

Interim Draft of National Energy Policy for Barbados 2017 to 2036

Presented to the Division of Energy and
Telecommunications in the Prime Minister's Office
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1. Introduction

Overview

This policy document has been developed for Barbados with the aim of providing clear direction to the government in the short, medium and long term, for various areas of development both in the renewable and non-renewable aspects of energy. In the course of the policy both aspects related to energy production and energy consumption will be considered.

In light of the present social and economic environment within the country, we have sought to make the policy relevant to the many possible future circumstances, and considered energy in its broadest sense looking at the many cross cutting sectors of the economy.

What this 2017 policy document is designed to achieve:

It should be noted that this policy document is intended to provide a framework to guide decision making in the various sectors that come under the umbrella of energy development. It defines at the outset broad mission and goals and objectives up to 2036. Later the document defines more specific objectives under the various sub sectors identified. There are also recommended activities given that could be part of the actions to achieve the goals identified.

The policy is however NOT been designed to be prescriptive in stating exact actions that need to be taken in any of the subsectors identifications. It also does not determine specific targets within the various subsectors, strategies needed within the sector or specific roles and responsibilities of individuals or agencies that are required to ensure that the goals or objectives outlined in the policy are achieved.

All these factors are undeniably important if the policy is to be effective, but it is expected that these will be explored in more detail in the “Action Plan” which will be developed as a follow up to this document.

This policy also suggests some overall targets for energy mix based on the Ministry of Energy and Telecommunications’ data highlighting the availability and cost of various energy sources. Given that the availability and costs of certain resources such as natural gas may change over the coming years, there needs to be a level of flexibility in establishing long term targets. Nonetheless, the targets herein are considered to be a good starting point to inform the decision making within the energy subsectors.

Barbados Background and International Context:

In seeking to develop an energy policy for Barbados it was important to examine Barbados in the regional and international context, including its position as one of the group of countries known as Small Island Developing States (SIDS).

Barbados, as a SIDS, is vulnerable to international and regional trends and momentary shocks that can affect technology, resource availability and the pricing of energy products. Barbados and other Caribbean Community (CARICOM) members face problems with regards to Climate Change which amplifies issues such as rising sea levels, vanishing coral reefs, food and water insecurity, intensified natural disasters and community displacement. Furthermore, many small islands lack the natural and financial resources to alleviate these ongoing challenges. (UN 2015).

“Due to their size and location, Caribbean SIDS are particularly susceptible to the impacts of climate change. As developing economies relying on sectors vulnerable to climate patterns such as tourism, agriculture and fishing, Caribbean nations would be greatly affected by the ongoing rise in sea levels, changes in rain patterns and temperatures, and

increasing intensity of natural disasters identified by the Intergovernmental Panel on Climate Change (IPCC).” (IADB, 2016)

Barbados is energy import-dependent and relies on trade to meet its energy needs; consequently, a momentary disruption or trade imbalance can lead to uncertainty of access to energy within the country as prices fluctuate on the world market. Over the last ten years Barbados faced significant constraints which led to weak economic performance where average Gross Domestic Product registered flat growth (Barbados Economic and Social Report). Additionally, Barbados similarly to many other Caribbean countries has been grappling with high fiscal deficit. Barbados registered fiscal deficits as a percentage of GDP as high as 11.8% in 2013. Rising debt has also presented a significant challenge to Barbados over the last ten (10) years, peaking at 138.4% (Barbados Economic and Social Report). The unemployment rate in Barbados has over those ten years hovered between 10% and 12%. The economic challenges that Barbados faced over the years have resulted in a number of credit downgrades that have impacted the cost of debt to the Barbados Government and the private sector.

It is recognized that Policies which consider energy in terms of its overall impact on economic, environmental and social systems, will allow the country to become more energy independent (UNEP, 2014). This National Energy Policy attempts to achieve sustainability in the energy sector by assessing those impacts and promoting the greater use of renewable and indigenous sources of energy

Regulatory and Legislative Background

In developing this policy document, it was important to take into consideration the current regulatory and legislative framework

within Barbados. In 2007 the Government of Barbados produced a Draft 1 Energy Policy to give direction to the development of the overall sector. This wide ranging policy addressed issues related both to fossil fuel and renewable energy resources. At the time the government was seeking to explore new potential offshore petroleum wells and also take advantage of emerging renewable energy technologies.

In keeping with the interest in developing offshore petroleum, the government developed the Offshore Petroleum Act and the Offshore Petroleum Taxation Act in 2007. These Acts contain the rules governing the exploration and production of offshore oil in Barbados and consider the limits and optimum levels of production that would ensure long term sustainability of the petroleum sector.

Recognising the changes and recent advances in energy technologies, a number of legislative and regulatory provisions have been introduced or updated in anticipation of development of new energy markets in Barbados.

Many of these changes in regulation and legislation have been in the area of the electricity sector. In 2002, the Fair Trading Commission (FTC) was established, taking over from the Public Utilities Board in ensuring that rates and standards of service for the Barbados Light & Power (BL&P) were maintained at a reasonable level. The provisions governing the regulation of the electricity utility are contained in the Utility Regulations Act (2002).

In the years since, the electricity sector has changed significantly, with the company being now owned largely by a Canadian company EMERA. The introduction of more renewable energy sources has made it more likely that the BL&P will face competition from other companies with the ability to generate electricity at a commercial level. In anticipation of such continuing developments, a new Electric Light & Power Act (ELPA) was produced in 2013. This Act, established in 2013, was revised for the first time since the early 1900s.

In view of the changing energy markets and technologies, there were also further energy policy documents produced in 2010 and 2013. In 2010 the Sustainable Energy Framework for Barbados (SEF B) was executed through the Inter-American Development Bank (IDB). The programme was designed to establish areas of technical assistance and support for sustainable energy programmes in Barbados. One element of this technical assistance was the development of the Energy Smart Fund.

Below are the six facilities provided through the Energy Smart Fund provided by the IDB.

- **Technical Assistance Facility** (BDS \$1 million) Grants for pre investment studies as well as economic and technical feasibility studies
- **Energy Efficiency Retrofit and Renewable Energy Finance Facility** (BDS \$12 million): Provides subsidized loans for implementing renewable energy projects that have been demonstrated to be financially viable.
- **Pilot Consumer Finance Facility (BDS \$ 1 million)**- Provides interest rate rebates for commercial entities offering renewable energy or energy efficiency products
- **CFL Distribution Facility (BDS \$ 2 million)**- Provides free compact fluorescent lamps to identified residential BL&P customers
- **A/C Rebate Trade in Facility (BDS \$3 million)** - A 50 percent rebate to residences and businesses who replace older air conditioners for more energy efficient models.
- **Discretionary Grant Facility (BDS 2 million)** - Funds for institutional support to execute and implement the Smart Fund. This includes education and awareness programmes.

In 2013, a Draft National Sustainable Energy Policy was produced.

This draft sustainable energy policy attempted to build on many of the aspects of the draft energy policy developed in 2007. The emphasis of the 2013 document was on the sustainable production and use of various energy resources. Efficient use of fossil fuel production and consumption was one of the foci of this draft policy along with the development of renewable energy technologies.

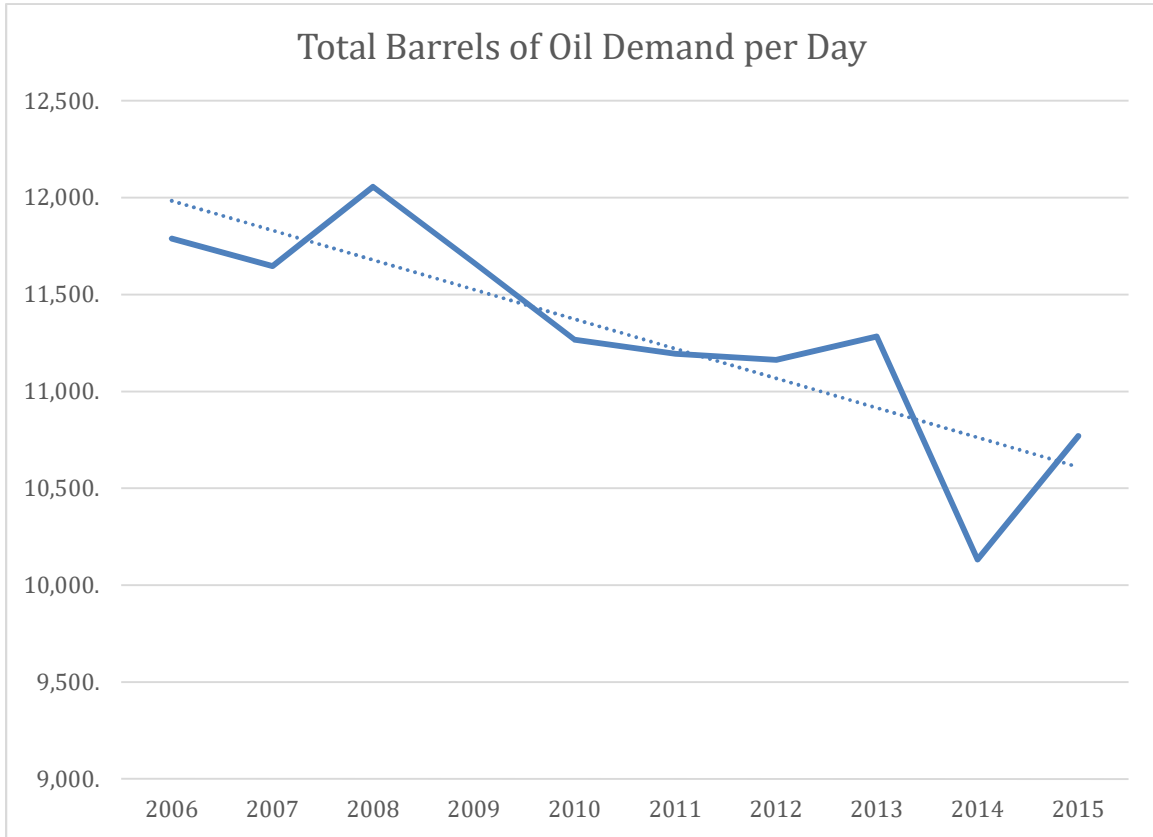
Further incentive for developing renewable energy technologies, was given through the establishment of the Renewable Energy Rider (RER) that was proposed by BL&P and approved by the FTC. The RER allowed for domestic customers to sell renewable energy back to the utility at the rate of 1.6 times the level of the fuel clause adjustment under a 'buy all, sell all" arrangement. In July 2016 the system changed, and the rate is now not tied to the fuel clause adjustment but rather is calculated using a resource cost approach. The temporary RER credit is now \$0.416/ kWh for photovoltaics (PV) and \$0.315/kWh for wind energy

This latest National Energy policy document (2017) is expected to promote and further facilitate economic and environmental sustainability through development of regulatory and legislative mechanisms to build on and support those that currently exist.

