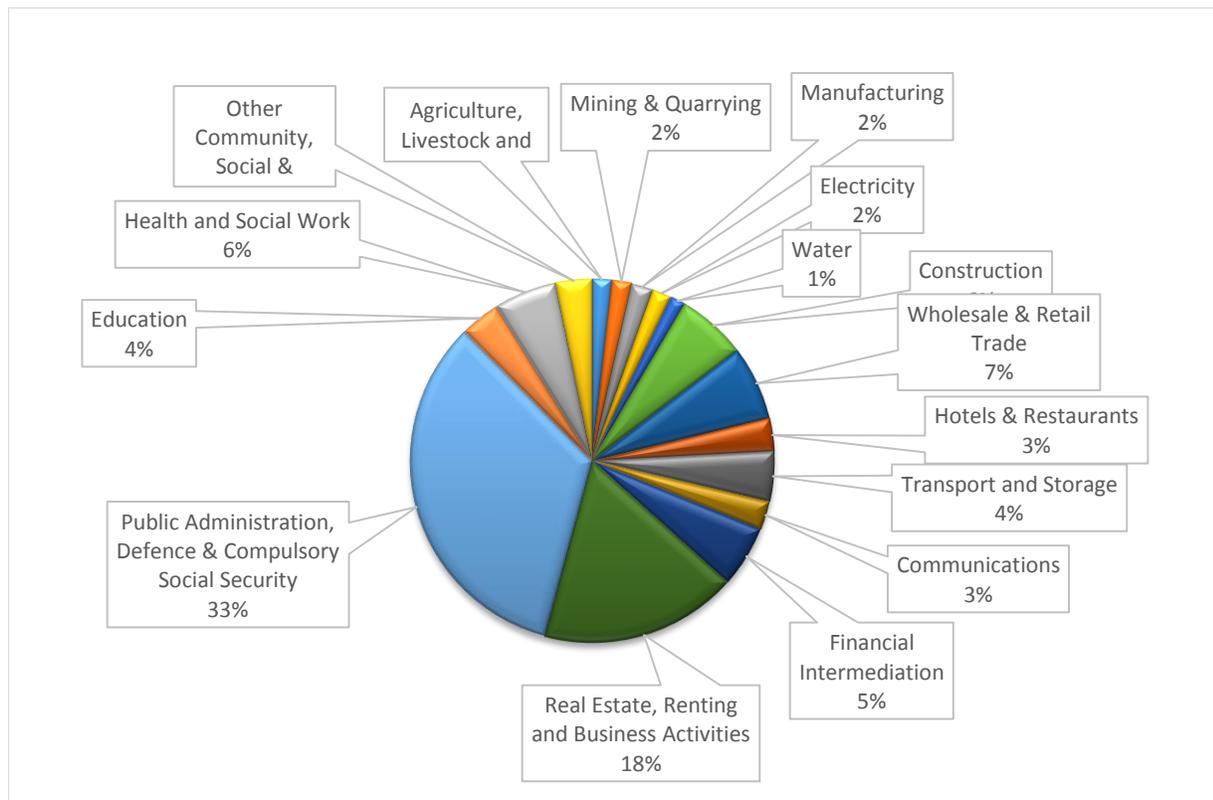
Despite its small size, the ecological/biological resources of Montserrat are of national, regional and global conservation importance because they support inter alia assemblages of single-island and regional endemic species of fauna and flora, as well as eight globally threatened vertebrate and plant species.

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<sup>1</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat

<sup>2</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat

## Economic Activities



**Figure 3: Percentage Contribution of Economic Sectors to Gross Domestic Product<sup>3</sup>**

Economic activities in Montserrat are consisting of agriculture, industry and services including tourism. The severe volcanic activity has put a damper on this small, open economy. The catastrophic eruption in June 1997 closed the airport and seaports, causing further economic and social dislocation. Two-thirds of the 12,000 inhabitants fled the island. Some began to return in 1998 but a lack of housing limited the number of returners. The agriculture sector continued to be affected by the lack of suitable land for farming and the destruction of crops. Today, prospects for the economy depend largely on developments in relation to the volcanic activity and on public sector construction activity. Half of the island's landscape remains uninhabitable.

