IRENA
International Renewable Energy Agency

GRENADA

RENEWABLES READINESS ASSESSMENT

About IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy.

IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

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GRENADA

RENEWABLES READINESS ASSESSMENT 2012

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List of Acronyms

CARICOM	Caribbean Community and Common Market
CARILEC	Caribbean Electric Utility Service Corporation
COTED	Council for Trade and Economic Development
ECCB	Eastern Caribbean Central Bank
ECERA	Eastern Caribbean Energy Regulatory Authority
CDM	Clean Development Mechanism
CREDP	Caribbean Renewable Energy Development Programme
ECH	Eastern Caribbean Holdings
ESA	Electricity Supply Act
FIT	Feed-In-Tariff
GARFIN	Grenada Authority for the Regulation of Financial Institutions
GDBS	Grenada Bureau of Standards
GDB	Grenada Development Bank
GEF	Global Environment Facility
GHTA	Grenada Hotel and Tourism Association
GIDC	Grenada Industrial Development Corporation
GOG	Government of Grenada
GRENLEC	Grenada Electricity Services
GRENSOL	Grenada Solar Power
GDP	Gross Domestic Product
GIZ	German Agency for International Cooperation
GPP	Grenada Private Power
GW	Gigawatt
HV	High Voltage
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
kWh	Kilowatt-hour
kWh/m^2	Kilowatt-hour square metre
kW	Kilowatt

kWp	Kilowatt peak
LPG	Liquid Petroleum Gas
LPH	Light and Power Holdings
LUCELEC	St. Lucia Electricity Services
LV	Low Voltage
m/s	Metre per second
MIPP	Micro-Independent Power Producer
MTOE	Million Tonnes of Oil Equivalent
MW	Megawatt
MWe	Megawatt electric
NGO	Non-Governmental Organization
NEP	National Energy Policy
NSAP	Non State Actors Panel
OECS	Organization of Eastern Caribbean States
OAS	Organization of American States
PJ	Petajoule
PUC	Public Utilities Commission
PSCCU	Public Service Cooperative Credit Union
RE	Renewable Energy
RESPV	Renewable Energy Special Purpose Vehicle
RRA	Renewables Readiness Assessment
TAMCC	T. A. Marryshow Community College
TPES	Total Primary Energy Supply
VAT	Value-Added Tax
SIDS	Small Island Developing States
UNDESA	United Nations Department for Social and Economic Affairs
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations International Development Organization

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Acknowledgements

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Foreword

In these trying economic times characterised by slow economic growth, declining foreign direct investment, stagnant remittances and high dependency on imported fossil fuel, electricity at affordable prices is not accessible. These and other factors severely restrict and dampen the economic growth of Small Island Developing States (SIDS) in the Caribbean and elsewhere. Grenada is no exception in these demanding times, as the global economic downturn continues to bite and the battle rages for sustainable energy.

The government of Grenada is seeking ways to stimulate economic stability and growth in order to limit its dependency on high and volatile oil prices, which have negative side effects on the country's economy. It is trying to avert the foreign exchange drain, typical of SIDS, caused by the import of petroleum products for transport and electricity. Since 2012 the government of Grenada has identified five key transformation sectors which will stimulate and enhance revenues and economic growth and create jobs in Grenada. A focus on the following pillars is expected to generate growth in the Grenadian economy:

- Tourism and hospitality services
- Health, wellbeing and education services
- Agribusiness
- Information and communication technology
- Energy development (renewable and non-renewable)

When the government of Grenada first heard the brilliant news that the International Renewable Energy Agency (IRENA) had selected Grenada as the first country in the Caribbean and Latin America (and most strikingly the first SIDS in the world) to conduct a Renewables Readiness Assessment (RRA), it readily accepted this challenge and opportunity. This was a positive appeal and gesture by IRENA, and demonstrated great trust in Grenada to manage such an intensive study on the renewable energy potential of the Spice Island. It could not have occurred at a better moment in the Government of Grenada's Energy Development Strategy.

The Grenada National Energy Policy was conceived, developed and approved by the Cabinet of Ministers in March 2011 and formally made public in November 2011. The policy document contains a ten-year Sustainable Energy Action Plan (January 2010 – December 2019) with measurable indicators or milestones of progress.

This RRA study has come at exactly the right time. It has therefore made a fundamental contribution to and is an essential part of the formulation of the GREENADA vision 2030. The Prime Minister launched GREENADA VISION 2030 at the Rio+20 conference in Brazil in June 2012 and again at the World Energy Forum in Dubai in October 2012. We visualise an economy with 100% renewable energy utilising base load geothermal and waste-to-energy, complemented by intermittent wind and solar in the energy mix by 2030.

The RRA activities and workshops brought the citizens of Grenada to the roundtable. They critically discussed and analysed Grenada's energy position – in particular renewable energy conditions, barriers and challenges and the ownership of the islands' potential resources. The Government of Grenada embraces the RRA findings. We have been and will use this report wherever possible in our attempt to win partners who can collaborate with us in possible investments and joint ventures. We will demonstrate the comparative advantages of using renewable energy technologies in Grenada. These equitable business relationships will strengthen our aspirations to realise the 2020 Low Carbon Development Strategy and the GREENADA Vision 2030.

The new development framework for Grenada's electricity sector clearly demonstrates the direction and action the Government of Grenada is now taking. The RRA exercise in Grenada was a timely catalyst.

A hearty thank you to IRENA and to all the individuals, organisations and other stakeholders in Grenada, consultants conducting the study, international partners and above all IRENA staff directly connected to the process of producing Grenada's RRA.

The Honourable V. (Nazim) Burke
Minister of Finance, Planning,
Economy, Energy and Cooperatives,
Government of Grenada

Preface

The Renewables Readiness Assessment (RRA) conducted in Grenada in 2012 marks an important step forward in IRENA's work to promote the widespread adoption and sustainable use of all forms of renewable energy worldwide. This report, the culmination of a country-led process based on IRENA methodology, is the first in the Caribbean – an island region with the potential to gain energy self-sufficiency through localised renewable energy solutions.

The RRA is a central pillar of the work of IRENA. It is a country-driven process, with IRENA helping to engage with all relevant stakeholders in a national or regional dialogue in order to pinpoint renewable energy drivers, comparative advantages and enabling policies and measures. The aim is to set out a concrete action plan to enable the development and scale-up of renewable energy. The first two pilot RRAs were conducted in Senegal and Mozambique in late 2011, with other African countries and regional groupings following suit. Meanwhile, countries as diverse as Grenada, Kiribati and Peru have also completed RRAs, expanding the range of reports available for comparison.

All these studies will help IRENA provide country-specific support and continued advice to the participating countries. More broadly, the RRA series spreads the knowledge of good practices essential for a successful global energy transition.

Grenada currently relies on costly oil imports subject to price and supply volatility for its energy needs, including the generation of electricity. As a result, consumers pay very high bills compared to other parts of Latin America and the rest of the world. The transition to renewables would support price reductions, improve the competitiveness of key sectors of the economy, particularly the tourism industry, create new jobs and help to stimulate the economy.

I hope that this RRA will enable Grenada to significantly increase its deployment of renewables, as called for in the Grenada National Energy Policy. IRENA is ready to provide continuing support to Grenada in implementing the actions identified.

Adnan Z. Amin
Director General, IRENA

Executive Summary

The State of Grenada consists of three islands – Grenada, Carriacou and Petite Martinique, which form the southern end of the Windward Islands in the Caribbean. The islands, which cover an area of 344 square kilometres, have a population of 103,000 that is growing at about 0.54% per annum. After hurricane Ivan in 2004, there was a spurt in the growth rate, which has since levelled out. The government of Grenada is projecting growth of 4.67% in 2012 and 4.98% in 2013, but due to the current economic recession these growth rates may not be realised. Over the past two decades, the economy has made a structural transition. Previously, it was dominated by primary industries, but the tertiary sector has started to play a key contribution to economic growth. The tourism sector is the highest foreign exchange earner in the economy. Remittances contribute significantly to the economy and amounted to about 3.5% of Gross Domestic Product (GDP) in 2011. But since it is a small economy, any change in trade, tourism and foreign direct investment (FDI) flows makes a major impact. This is further aggravated by limited fiscal room for manoeuvre, posing significant constraints on government ability to address development needs.

The energy sector in Grenada is characterised by a high dependence on fossil fuels which is typical of the region. The electricity sector accounts for 40%, and the transport sector for approximately half the primary energy use in Grenada. Grid access is over 99%. The utility has an installed capacity of about 50 MW and peak demand is around 30 MW.

Fossil fuel imports have grown steadily despite the economic slowdown. This could have an impact on the economic development and growth prospects of Grenada. The growth in demand for electricity is projected to double by 2028. To initiate the transition to a low carbon economy, fuelled mostly by renewables, the government of Grenada announced a new National Energy Policy (NEP) in 2011 and the GREENADA vision 2030 in 2012.

Grenada's commitment to the mission of the International Renewable Energy Agency (IRENA) is reflected in its willingness to participate in the Renewables Readiness Assessment (RRA). The RRA is a framework that enables countries to better understand the opportunities and constraints for the deployment of renewable energy technologies. It is a country-driven collaborative process, which provides a rapid and objective assessment of the status of renewable energy opportunities.

Geothermal resources in Grenada have the potential to generate electricity that can fulfil base load requirements. Coupled with wind, solar and waste-to-energy potential, this means the GREENADA vision can become a reality provided the enabling framework for attracting investments is put in place. Grenada's commitment to the mission of the International Renewable Energy Agency (IRENA) is reflected in its willingness to participate in the Renewables Readiness Assessment (RRA). The RRA is a framework that enables countries to better understand the opportunities and constraints for the deployment of renewable energy technologies. It is a country-driven collaborative process, which provides a rapid and objective assessment of the status of renewable energy opportunities. In addition, it identifies gaps and shapes the pathways necessary to achieve the aspirations and vision for renewable energy in a particular country. In facilitating this process, IRENA effectively leverages its comparative advantage as a unique intergovernmental agency dedicated to the promotion of renewable energy. It does so by offering countries access to a global network with the capacity to follow up on action and share best practice.

The government of Grenada has embarked upon many efforts to enhance the deployment of renewable energy technologies. One significant action is the participation in the regional initiative to establish the Eastern Caribbean Energy Regulatory Authority (ECERA). This initiative by the Organization of Eastern Caribbean States (OECS) will assist Grenada in the regulatory supervision of the electricity market and further support the deployment of renewable energy technologies.

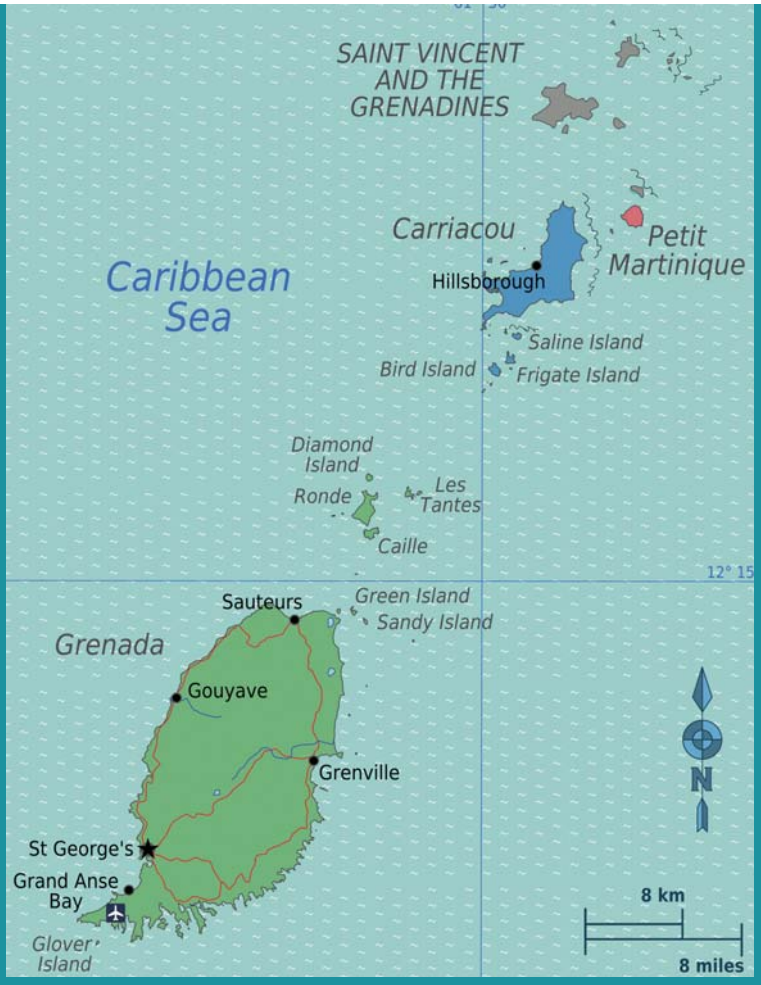
The government of Grenada is now considering an amendment to the Electricity Supply Act 1994 (ESA) to introduce a new interconnection policy for attracting investments from Independent Power Producers (IPPs) to set up renewable energy projects. This is in line with the action plan to achieve the 2030 GREENADA vision. To facilitate utility scale renewable energy generation, a special purpose vehicle (RESPV) is proposed which will mobilise finance for geothermal, wind and waste-to-energy projects. Financing of renewable energy projects often requires a mix of financial instruments that can reduce cost of finance and mitigate risk and the RRA, further recommended that strategies for renewable energy finance should be in alignment with the capacity building efforts aimed towards financial institutions.

KEY RECOMMENDATIONS

As a result of the Renewables Readiness Assessment in Grenada, the government of Grenada identified the following key recommendations to foster the deployment and sustainable use of renewable energy resources in the country:

- Set up an independent regulator for the electricity market.
- Finalise the concessionary agreement for geothermal, and conduct appropriate environmental and social impact assessments.
- Finalise the review of the present interconnection policy to promote business models that can increase the deployment of renewables.
- Enhance human capacity to enable financial and technology risk assessment; improve technical capacity to construct, operate and maintain renewable energy systems.
- Source concessionary loans and grants to support the deployment of large-scale renewable energy technologies and to establish mechanisms to reduce the cost of finance for renewable energy investors.

The boundaries and names shown on this map do not imply official acceptance or endorsement by IRENA.



Grenada

Geographical area
344 km^2

Population
103,000

GDP per capita
USD 7,220

Average electricity tariffs in Grenada in 2012
USD 0.40 per kilowatt hour

Sources: Government of Grenada 2012

I. Introduction

Small Island Developing States (SIDS) are unique because of their size and geographical isolation. Small islands are vulnerable to the high cost of imported fossil fuels – perhaps more so than any other type of country.

With most challenges come opportunities. Small islands also have the greatest potential to rapidly decarbonise their economies at relatively lower cost than any other country. Grenada is a typical small island developing state.