Energy use in Barbados (National Energy Context of Barbados)

The demand for energy in Barbados over the last ten years is characterized by a declining trend. The average demand of primary and secondary energy was estimated at 11,297 barrels per day. Energy demand over the period declined reflecting the economic challenges that Barbados has been facing. Barbados' demand for energy peaked in 2008 at an estimated 12,056 barrels per day while

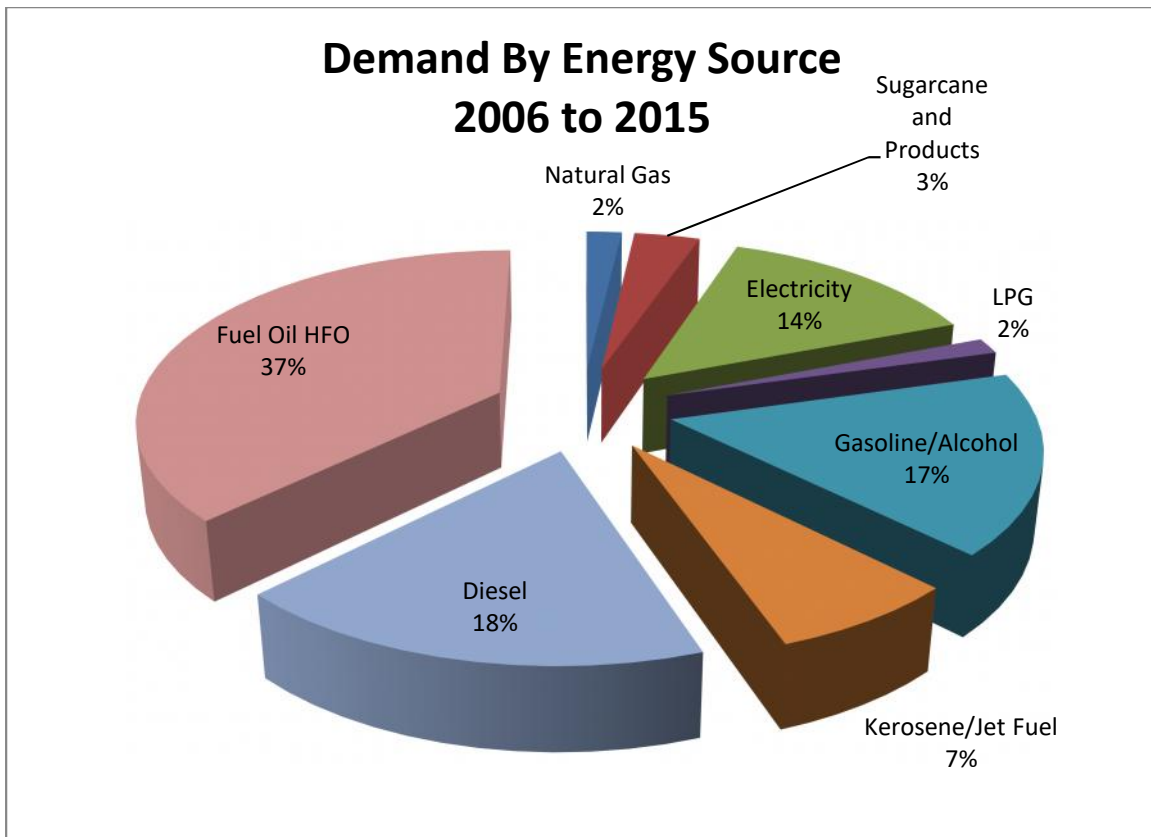
the lowest level of demand was observed in 2014, estimated at 10 132 barrels per day.



Currently, fossil fuels, predominantly heavy fuel oil, dominate Barbados's energy mix;

- Heavy Fuel Oil - 37%
- Diesel - 18%;
- Gasoline - 17%;
- Kerosene - 7%;
- LPG - 2%;
- Sugar Cane Bagasse - 3%;
- Natural Gas - 2%;
- Other (Electricity produced within utility) - 14%
- Solar water heaters- < 1%

The heavy fuel oil is mainly used in the generation of electricity



Natural gas is not a significant contributor in the energy sector, contributing only 2% to the energy mix. However, natural gas has significant use in the country for domestic cooking and use in the tourism and industrial sectors. The benefit of this fuel source is that it is less carbon intensive than other fossil fuels and can also lead to stability in prices. The use of natural gas within Barbados may well increase in the long term with current exploration for oil and gas offshore. The use of solar water heaters for domestic water heating has also risen significantly since being introduced in 1974. However, its effect on the overall energy mix is still under 1%.

Oil was discovered in Barbados as far back as the 18th Century. Currently, oil that is produced on the island is sent to Trinidad for refining. The Barbados National Oil Company (BNOC) a government owned company that engages in the production of oil and gas onshore in the country and imports fossil fuels. Onshore oil production is mainly from the Scotland Sand Formation located in the Woodbourne Development Area (WDA) field; Barbados

produces approximately 1000 bopd (barrels of oil per day). Regarding natural gas, 500 bopd equivalent is produced by BNOC under the operation of the National Petroleum Corporations (NPC). It should be noted that there is a merger in 2016 between BNOC and NPC.

Fuel Feed Stock for Electricity Production:

Over the last 20 years the fuel feedstock used in Barbados for the production of electricity consisted in large measure of fossil fuels. The main fuels included heavy fuel oil, kerosene, diesel, and natural gas. Within the sugar industry electricity production was mainly fuelled by bagasse. In recent times solar energy has become a small but growing contributor to electricity production. In 2015, the fuel input sources for electricity production was registered as follows:

- Heavy Fuel Oil - 74%;
- Kerosene - 17.4%;
- Bagasse - 5.6%;
- Diesel - 2.2%;
- Natural Gas - 0.2%;
- Solar - 0.6%

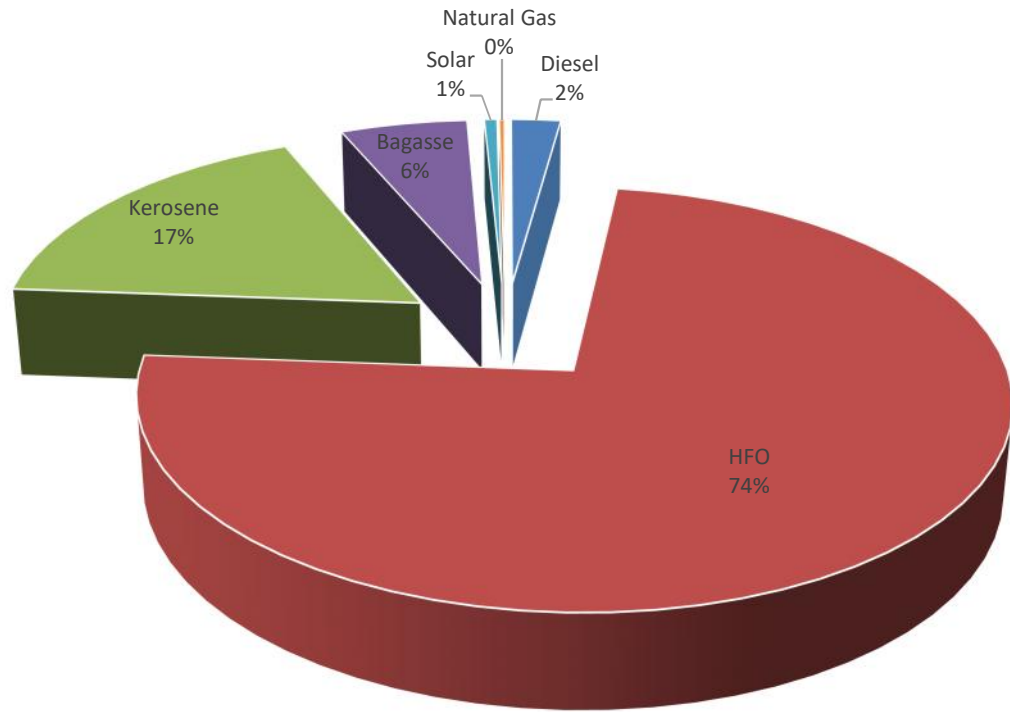
The above configuration demonstrates the high trade dependence required for Barbados to produce its electricity. However, it must be noted that in 2016 Barbados saw the production capacity for solar electricity doubled from 10MW to over 22 MW contributing an estimated 2.4% of the total electricity distributed. The table and chart below demonstrate the current fuel contribution to total electricity production:

Total Fuel Consumption for Electricity Production 2015

Fuels	Fuel Feedstock MMBTUs
Diesel	230,426.80
HFO	7,830,143.87
Kerosene	1,841,808.78
Bagasse	592,962.40
Solar	59,022.04
Natural Gas*	24,522.80
Total MMBTUS	10,578,886.69