In January 2013, the EU announced the disbursement of a \$55.2 million aid package to Montserrat in order to boost the country's economic recovery, with a specific focus on public finance management, public sector reform, and prudent economic management<sup>4</sup>.

<sup>3</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat and Delta Petroleum Limited, Montserrat

<sup>4</sup> European Union Delegation to Barbados and the Eastern Caribbean – Press Release No. 4/2013

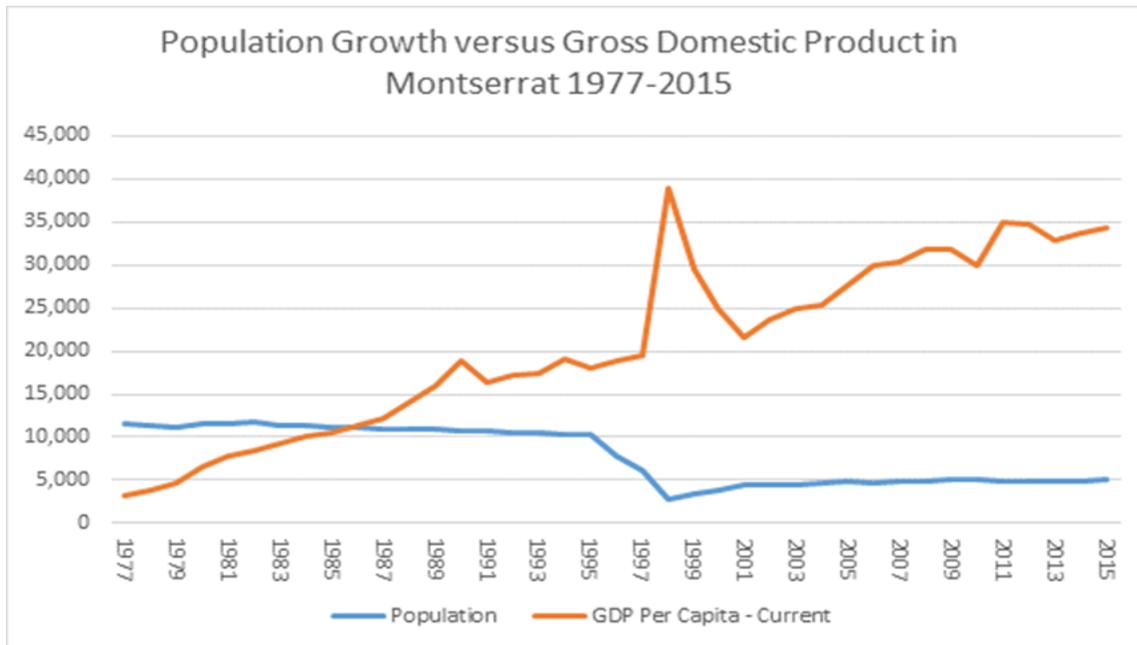


Figure 4: Population Growth versus Gross Domestic Product from 1977-2015<sup>5</sup>

Montserrat like many small island developing states is economically, socially and physically vulnerable by its very nature. That is, the island is:

- economically remote
- import-dependant as it is unable to produce all the goods and services to meet domestic needs
- dependent on tourism and overseas aid to generate foreign exchange to balance this demand for imported goods and services
- land constrained due to its small physical size and partly banned because of the volcano
- affected by impacts of climate change, as sea level rise, changes in the intensity and perhaps frequency of extreme weather events, more severe storm surge and change in rainfall patterns

The National Energy Policy (NEP) of Montserrat was drafted in 2008 for the period until 2027. This NEP already suggested the advancement of renewable energy and energy efficiency development. When drafted in 2008, geothermal and wind energy development was prioritized in the energy action plan over 5 years from 2008 to 2012 which was called Wave 1. The following 5 year-periods dealt with transforming the transport sector (Wave 2), future energy options (Wave 3) and greening Montserrat's economy (Wave 4). Apart from 2 geothermal well drillings and wind studies no physical investment activities have been implemented. Especially a designated Energy Unit had not been implemented as foreseen in the NEP.

<sup>5</sup> The 1995 disaster saw the reduction of the population to below half the original size. GDP when observed as a metric in itself looks high for a small nation. However this is provided through assistance from the United Kingdom to help rebuild the country and maintain economic activity since the mass exodus of most citizens. As demonstrated in Figure 3: Percentage Contribution of Economic Sectors to Gross Domestic Product most of the GDP is utilized in public administration and real estate. A switch to fossil fuels may reduce the funds spent on the import of fossil fuel products thus building resiliency and providing the opportunity for investment in green industries on island. The objective is to market the islands indigenous energy to attract investors and encourage the return of Montserrattians to their home.