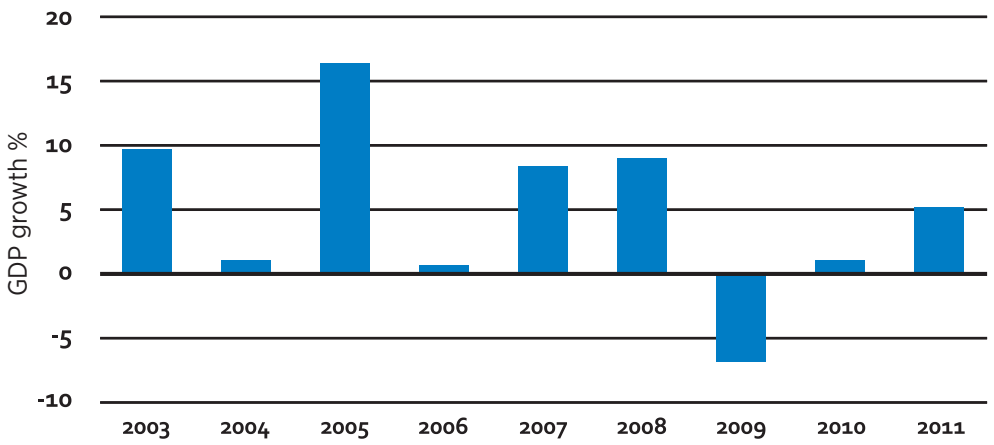
COUNTRY PROFILE

The three islands of Grenada, Carriacou and Petite Martinique together make up the small island state of Grenada nestling between the Caribbean Sea and the Atlantic Ocean. Grenada's population was estimated at 103,000 in 2012, and population growth is projected to be about 0.54% (Government of Grenada, 2012). The population density of Grenada is 299 inhabitants per square kilometre.

Grenada experienced robust economic growth in the aftermath of hurricane Ivan, which totally devastated the country in 2004. However, economic growth began to decline in 2006. The lowest growth was recorded in 2009 due to the global economic recession. Minimal growth occurred in the preceding period, as shown in figure 1.1. The Government of Grenada is projecting a growth of 4.67% and 4.98% in 2012 and 2013 respectively (Government of Grenada, 2012). However, due to the current economic recession these growth rates may not be realised.

The economic growth and development of Grenada used to depend mainly on the primary industry of agriculture. However, the economic development drive has shifted to the tertiary sector, driven mainly by services. Figure 1.2 reveals that in 2011 the key sectors driving economic growth and development are services, industry and agriculture. In 2011, the Eastern Caribbean Central Bank (ECCB) reported that the drivers of

Figure 1.1: GDP growth rates 2003-2011

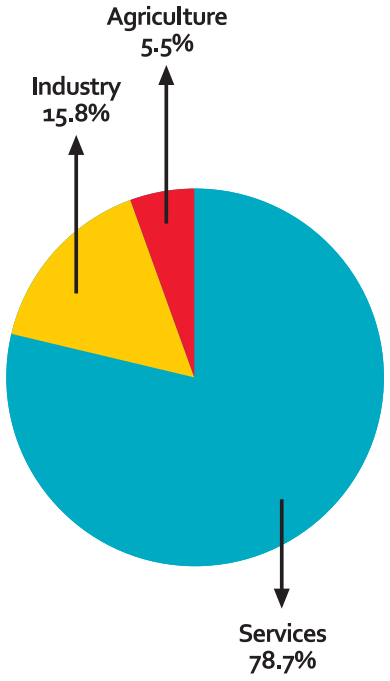


Source: Government of Grenada, 2012

the service sector are education (23.4%), transport and communications (17.6%), real estate (17.6%), financial services (10.3%) and hotels and restaurants (5.1%).

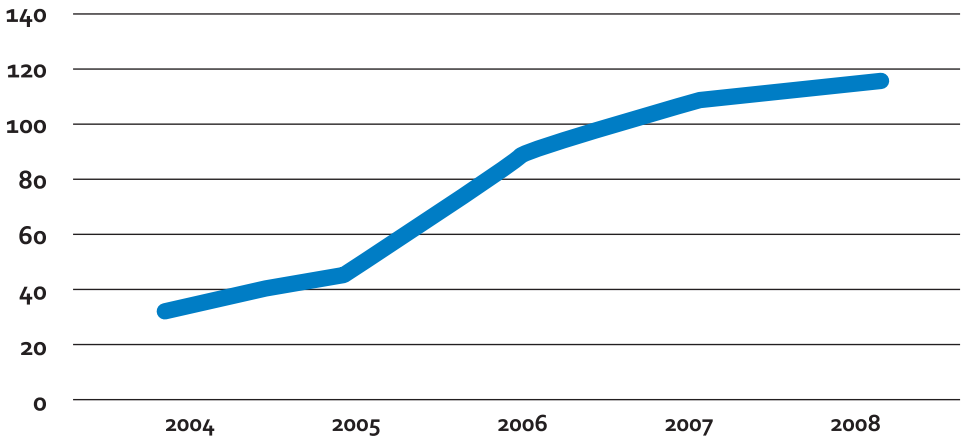
In the national accounts of Grenada, the term 'hotels and restaurants' is used as a proxy for the tourism sector. This representative sector accounts for a small portion of GDP, but it usually has a multiplier effect on other sectors such as transport, communications, real estate and financial services. In 2011, the Grenada Hotel and Tourism Association (GHTA) estimated that the average contribution of tourism to GDP of all islands in the Organization of Eastern Caribbean States (OECS) was about 43.2% (GHTA, 2012). In Grenada, its direct contribution to GDP has been estimated at 7.3%, but given the multiplier effect, this contribution is estimated at 24.2% for 2011 (GHTA, 2012). Similarly, tourism is estimated to have accounted for about 6.8% of direct employment; its impact on national employment is estimated at 22.4% for the

Figure 1.2: GDP contribution by main economic sector



Source: ECCB, 2011

Figure 1.3: Total fossil fuel imports (MTOE*)



*Million Tonnes of Oil Equivalent
Source: NEP, 2011

same period if the multiplier effect is taken into account (GHTA, 2012).

The Grenadian economy has a relatively high dependence on remittances. These have not grown significantly in the last five years and amounted to approximately USD 28.9 million in 2011, equivalent to 3.5% of GDP (Central Statistical Office, 2011). Foreign direct investment (FDI) has been declining in recent years as a result of the global economic crisis. In 2009, FDI accounted for USD 79 million, representing about ten percent of GDP (CSO, 2011).

Despite the increases in international oil prices and the slow economic growth, the quantity of oil imports has continued to grow (figure 1.3), putting pressure on the country's fiscal accounts. Oil imports bill in Grenada amounted in 2010 to USD 69.1 million representing 21.7 of total imports in the island (ECCB, 2012).

This dependence on oil imports is increasingly affecting the tourism sector and in particular the hospitality subsector. The price of electricity in the hospitality sector has increased by about 26% between 2009 and 2011 and has had an adverse effect on the competiveness of this key sector for Grenada, leading to the closure of a few hotels (GHTA, 2012).

Slow economic growth, declining FDI and stagnant remittances, coupled with the country's high dependence on imported fossil fuels, have significantly hampered the country's growth. Thus the government of Grenada has started to look at alternatives to promote economic growth and limit its dependency on high and volatile oil prices. One of these strategies is the use of existing and potential renewable energy resources.

A transition to renewable energy in Grenada will stem the massive outflow of

foreign exchange, and will provide a more reliable and secure supply of electricity. In addition, the move to renewables could have an impact on electricity tariffs, freeing up income for households and businesses which can be directed towards other expenditure and investments. Recognising the negative impact of high fossil fuel import dependency on Grenada's economy, the government took action. In 2011, it developed and adopted a National Energy Policy (NEP) focused on the transition to a low carbon economy.

RENEWABLES READINESS ASSESSMENT

A Renewables Readiness Assessment (RRA) is a comprehensive evaluation of the conditions for renewable energy deployment in a particular country. It also evaluates the actions that need to be taken to further improve these conditions and overcome existing barriers. The RRA includes all renewable energy services – on-grid and off-grid electricity and biofuels for transportation and other applications such as heating and cooling. The application of this approach to individual countries will provide a comprehensive analysis of the presence or otherwise of the enabling conditions for the development of renewables.

The RRA methodology means completing a set of templates designed to capture the key issues relating to present policy, regulations, finance, construction, operations and maintenance. The present business model or lack of it has a major bearing on the assessment.

The RRA is country-led, and the report emerging from the assessment is therefore owned by the particular country being assessed. This sets the RRA apart from other assessment processes led by international organizations. IRENA offers its support during the RRA, but it is the actions and insights developed through a country-owned process that provide the key to rapid deployment.

RRAs also facilitate a co-ordinated approach and priority setting. This can inform future bilateral and multilateral discussions with international and regional agencies, financial institutions and the private sector concerning the implementation of initiatives emerging from the RRA. With the support of IRENA, individual countries have access to a global network, giving them the capacity to follow up on actions and to exchange experiences.

The Grenada pilot was the third RRA in the world and the first in the Caribbean. The process started with a literature review of research in the energy sector. Then the RRA director and the programme manager at the Ministry of Energy identified key stakeholders, selected service - resource pairs (e.g. electricity/solar) of relevance to Grenada and matched them to groups of stakeholders. The stakeholders were selected from key government ministries, the private sector, NGOs and academia. A comprehensive outline of these stakeholders was provided in section 2.4.

The Grenada RRA workshop and assessment was held from 23rd to 25th of July 2012. In this three-day workshop, stakeholders were brought together to discuss the current status of the energy sector in

Grenada's Energy Profile

TPES: approximately
4.2 PJ

of which
renewable is
0.3 PJ

Energy self-sufficiency
6.7%

Oil import bill in 2010
USD 69.1 million

Electricity generation
204 GWh

Electricity use per capita
1,777 kWh

Electrical capacity (2011)
52.4 MW

of which renewable is
0.3 MW

relation to renewable energy in particular. During the last day a discussion with NSAP took place. NSAP is a group of stakeholders such as community-based organizations; NGOs; the GHTA; farming organizations and women's organizations. The meeting sparked very lively discussions and assisted to some extent with the validation of the actions listed at the two-day workshop.

The RRA methodology has proved to be a significant tool that Caribbean island nat-ions should use to assess requirements for the deployment of renewable energy. The RRA in Grenada has yielded a number of successful outcomes. It provided a clear understanding of the renewable energy environment and allowed a range of stakeholders to get involved and become sensitised and take ownership of RE issues and concerns. It also generated a range of practical measures that need to be taken - not least the validation of a practical and simple process and methodology.

II. Energy and Renewable Energy Context

ENERGY IN THE CARIBBEAN ISLANDS

Caribbean Islands are characterised by a high dependence on volatile fossil fuel costs to meet their energy demand. In 2010 it was estimated that about 90% of energy for transportation and electricity generation in the Carribean islands came from oil imports (UNDESA, 2010). This places a large drain on the foreign exchange earnings of SIDS, including those in the Caribbean. This situation exposes most island states to the vulnerabilities associated with the international oil market. As a consequence, the growth potential of these states is severely affected. This is because financial resources that could be made available for other development investments leak out of these regions.

Despite rising oil prices, energy demand in the Caribbean islands continues to grow. A study commissioned by the Caribbean Community and Common Market (CARICOM) shows energy demand in the region will almost double by 2028, so that there is a need to double generation capacity to meet demand. At the moment, most islands states' generating capacity meets their demand (figure 2.1). Hence, doubling their generation capacity using imported fossil fuels would have a very adverse impact on their economy and environment. This means renewable energy could play a critical role in meeting the future energy demand of these island communities in a clean and sustainable way. Renewables will help reduce their dependence on expensive imported fossil fuels, thereby reducing oil import bills and increasing energy security through the use of indigenous energy sources.

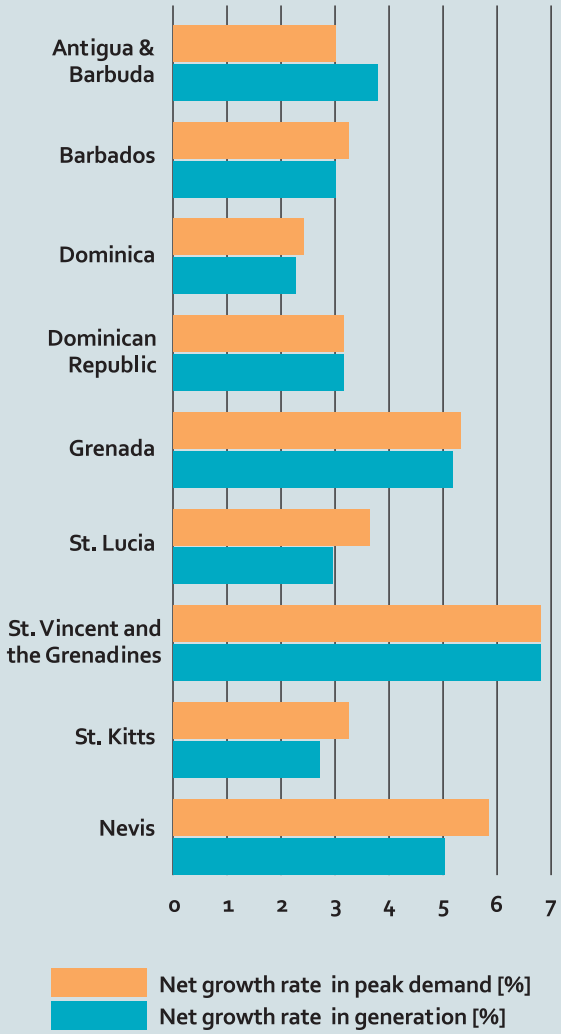
Table 2.1 shows the characteristics of energy markets in several Caribbean SIDS. Electricity access is over 90% in most Caribbean islands, with Antigua and Barbuda and Barbados achieving full coverage. However, most of the electricity generation in the region is fossil-fuel based. Fossil fuels account for more than 70% of the electricity mix (in some cases over 90%).

Another peculiarity of Caribbean electricity markets is their reliance on small, medium-speed diesel generators of about 2.5-10 megawatts. The cost associated with the operation and maintenance of these systems is relatively high. Utilities are allowed to pass on the full fuel costs to end users, resulting in relatively high electricity tariffs.

According to a 2010 tariff survey by the Caribbean Electric Utility Services Corporation (CARILEC), the average rate for electricity in Caribbean countries was approximately USD 0.32 per kilowatt hour (except for the Dominican Republic and St Kitts. In most islands, the electricity sector is managed by vertically integrated utilities (public and private). These have an exclusive licence to generate, transmit, distribute and sell electricity for a long periods (generally 50-99 years). This has limited the entry of new players, such as IPPs, into the electricity markets.

In order to address these challenges, CARICOM launched its energy programme in 2008 to harmonise Caribbean energy policy development and strategies. The main aim of the CARICOM energy programme is to increase regional energy security by diversifying the energy mix and through regional cooperation and integration. An interconnection feasibility study funded by the World Bank is one key project coming out of the CARICOM progamme. This project seeks to determine the feasibility of connecting the grids of St. Lucia, St. Vincent and the Grenadines, Grenada and Barbados. This would enhance the economies of scale and make renewable energy deployment in the Carribbean more cost-effective[1].

Figure 2.1: Growth rates in net peak demand and generation for a few Caribbean SIDS



Source: ECCB, 2011

Delegates at the 44th meeting of the Organization of Eastern Caribbean States (OECS) authority agreed that the challenges associated with the electricity market should be addressed regionally in two ways. Firstly, a regional regulatory framework should be set up – the Eastern Caribbean Energy Regulator (ECERA).

Secondly, electricity generation should be

1 In addition, an Eastern Caribbean natural gas pipeline project is under consideration and there is potential to use specialised shipping vessels for natural gas. However, in Grenada the policy is to consider natural gas as a transition fuel towards the ultimate deployment of renewable energy technologies.

Table 2.1: **Characteristics of energy markets in a few Caribbean SIDS**

Country	TPES (PJ)	Electricity use per capita (kWh)	Electricity access	Fossil fuel dependency in 2009
Antigua and Barbuda	6.9	1,264	100%	100%
Barbados	21.3	3,481	100%	89%
Dominica	2.0	1,229	90%	92%
Dominican Republic	338.8	1,358	95.9%	72%
Grenada	4.2	1,777	99.5%	93%
St. Lucia	5.6	2,040	98.0%	98%
St. Vincent and the Grenadines	2.7	634	91%	94%
St. Kitts and Nevis	4.2	2,095	95%	88%

Source: International Renewable Energy Agency (IRENA), 2012

diversified by increasing the use of renewables. As a result, the OECS authority approved ECERA at its 49th meeting, and it was endorsed by the Council for Trade and Economic Development (COTED) of the CARICOM. Another organisation, the Caribbean Electricity Utility Service Corporation (CARILEC) supports and informs the design of the regulatory agency.