* Account for use of natural gas to produce electricity in the manufacturing sector

FUEL INPUTS FOR ELECTRICITY PRODUCTION 2015 BARBADOS



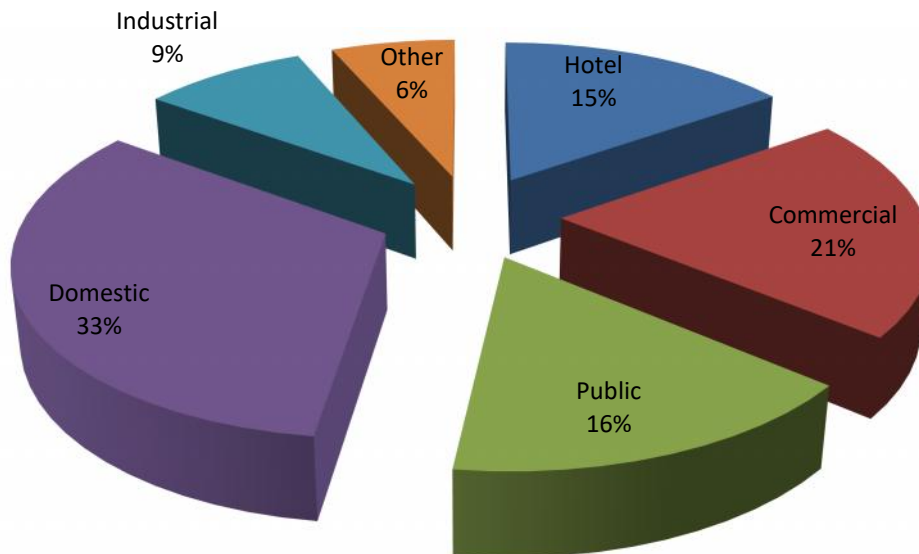
■ Diesel ■ HFO ■ Kerosene ■ Bagasse ■ Solar ■ Natural Gas

Power Generation

Electricity consumption over the last ten years was distributed as follows:

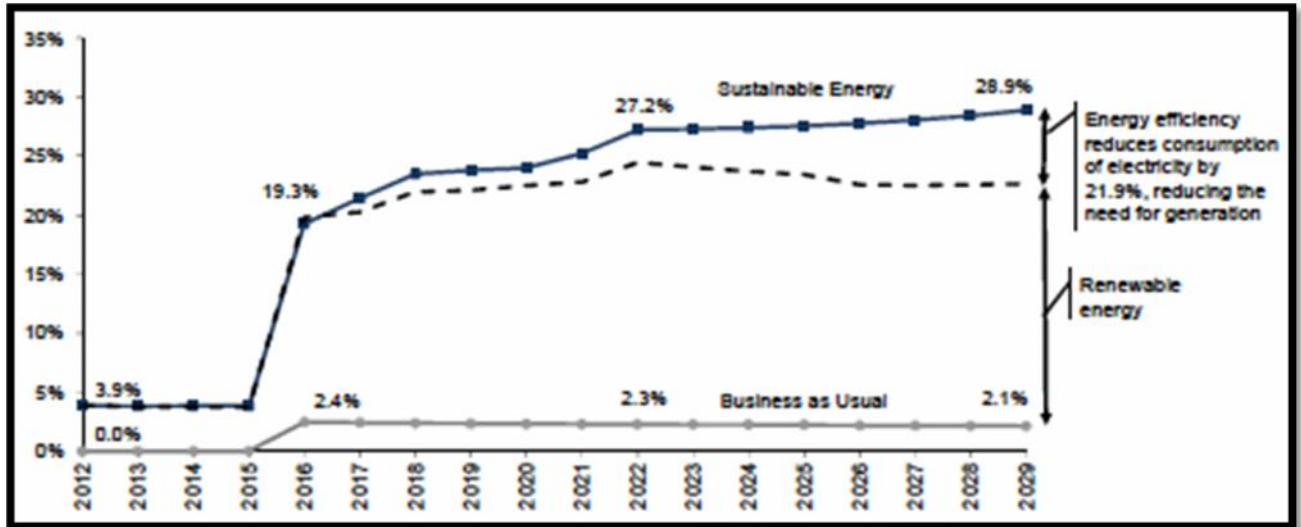
- Domestic - 33%;
- Commercial - 21%;
- Public - 16%;
- Tourism/Hotel - 15%;
- Industrial - 9%; and
- Other - 6%.

**Electricity Sales By Demand Group
2015**



The average consumption for electricity in Barbados during the period under consideration is 926.8 MWh. Electricity is central to economic output in Barbados and brings significant value to the country. In general terms, the social cost of the production of electricity was estimated to be \$0.06 for every dollar earned from the production and distribution of electricity. It is also important to note that the Barbados Economy produced on average, BDS\$8.00 from every Kwh produced and distributed. This 2017 policy seeks to build on the value that the electricity sector brings to Barbados by introducing the appropriate energy sources that will improve the sustainability of the electricity supply. Additionally, the policy will attempt to provide a balance between the interest of the society and that of the producers of electricity.

Barbados hopes to steadily increase its share of renewable energy in the local market, increasing the diversification of energy resources, promoting energy security and decreasing the reliance on imported fossil fuels, which is now based on about 90% imported resources (Draft National Sustainable Energy Policy for Barbados, 2013). The Draft National Sustainable Energy Policy in 2013 set a goal of 29% renewable energy share in the Barbados energy mix by 2029. However, an analysis conducted by the Ministry of Energy and Telecommunications suggest that this PV target could lead to high electricity prices. There may be a more sustainable mix of energy resources which will lead to a reduced long term cost.). Possible ways for achieving this target were identified as increased use of renewable energy technologies such as waste to energy, biomass, cogeneration, wind energy, solar photovoltaic and solar thermal. If this goal were to be achieved, it was suggested that fuel costs could be reduced by BDS\$1,338 million (6% discount rate). (Draft National Sustainable Energy Policy for Barbados, 2013).



Share of Electricity Generated from Renewable Energy Technologies as a percentage of Total Consumption (Business as Usual and Sustainable Energy Scenarios)
(National Sustainable Energy Policy, 2013)

Energy efficiency, the use of sustainable fossil fuels and increased energy education and awareness are the other tools discussed in the Draft National Sustainable Energy Policy for Barbados (2013) as means to achieve a more sustainable energy sector. The Government has increased its efforts to achieve increased energy efficiency and sustainability by promoting energy efficient technologies and their vision of "Green Economics", which provides incentives to the public to be energy efficient. Barriers to this sustainability effort have been identified as limited access to capital, limited supply of equipment, incomplete information and lack of grid connection rules.

This 2017 policy document further considers these issues as it seeks to provide strategies for overcoming some of these limitations to sustainable development within Barbados identified above.

Regional Energy Context and its Influence on Barbados

The Caribbean Community (CARICOM) encompasses twenty countries in the Caribbean region focusing on “economic integration; foreign policy coordination; human and social development; and security” (CARICOM, 2016). CARICOM seeks to safeguard each member’s access to clean, reliable, affordable and stable energy and also aids the progression of comparable regional industries.

The CARICOM Energy Policy (2013) is a wide-ranging framework document that considers issues of energy production and consumption (both renewable and non-renewable programmes) from a regional perspective. The issue of trade between territories and the impacts of programmes such as Petro Caribe are discussed in its policy. However, it should be noted that Barbados was not a signatory to the Petro Caribe agreement. The main goals of the CARICOM Energy Policy are below:

- “(a) Provision of sustainable and secure supplies of energy, accessible to all CARICOM citizens;*
- (b) Fundamental transformation of the energy sectors of the Member States of the Community so that they can contribute to the sustainable development of the Community;*
- (c) Optimization of domestic production of energy in an environmentally sound manner;*
- (d) Facilitating the growth of internationally competitive regional industries.”*

These goals are similar to some of the core values of the proposed Draft National Energy Policy for Barbados that are discussed in the next section.

Regional integration with other Caribbean countries is an option for meeting future energy supply needs (regional projects, sharing of research and development, harmonization of policies, laws etc.).

However, there are distinct challenges in the coordination of relevant policies, strategies and plans. There are also issues pertaining to the unavailability of timely and relevant data, pricing and the increasing international demand for petroleum, rising petroleum prices, and the security of supplies for regional trade (CARICOM Energy Policy, 2013).

International Energy Context and its Influence on Barbados

The state of the international or global economy can impact the economic performance of Barbados and can affect attitudes to spending and investments as well. While these aspects are connected to the state of the local economy, they can sometimes have effects that are independent. It is possible to have a recession locally even during a boom globally, or a thriving local economy even as there is a recession at the international level, depending on the nature, severity and countries affected.

Over the last eight years the international economy experienced contraction and low growth in some major industrialized countries. The global economy according to the United Nations grew at a slower pace of 1.8% over the period 2008 to 2015. The global economy during the last 8 to 10 years was characterized by:

- A financial debt crisis;
- High and escalating oil prices;
- Declining and low interest rates;
- High liquidity in the banking sector;
- Weak demand for goods and services;
- Fluctuating employment.

The global economy is comprised of countries and trading blocs that are recovering, as well as those that continue to grapple with economic uncertainty. The USA, for example, employed monetary policies such as quantitative easing to address its debt problem, while the European Union (EU) initially used austerity but with limited success. However, the EU has engaged its own brand of quantitative

easing which has resulted in some stabilization in employment, inflation, and GDP. Other countries whose economies are based on commodities, especially those based on oil, experienced economic contraction beginning in 2014.

China which operates a planned (not market driven) economy has engaged in a controlled decline of economic output of 7%. This controlled decline has resulted in decline in other markets, and in commodity based economies in particular. It is expected that global economic growth will continue to be uneven over the next decade.