Recent moves by the government of Montserrat to support investment in large geothermal production will respond to the challenges to the economy coming from emigration and the crackdown on offshore financial centers. Through 2017, it is believed that the expansion of the geothermal energy sector could keep real GDP growth positive given the size of the investment relative to the island's economy. Thereafter, however, Montserrat's real GDP might enter an extended period of contraction as poor infrastructure and competition from the rest of the region tempers expansion of the island's tourism industry.

In addition, the growth of the offshore financial sector, which has supported the Caribbean countries' growth, will be limited as the US, UK and EU implement crackdowns and threaten sanctions on countries where financial regulation is deemed too weak. These factors leads to 2015 and 2016 real GDP growth forecasts of 1.5% and 1.0% before the economy could enter a period of prolonged recession, averaging a 0.8% contraction between 2017 and 2019. "Greening" the economy of Montserrat based on a sustainable and affordable energy production and efficiency could be a pathway for avoiding economic still-stand.

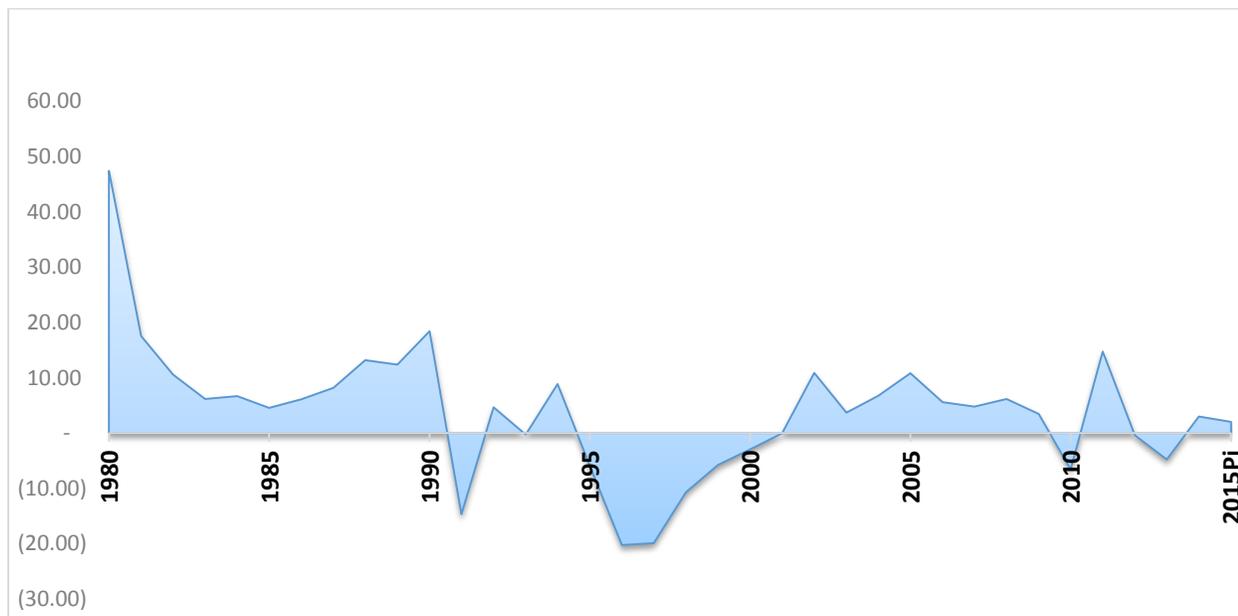


Figure 5: Growth Rate of Montserrat from 1980 to 2015<sup>6</sup>

<sup>6</sup> Montserrat has experienced contractions in growth that coincide with global events such as the 1991 recession. More noticeable is the fall out of the 1995 volcanic disaster where the growth rate reached a low of -20 growth. This contraction lasted until 2001. Again in 2010, Montserrat faced the fallout of the global economic recession and high fuel prices of the 2008-2009 global oil crisis. This was exacerbated by the 2010 volcanic activity and eruption.