The key objectives of ECERA are as follows:

- Maximise economies of scale in regulating the electricity sector in the OECS;
- Utilise more efficiently and effectively the scarce human resources available within the OECS islands;
- Provide necessary regulatory tools;
- Increase the capacity of OECS members to implement regional-scale arrangements for electricity trade.

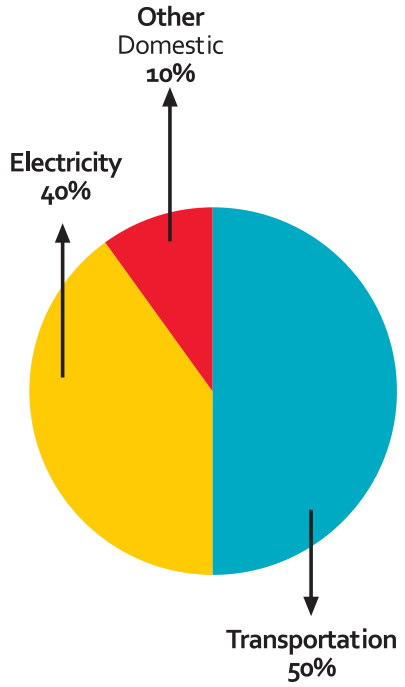
The main focus of ECERA will be to regulate tariffs, review investment plans and define a regional licensing framework for electricity market participants, facilitating renewable energy integration into the electricity mix.

ENERGY SECTOR IN GRENADA

Grenada's energy sector is typical of the Caribbean and depends almost entirely on fossil fuel products. The Total Primary Energy Supply (TPES) of Grenada consists of the following fossil fuel products: diesel, kerosene, liquid petroleum gas (LPG) and gasoline. The TPES in 2009 was 4.2 petajoules of energy. In 2000-2009 TPES grew by about 40%, most of which is accounted for by fossil fuels. Oil imports accounted for 93% of Grenada's TPES in 2009. Solid biofuels, which included mainly charcoal for cooking and solar, accounted for the remainder.

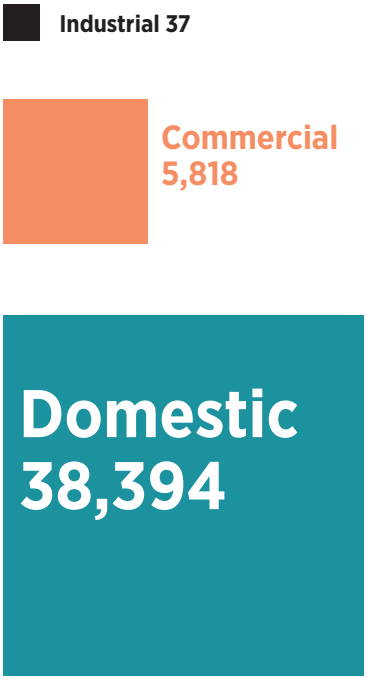
There are three sectors which use primary energy: transport, electricity and domestic (figure 2.2). Together transport and electricity consume approximately 90% of the energy supplied by fossil fuels. The trans-

Figure 2.2: Distribution of energy use by key services



Source:NEP, 2011

Figure 2.3: Number of electricity customers in 2011



Source: GRENLEC, 2011

port sector consisted of around 26,387 registered vehicles in 2009 (government of Grenada, 2011). It has seen an average annual increase of 1200 vehicles in the number of vehicles registered over the past 10 years.

Average prices for the main fuels used by this sector are USD 1.20 per litre of diesel and USD 1.24 per litre of gasoline. There is no significant work undertaken for alternative fuels for the transport sector. However, the government has stated in the NEP its intention to introduce electric vehicles into the Grenadian market. It wants the transport sector to make a transition to the electricity grid, which will be supplied by renewable energy such as geothermal. The transition of the transportation sector to renewable energy is critical to the government's realization of its renewable energy vision.

The transformation of the transport sector means opting either for electric cars or biofuels. The government of Grenada intends to introduce a pilot electric vehicle programme in collaboration with Grenada Electricity Services (GRENLEC). This will target agencies with large vehicle fleets. This pilot project will analyze the feasibility of operating electric vehicles in Grenada.

Households are the main consumers of LPG and kerosene, although some LPG is consumed by restaurants. LPG is used in the domestic sector for cooking. In 2012 the average price for LPG was USD 16.67 for a 20 pound cylinder.

Table 2.2: **Key electricity market indicators**

Key market indicators	2011	2010	2009	2008	2007
Peak demand (MW)	30.29	30.83	~29.5	~28.9	~27.1
Net generation (GWh)	196.82	201.40	195.39	189.82	178.67
Sales including street lighting (GWh)	180.88	184.78	177.33	172.50	165.23
Number of customers at year end	44,249	42,699	42,928	41,222	39,318
Av. consumption domestic (kWh)	1,835	1,901	1,833	1,847	1,921
Av. consumption commercial (kWh)	17,155	17,795	17,576	18,124	17,706
Av. consumption industrial (kWh)	163,906	169,345	157,434	156,352	185,143

ELECTRICITY SECTOR

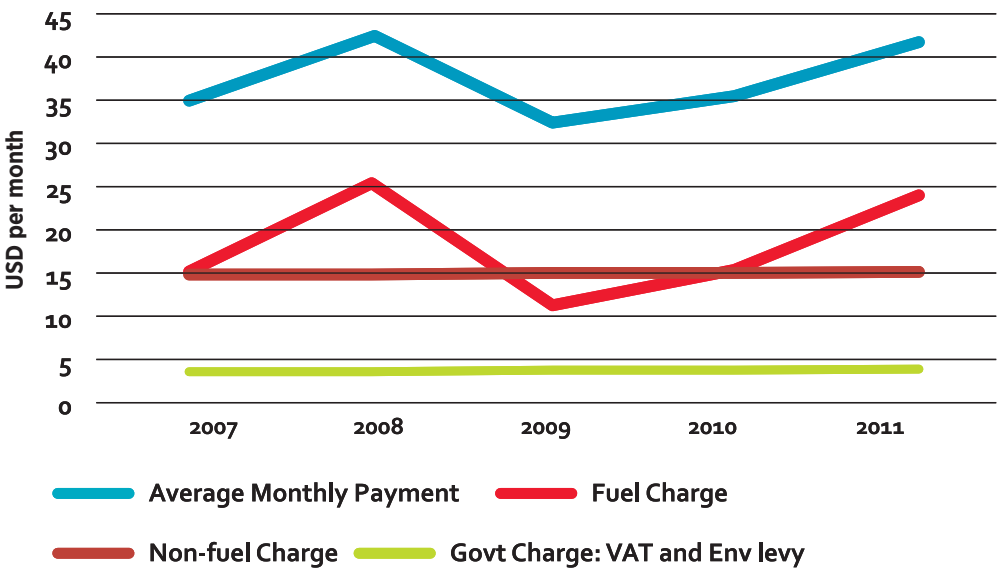
The electricity market is dominated by GRENLEC, a vertically integrated company. A private company, WRB (through its subsidiaries Grenada Private Power and Eastern Caribbean Holdings - ECH) owns a 61.4% share in GRENLEC. In late 2012, WRB announced it was selling its shares in GRENLEC. The imminent sale presented the government with the opportunity to craft a new developmental framework for the electricity sector. The details of this new framework are presented in section 2.4.

According to the NEP, the company operates a total installed capacity of 52.4 megawatts. This consists of 45.9 megawatts at the main generating plant at St. George's and 2.8 megawatts at St. George's University in Grenada. The rest is installed in Carriacou and Petite Martinique, which according to the NEP have capacities of 3.2 and 0.5 megawatts respectively. This installed capacity has remained constant since 2007. In 2007-2011, this capacity met a growing demand for electricity, increasing from 27.1 to 30.2 megawatts. At the same time, generation increased from 165 to 180 gigawatt hours with a maximum generation of 201.4 gigawatt hours in 2010 (table 2.2).

The three main electricity consumers in the country are in the residential, commercial and industrial sectors (figure 2.3). In 2011, the majority of the customers were households, accounting for 86.8% of total customers, while the commercial and industrial sectors accounted for 13.1% and 0.1% respectively. However, the average industrial customer consumed 163,906 kilowatt hours compared to 17,155 kilowatt hours in the commercial sector and 1,835 kilowatt hours for the domestic sector in 2011. The average consumption of each of these customers for the period is shown in table 2.2.

The average consumption of electricity in the commercial sector is very stable but declined in 2011 mainly as a result of high

Figure 2.4: Average electricity price/month for a domestic customer consuming 100 kWh/month



Source: GRENLEC, 2011 [1 USD = 2.7 XCD]

electricity prices and the efforts to reduce electricity consumption in the sector.

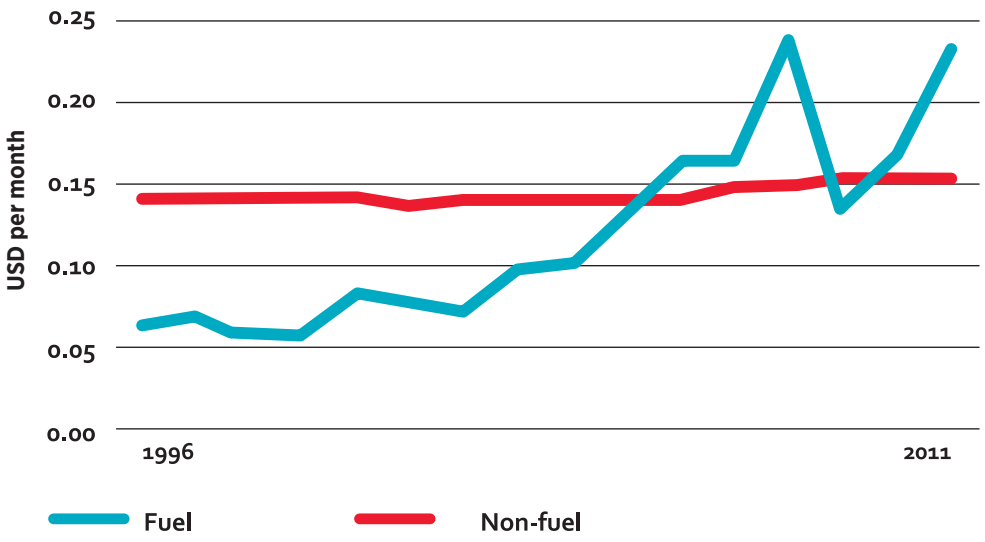
In 2012, electricity tariffs in Grenada were on average USD 0.40 per kilowatt hour, substantially higher than in Europe or North America. It is important to note that air conditioning consumes approximately 50-60% of electricity in buildings in Grenada (Telesford, 2004). The tariff structure consists of a fuel charge, a non-fuel charge, Value Added Tax (VAT) and an environmental levy paid only by the residential sector (figure 2.4).

At the moment, GRENLEC makes a monthly recalculation of the fuel charge based on the average of the cost of diesel fuel used to generate electricity in the previous quarter. The non-fuel charge is capped and based on the cost of living. These adjustments simply appear on the customer's bill at the end of each billing cycle and after every quarter. The environmental levy is used for the management of municipal solid waste. This amounts to USD 1.85 for consumption of 99-149 kilowatt hours and USD 3.7 for consumption over 150 kilowatt hours and above. The VAT for this category of customers is 15% of the non-fuel charge for consumption above 99 kilowatt hours. Industrial and commercial customers pay VAT on all units consumed.

Generally, the volatility of the price for fuel in the international market has a profound impact on the price for electricity on the local market. From 1996-2011 the fuel rate systematically increased, leading to simultaneous increases in the local electricity price. Meanwhile the non-fuel rate remained fairly stable (figure 2.5).

Despite these high prices and their adverse impacts on the Grenada economy, it is important to highlight that the electricity supply has been extremely reliable since GRENLEC was privatised in 1994. One of

Figure 2.5: Fuel and non-fuel rates 1996-2011



Source: GRENLEC, 2011

the key reasons for privatization was the development of a rural electrification programme and grid extension. This means 99.5% of the island now has electricity access. Electricity is generated from one central plant in St. George's, the capital of Grenada. It is distributed throughout the island via a 600 mile high voltage (HV) transmission system and 800 miles of low voltage (LV) distribution lines (figure 2.6).

Each of the coloured lines indicates a main feeder from the main generating station located on the south-western side of the island. Figure 2.6 confirms the very high penetration of the grid. It runs along the entire coastline of the island and through a main feeder penetrating the Grand Etang hills through the centre of the island from the south-west to the north-east. The grid's penetration through the Grand Etang hills is very important since there is a plan to develop a geothermal plant in the neighbouring area of Mount St. Catherine. The prospects for this potential project may have improved now that GRENLEC has the experience of developing the grid in this area.

RENEWABLE ENERGY SOURCES AND POTENTIAL

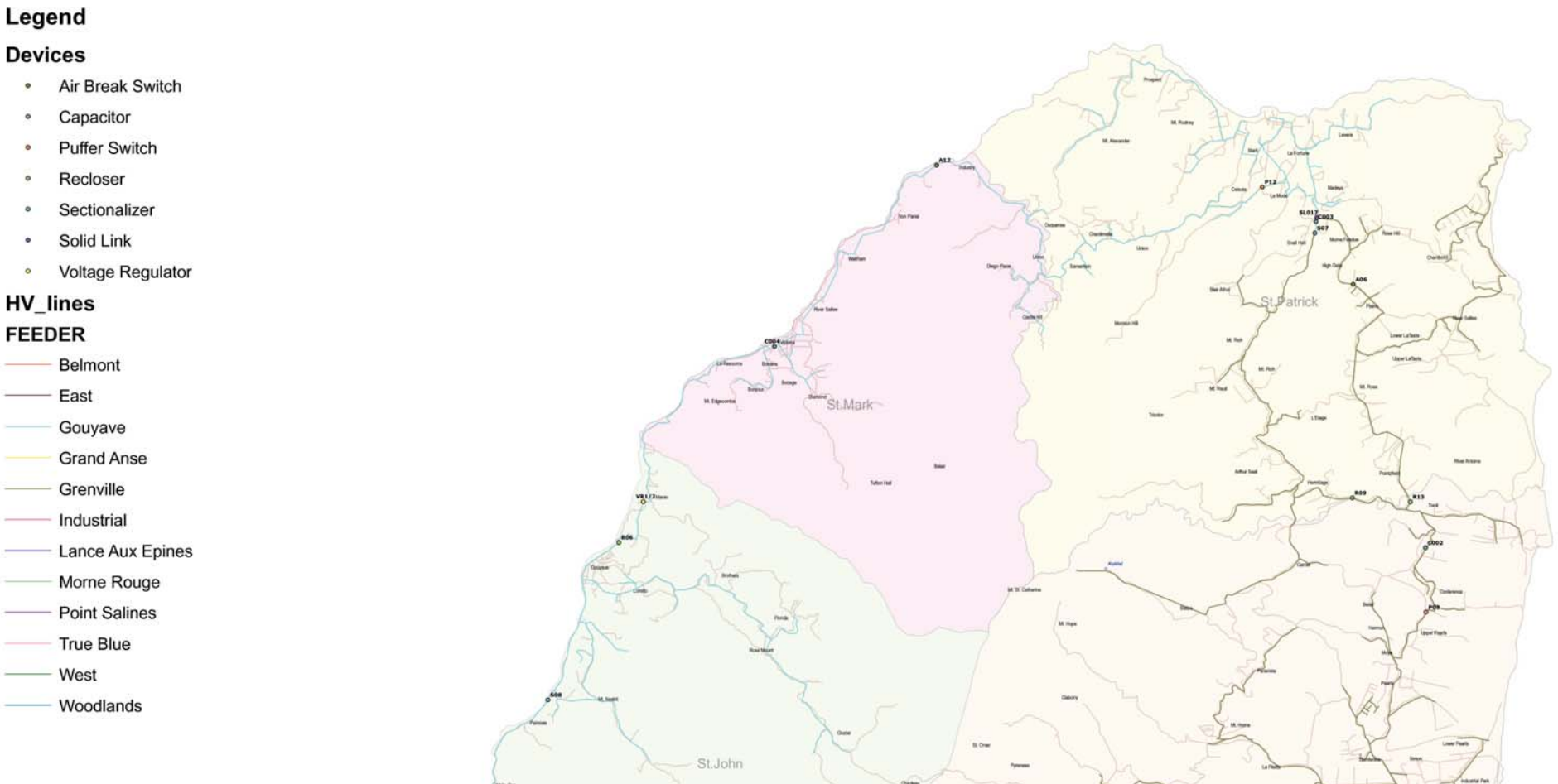
Grenada has the potential for renewable energy from geothermal, solar and wind. However, only small rooftop-mounted solar PV systems have made any penetration into the market. They now represent around one percent (300 kilowatts) of peak demand. In recent years there has been substantial debate on how to move forward with the development of these resources.