Small Island Developing States (SIDS) such as Barbados are especially vulnerable to international factors, mainly because of their remoteness, lack of economic diversification and high reliance on international trade. Below are a few key external international factors that could potentially impact Barbados and its development of energy resources both in the area of fossil fuel and renewable energy.

International Oil Price

- International oil price impacts short and medium term renewable energy development. Higher oil prices result in more interest in renewable energy development to offset the high cost of energy from fossil fuels. Higher oil prices also allow for extraction of more petroleum products, which may initially have been too costly to produce. Lower oil prices result in fewer incentives to sell energy from renewable technologies to the grid. It is important to ensure that incentives for renewable energy remain high both when oil prices are high and when oil prices are low.

It has been shown that the price of oil on the international market has had an impact in the short and medium term, particularly in the area of renewable energy development. As oil prices soared to \$147 per barrel in 2008 (far above the long-run average of \$45 per barrel), there was considerable interest in the development of renewable energy technologies throughout the Caribbean, to mitigate the impact of the

higher cost of energy from fossil fuels. In 2010, the RER was introduced and this led to a substantial increase in the number of PV installations. During the period 2013 to 2015 PV installations expanded five-fold, moving capacity from 1.6 megawatts to 9MW (Investigation of Likely Reactions to the Removal of Green Energy Incentives – Antilles Economics 2016). Accordingly, the expansion of Solar PV benefited in large measure from the RER, and the fiscal incentives implemented in 2013 to support the use of RE in electricity supply by homes and businesses (Investigation of Likely Reactions to the Removal of Green Energy Incentives – Antilles Economics 2016). This proved to be a good incentive for development and installation of PV and other renewable technologies. However, as oil prices have fallen, the fuel clause adjustment of BL&P has also been reduced, resulting in considerably less incentive for new individuals to start generating electricity to sell to the grid through renewable energy technologies. Meanwhile, higher oil prices internationally increased the incentive to explore and extract petroleum resources that may be more costly to produce.

One of the main aspects of this energy policy is to ensure that the incentives for renewable energy generation remains high both in times when oil prices are high and when oil prices are low. There will also be need to ensure that Barbados is able to take advantage of onshore and offshore petroleum resources when prices on the international market are favourable to their development.

Climate Change Policy

- Climate change impacts such as extreme weather events, rising sea levels, and contamination of ground water are brought about by the increasing CO₂ levels. The use of renewable energy technologies (Renewable energy and Energy Efficiency projects) can reduce the volume of these emissions. Carbon trading schemes (Clean Development Mechanism) can be used to set goals and targets for reduced CO₂ emissions.

Similar to most other small island developing states, Barbados is extremely vulnerable to climate change impacts. These impacts can be felt through effects such as higher frequency of extreme weather events, rising sea levels, destruction of coastlines and inundation of ground water. These types of impacts can have a profound effect on the economy and are in a large part caused by carbon dioxide emissions related to combustion of fossil fuels. The economic consequence of fossil fuel consumption in Barbados is that there is a loss of resource as a result of the foreign exchange, efficiency and environmental costs associated with fossil fuel consumption. The analysis which was conducted indicates that under a 'Business- as - Usual' scenario the Barbados Economy is likely to lose on average \$0.64 for every dollar of benefit it receives from the supply and consumption of fossil fuel.

Therefore, one way of mitigating these impacts is to reduce the volume of carbon dioxide emissions by increasing the use of renewable energy technologies. Over the years, there have been attempts at the international level to develop schemes to reduce carbon dioxide emissions worldwide. Carbon trading schemes such as the Clean Development Mechanism, have provided in some cases funding opportunities for Caribbean islands to develop renewable energy and energy efficiency projects. These types of mechanisms can feed into energy policies and become a means by which goals and targets in renewable energy can be achieved.

Technology Developments

- The development of technology, to more easily extracts petroleum resources or to use renewable resources more efficiently and at lower cost, can increase the economic viability of renewable technologies. This can result in more attractive costs to investors with lower payback times. Additionally, improvements in energy storage technologies affect the stability and reliability of renewable energy technologies, which can now be ramped up or down to the grid as needed, even with their intermittent nature.

There have been developments in technology worldwide that have affected energy development within Barbados and the Caribbean on the whole. For example, the development of fracking as a means of extracting natural gas reserves has increased the availability of this particular commodity worldwide and costs have been reduced as a result. This factor has meant that some traditional natural gas producers, such as Trinidad and Tobago, have lost market share in locations such as the US. There has been as a result greater incentive to look for markets in the Caribbean, including Barbados to purchase this natural gas. This 2017 energy policy being takes this factor into consideration as well.

Developments in new technologies in renewable energy sources such as wind and solar, have also seen reduction in prices per kilowatt hour in recent years. This increased economic viability of many renewable technologies, has led to growth in the industries worldwide, as investors and IPPs can now have lower payback times for their investments. Barbados and Caribbean islands, with their high resource availability of wind and solar energy and comparatively high cost of conventional fossil fuels, have become more attractive to investors in renewable energy technologies in various parts of the world. However, a balanced view of the energy sector and renewable energy subsector as an important element to reducing Barbados' dependence is warranted at this juncture. In Barbados solar electricity from photovoltaics is the renewable energy technology that is growing to the greatest extent. This technology is one of the more costly technologies at this time although prices per kilowatt hour are steadily declining. This 2017 policy promotes a practical approach that engages solar electricity technologies that result in an overall benefit for Barbados. This policy advances an energy mix that considers both intermittent and baseload renewable energy technologies, as well as clean fossil fuels such as natural gas where they are available and cost effective.

For further development of renewable energy technologies, there will also need to be improvements in energy storage technologies. This

will reduce the reliance on grid tied renewable energy technologies which affect the stability of the grid due to their intermittent nature. The issue of energy storage is particularly relevant to a small island such as Barbados, as the grid is isolated, with no provision to interconnect to other island grids.

In conclusion, the 2017 National Energy Policy for Barbados strives to produce a vigorous document that takes into consideration international, regional and national contexts, but will be applicable and relevant regardless of the socio economic conditions that exist within Barbados.

Barbados Energy Roadmap- Produced by IRENA

During the development of this policy document, the Ministry of Energy and Telecommunications also engaged the International Renewable Energy Agency (IRENA) to develop a Renewable Energy Roadmap for Barbados.

IRENA's study focused to a large extent on the electricity sector and the possibilities for greater efficiency and an increase use of renewable energy. That roadmap identified the following goals as part of the Barbados government vision.

An energy sector that:

- enhances economic growth by reducing energy costs
- Improves energy security by reducing dependency on imported fossil fuels
- Reduces cost of energy service for consumers
- Reduces investments needed for power generation by promoting energy efficiency and conservation.
- Reduces the emission of greenhouse gases and local pollutants from fossil fuels.

The economic, environmental and social goals identified in their study are in keeping with the goals identified through the analysis of the Barbados energy sector in developing this policy. The goals identified in the Roadmap are built on and expanded on in this policy.

The roadmap considers future scenarios with increased energy efficiency on the demand customer side, a low oil price scenario and a scenario where a greater number of electric vehicles are imported. All of this is considered within the context of the Government's Nationally Determined Contributions (NDC) which sets a goal of 65% of electricity generated to be produced from renewable sources.

This 2017 policy takes into consideration the identified path within the Roadmap in the broader context of the overall energy sector, including the fossil fuel based industries, recognizing how these potential changes in electricity and transport sector will impact other cross cutting sectors within the energy space.

Energy Outlook- International Energy Market

According to the U.S. Energy Information Administration (EIA) the expectation is that global energy consumption will continue on its upward trend over the next thirty years. This view of future demand is driven by the conclusion that economies such as China and India will account for more than half of the world's total increase in energy by 2040. The International Energy Outlook 2016 as presented by the EIA, projects that by 2040 global energy consumption will increase by 48% from 549 quadrillion BTUs (99.2 billion barrels of oil) to 815 quadrillion BTUs (147.2 billion barrels of oil). It is further anticipated that much of the increased consumption of global energy will be derived from the developing and emerging economies which is expected to register an increase in energy consumption of 71% by 2040.

The increased consumption in global energy is expected to be driven by increased economic growth in the developing and emerging economies. Indeed the International Energy Outlook 2016 has projected that the world's GDP, adjusted for purchasing power, will increase at an annual rate of 3.3%. Furthermore, the Outlook projects that economic growth in the developing and emerging economies will expand on average by 4.2% per annum.

The International Energy Outlook 2016 further indicates that its expectation is for increased consumption across all the major energy sources. Interestingly, the Outlook points to renewable energy sources being the fastest growing energy source for the period up to 2040, with consumption of this resource growing at an annual rate of 2.6%. The view of the International Energy Outlook 2016 is that nuclear power will be the second-fastest growing energy source by 2040, expanding at an annual rate of 2.3%. The long term international consumption of natural gas is expected to increase at a rate of 1.9% per year where annual consumption is forecasted to be approximately 203 Tcf by 2040. According to the US Energy Information Administration – International Energy Outlook 2016, natural gas is an important fuel in the production of electricity. This is the case, as natural gas is viewed as an attractive fuel source because of its fuel efficiency. As a consequence, several governments worldwide, as a means of reducing CO₂ emissions, promoted the use of natural gas to displace the more carbon-intensive fuels. To meet the expected growing demand world producers are projected to increase natural gas supplies by an estimated 69% by 2040. Although consumption of non-fossil fuels is expected to grow at a faster rate than fossil fuel, the Outlook projects that fossil fuel will account for 78% of energy use by 2040.