Population	5.215
Population per sq. Km	51
Population growth (%)	0.5%
Literacy rate (%)	99
Life expectancy (years)	74.14
Land area (km <sup>2</sup> )	102.6
GDP (US\$ million, PPP)	83.7
GDP real growth	3.5 %
GDP per capita (US\$, PPP)	8.500
Consumer electricity price (US\$ per kWh)	0.49

**Table 1 Montserrat Key Country Data<sup>7</sup>**

## Appendix B: Overview of the Energy Situation

Like the majority of CARICOM countries, Montserrat is ideally suited for development of cost-effective, indigenous renewable energy systems, with significant geothermal, solar, wind and other resources. Nonetheless, the existing energy supply continues to be completely dependent on imported fossil fuels; the country has high levels of electricity coverage with operational efficiency but increasing maintenance costs. It also experiences high supply costs because of limited load concentration, relatively high cost of low volume generation plant and high fuel transport costs. Montserrat has a vertically integrated electricity utility, Montserrat Utilities Limited (MUL), which handles the electricity needs of the island. However, because of the small size and limited institutional capacity in Government for energy planning and energy management, the regulation of energy remains elementary.

The price of electricity (July 2015) in Montserrat is around XCD 1.00 (USD 0.37) per kWh, which is among the highest in the Region<sup>8</sup>. A significant portion of the cost can be attributed to the fuel surcharges of around XCD 0.50 (18.5 cents USD) per kWh, which – even in the current period of “low” global oil prices – constitute half of the charges<sup>9</sup>. The importation of expensive diesel for power generation is causing high electricity bills and concomitantly, increases the overall cost of living to Montserratians and reduces the attraction of Montserrat to energy-intensive sectors. Under the existing energy situation, the paying of energy bills has been difficult and continues to divert funds from other needs related to maintaining the level of economic status on the microeconomic level whilst inhibiting the ability of the country to address its goal of growth and development on the macro-scale.

Over the last five years, there has been collaboration between the Government of Montserrat and the UK Department for International Development (DFID) in addressing the unsustainable energy situation in the country but much of the focus in the proposed transformation of the energy sector in Montserrat has been on the substitution of “imported diesel” with geothermal power generation. Only recently, however, has cost-effective solar PV and wind options, as well the

<sup>7</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat

<sup>8</sup> Montserrat Utilities Limited (MUL)

<sup>9</sup> Montserrat Utilities Limited (MUL)

critical areas of energy efficiency and energy conservation, been investigated more thoroughly to provide affordable alternatives and significant opportunities to reduce diesel imports.

This requires simultaneous pursuance of the “twin objectives” for 1) **improvement in power generation, and end-use reliability and efficiency**; and 2) **increasing the share of power generation provided by indigenous renewable sources**, focusing initially on an integrated mix of geothermal and solar. Wind and (possibly) waste, might assist in any further diversification of energy and in dealing with local geographical issues.

### Current Profile of Montserrat's energy

The following provides a snapshot of Montserrat's energy sector and sets the base for the goals and strategies that have been articulated in this Energy Policy. Montserrat's energy sector can be described as being completely (100%) dependent on fossil fuels, with high per capita carbon emissions – 12.98 tons per capita – and looking at figures for 2011 Montserrat was in the worst 20 in the world<sup>10</sup>.

There are three primary sources of fossil fuel energy:

- Cooking Gas (Liquid Petroleum Gas) for domestic consumption in cooking appliances LPG
- Diesel for heavy vehicles, the Ferry, and for the generation of electricity DSL
- Gasoline (petrol for cars and light vehicles) GSL

All of these are imported onto Montserrat by Delta Petroleum Limited. Sales across 2014 and 2015 have been fairly consistent at<sup>11</sup>:

- LPG 165,000 Imperial Gallons
- DSL 1,200,000 Imperial Gallons
- GSL 750,000 Imperial Gallons

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<sup>10</sup> World Bank - CO2 emissions (metric tons per capita) 2011 data

<sup>11</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat and Delta Petroleum Limited, Montserrat