GEOTHERMAL

A preliminary estimate of the geothermal potential in Grenada, Carriacou and Petite

Figure 2.6: Outline of Grenada transmission system

The boundaries and names shown on this map do not imply acceptance or endorsement by IRENA.



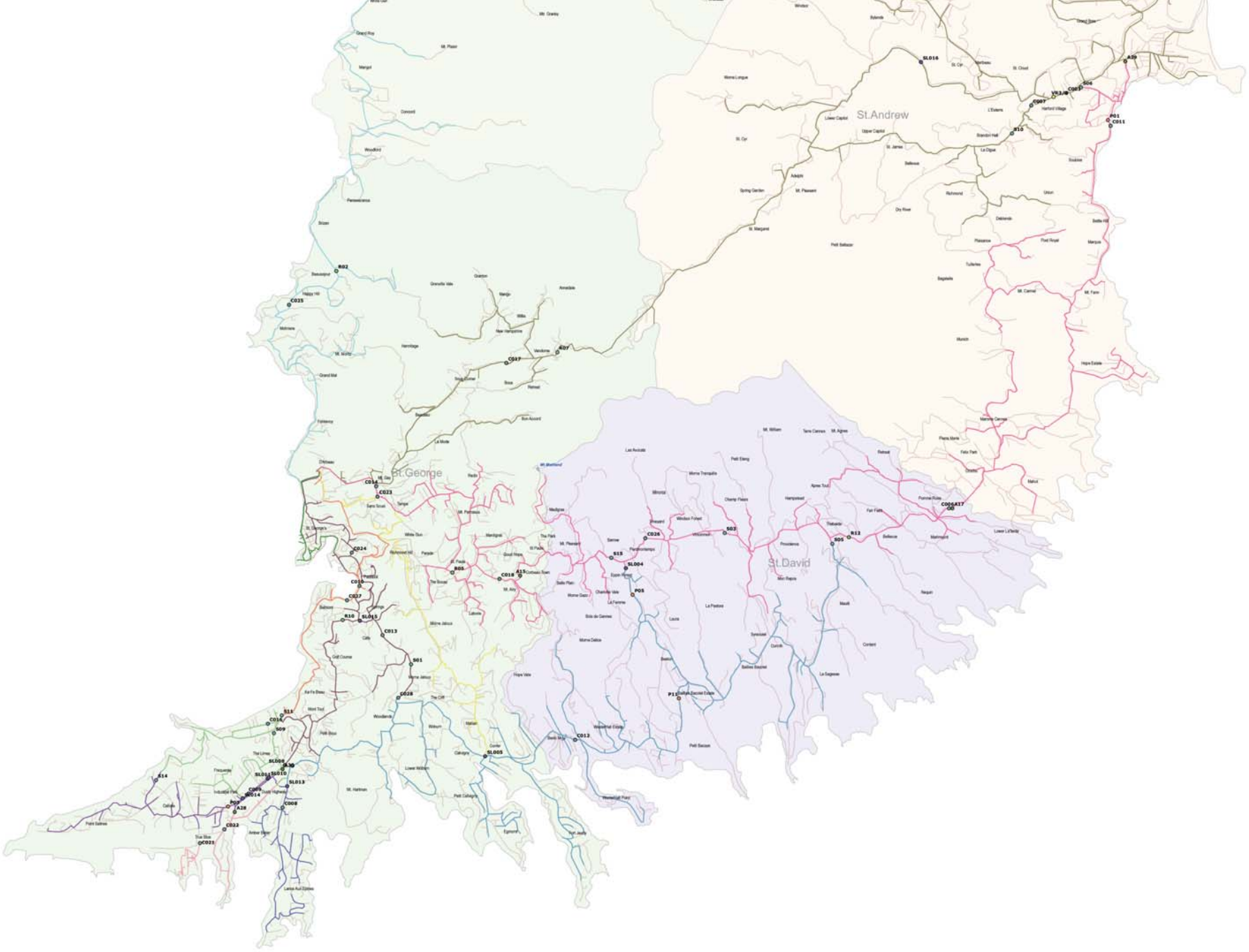
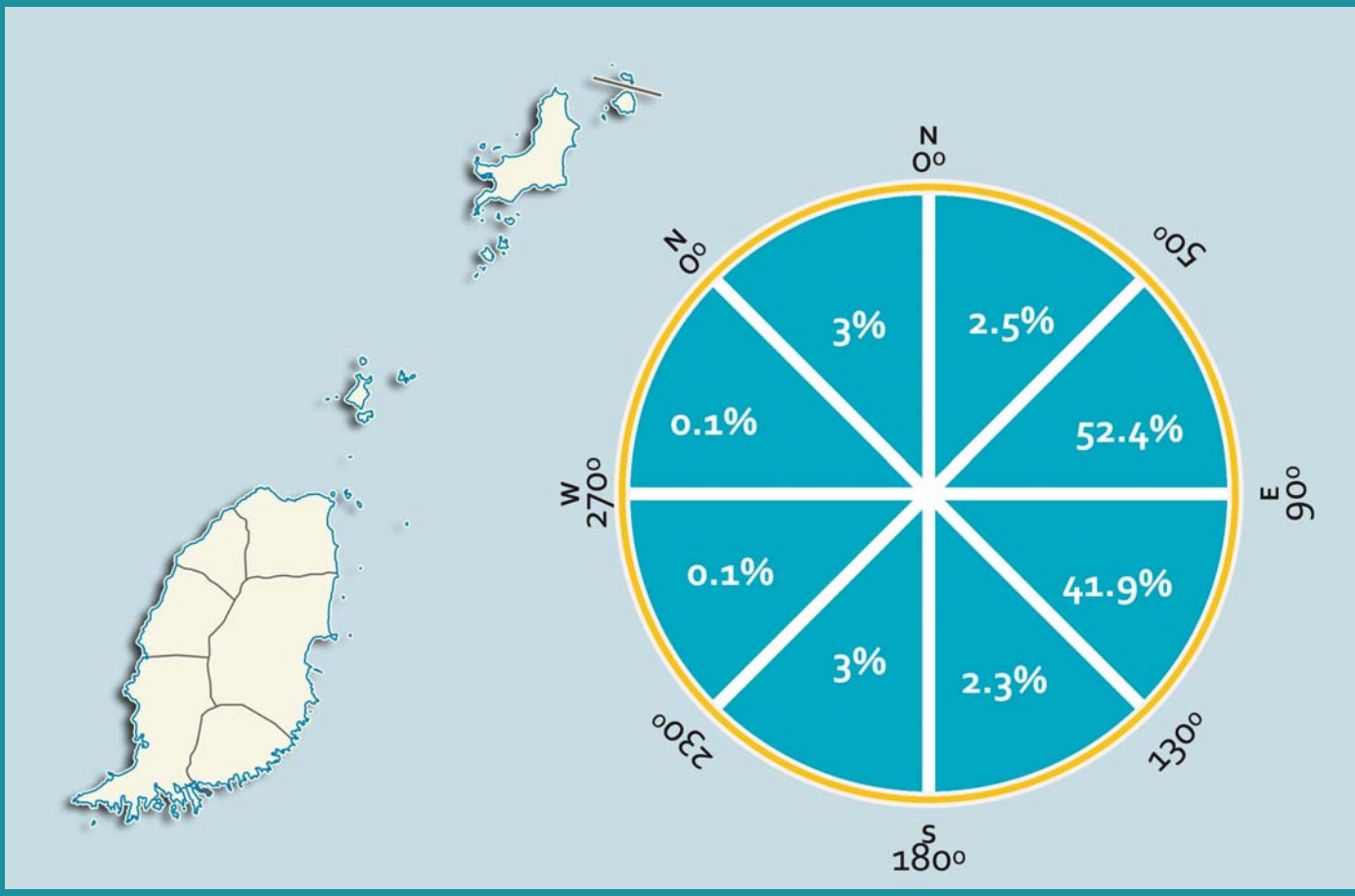

St.Andrew
St.George
St.David

Figure 2.7: Wind rose for Grenada



Source: Weisser, 2004

Martinique came to around 1,100 MWe (UNDESA, 2012). This includes the underwater volcanic region of Kick-Em-Jenny. The resources are concentrated in the main island of Grenada and more specifically in the Mount St. Catherine region. Preliminary assessments by GRENLEC suggest that about 50 megawatts of electrical energy can be reliably produced from geothermal resources in the Mount St. Catherine region.

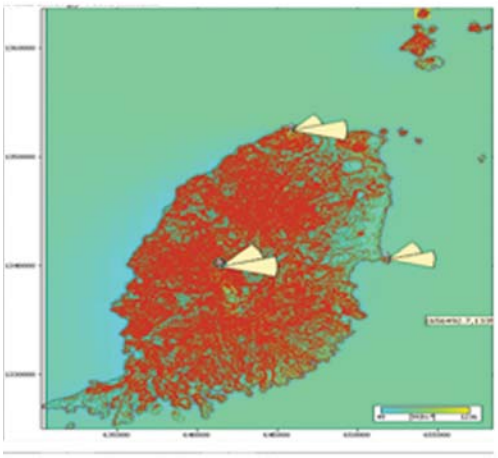
WIND

There is also significant potential for wind power especially along the eastern corridor of the island. The average wind speed ranges from 4.9-6.2 miles per second (Weisser, 2004). However, wind speeds of up to 9.7 miles per second were measured by GRENLEC in 2010 at a height of 50 metres in the Top Hill region in Carriacou.

Over 90% of the wind blows from the north-eastern and south-eastern parts of the island (figure 2.7). Preliminary wind resource maps have been developed for Grenada, Carriacou and Petite Martinique (figure 2.8). Preliminary analyses of these three islands have identified the best wind resources. These are concentrated in the northern peak of St. Patrick and on the eastern corridor, especially at Pearls point, located in St. Andrew (Hamlin).

Figure 2.8: Preliminary wind assessment for Grenada, Carriacou and Petite Martinique

Grenada



Carriacou and Petite Martinique

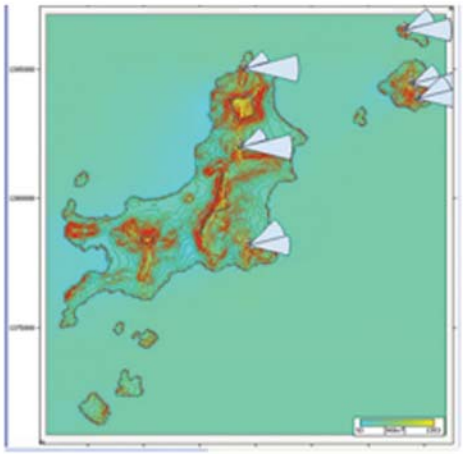


Figure 2.9: Preliminary solar map for Grenada

Source: Hamlin

The boundaries and names shown on the maps on these pages do not imply official acceptance or endorsement by IRENA.

The central point of interest is in the most mountainous part of the island but it may not be practical to build wind farms there as it is difficult terrain. For example, Grand Etang with an elevation of 1,950 feet and Mount St. Catherine at 2,756 feet are located in the centre of the island. There are three points of interest along the north-eastern corridor in the island of Carriacou.

SOLAR

Grenada benefits from a high number of sunny days. It has a radiation on a horizontal surface around of 5.81 kilowatt hours per square metre (Weisser, 2004). The country has two main seasons - rainy and sunny. Daily insolation ranges from between five to seven kilowatt hours per square metre, with a total annual insolation of 2,120 kilowatt hours per square metre.

Although solar incidence is high in all the inhabited areas of Grenada, the strongest solar radiation is in the southern part of the island and along the coast (figure 2.9).

Frequent cloudiness in the centre of the island means solar radiation is reduced. However, that part of the island consists mainly of rainforest and is sparsely inhabited. The resource potential of solar, together with falling investment costs for solar PV and the rising price for fossil fuels, mean solar is a very attractive option.

MICRO-HYDRO

Precipitation in Grenada varies by season, so there are fluctuations in the flow of water in Grenada's rivers and streams. In the dry season river flow is reduced. Since the average annual rainfall varies from the long term average, it is likely that the stream flow will vary annually. Nevertheless, Weisser (2004) concludes there is a constant base flow that facilitates pico and micro-hydro plants. This is due to the topology of the intake of the water source.

KEY STAKEHOLDERS

The table on pages 38-39 provides an overview of the key stakeholders in the energy market. These stakeholders were involved with the development of the RRA. Most of them participated through the workshop or via an interview. The Table 2.3 describes the meeting with the Non-State Actors Panel (NSAP), which provided further insight for the RRA.

IMPORTANCE OF CIVIL SOCIETY

Civil society and Non-Governmental Organisations (NGOs) are important stakeholders in the RRA in that they ensure social and environmental integrity are maintained as society moves towards wide-scale renewable energy deployment. In a small society, developments which can have both positive and negative social and environmental impacts must be monitored closely by independent organizations. Engaging a wider cross-section of such org-anizations at an early stage in the development of the RRA is crucial. This ensured buy-in and ownership of the RRA. The incorporation of feedback from these organizations into the RRA is important to the successful implementation of the recommendations contained in this document.

Thus a meeting was held to engage the member organizations of the NSAP. Its purpose was to build on the two-day workshop in which there had been limited representation of this umbrella body. The membership of NSAP is diverse and consists of organizations such as the Agency for Rural Transformation (ART); North East Farmers Association; Grenada Association of Poultry Producers; Grenada Network of Rural Women Producers; National Development Foundation and Friends of the Earth Grenada.

The key outcome of the meeting was the validation of some specific recommendations coming out of the workshop. NSAP and its representative members were particularly supportive of stand-alone renewable energy technologies, especially to provide an affordable and sustainable energy supply to energy-poor individuals and communities.

Courtesy of GRENLEC

Table 2.3: Key stakeholders in the Grenada Energy Market

Ministry of Finance, Planning, Economy, Energy and Cooperatives

- The energy division within this ministry is responsible for the entire energy market including electricity and other products.
- The division is also responsible for the development and deployment of renewable energy.

Ministry of Agriculture

- This ministry has an integral role in the energy market as it handles pumps for irrigation and utilises a proportion of energy sources such as diesel.