Given the foregoing, oil prices are expected to continue to be volatile contributing to uncertainty within the energy sector in the future. If expectations for future consumption within the developing and emerging economies hold true the follow-on would be significant increases in oil prices. However, a countervailing factor to this view is that renewable energy is projected to hold more prominence within

the energy market and will be a constraining factor in energy prices. The International Energy Outlook 2016 proffers a reference oil price forecast of US\$141.00 per barrel for the period up to 2040. Of course this forecast may vary, and consequently, the Outlook points to a minimum price of US\$76.00 per barrel and a maximum oil price of US\$252.00 per barrel in the very long-run. However, in the short to medium international oil prices are expected to fluctuate between US\$20.00 to US\$52.00 for the most part, with some occasions where there may be breaches of these support and resistance boundaries.

Regional and Local Outlook

Within the Caribbean Region, the energy context is dictated by the international energy market, as fossil fuels accounts 80% of primary energy supply. Other major resources of energy within the Region are hydro, solar, wind, biomass, and geothermal. The Caribbean Community has established targets of 47% reduction in fossil fuel by 2027 (C-SERMS).

Under the current set of policy circumstances the Barbados' energy consumption is expected to be dominated by fossil fuel. The current target for energy consumption is that 29% of its electricity consumption is to be supplied by renewable energy by 2029 (Draft Energy Policy, 2013). The long-term energy price outlook for Barbados will be influenced by the global price of energy on the one hand, and its ability to move in a significant way away from fossil based consumption. One of the fundamental constraints to moving towards more renewable energy sources is the heavy reliance Government on the revenue that is raised from fossil fuel consumption. Indeed, this is a paradox in that fossil fuel consumption contributes significantly to the loss of the national resource. Therefore, if Barbados is to move towards significant reduction in fossil fuel by 2036, the Government of Barbados must overcome its dependence on fossil fuel for revenue. This will be one of the key issues to be addressed in determining the measures and

strategies for this energy policy and the long term energy development of Barbados.

DRAFT

2. Mission Goals, Values, Targets and Objectives

In setting a clear policy direction and ensuring that there is overall shared understanding and 'buy-in' from energy stakeholders and members of the general public, it is important that there is an all-encompassing Mission Statement that can set the framework for the policy activities in the sector.

Based on discussions with the Task Force, interviews with various Barbados energy stakeholders, analysis of the energy sector and the initial outline provided of relevant themes; the areas of energy security, affordability and diversity appeared to be most critical. Additionally, stakeholders thought that generally a more collaborative rather than competitive/ confrontational approach to future energy development was ideal.

Hence, the following Vision Statement was recommended.

Vision Statement: *“Energy security and affordability through diversity and collaboration: Establishing and maintaining a sustainable energy sector for Barbados.”*

The following are potential visionary goals for Barbados emerging from the Mission Statement and are supporting statements that reflect the general direction where stakeholders wished the sector to go and what they wanted to see the sector achieve. These are also consistent with previous policy documents produced in Barbados and the wider Caribbean.

Visionary Goal 1: An energy sector that reflects a collaborative and participatory approach to development

Visionary Goal 2: An energy sector that offers a diversity of sustainable energy options both renewable and non-renewable, with a trajectory towards an increasing percentage of renewable energy in the energy mix.

Visionary Goal 3: An energy sector that offers energy products that are affordable to local citizens.

Visionary Goal 4: An energy sector that offers continuous and reliable supply of energy in all associated sectors and subsectors.

Visionary Goal 5: An energy sector that offers significant opportunities for local entrepreneurship and international investment.

Visionary Goal 6: An energy sector that minimizes the environmental impacts and contribution to global climate change.

Visionary Goal 7: An energy sector that offers opportunities for development of human capacity and increasing core skills in energy and energy related fields.

Visionary Goal 8: An energy sector that promotes sound management of returns of economic rent from energy resources, and clear legal regulatory frameworks to buttress its development.

These Visionary goals are expected to create an energy sector that engages in energy production and consumption that is economically, financially, and environmentally viable, using technology that has been technically proven, governed by a transparent and comprehensive regulatory framework.

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Core Values

Recognizing that the policy document will need to embrace core values before specific measures or targets can be established, stakeholders were asked in semi structured interviews what they thought were key core values that the policy should be seeking to embrace. Both the Vision statement and visionary goals listed also

gave some direction to the core values discussed below. In establishing these core values, reference was also made to critical issues identified in previous policy documents made for Barbados as well as those contained in other regional policy documents including the CARICOM Energy policy and Jamaica National Sustainable Energy Policy. Recent research conducted by the consultant into factors affecting the development of renewable energy in the Caribbean was also considered (Ince, Vredenburg, Liu, 2016).

In general, stakeholders thought that the policy should aim to provide a level playing field to support anyone with an interest in participating in renewable and sustainable energy activities in the energy markets. The view was that with the size of the Barbados market, a collaborative approach was likely to be more effective than a competitive one.

With respect to the electricity sector in particular, it was thought that the most important aspect was to maintain standards and reliability of production and supply for all customers in Barbados, whatever the eventual structure of the market and the regulatory environment. It was considered essential that those standards of production and service should be safeguarded throughout the sector.

Below is a list of some of the general core values identified.

- Stability- price, regulatory, technical
- Reliability- including continued access to energy
- Diversity- reduction of vulnerability through use of multiple sources
- Ownership of business: Opportunities for local investment
- Maximum use of Indigenous energy resources
- Entrepreneurship development
- Maximum level of collaboration
- Multidisciplinary cross cutting approach
- Gradual, systematic evolution to an energy sector based on renewable energy
- Education, Awareness and Capacity Building

- Environmental Protection, Ecology- especially connection with public health

From these general core values, the following overall objectives were developed. These objectives are not specific to any sector within the industry but are relevant to the general energy sector. The section that follows provides more sector specific objectives that flow from these Overall Objectives. In order to fulfil the core values and goals above the following objectives must be achieved:

Overall Objective 1: Achieving stability and predictability of energy product prices over the long term.

Overall Objective 2: Establishing a consistent and comprehensive regulatory framework, (regulations and legislation) to govern activities in various energy sub-sectors.

Overall Objective 3: Increasing the amount of renewable energy sources used in the energy mix to the extent that it can be accommodated from a technical and socio-economic perspective.

Overall Objective 4: Increasing the diversity in types of energy sources utilized within both the renewable energy and fossil fuel energy sectors.

Overall Objective 5: Encouraging local investment in energy projects and programmes within Barbados, with a view to increasing the number of shareholders and players in the various energy subsectors.

Overall Objective 6: Increasing the extent of energy resources used in Barbados that are obtained from indigenous sources.

Overall Objective 7: Encouraging local investment in energy projects and programmes within Barbados, with a view to increasing number of shareholders and players in the various energy subsectors.

Overall Objective 8: Promoting increased entrepreneurial activities locally in renewable energy and fossil fuel energy development throughout the energy subsectors.

Overall Objective 9: Increasing collaboration within the energy subsectors and among the cross cutting sectors that have an impact on energy supply or consumption.

Overall Objective 10: Improving the efficiency in the production and consumption of energy products within the various subsectors.

Overall Objective 11: Improving the awareness and understanding of energy production and consumption, its impacts and the associated environmental and socio-economic consequences within all sections of the public.

Overall Objective 12: Increasing the number of persons locally with qualifications and skills relating to energy production and management of renewable and fossil fuel sources.

Overall Objective 13: Reducing the environmental impacts associated with the production and consumption of energy resources locally.

Overall Objective 14: Ensuring reliability and continuity of energy supply in the various local energy subsectors.

Overall Objective 15: Attaining the lowest price that can be sustained by the local economy for various energy sources consumed within Barbados

Overall Objective 16: Establishing effective partnerships between national and international entities for local energy projects

Energy Mix Targets

In considering the energy mix targets, cognizance was given to some key factors which included:

- The market cost of energy;
- The socio-economic and environmental cost of energy;
- The maturity of energy technologies;
- The financial and economic benefits of applying various energy sources and technologies; and
- The economic and fiscal context of Barbados.

The market and economic costs of energy dictated the rate at which fuel switching could occur given the need to ensure that the competitiveness of Barbados was not negatively impacted over the twenty year planning horizon of the policy. Furthermore, the energy target mix recognizes that fossil fuel represents a significant drain on the economic resources of the country and seeks to provide the most effective path to significantly reduce the consumption of fossil fuel.

The major constraint was that some of the renewable energy sources considered were variable in nature, and as such presented a major challenge in addressing the cost of ensuring reliability in the supply of energy. Another significant challenge is that the benefits i.e. savings in foreign exchange from renewable energy sources are not immediately transferred to Government's revenues. The concern here is that in order to progress in a substantial way to an alternative energy mix, Government will likely be required to incentivize the transition from fossil fuels to cleaner and renewable energy sources in a greater way.

The energy mix target in this policy consisted of renewable energy, variable and intermittent technologies, as well as cleaner fossil fuel such as natural gas. The target proposed in the policy requires 75% reduction in total fossil fuel (heavy fuel oil, diesel, gasoline, kerosene and LPG) consumption and replaced accordingly with the following:

- 15% Solar;

- 20% Wind;
- 30% Biomass;
- 15% Biofuels;
- 20% Natural Gas.

It should be noted that this suggested mixed is based only on current prices and predicted availability, and may change as further developments in renewable resources and technology as well as exploration of natural gas occur over the next five to ten years.

The above energy mix target views natural gas as an important bridge to the eventual complete removal of fossil fuels from Barbados' energy consumption. The use of natural gas will not require significant additional investment in plant as available electricity generation plant can be converted to use natural gas as a baseload fuel. Additionally, biomass which is expected to consist of bagasse and river tamarind was allocated the largest portion, as its costs of production was among the lowest for renewables at \$0.28 per kwh and can contribute to baseload energy production effectively. Its major constraint for use is the land requirement which is about 25 000 acres. The Fair Trading Commission's decision in 2016 to amend the Renewable Energy Rider has resulted in a fixed price for electricity from solar and wind of \$0.416 per kwh and \$0.315 per kwh respectively. It must be noted however, that the cost of photovoltaics and wind turbines are declining annually. The fuel cost of natural gas is estimated at \$0.15 per kwh.