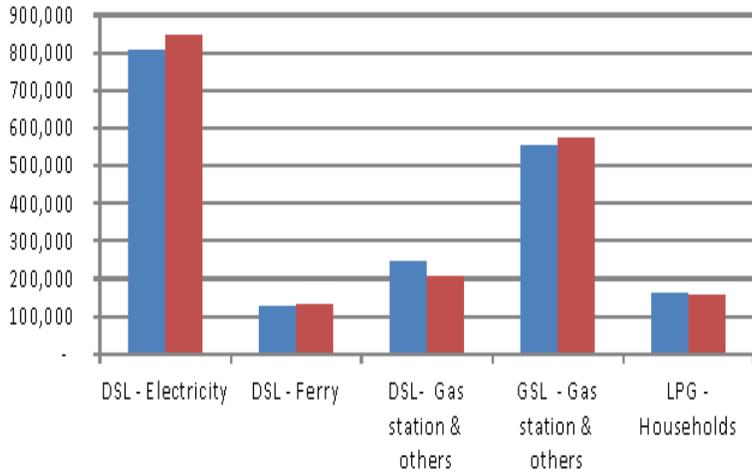


Figure 6: Sales across the sectors for 2014 (blue) and 2015 (red)

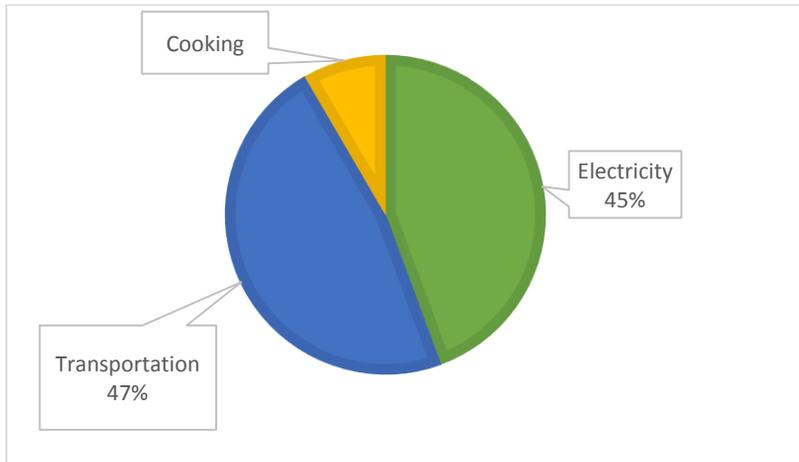


Figure 7: Breakdown of Total Imported Fossil Fuel (1.9 Million Imperial Gallons) by End Use. Prepared by the Montserrat Statistical Department.

### Basic Energy Statistics<sup>12</sup>

- Montserrat has 100% electricity coverage of residential and commercial properties.
- The country has a high level of service reliability, averaging approximately 99.85% (first eight months of 2015) amounting to 13 hours of non-coverage for the year.
- Installed capacity in Montserrat is currently greater than the demanded peak capacity. Installed capacity is approximately 5.44 MW and peak is 2.1 MW (Sep 2015).
- Cost of electricity to the domestic consumer is around US 37 cents per kWh (Sep 2015).
- Each Montserratian household uses on average approximately 2008 kWh of electricity annually – Montserrat has approximately 2800 households.
- Households consume approximately 52% of all electrical power.
- Although no surveys have been carried out it is thought that the majority of the energy consumed by households is for cooling or cooking purposes.
- Peak demand for the island is currently 2.1 MW and typically takes place between 11am and 12 noon. At night demand is approximately 1.2 – 1.5 MW.
- Technical losses are at 12.3%.

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<sup>12</sup> Montserrat Utilities Limited (MUL)

Average Electricity Tariffs		XCD	US\$
Domestic Tariff for Customers below 75 KW	Fuel Surcharge	EC\$0.86	\$0.32
	Domestic < 75 units	EC\$0.48	\$0.18
	<b>TOTAL</b>	<b>EC\$1.34</b>	<b>\$0.50</b>
Domestic Tariff for Customers above 75 KW	Fuel Surcharge	EC\$0.86	\$0.32
	Domestic > 75 units	EC\$0.55	\$0.20
	<b>TOTAL</b>	<b>EC\$1.41</b>	<b>\$0.52</b>
Commercial Customer Tariff	Fuel Surcharge	EC\$0.86	\$0.32
	Commercial	EC\$0.59	\$0.22
	<b>TOTAL</b>	<b>EC\$1.45</b>	<b>\$0.54</b>
Industrial Customer Tariff	Fuel Surcharge	EC\$0.86	\$0.32
	Industrial	EC\$0.52	\$0.19
	<b>TOTAL</b>	<b>EC\$1.38</b>	<b>\$0.51</b>