Ministry of the Environment

- This ministry is responsible for climate change issues intricately linked to the use of energy, especially from fossil fuels.
- The ministry has embarked on climate mitigation projects that include the use of renewable energy sources.

Grenada Electricity Services (GRENLEC)

- The company is the sole generator, supplier and retailer for electricity.
- The company has a strategic role to play in the development of renewable energy in Grenada and has established an interconnection policy to accommodate renewable energy generation in the grid.

Grenada Solar Power Ltd (GRENSOL)

- A privately owned solar energy company that has installed several PV systems under the interconnection policy.

Grenada Hotel and Tourism Association (GHTA)

- The GHTA consists of hotels and resorts and consumes high quantities of electricity. The GHTA has expressed the need to move its members to renewable energy sources and is working on projects with that aim.

Grenada Development Bank (GDB)

- Government supported development bank that has the potential to be a key financier for renewable energy projects.

Grenada Industrial Development Corporation (GIDC)

- The GIDC promotes and supports investments in Grenada and has identified the energy sector as a lucrative sector for investment especially in the manufacture of solar systems.

Grenada Bureau of Standards (GDBS)

- This body plays a key role, providing standards and certification to ensure good quality renewable energy equipment is entering the market.

St. George's University (SGU)

- The SGU has signed a Memorandum of Understanding with the government of Grenada to collaborate on research and development in energy efficiency and renewable energy.

T. A. Marryshow Community College (TAMCC)

- This institution trains technicians and technologists in trades such as electrical installation. It also has the role of retraining technicians to install and maintain renewable energy technologies.

Non State Actors Panel (NSAP)

- The panel consists of NGOs, CBOs and other non-state related organisations. Its role is to stimulate and promote the uptake of renewable energy technologies, especially in rural and energy-poor communities.

Association of Architects

- This association is critical to the installation of integrated renewable energy sources in buildings.

Courtesy of GRENLEC

ENERGY POLICY AND REGULATORY FRAMEWORK

A department of the government of Grenada first set up the country's electricity supply in 1928. In 1960, Grenada Electricity Services was created by an act passed by the Grenada Legislative Council. The company was incorporated as a public liability company and as a subsidiary of the Commonwealth Development Corporation (CDC). The government of Grenada was a shareholder. In 1961, the Electricity Supply Ordinance gave GRENLEC the sole and exclusive licence to generate, transmit, distribute and sell electricity for 80 years (GRENLEC, 2011).

In 1982, the government became the sole owner of GRENLEC. Later the government decided to divest its shares as part of a structural adjustment programme and an effort to inject funds and facilitate technology input into the utility. GRENLEC became a public company in 1993. In 1994, the government sold half of GRENLEC to a private enterprise, retaining only 10 percent equity and selling the remainder to other investors including employees and ordinary Grenadians. During the same year, the government published a new Electricity Supply Act (ESA). It provided GRENLEC with a licence to operate until 31 December 2073. The act effectively maintained the monopolistic electricity market.

The ESA also sets out the mechanism for determining tariffs. As part of the ESA a Public Utilities Commission (PUC) was to be established to which GRENLEC was to apply for tariff adjustments. Although the PUC was never established under the ESA, there is currently a strong commitment to establish one.

In addition, the current ESA states that the sole operator - GRENLEC - can harness hydro and wind power in any part of Grenada free of charge. This clause is controversial and sets the tone for creating a monopolistic environment as wind and hydro power develop. The ESA does not specify this condition in relation to other resources such as geothermal and solar. With the current proposal to amend the ESA this will change as explained later in this section.

The ESA requires GRENLEC to maintain an excess minimum generating capacity of 20-30% above the daily average peak demand of the previous year, providing an opportunity for renewables. Finally, under the ESA, the government of Grenada has the option to revoke the licence after 30 or 55 years. However, there are extreme penalties for doing so, since the government of Grenada must pay all shares and debentures to all shareholders as it purchases the company.

An important development in recent months has been the intention of WRB (the majority shareholder in GRENLEC) to sell its majority shares in GRENLEC. The government of Grenada has used the opportunity to craft a new framework for the electricity sector that supports the government's policy for deploying renewable energy technologies. The main changes are summarised in the box below and a full explanation can be found in Appendix B. An important adjustment to the framework is the government of Grenada's potential removal of restrictions to the entry of IPPs using renewable energy. With these new adjustments, Grenada will be firmly on the path to realizing the action outlined in the NEP.

ENERGY PLANNING

1960 An act is passed by the Grenada Legislative Council, establishing GRENLEC

1961 The Electricity Supply Ordinance gives GRENLEC the sole and exclusive licence to generate, transmit, distribute and sell electricity for 80 years

1982 The government of Grenada becomes the sole owner of GRENLEC

1994 The government of Grenada privatises GRENLEC and licences are renewed for a further 80 years

2011 The government of Grenada adopts the first National Energy Policy and includes a target of 20% renewable energy in the electricity mix by 2020

2012 The government of Grenada announces the Greenada vision 2030 in which Grenada will have 100% renewables to support transportation and electricity

2012 The WRB announces the sale of its shares in GRENLEC. The government uses the opportunity to develop a new framework that will amend the 1994 Electricty Supply Act and introduce RPS and FITS for RE

In 2011 the Grenada NEP was adopted by the cabinet of the Grenada government. The policy contains a ten year Sustainable Energy Action Plan 2010 – 2020, which is being implemented. This policy is the most comprehensive approach to date that articulates the government of Grenada's intentions on energy in general and renewable energies in particular. In the NEP, the government proposes to "have 20% of all domestic energy usage (electricity and transport) originate from renewable energy sources by 2020".

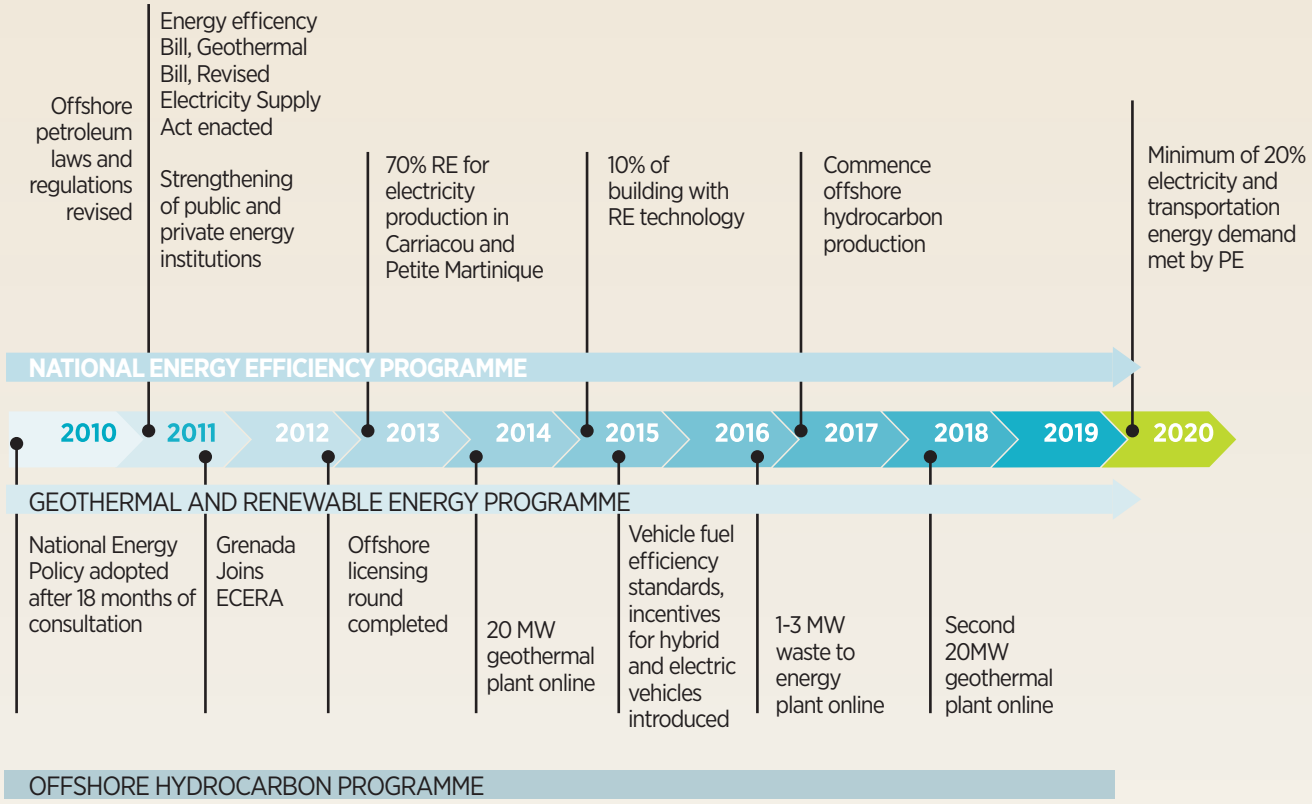
The NEP also outlines a strategic roadmap for realizing this vision (figure 2.10). This roadmap is focused mainly on the development of utility-based renewable energy.

Furthermore, the government of Grenada announced its GREENADA VISION 2030 on 8 May 2012 at the Sustainable Energy for All SIDS summit. This is a plan to make Grenada "one of the first countries in the world to go virtually 100% green in its energy sector (electricity and transport)."

The government believes that this can be achieved with relatively little capital investment[2]. This is because Grenada is endowed with its own local renewable sources - such as geothermal, wind, solar and ocean ther-

2 Meeting with Dr. Hugh Sealy, Energy Policy Adviser, Ministry of Energy, held on 20 December, 2012

Figure 2.10: Grenada's renewable energy roadmap



Source: Grenada 2020 vision paper

mal – and also has a relatively small economy. In adddition, the small generating capacity in Grenada (around 50 megawatts) allows for a smoother transition to RE without significant stranded costs of fossil-fuel generating units.

GREENADA, the vision for 100% renewable energy, consists of four major projects. Three are focused on utility scale generation: geothermal, wind and waste-to-energy. The remaining project will depend on distributed solar.

The nature of the projects, such as the geothermal plant, will require more extensive planning. This could potentially delay the 100% vision. Therefore, in the short term, the government of Grenada is also focusing on the distributed aspect of the GREENADA plan while not losing sight of the major utility scale projects.

The Renewables Readiness Assessment (RRA) will help the government of Grenada realise its new drive to renewable energy deployment. The RRA will help identify the key barriers to renewables deployment and make critical recommendations towards the realization of the NEP and related strategies.

Proposed framework for Grenada's electricity sector

1. An exclusive licence will be granted to GRENLEC to generate electricity from fossil fuels only and for all transmission, distribution and supply for a period of 45 years. However, no future owner of GRENLEC will have any exclusive licence for longer than 30 years.

2. The government of Grenada will legislate Renewable Electricity Portfolio Standards in the amended ESA, with penalties for non-compliance. These standards will determine the amount of renewable energy that GRENLEC must use to generate electricity at different times in the future.

3. Renewable Energy Special Purpose Vehicles (RESPVs) will be established for electricity generation from renewable energy sources including geothermal, wind, solar and waste materials.

4. No entity will be allowed to own more than 50% of GRENLEC or of an RESPV without the consent of the government of Grenada.

5. The government anticipates that it will be a major shareholder in these RESPVs.

6. An exclusive licence to explore geothermal resources and to produce electricity from a geothermal resource will be granted to the geothermal RESPV and NOT directly to GRENLEC.

7. LPH will be allowed to participate in the RESPVs up to a maximum of 50% and will be allowed to be the managing partner. However, if LPH fails to perform (by reaching key milestones and deadlines), the government of Grenada will have the right to choose another partner.

8. GRENLEC must purchase electricity from the RESPVs at a reasonable rate to be determined by the proposed independent regulatory authority, ECERA.

9. A new interconnection policy for distributed generation will be established.

10. The government intends to pursue a strategy for electric vehicles in Grenada. LPH has indicated that there are currently active pilot projects for electric vehicles under way in Emera-owned companies. Upon successful conclusion of discussions regarding GRENLEC, it would be the intention to pursue this kind of initiative in Grenada too.

11. An insurance fund will be established using best actuarial practices for companies operating in jurisdictions with similar risk profiles.

12. An employee share purchase plan will be maintained to allow employees to purchase shares in GRENLEC that the government of Grenada may put up for sale.

13. GRENLEC will contribute at least five percent of its income before taxes to local charities within Grenada.

14. LPH will take steps to ensure that GRENLEC provides training locally and overseas, including Canada. This is to enable GRENLEC employees to improve and acquire technical and management skills relating to the business.

15. When requested to so do, GRENLEC will apply a ten percent discount on the commercial power rates charged to the government of Grenada. This provision will not apply to street lighting or to statutory corporations. As indicated, the government intends to empower ECERA when established to regulate all rates offered by GRENLEC.

16. The scope of what may be defined as repurchase events has been reduced, removing those elements that are beyond the direct control of the government.

17. The length of time granted to the government of Grenada to assert its first offer and first refusal rights has been increased from 30 to 90 days.

18. Inappropriate representations and warranties have been removed.

19. A robust compliance mechanism is to be inserted both into the successor agreement and the amended Electricity Supply Act.

20. The establishment of an independent regulatory authority (ECERA or any other) with the power to change the means of rate adjustment has been acknowledged.

FINANCE AND INVESTMENT

Grenada enjoys a very stable financial landscape. The financial system consists of commercial banks, credit unions and a development bank. The commercial banking system is regulated by the ECCB. This also governs and regulates the commercial banking system in St. Vincent, St. Lucia, Dominica, St. Kitts and Nevis and Antigua. The local credit unions and other organizations providing finance are regulated by the Grenada Authority for the Regulation of Financial Institutions (GARFIN).

Energy development has been highlighted in the Grenada Investment Generation Strategy 2012-2016 developed by the Grenada Industrial Development Corporation (GIDC) in 2011. This organization stated that there was tremendous potential for investment in renewable energy technologies in particular. The GIDC was established to encourage and facilitate investments in the industrial sector. The strategy suggests there are niche markets in the manufacture of solar water heaters and in the operation and maintenance of both solar water heaters and PV systems. However, this will require the development of a partnership with GRENLEC.

Financing for such investments, especially solar and wind projects, could be provided by local financial institutions. Nevertheless, the cost of finance can be prohibitive at a current interest rate of 10-12% per year. Affordable finance, however, may be granted by the Grenada Development Bank (GDB), which was established by the government to provide funding and developmental assistance to local investors. However, the GDB finds grant funding a challenge at the moment mainly as a result of the global economic situation.

Remittances in the island amount to nearly four percent of GDP and represent an important resource within the country's balance of payments as well as for economic development. As remittances have a significant macroeconomic impact, they could be put to productive use, such as the development of renewable energy.

The government of Grenada has identified sources of funding from international organizations for RE development. One of the most important of these is SIDS Dock, a new funding mechanism established to support SIDS sustainable energy programmes. It will assist SIDS in their transition to low emission, climate-resilient development and open up a pathway to limiting temperature increases. SIDS Dock is meant to serve as a docking station through which SIDS can centralise learning and technical abilities. It will also give them access to global financial flows, especially through the carbon market. The Abu Dhabi Fund for Development (ADFD) is also considered an important new source of potentially affordable finance.

One development partner active in the Caribbean region is the German Agency for International Cooperation (GIZ), which has been working with the Caribbean Renewable Energy Development Programme (CREDP). Iceland, Brazil and Denmark are other countries that may offer bilateral assistance relating to Grenada's focus on RE. Multilateral banks such as the International Bank for Reconstruction and Development (IBRD) and the International Development Association of the World Bank are also involved and are funding Grenada and St. Lucia in their development of the ECERA. The Organization of American States (OAS) has supported several technical assistance programmes through the Caribbean Sustainable Energy Program (CSEP).