The proposed target mix is anticipated to result in an annual total energy discounted cost, from total supply to final consumption, of \$720 million per year at market prices. This is estimated to be a reduction of 40% given an initial estimate of energy costs of \$1.2 billion. In the case of electricity, it is estimated that the discounted costs of electricity production will be approximately \$329.1 million per year representing a reduction of 24%. The initial cost of production of electricity is estimated to be approximately \$438.0 million per year. From a socio-economic perspective the discounted

social profit or benefit to Barbados is estimated \$2.2 billion annually from the removal of fossil fuels. In order to achieve the above benefits the fossil fuel reductions required are

- 19% fossil fuel reduction by 2021;
- 38% fossil fuel reduction by 2026;
- 56% fossil fuel reduction by 2031;
- 75% fossil fuel reduction by 2036.

It should be noted here that the reduction in fossil fuel does not include natural gas which is considered as a sustainable fuel and part of the 'renewable' category in this discussion.

The above fossil fuel reduction targets can be stated as increased 'renewable' energy (including natural gas) production targets for electricity generation of:

- 34% by 2021;
- 50% by 2026;
- 56% by 2031;
- 75% by 2036.

3. Sector Specific Objectives and Measures

The following Sector Specific Objectives emerged from the Overall Objectives above. They also reflect specific objectives that were suggested during the interviews with members of the various sectors identified. Based on the Sector Specific Objectives, possible measures under the various themes were identified. The categorization of the themes and the sectors was based on those suggested by the Energy Task Force in the document "Policy Outline and Thematic Areas" (2016).

Energy Supply

The theme of “Energy Supply” considers both the sectors of renewable and petroleum based energy. It was considered that a critical part of the policy was setting a path for the necessary transition from a fossil fuel economy to one based primarily on renewable energy. Barbados being cognisant of the reality that its transition to an economy based on renewable energy will be gradual, has also turned its attention to exploring for hydrocarbon resources in its Economic Exclusive Zone. Indeed, this 2017 policy recognizes that if Barbados locates significant quantities of natural gas, this resource would be valuable in assisting the country in its transition to renewable energy in a more cost effective manner. While the goal of creating a sector based on renewable energy alone was perceived as an aspirational goal rather than a short term one at this stage, it was still seen as important to set targets over five, ten and twenty years to chart direction. Discussion on targets for renewable energy is included in the next section.

In the meantime, it was considered that the discoveries of oil and gas within Barbados should be developed in a way that strengthens the overall economy as well as safeguards long term environmental protection. Natural gas in particular, is a fossil fuel resource that has a lower environmental impact than other types of petroleum based fuels. It is often regarded as a bridge between fossil fuel based energy and renewable energy. Bearing this in mind there are objectives identified that seek to increase natural gas use as part of the strategy to eventually move towards a greater use of renewable energy.

The sector specific objectives emerged from overall sector objectives and discussions with stakeholders and will ultimately be critical in helping to achieve targets.

The objectives identified in this section relate to the following important Energy Supply issues and are separated into ‘Oil and Gas’ and ‘Renewable Energy’ supply sectors.

- Production - Renewable Energy and the Exploration and Production of oil and gas;
- Distribution and sale of energy output;
- Fuel and energy diversification;
- Energy Pricing and Affordability;
- Energy Security;
- Cross-border trade in Energy;
- Energy integration; and
- Storage - energy and fuel.

Oil and Gas Supply Sector Objectives

In order to achieve an energy sector that promotes sound management of returns of economic rent from energy resources, and clear legal regulatory frameworks to buttress its development, the objectives below will result in a sector that:

- ensures security of supply of oil and gas products;
- ensures a suitable legal and administrative regime to promote the successful exploration and development of commercial discoveries of oil and gas;
- clearly identifies agencies such as NPC/BNOC as the implementing agency for government policies in various energy areas;
- maximizes exploration, production and distribution of petroleum products available locally;
- includes activities that seek to promote greater use of natural gas as a means to establish more internationally competitive local industries;
- supports extending the potential uses of natural gas, determining relative benefits and challenges when compared to renewable energy;
- promotes the development of new industries that support infra structure that may be developed around possible new natural gas finds;

- clearly defines rules surrounding allocation of economic rent payable to government and developers, supported by a high level of transparency in the way these values are determined;
- has an established system to ensure that a fraction of the revenues generated in petroleum based resources are used in the development of local renewable energy technologies;
- encourages increased use of natural gas to improve economic performance and reduce barriers to entrepreneurship;
- Has a high level of collaboration between private oil and gas developers that are IPPs and the incumbent utility;
- promotes an increased use of LPG and natural gas for cooking;
- includes a clear retirement strategy for generation plant owned by the utility with appropriate compensation;
- includes the use of LNG and natural gas in local mass public transit;
- has stability in as many components of energy pricing as possible;
- has well understood links between upstream and downstream process in the energy systems by energy providers and consumers;

Policy Measures- Oil and Gas Supply

In order to achieve sustainable production of oil and gas within Barbados' Exclusive Economic Zone Barbados will:

- establish regularly held investor conferences to inform potential developers about the rules and requirements needed to undertake activities in the oil and gas sector;
- increase cultivation of data relating to the geological and geophysical conditions in the offshore oil and gas sector to

aid the government in setting license fees and determining levels of royalties;

- develop a licensing system with clear criteria on the ranking of various factors critical to the decision on bids. This system should be made available widely to potential bidders as well as the general public;
- develop a clear legislation governing environmental management in off shore oil and gas activities with provisions for removal of licenses if stipulations are not met;
- develop a capacity building program locally to prepare the workforce to be able to find employment in the emerging oil and gas offshore sector;
- develop an enabling environment that will empower local business to effectively participate in the supply of goods and services to the offshore oil and gas sector;
- establish fiscal incentives for developers which are tied to factors such as the expected internal rate of return;
- establish a wealth management programme to ensure that revenues from the offshore oil and gas sector are effectively used;
- establish a protocol surrounding the use of the proposed Petroleum Heritage Stabilization fund;
- establish an unambiguous system for determining whether a future gas find should be used for export or included as part of the domestic market;
- develop legislation that identifies limits on the amount of oil and gas resources that can be exploited in the short term; and
- develop and establish a defence and security framework to protect the Exclusive Economic Zone.

Renewable Energy Supply

The development of renewable energy resources available in Barbados will be essential to maintaining and improving the overall sustainability of the sector. There is a need to identify overall strategies to increase the penetration of renewable energy technologies in the energy generation mix, but there is also a need to identify what is the appropriate level of development of specific renewable energy technologies.

It is expected that solar PV, solar thermal, wind, biofuels and biogas will all form part of the mix of renewable energy. However, it will be important to determine the activities that will be needed to ensure that each of these technologies is developed to their full potential. As a result, some of the objectives identified will relate to renewable energy as a whole, while others will speak to a specific technology or a subset of technologies.

Renewable Energy Supply Sector Objectives

The main issues which will be addressed by the transition to an economy powered significantly by renewable energy are:

- Need for reduced importation and consumption of fossil fuels which result in loss of foreign exchange;
- Need for more efficient energy producing technologies;
- Need for reduction in Barbados' dependence on fossil fuel;
- Need to preserve the natural environment of Barbados

In order to increase the consumption of renewable energy, the objectives below will ensure a renewable energy sector that:

- takes into context the need for retooling the workforce to be able to work with newer renewable energy technologies;

- allows for the greatest viable number of competing players in the market and provides significant opportunities to generate wealth;
- includes a net billing/ net metering regime to facilitate greater integration of intermittent renewables in the electricity grid;
- has greater involvement of smaller investors in the system, playing an important role in sector decision making;
- has a strong relationship between local renewable energy projects and regional renewable energy initiatives;
- demonstrates clarity in determining the long term strategies that would be needed in order to get to 100% energy from renewable energy in the long term and support economic growth and competitiveness in the process;
- facilitates further studies into the possibilities of storage technologies to make renewable energy technologies more technically and environmentally viable;
- provides for a greater availability of resource availability studies conducted throughout the renewable energy sector;
- facilitates greater partnerships between local and international companies in development of renewable energy projects;
- has greater emphasis on development of small scale renewable energy systems. (150 KW or less);
- has optimum account separation of generation from transmission and distribution assets;
- has a greater divestment of electric utility assets to develop a potentially more open energy market;
- establishes a clear direction for level of optimum diversification of energy resources within the renewable energy sub sector;
- provides clarity for the electric utility on the direction of the market;
- has an appropriate business model for the market that includes more players in the renewable energy sector;

- encourages ongoing research into newer, less mature renewable energy technologies to allow for effective development in the long term;
- establishes a clear and stable cost for renewable energy technologies to the greatest extent possible;
- has strong management systems in new emerging renewable energy companies;
- has clear understanding of roles and accountability for installation and maintenance of new renewable energy systems;
- has strong NGO representation, that has capacity to promote awareness and understanding of issues in the general community;
- establishes clear measurements of indicators and standards for various renewable energy technologies;
- maximizes the amount of manufacturing or assembly of renewable energy products within the country;
- maximizes training opportunities in the application of new established and emerging renewable energy technologies;
- Has appropriate tax incentives to motivate investment in new renewable energy technologies;
- adjusts the levels of tax incentives offered as the level of maturity of a technology increases;
- establishes a renewable energy sector where returns on various investments are not tied directly to prices of competing petroleum products;
- Has a level of license fees for new players that are an incentive to investment;
- shows increased use of renewable energy in vehicles (e.g. biofuels and EVs);
- has a greater use of renewable resources produced in a business for manufacture of energy within that business (e.g. use of biogas rather than PV for farms);
- has a high level of transparency in granting of licenses to players within the renewable energy sector;

- has lower duties on EV to increase demand;
- has highly skilled technicians in maintenance of EVs;
- builds on the example of solar water heaters in Barbados to drive other aspects of renewable energy;
- contains an optimum level of diversity in energy resources used in the renewable energy sub sector (cost to be balanced against the level of diversity);
- provides equity for customers unable to pay for renewable energy installations;
- has effective collaboration and coordination of players in the renewable energy industry;
- includes a programme to stimulate job creation within the renewable energy sector;
- includes a clear system for disposal at end of life of renewable energy equipment and associated technologies such as batteries;
- has greater emphasis paid to the development of renewable energy technologies ideally suited to Barbados or Caribbean conditions; and
- has the movement from petroleum based energy to renewable energy mirroring the transition being observed globally in transitions to 'green economies'.