Table 2: Average Electricity Tariffs by Customer Class 2015

year	1988	1994	2011	2012	2013	2014	2015
Domestic	4013	4500	2673	2726	2803	2856	2882
Commercial	531	696	614	627	619	639	682
Industrial	32	19	6	6	6	6	6
Street Lights	65	6	12	15	16	18	20
<b>Total MUL Customers</b>	<b>4641</b>	<b>5221</b>	<b>3305</b>	<b>3374</b>	<b>3444</b>	<b>3519</b>	<b>3590</b>

Table 3: Breakdown of total MUL Customers for Select Years

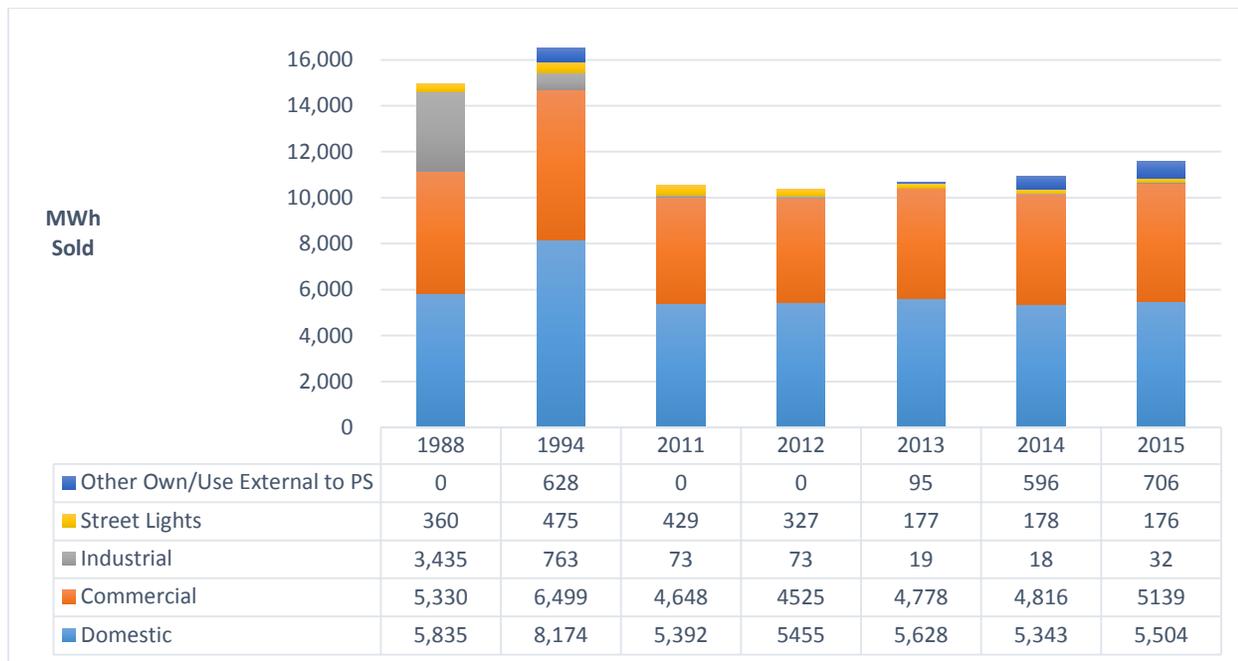


Figure 8: Electricity Sold by Customer Class for Select Years<sup>13</sup>

### Energy Efficiency Statistics

Montserrat has one utility company. Montserrat Utilities Limited (MUL) is a vertically integrated utility and has responsibility for generating, transmitting and distributing electricity; and producing and distributing water. The company is the sole concessionaire for electricity and water distribution. It is a parastatal company – limited by shares, and both shares are owned by the Government of Montserrat. MUL produces about 12,282 MWh of electrical power annually<sup>14</sup>.