Grenada also has access to international funding agencies such as the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC) and the Global Environment Facility (GEF). The government of Grenada, with other CARICOM members, has secured funding through the GEF for the Energy for Sustainable Development in Caribbean Buildings project (GEF ESD Caribes Project). Grenada will focus on soft loans for investments in renewable energy projects. It will also focus on deploying renewable energy in the health sector and ensuring emergency shelters are functioning in the aftermath of natural disasters. The government of Grenada has already drawn funds from the African, Caribbean and Pacific-European Union Energy Facility. It managed to secure EUR 2.5 million as match funding supporting the Carriacou wind energy project.

In addition, the government of Grenada provides a tax incentive (exemption of the 15% VAT) for people investing in renewable energy and energy efficiency technologies. This is to further support the development of RE in the island.

RE FINANCING

Financing sources

- Bilateral and multilateral funding donors
- GDB
- Private banks and credit unions

A perception of high risk for RE investments may prohibit financing opportunities

GIDC is looking to invest in energy development

Funding has been secured under the EU-ACP Energy Facility to invest EUR 2.5M in a wind farm on the island of Carriacou

Grenada's Ministry of Finance has also produced a list of energy efficient equipment, including energy saving bulbs and renewable energy technologies, which are also exempt from VAT.

III. MARKET DEVELOPMENT AND TRANSITION BY SECTOR

ON-GRID ELECTRICITY FROM GEOTHERMAL

A critical component of the government of Grenada's GREENADA vision is to generate 60 - 70% of electricity from geothermal sources. The proposal is to implement this project in two stages, one in 2014 and the second in 2018. Initially a 20 megawatt plant was planned as the first phase of the project, with a further 20 megawatts planned for the second stage. These projects were planned for the Mount St. Catherine area. These plans have since been revised. In stage one the plant capacity was reduced to a ten megawatt generating plant to be installed in the fourth quarter of 2015.[3] The reduced capacity of the plant was "... due to caution over the sustainability of the resource".[4]

Geothermal has the best potential among renewables for providing baseload electricity generation. However, a higher risk is associated with geothermal. This is due to the high costs and risks of failure in proving the existence of the resource, large upfront investments and longer planning cycles.

The strategic approach proposed by the Government of Grenada is to form a Special Purpose Vehicle (SPV) to harness geothermal potential. To implement this project, a public-private-partnership is proposed. A geothermal bill and a concessionary agreement are under way to facilitate the process. The bill will provide the legal framework for developing the project and managing the resources. In the new developmental framework, the government will negotiate a resource development agreement with an entity established under the SPV.

This concessionary agreement is designed to reduce the risks to this entity by defining a number of issues. These include how resources are to be allocated and the period of access to the land and resources allowed to the entity established under the SPV. Hence the agreement will guarantee the SPV entity access to the resource and allow it to op-

3 Status of Implementation of Grenada's Sustainable Energy Action Plan – July 2012
4 Ibid

erate a plant over an extended period of time.

These negotiations are ongoing and are partially financed by the OAS under the Energy and Climate Partnership of the Americas. The government of Grenada is also assisted in its negotiations by the Clinton Foundation. The concessionary agreement further aims to provide GRENLEC with the necessary guarantee to obtain finance for the project. The geothermal bill needs parliamentary approval. Since this approval is still outstanding, the signing of the concessioary agreement is delayed. This has further delayed progress with the geothermal project.

A second critical barrier to the development of the project, contained in the concessionary agreement, is the need for environmental and social impact assessments. These assessments are usually costly; however, the developer has to bear the cost of these assessments. In addition, the areas selected for the geothermal project are environmentally and socially sensitive. The Mount St. Catherine area contains a forest reserve which is the most important habitat for wild flora and fauna on the island and is rich in biodiversity. It is also a major tourist attraction and serves local communities by providing water and other resources. As a result, civil society organizations have called for a more comprehensive national consultation on the geothermal project.[5]

The environmental concerns relating to the Mount St. Catherine area are significant in that access to the terrain for the project site is difficult. Access will mean some collateral damage cannot be avoided. The need to fell trees and pave over ground will have to be carefully assessed to minimise long-term environmental damage. Other environmental concerns need to be addressed, including residue from drilling. The government of Grenada has indicated that if the environmental and social impact assessments reveal adverse environmental impacts that cannot be effectively mitigated, the geothermal project will grind to a halt. The government will not consider 'enhanced geothermal extraction' that requires the rocks to be fractured and is associated with seismic activity.[6]

The development of geothermal in Grenada also needs to be looked at from the perspective of project finance. This is an important consideration since the consumer base is small (around 44,000 consumers). If the cost of developing the project is to be eventually recovered from consumers, they are likely to be burdened with tariffs which may not be significantly lower than the present tariff. The geothermal project would enable the country to be self-sufficient in terms of energy and protect the consumer from future volatility in oil prices. However, the cost of capital for a geothermal project or any other kind of renewable energy (e.g. wind) will be the single largest portion of the tariff paid by the consumer. Hence, access to affordable finance is critical.

Given the high cost associated with the construction of the plant and with the present tariff, it is difficult to see immediate price benefits to the end users. Given their small number, customers could end up paying significant sums if the recovery of investment costs is to take place over a reasonable period of time. However, with grant

5 Friends of the Earth Grenada, writing in the Grenada Informer, 26 October 2012
6 McKay, David (2009) Alternative energy: without the hot air p 98

or concessionary funding and effective regulation of the utility, the benefits to the end user can be increased.

RECOMMENDED ACTION

No full inventory has been taken of the potential in the Mount St. Catherine area. This can only be done after wells have been drilled and tested. High capital expenditure is required to drill wells, and the presence of enthalpy (heat) is only confirmed once this capital outlay has been made. Despite the reliability of geothermal resources in supplying baseload electricity, the risk associated with exploration and extraction is high.

Even before starting the exploratory phase, it is important to undertake a comprehensive and comparative analysis of costs and benefits of the geothermal plant compared with fossil fuels and other renewables. The outcome of this analysis should be made public so that all stakeholders have a clear understanding of the benefits of the project. It is further recommended that the social and environmental costs and benefits be a critical component of this assessment and results subject to a public consultation.

Given the peculiarity of geothermal resources and the low consumer base, it will be in Grenada's interests to obtain concessionary or grant finance for the exploratory and drilling phases. This means costs paid by consumers only relate to investments made to build and operate the power plants.

While finalising the concessionary agreement, the government of Grenada will need to provide adequate safeguards to ensure there are no adverse environmental and social impacts. In order to manage this geothermal initiative, Grenada will need to further develop capacities at different levels. These could include the public and private sector as well as financial institutions. Public institutions should have the technical capacities to establish and monitor the necessary regulatory framework.

The capacity within the public sector to make decisions on the results of the environmental and social impact assessments are also required. Private institutions should gain the necessary capacities to effectively manage the very specialised geothermal operations. Finally, financial institutions should increase their ability to assess risks associated with financing geothermal projects. However, to deal with the risks associated with geothermal projects a regional approach is proposed. Several countries in the region are at the exploration stage in their development of geothermal. This means the feasibility of a regional geothermal risk fund could be explored further.

ON-GRID ELECTRICITY FROM WIND AND SOLAR

In order to stimulate the deployment of grid-connected renewables, GRENLEC developed an interconnection policy in 2008. This policy allowed customers in both the domestic and commercial sectors to install grid-tied renewable energy systems to a maximum installed capacity of 300 kilowatts. Domestic customers were permitted to install a maximum of 10 kilowatts, while commercial customers could install as much as 100 kilowatts. During this pilot phase a fixed option (net metering) scheme was introduced.

The interconnection scheme entered a second phase with an increased allocation of 500 kilowatts of renewables in 2011-2012. During this second phase, two schemes were introduced: a fixed option (net me-

tering) and a variable option (net billing). Under the fixed option, customers sold electricity to GRENLEC at USD 0.17 per kilowatt hour for a fixed period of ten years. The variable option allowed GRENLEC to deduct from the customer's bill an adjusted annual average avoided fuel cost, relating to the previous year. (This represents fuel GRENLEC has avoided burning).

This second phase resulted in limited installation of additional capacity, as consumers perceive the payback period as too long and the scheme too risky. The government of Grenada is currently negotiating a new and more equitable interconnection policy with the proposed new majority shareholder of GRENLEC. The details of this new scheme are shown in the box on the next page.

As part of the NEP, the government of Grenada indicated in 2011 that as much as 20% of the electricity mix should come from wind and five percent from distributed solar. Hence wind farm projects are now planned for the islands of Grenada and Carriacou.

Solar and wind farms require the development of large plots of land. Given the characteristics of these islands, limited land is available and it is usually prioritised for agriculture and tourism. Other problems associated with the development of solar and wind projects are related to land tenure. Much of the land suitable for wind farm projects is privately owned and highly priced. In addition, the process for obtaining lands owned by government can be lengthy.

Wind and solar potential are abundant on the eastern corridor of the three islands of Grenada, Carriacou and Petite Martinique. This is where the main settlements are concentrated. However the high investment cost for these types of projects means concessionary financing will be required to make such projects a reality. Economies of scale are another obstacle to the development of the technology. The Carriacou wind project, for instance, is a relatively small project. This presents a challenge to suppliers used to developing wind farms that are more profitable due to their larger scale and capacity. This means the cost of supplying equipment to these small projects may be relatively high.

Image 1: GRENLEC micro wind turbine at Fort Frederick, Grenada
Courtesy of GRENLEC

Environmental and social concerns are

NEW INTERCONNECTION POLICY

The following are indicative rates for the interconnection of renewable energy sources to the GRENLEC grid:

- An overall cap on distributed generation will be initially set at five percent of peak generation and will be revised after consultation with GRENLEC and studies on grid stability thresholds.
- Maximum capacity will be 100 kilowatts for commercial establishments and 15 kilowatts for households.
- An excess net billing system will be used. Owners of small generating systems will be allowed to use the energy that they produce and sell the excess to GRENLEC.
- Distributed generators will only be compensated for generation up to 1.5 times their monthly consumption.
- A floor price of XCD 0.53 (USD 0.20) per kilowatt hour has been established for the first set of contracts, with the ability to revise the floor in year five of a ten year purchase contract.

other critical barriers to the development of wind farms in particular. Concerns include noise, aesthetics and disruption to the flight paths of birds. Wind turbines have been associated with low frequency noise from continually rotating rotor blades. Their high towers may spoil the view of an otherwise beautiful landscape. Civil society groups usually draw attention to environmental problems, and their opposition to these projects needs to be softened.

RECOMMENDED ACTION

The islands are perceived as having relatively good wind and solar potential, identified in the preliminary solar and wind resource maps. However, substantial efforts are needed to make further ground assessments of these resources to develop site-specific data. This would enable lower initial investments in the development of the resource. Resource maps will also assist small investors deciding whether to invest in a particular resource or combination of resources based on location. To this end there is a need to conduct more local research with local expert organizations such as the meteorological office to create comprehensive RE resource maps for Grenada.

Areas with high solar and wind potential need to be identified on the basis of resource maps and present grid infrastructure. This will allow relevant authorities to allocate parcels of land for the development of RE projects. Buy-in from the relevant government departments is required as they can allocate RE projects to Crown lands not already allocated for other development purposes. This will incentivise potential investors to develop projects on sites with high renewable energy potential and free of land tenure issues.

GRENLEC has invested in installed capacity using fossil fuel which will meet consumer demand during the coming years. The current tariff structure and the fact that GRENLEC investment is already locked into diesel generation means it has no incentive to

Image 2: Erecting wind test equipment in Carriacou [Above]
Image 3: Wind test tower in Carriacou [Above right top]
Image 4: Wind test tower erected in Grenada [Above bottom right]
Courtesy of GRENLEC

substitute fossil fuels for renewable energy. The cost of renewables will only be marginally lower or equal to the current cost of generating electricity from fossil fuels. Introducing more renewables might not lower the average electricity tariff and therefore there is no additional benefit to the end user. In order to support renewables development, the government of Grenada should secure grant and concessionary funding leading to lower average consumer tariffs and creating a greater buy-in for renewables.

In addition, finance made available to end users wanting to invest in distributed renewable energy technologies (especially solar PV) at concessionary rates will lead to more renewable energy within the grid. Lending institutions such as the GDB can accommodate this in the form of concessionary soft loans for investment in RE. The government of Grenada has received grant funding of USD 400,000 to provide such soft loans through the GDB to potential investors[7].

In addition to the newly agreed intercon-

7 Meeting with Hugh Sealy, Energy Policy Advisor, Minister for Energy, held on 21 December 2012

nection policy, the benefits of VAT removal should also be evaluated. Its payment can be perceived as a barrier to the development of grid-connected PV, since customers in the scheme still have to pay it. The government will have to speed up the creation of an independent regulatory entity that has an overview and arranges pricing within the electricity market.

Capacity building is critical to the development of wind and solar. The meteorology office's capacity to conduct a comprehensive RE potential assessment and mapping needs to be further reinforced. Lending organizations such as the GDB will play an important role in the development of the sector. However, they need to further develop their capacities to assess risks associated with loans for renewable energy investments.

On a small island like Grenada which would import most renewable energy equipment, standards and quality assurance are critical to protect consumers and the grid. The Grenada Bureau of Standards (GDBS) would need to register and implement the standards ensuring the use of high quality RE equipment and related technologies. The capacity of the relevant staff within the bureau would need to be enhanced. Grenada has a very good technical institute in T. A. Marryshow Community College (TAMCC) which has been training technicians in many fields. This institute could collaborate in training technicians in renewable energy technologies.

OFF-GRID/STAND-ALONE APPLICATIONS

The NEP does not specify a strategy for the deployment of stand-alone technologies, since there is already a high electricity access rate (99.5%). However, at times

Image 5: Stand-alone system, 1.8kWp
Courtesy of www.grensol.com

when there may be no access to the grid, such as in the aftermath of a hurricane, stand-alone technologies will become very beneficial. Grenada's Ministry of Environment has therefore embarked on a project to install solar PV on emergency shelters and health stations. Its main objective is to ensure there is adequate power available in the aftermath of a hurricane, which may make access to the grid impossible. The government of Grenada has already secured about USD 300,000 for this project under the GEF ESD Caribes Project. In addition, off-grid renewable energy technologies could also provide cheaper energy for productive activities like agriculture and fisheries in isolated areas, which are not grid-connected.

The ESA provides GRENLEC with the exclusive right to generate, transmit and distribute electricity throughout the island. This implies that even if a commercial consumer like a hotel wants to set up an off-grid captive plant for its own consumption, it would need to obtain permission from GRENLEC. The consumer base in Grenada is small and GRENLEC has already invested in generating capacity to meet its require-

ments. This means it is not willing to give such high energy consumers the option to put up captive plants whilst also drawing electricity from the grid. Given the intermittency of wind and solar, consumers will need the utility as a back-up.

Off-grid solutions can provide electricity where possible, especially for households that do not have access to the grid. However this will require financing. Yet the lack of concessionary finance and after-sale services is among the barriers to off-grid technology deployment on the islands. The lack of information on the potential of these resources available to individuals and communities is another barrier to off-grid renewable energy.

Communities need to be empowered with reliable information on the resource potential of technologies considered here. This will allow them to make well-informed decisions on the types of renewable energy technologies and the most reliable and affordable combinations available. Most developments in stand-alone systems, particularly solar PV, have so far come through NGOs, who are particularly interested in the benefits of these systems to local communities.