Sector Objectives Specific to solar energy

A sector that:

- shows significant use of solar thermal applications beyond the use of domestic solar water heaters (e.g. solar cooling, distillation, parabolic solar for power production); and
- shows a greater integration of electric installation companies into the solar photovoltaic and other renewable energy grid connected technology industries.

Sector Objectives Specific to biofuels

A sector that:

- shows increased use of liquid fuels prepared from local crops on unused land (e.g. biodiesel) to replace imported fossil fuel where feasible;
- has a requirement for larger farms to install capacity on site for producing biogas for electricity production;
- has streamlined systems for waste management/ separation in order to facilitate waste to energy projects;
- has an adequate amount of agricultural land set aside for development of biodiesel or biomass fuels; and
- includes the production of biodiesel for buses.

Sector Objectives Specific to wind energy

A sector that:

- has specific clearly defined wind energy zones.

Policy Measures- Renewable Energy Sector

In order to achieve a sustainable transition to renewable energy Barbados will:

- diversify and optimize the renewable energy mix that results in the maximization of socio-economic and financial benefits to Barbados;
- develop a capacity building program locally to prepare the workforce for employment in the renewable energy sector;
- develop a central database containing details on extent of renewable energy resource available at various locations in Barbados (solar, wind, bioenergy potential);
- develop legislation and regulations that provide for a

- transparent process in acquiring licences for supplying electricity from renewable energy sources;
- establish standards of electricity production according to the specific type of technology;
 - provide an enabling environment that encourages collaborative approaches to producing renewable energy that is financially, economically, and environmentally viable, as well as technically sound;
 - establish an international agenda that can effectively support the supply of renewable energy within Barbados in a way that supports economic growth and competitiveness;
 - increase staffing (secretariat) and human capacity to support local NGOs such as BREA;
 - establish a clear protocol for clients to follow for investigating and trouble shooting in new renewable energy systems with a method of recourse for clients in case of unsatisfactory company performance;
 - establish regular and clear communication to the public on developments and changes (including prices) within the renewable energy industry;
 - establish efficiency standards for manufacturing of local renewable energy products such as solar water heaters;
 - establish appropriate fiscal incentives for new renewable technologies;
 - promote an enabling environment that encourages local involvement in renewable energy projects. (Possible Ring fencing some renewables for Barbadian investment); and
 - establish a legal and administrative system to ensure protection of intellectual property and patents of new renewable technologies developed in Barbados.

Electricity Sector

The electricity sector is a critical sector to be addressed in the movement towards a sustainable energy sector. In order to obtain the

maximum benefit of renewable energy technologies, there will need to be integration of these technologies into existing grids.

The resulting agreements between the utility and renewable energy developers will be required to share the risks and opportunities in an appropriate way. The involvement of the utility is also important in promoting demand side management and energy efficiency at the customer level.

Given that 50% of energy used within Barbados is provided by the electricity utility, more renewable sources in the generation of electricity will go a long way to reach long term targets. It is important that the utility is clear on government's long term strategy, in order to ensure that appropriate decisions in investment in technologies are made that support the achievement of the targets set out. The utility should also play a part in determining targets and establishing plans for the transition towards a grid with a greater use of renewable energy and more sustainable fossil fuels.

Electricity Sector Specific Objectives

The production and distribution of affordable electricity to all citizens in Barbados will be maintained as Barbados transitions to a renewable energy based economy, and will be achieved under the following objectives which will ensure a sector that:

- provides a reliable service, minimizing brown outs and black outs;
- provides an affordable service to customers in all categories;
- establishes a greater percentage of renewable energy in the fuel mix for electricity generation. (Aspirational goal of 100%);
- establishes clear rules governing the participation of Independent Power Producers (IPPs) in the sector;

- has specific pricing for each renewable energy source in finalizing Power Purchase Agreements (PPAs);
- establishes clear rules governing the rules for writing off sunken assets of BL&P in transition to more renewable and sustainable fuels;
- Establishes clear rules defining investments for firm capacity and intermittent capacity;
- establishes a demarcation of obligations for provision of universal service between the incumbent utility and the potential new renewable energy players;
- establishes an ideal mix of technologies in renewable energy. Percentage to be provided by (wind, solar, biomass etc.);
- provides an optimisation for size of components of the renewable energy system (Utility scale vs distributed renewable energy);
- Establishes a transparent system for determining when to include newer renewable technologies into long term utility planning (OTEC, wave, etc.);
- shows increased use of natural gas and less environmentally deleterious fossil fuel used in electricity generation;
- maximizes the potential in using storage technologies to improve dispatchability of supply;
- has clear rules on how utility planning should be undertaken. Moving away from a 'Least Cost model' to a multi-criteria 'Sustainable model';
- has transparency in roles of the utility, the government ministry and regulator in establishing long term planning and integration of IPPs in the new competitive market;
- prioritizes reduction of carbon emissions in line with climate change national and global targets;
- has an effective interaction between the utility and regulatory body, maximising interaction without compromising independence, could be "Chinese Walls" between staff and (Commissioners) decision makers;

- increases involvement of the electricity utility in other sectors such as transport (e.g. Supply of energy for EVs);
- determines the optimum level of competition and collaboration in the sector while maintaining reliability of supply;
- establishes a transparent ranking system of the conflicting values in the electricity production sector (cost, security of supply, environmental protection etc.);
- integrates with telecommunications providers to improve efficiency in infra structure provisions, (lines, poles etc.);
- establishes a grid operator with clear roles and responsibilities;
- has streamlined and transparent rules determining the issue of licenses for IPPs (Could be an auctioning or RFP process to an independent body);
- has a market that is well understood by the players and members of the general public;
- establishes a market with maximum participation of local entrepreneurs and international partners;
- establishes a system where customers unable to afford renewable energy installations are not saddled with higher electricity costs because they purchase from the grid;
- has stable and predictable electricity prices for all classes of customers;
- offers financial incentives for investors that promote renewable or more sustainable energy sources;
- establishes rates for customers that take into consideration wider social and environmental values;
- has efficiency of production in electricity generation minimizing technical and non-technical losses; and
- establishes efficiency in consumption practices including the use of demand side management.

Policy Measures Electricity Supply

In order to establish an electricity sector that is powered by affordable renewable energy Barbados will:

- establish electric market structures that reduce monopolistic operations where financially and economically feasible;
- establish a pricing mechanism for electricity from renewable energy suppliers;
- establish protocols for interconnectivity between IPPs and the utility to supply electricity;
- establish an office of electricity regulation and standards (could be extension of FTC) to carry out a suite of regulations to manage generation, distribution, supply, dispatch, transmission, distribution and electricity use within the electricity sector;
- establish standards for generation, supply, dispatch, transmission, distribution and consumption that allow the electricity sector to operate in a financially, economically, environmentally, and technically viable manner;
- establish a cap on CO₂ emissions in the electricity sector and issue permits for allowable amounts of CO₂ emissions;
- promote the use of renewable and clean sources of energy to produce electricity;
- establish clear rules determining roles and timelines for updating the Integrated Resource Plan;
- establish generation capacity that can use natural gas as fuel. (dual fuel burners);
- reduce use of the most expensive fuels for generating electricity (jet fuel); and
- use SMART meters for distribution management, to facilitate use of more intermittent technologies and aid in demand side management.

Energy and Transportation (Land, Marine, Air)

The transportation sector is a large consumer of fossil fuel and therefore a significant contributor to green-house-gas emissions in Barbados. Transportation is responsible for about 25% of the local energy sector. Giving the ever expanding fleet of vehicles on the roads, management within the transport sector will be important in charting a sustainable path for energy development on the whole.

In addressing the transport sector it will be crucial to consider both the technology development and issues of management and organisation within the sector. There will also need to be focus placed on infra structure such as roads and refuelling systems.

The expansion of the local fleet of electric vehicles was identified as a principal area of development alongside other changes to alternative fuels or improvements in overall efficiency,

. As a consequence, the energy policy seeks to provide measures to address the following issues:

- Energy consumption and efficiency within the transportation sector;
- Conversion from fossil fuel use to electricity;
- Transportation Management;
- Fuel switching within the transportation sector; and
- Clean energy use and emissions control within the transportation sector.

Transport Sector Specific Objectives

The transformation of the energy consumption within the transportation sector will be achieved giving rise to a sector that

- has a greater percentage of electric vehicles (EVs) in the local fleet;

- has a skilled workforce available to provide effective maintenance on EVs;
- provides greater information to potential buyers of various advantages of purchasing EVs;
- has greater information available to customers on operating cost of running diesel, gasoline and EVs;
- has a greater number of PV systems installed that can be used as charging stations for EVs;
- reduces the levels of duties on the importation of EVs;
- has a greater use of batteries and other storage technology to facilitate charging of vehicles 24 hours per day;
- has greater concessions in infra structure cost to encourage more local automobile dealers to be involved in the EV market;
- has a greater number of hybrid vehicles in the local fleet;
- collects more detailed information of number of EVs, hybrids and other alternative fuels vehicles in the country;
- includes the use of EVs, biofuels, and other alternative fuels in public transport;
- has a fewer vehicles per capita to reduce the level of traffic congestion in the country;
- has a public transport sector that provides a more convenient and attractive option to consumers;
- has a more sensitized public to the benefits of using mass public transit rather than using private cars;
- has a disaggregated sector plan within transport;
- has a consistent transportation policy that makes investment in new technologies worthwhile;
- has a well maintained system of charging stations at strategic points in the country; and
- has a fleet with a greater average efficiency of performance of vehicles within Barbados.