In general, approximately 10,780 MWh of electricity is utilized annually by the end users<sup>15</sup>. This is an energy use of around 2.15 MWh per person<sup>16</sup>. This represents about 45% of the total fossil fuel based usage over the year, with the remainder being used for travel and cooking. So in round figures it might be assumed that Montserrat uses (in total) about 4.81 MWh per person per year<sup>17</sup>. If Energy Efficiency is calculated as units of energy per unit of GDP, The United Nations indicates that Montserrat's 2013 Gross Domestic Product (GDP) was \$US 11,565. So the Energy Efficiency is 384 W which compares with the highest Energy efficiency Caribbean countries of the Bahamas (615 W) and Trinidad and Tobago (614 W) respectively<sup>18</sup>.

<sup>13</sup> Industrial Customers have shrunk significantly since the 1980s and even further after the 1995 volcanic eruption.

<sup>14</sup> Montserrat Utilities Limited

<sup>15</sup> Montserrat Utilities Limited

<sup>16</sup> Montserrat Utilities Limited

<sup>17</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat

<sup>18</sup> Data provided by Statistic Department, Ministry of Finance and Economic Management (MoFEM), Montserrat

### Diversification of Energy Sources

- Montserrat has no existing renewable energy power in its current electricity supply.
- Over the last five years however, there has been interest and activity towards the development of geothermal power generation.
- Between March and September of 2013, Montserrat's first two geothermal wells were drilled to depths of 2,300 and 2,900 yards, striking temperatures of more than 260°C. While testing is still ongoing, the initial results suggest that the fluid flowing from the wells will be able to generate significant amounts of geothermal power.

In the last year, plans are also being developed for the integration of up to 1 MW solar photovoltaic system into the new power station in Brades. This has the potential to significantly reduce the amount of diesel used in power generation and provides a clear and present opportunity for Government to directly address the high fuel surcharge in the electricity tariff (Table 2). A typical photovoltaic diesel hybrid system can feed solar power into the local grid at up to 60% of the installed diesel generator set capacity.



*Picture 8: Current Generators Utilized for Electricity Production at Montserrat Utilities Limited.<sup>19</sup>*

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<sup>19</sup> These generators are in the process of augmentation with one medium speed higher efficiency generator.



*Picture 9: Diesel Generator Replacement as part of the Montserrat Power Generation Improvement Project funded by the UK Department for International Development<sup>20</sup>.*

### Carbon Emissions

Montserrat is in full support of the reduction of carbon emissions. Despite its relatively small total carbon emissions relative to the world, Montserrat has a high emissions per capita within the worst 20 countries in the world at 12.98 tonnes per capita in 2011. Given such statistics, Montserrat intends to demonstrate climate leadership as an island to the rest of the world. Collectively, with other Caribbean nations, Montserrat intends to lead in support of climate mitigation. Moving forward towards 100 percent renewable energy will reduce the use of the high efficiency diesel generators and the total emissions the island contributes to global volumes. This positions Montserrat as a sounding board for effective global governance dialogue. This timing is strategic given the ratification of the Small Island Developing States (SIDS) Sustainable Energy and Climate Resilience Initiative (SIDS DOCK) Treaty on September 30<sup>th</sup> 2015 during the United Nations General Assembly in New York, USA.<sup>21</sup> SIDS DOCK establishes all small island nations in solidarity against the impacts of anthropogenic climate change and mobilizes actions towards renewable energy.

Fuel Type	Sector	Volume (gal)	Factor (kg/gal)	Emission Total (tons)
Diesel	Transport (Vehicles & Ferry)	325,000	3.24	1,053
Gasoline	Transport (Vehicles)	580,000	2.89	1,676
Diesel	Electricity (Power)	850000	3.24	2,754
LPG	Household (Cooking)	160000	1.9	304
<b>TOTAL</b>		<b>1,915,000</b>		<b>5,787</b>

*Table 4: Carbon Emissions by End Use of Primary Energy Imports*

<sup>20</sup> This project was implemented by the previous administration. Geothermal projects take a minimum of four years to develop after resources have been proven. During this time, MUL hopes to utilize these generators as renewables are phased into the electric system. The generators will be utilized as back up in the case of emergencies faced by the island. <https://devtracker.dfid.gov.uk/projects/GB-1-202374/documents>

<sup>21</sup> SIDS DOCK (2015) <http://sids-l.iisd.org/news/sids-dock-treaty-enters-into-force/>.

## Appendix C: Key Energy Stakeholders

ACCESS TO ENERGY IS CRITICAL TO LIFE, QUALITY OF LIFE AND DEVELOPMENT.