RECOMMENDATIONS

Barriers to finance must be removed in order to deploy renewables off-grid. This sector will for the most part target households, especially those with a low income. This means development grant funds should be the main source of finance for projects in this area. People interested need to make specific grant applications. Possible sources of funding are the GEF under the United Nations Development Programme (UNDP), which offers grants of up to USD 50,000 for projects with a direct impact on local communities. It focuses on environmental protection, such as the mitigation and adaptation of climate change. The ACP EU Energy Facility has allocated a minimum of EUR 10 million for such projects.

To further support off-grid deployment, business models that make use of inward remittances should be actively promoted. A policy to promote these business models should be developed in collaboration with the government of Grenada, NGOs and the private sector.

The capacity of technicians developed for grid applications can also be employed to promote these niche applications. The need to register appropriate standards and ensure quality renewable energy and energy efficient equipment is also critical to support this proposed model.

THERMAL HEATING AND COOLING

Solar hot water systems are commonly used in middle to upper-income households and in hotels. Between 2000-2008, the overall number of solar thermal collectors imported into Grenada increased by 400%. In 2008, 4,000 solar water heaters were installed in Grenada. The NEP clearly underlined the importance of solar water heating. It is highlighted as a policy standpoint mandating the use of solar water heaters in all government buildings, hotels and other commercial buildings with a demand for hot water. However, it does not have a provision for the residential sector.

Although it does promote energy-efficient buildings and equipment, the NEP does not promote the use of RE technologies for cooling applications. The prospect for solar cooling in the Grenada hotel sector could be explored. However, since the initial cost

of the technology is higher than regular units, incentives will be necessary to encourage the uptake of this technology.

The agriculture sector is critical to the NEP. Policy goals call for the production and manufacturing of primary, value-added agricultural and tertiary goods and products in the most efficient and sustainable manner viable. The potential for the use of renewable energy technologies in the agricultural sector, especially solar drying for agriculture produce, is good. In the spice sector, the solar drying of mace from nutmeg is an example. However, other applications can benefit from solar drying, such as fisheries and other condiments in the agricultural sector.

Agricultural lands are primarily irrigated using diesel pumps. The government of Grenada seeks out projects to procure and deliver small irrigation pumps to farmers, albeit fossil fuel pumps. The hydraulic ramp pump is a practical solution for farmers. The farming community has high demand at the moment for these pumps, which could be complemented by the solar pumps. The application of these technologies is however restricted by its upfront cost and a lack of knowledge of its operation and long term benefits.

There have also been other applications in the past. For example, windmills were used to pump rain water out of drains to prevent flooding during heavy rains. Wind-powered pumps were used in the town of Grenville, St. Andrew, which is below sea level, to assist the flow of water from the town during downpours.

Waste from the production of sugar cane was used in the past as a fuel for boilers in the production of rum. Running water was also applied as the source of energy to grind sugar cane for producing sugar and rum. In some of the rum-producing factories, watermills are still used to grind sugar cane to produce molasses.

RECOMMENDED ACTION

Further measures to encourage solar water heating should be taken. Funding in the form of soft loans can be made available to people wishing to invest in solar water heating and to build awareness of its potential benefits. The model for this can be taken from the Public Service Cooperative Credit Union (PSCCU), which has received grant funding from the OAS and the United Nations International Development Organization (UNIDO). The loans are provided at a low interest rate for a period up to five years. System costs and installation range between USD 1,100 and USD 1,480. This fund has been available since 2010. Other institutions such as the GDB and credit unions can use this model to provide affordable funding to investors in solar water heating.

Solar cooling (or air conditioning) could follow a similar path to solar water heating but would have to be driven by the private sector. As was previously mentioned, the cost of solar cooling is high compared to conventional systems. These investments would, therefore, benefit from more incentives. To this effect, these units could be included in the list of items contributing to energy efficiency and could benefit from VAT exemption.

Grenada's building code is silent on the use of energy-efficient equipment, such as air-conditioning, to improve overall energy efficiency in buildings. It is therefore recommended that consideration be given to the

inclusion of this critical component in the building code. This will support the deployment of renewable energy systems in buildings. The issue of energy efficient builidngs will be addressed through the GEF ESD Caribes Project.

In the agricultural sector, the government of Grenada can take the lead through the Ministry of Agriculture. The government can seek out finance for projects that utilise RE technologies. It has been noted that the cost of ramp pumps is extremely high. The government of Grenada should provide fiscal incentives to make these pumps more affordable, in keeping with the policy it previously articulated for the agricultural sector. For example, ramp pumps can also be included in the list of energy efficient equipment exempt from VAT.

The government may also receive funds or donations of irrigation equipment. It could request such funding be used to purchase renewable energy powered pumps or that pumps from donors be powered from renewable energy sources. This can then be used to develop projects in collaboration with farmers and the Ministry of Agriculture and Energy to deploy the use of these pumps on farms.

Cost/benefit analyses must be conducted in order to further support the resource development strategy. These should take the form of comparative analyses between present fossil fuel equipment and that of proposed renewable energy technologies. An analysis of the life cycle of this equipment should be considered, in which related environmental concerns must be an integral component. These comparative studies will assist in making decisions on a life cycle basis rather than on the commonly-used first cost basis.

To conclude, capacity building in all the relevant sectors must improve. The capacity of technicians has to be increased to ensure they have the ability to design, install, operate and maintain the technologies. The necessary capacity requirements at the GDBS needed to deal with new ramp pump technology should be improved to ensure quality renewable energy equipment is procured. Risk assessment capacity within lending institutions is equally necessary. Finally, institutional capacity needs to considered. This will include building capacity within the Ministry of Energy by upgrading the current energy division to a national sustainable energy organization.

IV. RECOMMENDED ACTIONS

The measures recommended below were offered by the stakeholders following the findings of the RRA workshop.

ON-GRID ELECTRICITY: WIND, SOLAR AND GEOTHERMAL

- Develop a comprehensive strategic plan to support a roadmap in the NEP.
- Set up an independent regulator for the electricity market.
- Finalise the concessionary agreement for geothermal and conduct appropriate environmental and social impact assessments (including road access to the chosen site).
- Allocate lands for RE development in zones with high renewable resources such as wind and solar.
- Finalise the review of the current interconnection policy to promote business models that can increase the deployment of renewables.
- Waive the payment of VAT in electricity bills paid by consumers producing electricity using renewable energy.
- Develop GDBS capacity to provide standards and ensure quality renewable energy equipment.
- Support TAMCC in developing a curriculum and training technicians in renewable energy technologies.

- Develop the capacity of the meteorological office to carry out comprehensive renewable energy resource assessments.

- Source concessionary credit lines for the GDB so that it can make soft loans available for investment in renewable energy technologies. Develop the capacity of lending agencies to assess associated risks.

OFF-GRID

- Develop a business model to design and install stand-alone renewable energy systems, especially in the household sector.

- Promote solar pumps for farmers.

HEATING AND COOLING

- Encourage building codes to be updated.

- Encourage the uptake of solar water heaters for domestic and commercial water heating through an enabling policy framework.

V. BEST PRACTICES AND FUTURE COOPERATION

GOOD PRACTICE CASE STUDIES

Good Practice Case Study 1: The first phase interconnection policy

The first stage of the GRENLEC interconnection policy was a good example of a more economically viable interconnection business model. Under this first phase, customers in both the domestic and commercial sectors were allowed to install grid-tied renewable energy systems up to a maximum installed capacity of 300 kilowatts. Domestic customers were permitted to install a maximum of 10 kilowatts, while commercial customers could install as much as 100 kilowatts. During this initial phase, a fixed option (net metering) was introduced.

The programme was very popular; 54 customers responded, and they are now generating electricity from solar. The allocated generation of 300 kilowatts was rapidly exhausted. According to GRENLEC, the success of the programme prompted the establishment of a second phase.

Good Practice Case Study 2: A wind farm project in Carriacou

The wind farm project in Carriacou is a good example of a private/public partnership. The government of Grenada was successful in securing grant funding from the European Union. These funds attracted match-funding from GRENLEC to develop a 1.1 megawatt wind farm on the small island of Carriacou.

When this project is completed, the price of electricity to Carriacou

customers may be reduced. The avoided fuel dependency will at least allow this small island to have a more secure and independent electricity supply. Coupled with these economic benefits, the island will move one step closer to becoming a green economy.

NEXT STEPS

The RRA in Grenada assesses the current situation while also providing a forward-looking framework of action that will enhance deployment of renewables. It has enabled IRENA to work with the government of Grenada to facilitate a coordinated approach for setting priorities. This can inform their discussions and shape the dialogue with funding agencies concerning the implementation of action and initiatives emerging out of the RRA. In facilitating this process, IRENA leverages its comparative advantage as a unique inter-governmental agency dedicated to the promotion of renewable energy by offering countries access to a global network with the capacity to follow up on actions and share best practice. The involvement of key national stakeholders in assessing opportunities and challenges for deploying renewable energy technologies in Grenada exemplifies the collaborative and holistic approach of the RRA process.

The RRA findings show that Grenada is taking a two-pronged approach to enhancing deployment of renewable energy: utility-scale projects for geothermal and wind, and distributed generation primarily using solar PV technology. The RRA lays the foundation for broader private sector participation in the renewable energy sector and also recommends that measures should be put in motion to secure low cost financing for renewable energy projects and in parallel develop a strategy for building the capacity of various stakeholders.

The process and outcomes of the RRA has generated significant interest in Grenada; the experience from this extensive process of engagement with this country has, in turn, helped strengthen the methodology. IRENA will facilitate the interaction with supporting entities, including international funding agencies and the private sector in order to further the implementation of action plans formulated by countries as a result of the RRA. Partnerships will be built with organisations working in the region. IRENA has indeed already initiated the process and garnered some funding to support actions identified to take the geothermal development forward. Discussions with the CARICOM are underway to see how the RRA can enrich the regional plan for RE deployment and assist in its implementation.

IRENA will also initiate the development of advisory services as a follow up to the RRAs. These will initially include: a capacity needs assessment, resource assessment, technology roadmaps, local content and finance. These advisory services will be offered to countries where RRAs have been conducted and upon request. The RRA is just the beginning of a structured engagement with the country and will enable IRENA to respond with country-specific support and advice in future.

Courtesy of GRENLEC

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Courtesy of GRENLEC

VII. ANNEXES

ANNEX A

DETAILED LIST OF RECOMMENDED ACTIONS

Action 1

Finalise the review of the current interconnection policy.

Renewable application	On-grid/solar and wind.
Description	• A review of the current interconnection policy could include an analysis of the pricing mechanism for electricity. Emphasis could be placed on the fuel charge component of the tariff and on the VAT. A comprehensive review of the tariff as it relates to the three consumer types: residential; commercial and industrial could also be conducted. • Case studies, such as in the hotel sector; private individuals who are grid-connected and other commercial customers could be provided to support the recommended action. • An analysis of the investments required by different types of consumers. • The government of Grenada is now negotiating a new more equitable interconnection policy with GRENLEC.
Actors	• Government of Grenada (Ministry of Finance, Planning, Economy and Energy) • GRENLEC • Renewable energy companies e.g. GRENSOL • Domestic consumers • GDB
Deadline	End 2013
Key risks and challenges	Amendment to the ESA, secure enactment and implementation expeditiously.

Keys outcomes	• Initiation of negotiations between the government of Grenada and GRENLEC. • Stakeholder consultation to establish acceptance of revised policy. • Revised interconnection policy implementation.

Action 2

Create and start up an independent electricity regulator.

Renewable application	On-grid solar and wind.
Description	• At the moment, the electricity market is self-regulated by GRENLEC under the 1994 ESA. • This action therefore calls for the creation of a regulator that will independently regulate the uptake of renewable energy technologies, especially the appropriate, economically viable pricing tariff for the stakeholders involved. • Grenada is participating in the ECERA project, but there is need to have the 1994 ESA adjusted, or to put in place new laws outside of the geothermal act. This will govern the establishment of the regulator and remove current barriers created by the 1994 ESA.
Actors	• Government of Grenada (Ministry of Energy; Ministry of Legal Affairs) • GRENLEC • GRENSOL
Deadline	End 2013
Key outcomes	• Regulatory framework designed.

	• Unresolved ESA issues clarified. • Regulatory framework discussed with key stakeholders. • Regulatory authority created.

Action 3

Finalise the concessionary agreement.

Renewable application	On-grid geothermal.
Description	• The concessionary agreement currently being negotiated between the government of Grenada and GRENLEC is intended to provide concessionary rights to GRENLEC to develop the geothermal resource in Grenada. • Before construction of the plant begins, these concessions must be agreed. This action proposes that the whole project is cancelled if the agreement is not mutual.
Actors	• Physical Planning Unit • Department of Forestry • GRENLEC • Ministry of the Environment • Community-based organizations • NGOs
Deadline	End 2013
Keys for success	• Concessionary terms agreed. • Geothermal act passed and published.

Action 4

Conduct appropriate environmental and social impact assessments (including road access to the chosen site)

Renewable application	On-grid solar and wind
Description	• EIAs and SIAs are critical at all stages of the project to ensure competing resources are optimised. • EIAs and SIAs must also be discussed and buy-in sought with the key stakeholders at each stage of the project life cycle or development.
Actors	• Physical Planning Unit • Department of Forestry • GRENLEC • Ministry of the Environment • Community-based organizations • NGOs
Deadline	End 2014
Keys for success	• EIAs and SIAs conducted. EIA and SIA consultations held with key stakeholders. Project begins.

Action 5

Allocate land for RE development in zones benefitting from high renewable resources such as wind

Renewable application	On-grid solar and wind
Description	• Obtaining lands for the development of wind and solar farms is a challenge for investors such as GRENLEC and GHTA. Added to this is the challenge of building data for resource maps for Grenada. • This action means the government of Grenada potentially allocates lands through relevant authorities in zones with high RE resource potential for the development of RE projects. This action must be supported by comprehensive renewable energy resource maps.
Actors	• Ministry of Finance, Energy and Planning (Energy Division) • Ministry of Agriculture and Lands • GRENLEC • Renewable energy companies • Grenada Hotel and Tourism Association
Deadline	End 2013
Key risks and challenges	Land tenure and the allocation of lands for competing developments is sometimes a challenge to the government. This may affect the allocation of land for new RE development.
Key outcomes	Land identified in areas with high RE resource potential. The relevant allocation authority is engaged. Lands are allocated.

Action 6

Develop GDBS capacity to provide standards development and quality for RE equipment and technologies.

Renewable application	On-grid solar and wind
Description	• GDBS was established to provide services to industry and consumers, by ensuring fair trading in goods and services. The GDBS Act authorises GDBS to carry out its work mandating provision of quality and testing services, standards development and implementation and inspection services. • Imports of high quality products must be ensured as Grenada moves towards an electricity market utilizing renewable energy equipment and technologies. This action is intended to improve and increase the capacity of the GDBS to provide services such as testing, third party verification, standards development and adaptation to renewable energy products. • Capacity building required relates to human capacity and necessary equipment to provide testing where applicable.
Actors	• Grenada Bureau of Standards • Ministry of Energy • Ministry of Trade • Other external donors
Deadline	End 2013
Key risks and challenges	Sourcing funds to develop the required capacity. This project, as with all other capacity building recommendations, can be blocked or delayed due to lack of funding.
Key outcomes	• Project identified for capacity building within GDB. • Capacity building project designed. • Project discussed with key stakeholders. • Project submitted to donors for possible funding .

Action 7

Develop the capacity of TAMCC to provide curriculum development and training for technicians in RE technologies.