Framed in this way all individuals and entities in a society are, at some level a stakeholder with Government. In fact, anyone who pays for energy would resent being excluded from the list of stakeholders.

The key energy stakeholders in Montserratian society are:

- Government
- Importers and retailers of petroleum products
- MUL
- Montserrat Chamber of Commerce & Industry Inc.
- The Montserrat Taxi Association
- Montserrat Hospitality Association
- Montserrat National Trust
- Montserrat Farmers Association
- Montserrat Boaters & Fishers Association

Each of these groups has an interest in the development of a National Energy Policy and strategy and a role to play in its successful implementation.

## Appendix D: Identification of the Energy Sector’s Strengths, Weakness, Opportunities and Threats

The Strength, Weakness, Opportunities and Threats (SWOT) represents the internal assessment of the sector issues while the consideration of the likely opportunities and threats represents the analysis of the impact on the sector of the external environment.

The SWOT analysis, when considered with the energy sector situation in Montserrat, allows the identification of the goals and policy actions that can be employed to foster the strengths of the sector, address the weaknesses, capitalize on the opportunities and mitigate the threats to the long-term development of the sector.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>-Has good proven renewable energy resources, particularly in the form of geothermal and solar</li> <li>-Has proven geothermal energy resources The current net geothermal power generation capacity of a single well is 1.3 MW (MON#1) or 1.7 MW (MON#2)<sup>22</sup>. As the island’s current peak load is approximately 2.1 MW<sup>23</sup>, we propose the drilling of a 3<sup>rd</sup> well to meet the base load, to provide for near term demand growth, and end a dependence on diesel power except as a backup.</li> <li>-Has an established petroleum supplier and distributor</li> <li>-Has a well-established power production and distribution system with more than 99 percent of the population having access to electricity</li> <li>-73 percent of the power company’s diesel plant is less than 20 years old<sup>24</sup></li> <li>-Relatively low electricity distribution losses by Caribbean standards (approximately 11 percent)<sup>25</sup>.</li> <li>-Government oversight of the electricity and energy sectors</li> </ul>	<ul style="list-style-type: none"> <li>-Growing dependence on imported fossil fuels</li> <li>-No known fossil fuel resources</li> <li>-High and growing energy import bill</li> <li>-High cost of electricity (the highest in the OECS in 2014)<sup>26</sup></li> <li>-The absence of, and urgent need for this new policy as perceived by stakeholders.</li> <li>-No recent development of new renewable energy supply (the most recent study was wind energy in 2008)</li> <li>-Large volume of used car imports, significant and growing stock of energy-inefficient motor vehicles</li> <li>-Rugged terrain imposes constraints on physical development and maintenance of projects and transportation efficiencies</li> </ul>

<sup>22</sup> Montserrat Geothermal Well Long Term Test Report – Capuano Engineering Company October 2014

<sup>23</sup> Montserrat Utilities Limited

<sup>24</sup> Montserrat Utilities Limited

<sup>25</sup> Caribbean Electric Utility Services Corporation (CARILEC) – Electricity Tariff Report 2014

<sup>26</sup> Caribbean Electric Utility Services Corporation (CARILEC) – Electricity Tariff Report 2014

Opportunities – External	Threats – External
<ul style="list-style-type: none"> <li>-Energy Efficiency is a small but growing interest which could be nurtured to capture early cost savings</li> <li>-Existence of proven technologies to exploit geothermal and other renewable energy sources</li> <li>-Favorable and ongoing relations with multilateral development institutions</li> <li>-Potential to be a Caribbean Center of Sustainability</li> <li>-Relatively small population and geographical area may make this location a good trial area for developing renewable energy and smart grid technologies</li> </ul>	<ul style="list-style-type: none"> <li>-Continued high dependence on imported petroleum products</li> <li>-Continued volatility of oil prices</li> <li>-Potential impact of natural hazards on the energy sector particularly the Soufriere Volcano on the geothermal development</li> <li>-Geopolitical influences on international energy supply and demand</li> <li>-Potential impact on local economy of high energy prices</li> <li>-Potential impact on international economic competitiveness caused by chronically high energy costs and inefficient energy use</li> </ul>

Appendix E: Map of Montserrat Indicating the Electrical Grid Distribution