Renewable application	On-grid solar and wind
Description	• New renewable energy technologies will require the training and retraining of technicians and technologists to design, install and maintain RE technologies and associated equipment. • TAMCC is the college providing education and training to the local population in technical areas such as electrical installation, refrigeration and air conditioning, plumbing and other building-related trades. • This action proposes to develop the teaching capacity and to some extent research within TAMCC to develop training courses geared towards training technicians and technologists in renewable energy technologies.
Actors	• TAMCC • Ministry of Energy • St. George's University • Other external donors
Deadline	End 2013
Key risks and challenges	Sourcing funds to develop the required capacity. This project, as with all other capacity building recommendations, can be blocked or delayed due to lack of funding.
Key outcomes	• Conduct audit to determine a suitable curriculum. • Design projects to improve curriculum. • Identify material and equipment to supporting curriculum delivery. • Identify human capacity needs. • Implement aspects of project that do not require funding. • Seek funding to further develop capacity (equipment and training).

Action 8

Develop the capacity - equipment and human - within the meteorological office and the Ministry of Agriculture to carry out a comprehensive RE resource assessment that can be used to develop solar and wind maps for Grenada.

Renewable application	On-grid solar and wind
Description	• A critical problem is the lack of reliable data to prove the resource potential of renewable sources, especially wind and solar. • This action proposes to upgrade where possible the skills and equipment required to gather data on the islands' resource potential. • Resource maps generated by this exercise will be for public use. They will assist all developers, including the domestic consumer wishing to install renewable technologies, in making an informed decision on investments.
Actors	• Meteorological Office • Ministry of Lands and Agriculture • TAMCC • GDBS • TCommunity-based organizations • TNGOs • TGHTA
Deadline	End 2013
Key risks and challenges	Sourcing funds to develop the required capacity. This project, as with all other capacity building recommendations, can be blocked or delayed due to lack of funding.
Key outcomes	• Design project to conduct resource mapping. • Assess current institutional capacity.

- Seek funding to realise the project.
- Conduct data-gathering exercise.
- Design maps.

Action 9

Source concessionary credit lines for the GDB to make available soft loans for investments in RE technologies. Develop lending agency capacities to assess risks associated with these loans by supporting their collaboration with the GDB.

Renewable application	On-grid solar and wind
Description	• The initial cost for investing in renewable technologies can be prohibitive, so there is a critical need to seek low cost funding for investors, especially for the domestic consumers. The ability to assess the risk associated with these investments within Grenada funding agenciesis also limited. • GDB efforts to source concessionary credit lines have been thwarted by the government's current economic circumstances. The interconnection policy offered by GRENLEC is unattractive and has prevented GDB from raising grants that could be used to support RE investment. • This action thus proposes to assist the GDB and other funding organizations in finding concessionary loans and where possible grants for RE investments.
Actors	• GDB • Government of Grenada (Ministry of Finance) • Private sector • GIDC • Private Banks Association • Credit unions
Deadline	Mid-2014

Key outcomes	• Review the current funding landscape.
	• Develop a funding mechanism proposal.
	• Develop proposals for funding.
	• Submit funding proposals.
	• Seek partnerships with international funding agencies with experience in RE investments.

Action 10

Develop a business model to design and install stand-alone RE systems, especially in the household sector and in rural areas;test and refine the model by developing and driving through a pilot project.

Renewable application	Off-grid wind/solar/hydro (micro renewables)
Description	• There is no business model at present supporting stand-alone RE systems, but the business prospect for stand-alone generation is high. This is especially true for some rural communities. • In 2011 there were approximately 38,000 domestic consumers of electricity. • The ESA 1994 allows domestic consumers to generate their own electricity, but customers wishing to do so most disconnect from the grid. • This action consists of a comprehensive analysis of the present situation and the development of an optimal business model allowing individuals and communities to develop stand-alone RE systems.

Note: the design of this business model is the basis for any other action relating to this issue, including financial decisions.

Actors	• Government of Grenada (Ministry of Finance and Energy, Ministry of Social Development; Physical Planning Unit) • Private sector (Chamber of Commerce) • GIDC

	• NGOs • Community-based organizations
Deadline	End 2013
Key outcomes	• Research prospects for stand-alone RE systems. • Design business models. • Design a pilot project. • Gather project data. • Refine business model. • Implement business model on a large scale.

Action 11

Encourage the uptake of solar water heaters for domestic and commercial water heating

Renewable application	Heating and cooling/solar
Description	• The PSCU is currently offering soft loans to its members for the purchase and installation of solar water heaters. Most of the PCSU 8,000 members are households. • The PSCU was able to secure a grant to provide the loans. However, to date only around 20 members have secured loans to install water heaters. The problem seems to be a lack of awareness of the financial benefits of solar water heating. Although the grant also provides for advertising the available loans, the lack of uptake suggests that people are still not convinced of the benefits. This action therefore proposes to assist PSCU and other organizations embarking on such projects to raise awareness of solar water heating benefits.
Actors	• PSCU

	• Energy Division, Ministry of Finance, Planning, Economy, Energy & Co-operatives • Companies and individuals selling solar water heaters
Deadline	Mid-2013
Key outcomes	• Engage key stakeholders • Create an educational and awareness campaign

Action 12

Review the technologies past and present for farm pumps.

Renewable application	Motive (pumps) - solar/wind
Description	• Renewable energy technologies have been used for irrigating lands for farming and for other pumping applications like flood prevention in low-lying areas. • This action calls for a review of these technologies with the aim of powering them using renewables.
Actors	• Ministry of Agriculture • Ministry of Energy • Ministry of Works
Deadline	End 2013
Key outcomes	• National review established. • Review conducted. • Results and finding documented. • Review recommendations are adopted.

ANNEX B

Amendments to the present electricity sector
by the Government of Grenada

A NEW DEVELOPMENTAL FRAMEWORK FOR GRENADA'S ELECTRICITY SECTOR

THE OPPORTUNITY

In November 2012, GPP, the majority shareholders (50%) of GRENLEC (figure 1), advised the government of Grenada that GPP wished to sell all its shares in GRENLEC to Light & Power Holdings (LPH) of Barbados. LPH is majority-owned by Emera Inc., a Canadian utility and energy services company based in Halifax, Nova Scotia. It is the parent company of the Barbados Light & Power Company and also has a 19.1% interest in St. Lucia Electricity Services (LUCELEC).

The government of Grenada also became aware that the shares (11.4%) owned by ECH were effectively controlled by the parent company of GPP – WRB Enterprises based in Florida. LPH had also expressed an interest in purchasing these shares.

The pending sale of the GPP and ECH shares provided the government of Grenada with the following options:

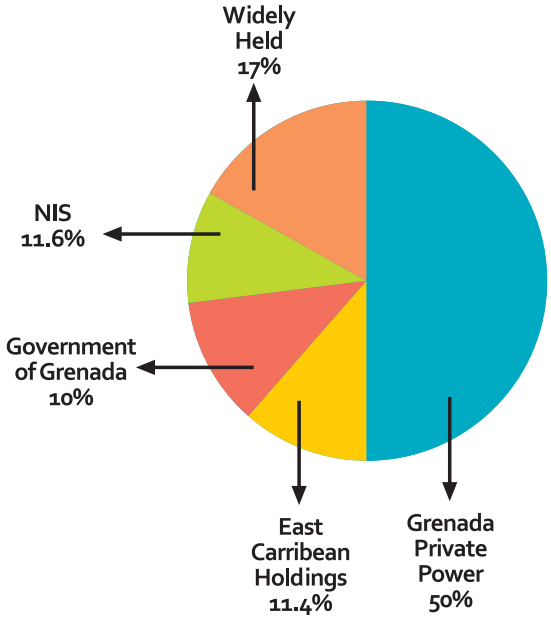
A. It could assert its time-limited right to submit a bid to purchase these shares outright. However, GPP retained the right, without any reasons given, to sell to another bidder.

B. It could use the opportunity to review and revise the ESA which governs the relationship between the state and the electric utility. Its purpose would be to negotiate a successor agreement with LPH that was in the best interests of Grenada, provided that LPH met the government's requirements for a Qualified Purchaser.

The government initially decided to pursue both options simultaneously, with the view that a parallel approach increased its chances of fulfilling the key objectives for the electricity sector.

Although the government of Grenada did formally submit a bid for 50% of the shares held by GPP and 11.4% of the shares held by ECH, the preferred option was for the utility to continue to be run effectively by the private sector. The government would have an increased role in guiding

Figure 1
Current ownership in GRENLEC
Share in %



policy direction and would establish an independent regulator to ensure effective regulation of service provision and the setting of tariffs.

Therefore, over the last few weeks, the government has aggressively pursued option B. The Office of the Attorney General and the Ministry of Finance and Energy have worked assiduously to prepare amendments to the ESA and have been in active negotiations with the prospective purchaser – LPH.

On 27 December, the major terms and conditions of a successor agreement between the government of Grenada and LPH were agreed. An amended ESA will govern this successor agreement.

EASTERN CARIBBEAN HOLDINGS

The shares (11.4%) owned by ECH represent an opportunity for the government of Grenada to increase its share ownership in GRENLEC through the NIS or directly.

KEY OBJECTIVES FOR GRENADA'S ELECTRICITY SECTOR

- **Ensuring efficient and reliable operation of the service**
- **Ensuring that consumers pay a fair and equitable rate**
- **Making a transition to renewable energy in the fuel mix used for generation, in line with the National Energy Policy and GREENADA Vision 2030**
- **Facilitating distributed generation using renewable energy by individual households and commercial establishments**

A NEW ELECTRICITY SECTOR FRAMEWORK
AMENDMENTS TO THE ESA AND A NEW SUCCESSOR AGREEMENT

2.1 ISSUES THAT NEEDED TO BE RESOLVED

The government identified the following aspects of the existing legal and contractual framework that were considered disadvantageous to the citizens of Grenada

Problems with the old framework.

1. The period for the exclusive licence to generate, transmit, distribute and supply was too long and could not be justified on commercial terms. The current licence was not due to expire until 2073 (60 years from now).
2. There was ambiguity as to whether any entity could own more than 50% of GRENLEC. It is this government's policy to limit ownership by any entity to 50% without the written consent of the government.
3. The government had very limited means of ensuring that the utility implemented national policy by making a transition to renewable energy for its own generation and by allowing for IPPs using renewable energy.
4. The interconnection policy being applied by GRENLEC for distributed generation by Micro-Independent Power Producers (MIPPs) has proved to be highly unattractive to consumers.
5. The means of insuring the utility assets was not as robust as desired.
6. The scope of what could be defined as repurchase events was too onerous.
7. Time restrictions on the government of Grenada to assert some of its rights were too stringent.
8. A number of government representations and warranties in the original Share Purchase Agreement, including protection of the purchaser from environmental liability, were not appropriate to a Successor Agreement.
9. The compliance mechanism and penalties for non-performance on the part of GRENLEC were non-existent or too weak.
10. The present agreement and legislation was written before the establishment of the Eastern Caribbean Energy Regulatory Authority (ECERA) had been proposed. It is the government of Grenada's intention to empower ECERA (when established by Grenada and St. Lucia in the next 24 months) to regulate the tariffs/rates set by GRENLEC.

Indicative rates for interconnection of renewable energy sources to the GRENLEC grid:

- **An overall cap on distributed generation will be initially set at five percent of peak generation and will be revised after consultation with GRENLEC and studies on grid stability thresholds.**
- **Maximum capacity will be 100 kilowatts for commercial establishments and 15 kilowatts for households.**
- **An excess net billing system will be used. Owners of small generating systems will be allowed to use the energy that they produce and sell the excess to GRENLEC.**
- **Distributed generators will only be compensated for generation up to 1.5 times their monthly consumption.**
- **A floor price of XCD 0.53 (USD 0.20) per kilowatt hour has been established for the first set of contracts, with the ability to revise the floor in year five of a ten year**

In the new agreement, LPH will be allowed to purchase initially both the GPP (50%) and the ECH shares. However, in keeping with the government's policy that no entity shall own more than 50% of GRENLEC, the new agreement blocks LPH from having any voting rights associated with the ECH shares. It also allows the government of Grenada to purchase the former ECH shares up to one year after the initial purchase is concluded at the same price that LPH purchased them.

The government of Grenada intends to exercise its right to acquire the ECH shares. It also intends to provide the general public with the opportunity to purchase a portion or all of the acquired ECH shares.

CONCLUSIONS

The government has moved swiftly and decisively to protect and enhance the interests of its citizens in a sector that is vital to national security. Access to affordable, reliable and clean energy is critical for the sustainable economic development of Grenada.

Amongst other changes, the new developmental framework for the electricity sector provides the following benefits:

- Strengthens the capacity of the government to implement the national energy policy. This is achieved by putting the framework for connection of renewable sources of energy to the grid in place and by introducing standards and penalties for non-compliance.
- Charts a clear path towards a low carbon economy by defining the commercial mechanisms that will be used to facilitate the transition to renewable energy.
- Protects Grenadians by supporting the establishment of an independent regulatory authority – ECERA.
- Empowers the ordinary citizen to own and operate small electricity generation systems using indigenous renewable energy sources.

THE NEW FRAMEWORK FOR GRENADA'S ELECTRICITY SECTOR

1. An exclusive licence will be granted to GRENLEC to generate electricity from fossil fuels only, and for all transmission, distribution and supply for a period of 45 years. However, no future owner of GRENLEC will have any exclusive licence for longer than 30 years.

2. The government of Grenada will legislate Renewable Electricity Portfolio Standards in the amended ESA, with penalties for non-compliance. These standards will determine the amount of renewable energy that GRENLEC must use to generate electricity at different times in the future.

3. Renewable Energy Special Purpose Vehicles (RESPVs) will be established for electricity generation from renewable energy sources including geothermal, wind, solar and waste materials.

4. No entity will be allowed to own more than 50% of GRENLEC or of an RESPV without the consent of the government of Grenada .

5. The government of Grenada anticipates that it will be a major shareholder in these RESPVs.

6. An exclusive licence to explore geothermal resources and to produce electricity from a geothermal resource will be granted to the geothermal RESPV and NOT directly to GRENLEC.

7. LPH will be allowed to have a maximum 50% participation in the RESPVs and will be allowed to be managing partner. However, if LPH fails to perform (by reaching key milestones and deadlines), the government of Grenada will have the right to choose another partner.

8. GRENLEC must purchase electricity from the RESPVs at a reasonable rate to be determined by the proposed independent regulatory authority, ECERA.

9. A new interconnection policy for distributed generation will be established (indicative terms are shown in the box on opposite page).

10. The government intends to pursue a strategy for electric vehicles in Grenada. LPH has indicated that active pilot projects for electric vehicles are under way in Emera-owned companies. Upon successful conclusion of discussions relating to GRENLEC, it has indicated it intends to pursue this kind of initiative in Grenada too.

11. A self-insurance fund will be established using best actuarial practices for companies operating in jurisdictions with similar risk profiles.

12. An Employee Share Purchase Plan will be maintained to allow employees to purchase shares in GRENLEC that the government of Grenada may offer for sale.

13. GRENLEC will contribute at least five percent of its net income before taxes to local charities within Grenada.

14. LPH shall take steps to ensure GRENLEC provides training locally and overseas, including Canada, so as to enable GRENLEC employees to improve and acquire their technical and business management skills.

15. When requested to so do, GRENLEC will apply a ten percent discount on the commercial power rates charged to the government of Grenada. This provision will not apply to street lighting or to statutory corporations. As indicated, the government of Grenada intends to empower ECERA when established to regulate all rates offered by GRENLEC.

16. The scope of what may be defined as repurchase events has been reduced, removing those elements that are beyond the direct control of the government of Grenada.

17. The length of time granted to the government of Grenada to assert its rights of first offer and first refusal has been increased from 30 to 90 days.

18. Inappropriate representations and warranties have been removed.

19. A robust compliance mechanism is to be inserted both into the Successor Agreement and the amended Electricity Supply Act.

20. The establishment of an independent regulatory authority (ECERA or any other) with the power to change the means of rate adjustment has been acknowledged.

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