Policy Measures Transport Sector

In order to achieve the significant change in the consumption of energy to more efficient, clean and renewable energy, Barbados will:

- establish biofuel standards for wholesale and retail supply of vehicles;
- establish a transportation information system to provide data for transportation and energy policies and strategic planning, as well as tracking of CO₂ emissions and environmental impacts;
- introduce more renewable energy and clean energy into the public transportation system;
- provide appropriate incentives to promote “green pumps” within service stations and on commercial properties;
- remove MTBE from gasoline and diesel and replace with ethanol and biodiesel;
- promote linkages with agriculture sector to encourage the production of agro-energy crops where financially and economically viable;
- promote energy efficiency in the transportation sector;
- provide tax deductions to vehicle dealerships that have trained their mechanics to maintain and repair EVs;
- establish a programme for identifying appropriate international sources of funding to facilitate and assist the Government in transitioning from fossil fuels to EVs;
- remove duties and VAT from EVs in a phased manner to encourage a scheduled approach to increasing EVs in the national transportation fleet in a manner that will not harm government’s revenue;
- develop a road network that promotes energy efficiency;
- establish the use of management technology in public transit e.g.: use of smartphone apps to verify arrival times of buses;
- establish a system that includes mobile charging stations for vehicles;
- Introduce ethanol rather than MTBE as an anti-knock agent.

- Implement more stringent regulations on vehicles exhausts and emissions;
- establish charging stations integrated with traditional gas stations;
- establish a greater number of charging stations for EVs;
- control the level of carbon dioxide to be maintained in levels consistent with local and global climate change targets;
- establish a system that facilitates the changeover from traditional to renewable energy vehicles by taking into consideration transition costs;
- develop standards for streetlight efficiency;
- establish cost incentives that encourage investment in required infrastructure with charging stations etc.;
- acquire more details on number of vehicles using each fuel type; and
- establish standards in charging and other renewable energy infra structure related to fuelling.

Energy Efficiency and Energy Conservation

Energy efficiency and conservation are critical to achieving the national desire to contain the foreign exchange expenditure relating to the fuel import bill. It is often more cost effective to save a watt of energy on the supply side than to pay to generate a watt through an alternative source of energy. Energy efficiency should also precede the transition to renewable energy as the lower the amount of energy that is needed for production, the smaller will be the size of the renewable energy system needed.

The energy policy will seek to tackle the following:

- Retrofitting;
- Energy efficiency management;

- Energy efficiency and electricity;
- Incentive development for energy efficiency and energy conservation;
- Standards for energy efficiency and energy conservation;
- Regulatory development;
- Behavioural change; and
- Human Resources development.

Energy Efficiency and Conservation Sector Specific Objectives

The efficient consumption energy in Barbados will result in a sector that:

- establishes efficiency standards for manufacturing of local renewable energy products;
- integrates energy efficiency activities with renewable energy, viewing renewable energy as energy efficiency with zero cost; and
- establishes retrofits or energy efficiency where feasible e.g. LED light replacement of florescent lights.

Policy Measures- Energy Efficiency and Conservation

To conquer the challenge of efficient use of energy Barbados will:

- establish efficiency standards for electricity production for utility scale and distribution scale operations;
- establish a maximum life of operations for generation equipment;
- develop and establish legislation and regulations to govern movement towards greater energy efficiency in businesses and residences within Barbados;

- establish an energy consumption education and awareness programme that will promote life style changes of Barbadians in the consumption of energy;
- promote energy efficiency in the productive and trading sectors
- develop building energy consumption standards by sector and encode these standards in the town planning act;

Energy and the Environment

It has long been observed that the production of energy has had an impact on our natural environment through the emission of various pollutants, and that such costs have for many years been externalized from the sector, and not seen as a cost to doing business.

Given the focus on long term health and environmental issues related to marine life, ground water and air quality; exploring the impact of energy and the environmental impact and associated costs is an important consideration.

The emphasis on environmental factors also relates to the discussion on the issue of climate change presented in a later section.

The policy will establish a course of action for the following issues:

- Energy's impact on the environment – such as air and ground water quality;
- Oil spill management;
- Information management and education;
- Establishment and enforcement of environmental standards;
- Clean energy; and
- Waste and Energy.

Energy and Environment Sector Objectives

The achievement of a sustainable balance between energy production, transport and consumption, and protecting the environment will produce a sector that:

- promotes information flow within the energy sector and the society on the environmental effects of various types of energy production technologies;
- has infrastructure that allows the authorities responsible for environmental protection to assess and monitor environmental standards within the energy sector;
- possesses the information infrastructure that would allow for the dissemination of environmental best practices on the production, transportation and consumption of energy;
- requires by legislation and regulation all participants to adhere to the principle of zero harm to people and the environment in pursuit of energy production, transportation and distribution; and
- progresses in a sustainable way towards the 'green' and 'blue' economies.

Policy Measures -Energy and the Environment

In order to ensure that environmental concerns and objectives are addressed fully Barbados will:

- establish standards and protocols for the safe and effective disposal of equipment and devices in the energy sector;
- establish a sustainable environmental management framework for the upstream offshore petroleum sector;

- establish a decommissioning fund for the energy sector to facilitate the decommissioning and abandonment of energy operations and facilities;
- establish standards and protocols that promote and encourage the goal of zero harm to the people and the environment in the production of energy in the petroleum and renewable energy sub-sectors;
- Establish information systems and infrastructure that promotes the flow of information requiring environmental standards, best practices and legislation; and
- Establish studies within the sector that assess the correlation between carbon dioxide emissions and health risks (e.g. cancer, asthma).

Human Resources and Institutions: Capacity and Development

In order to implement the policy the institutions and human resources which service the energy sector must be honed and applied in a meaningful way. The move of the energy industry towards a greater reliance on renewable energy represents a paradigm change in both the way how energy is produced and consumed. It will be necessary to ensure that the workforce is adequately prepared for the new skills that are needed and for institutions to be restructured to regulate and manage activities within the new sector.

This section addresses and anticipates these changes and developments needed in the area of human resources and institutional capacity.

Therefore, the energy policy will address the following issues:

- Research and Development;
- Education and skills development;

- Energy information management;
- Knowledge Development; and
- Capacity development and institutional strengthening.

Human Resource and Institutions Capacity Objectives

The development of skills and knowledge in the energy sector will result in a sector that:

- has a skilled workforce able to fulfil the requirements of the new renewable energy sectors;
- has standards of qualification for all aspects of the energy sector especially in renewable energy;
- maximizes information sharing between educational institutions and the energy sector in establishing degree programmes, vocational programmes and school curricula;
- Incorporates new skills relevant to emerging conventional and renewable energy sectors in syllabuses in BCC, SJPP, and UWI etc.;
- has an increased number of scholarships available for persons interested in studying new areas related to renewable energy and aspects of sustainability in the oil and gas sector;
- Establishes a framework that allows for flow of energy information from regional institutions to local environment and also from local industry to regional institutions;
- has an increased number of qualified persons in conducting energy audits;
- emphasizes the context of 'innovation' throughout curricula related to energy at various levels of education;
- has an effective use of various media on a regular basis to communicate to the general public important issues relevant to energy policy and sustainable energy development within the country;

- ensures that the commercialization of new and renewable energy technologies within the country is maximized;
- establishes significant internship opportunities in energy technology development within the private sector;
- offers significant opportunities for the private sector to sponsor local energy development projects;
- facilitates financial contribution of the general public towards the development of various projects;
- has greater use of international standards and best practices in the development of the energy sector;
- encourages pursuit of vocational skills that are important in building an effective renewable energy sector;
- establishes an environment that motivates personal entrepreneurship in areas of small business development in energy related fields;
- establishes a community teaching programme in renewable energy; and
- offers clear levels of acceptable standards of service for various energy products with possibility of recourse for consumers if standards are not met.

Policy Measures for Human Resources Institutions: Capacity and Development

To achieve the objectives that will lead to a significant improvement in human resources and capacity development Barbados will:

- develop and establish energy studies curricula for secondary and tertiary institutions;
- establish a Department of Energy Studies within the UWI;
- establish an Energy Workbook that makes use of an integrated approach including general concepts in maths, science etc.;
- establish a partnership between stakeholders within the energy sector and the Ministry of Education;

- establish an information network between the energy sector and the education sector to communicate skills and expertise requirements;
- mobilise funding for training and development of persons employed in the energy sector and fields of disciplines that support the energy sector;
- create, develop and promote institutional capabilities in the energy sector including:
 - Energy policy formulation, management, assessment and audit;
 - Legislative review and reform;
 - Energy sector planning
- support, promote and maintain timely supply of data and information to the Barbados National Energy Information System;
- establish regional and International agenda to develop technical capacity;
- establish guidelines for the adaption, diffusion, and transfer of energy technologies;
- promote cooperation in research and technological development within the energy sector;
- support research and development into smart grid technologies for electricity and natural gas sub-sectors;
- establish an effective system of knowledge transfer of higher order energy skills available in international institutions to local educational and vocational institutions;
- establish an educational system that supports efforts for entrepreneurship in the energy sector;
- establish research programs that illustrate the link between the development of the local energy sector and the economic drivers throughout industry;
- establish new jobs throughout the energy industry that increase overall employment opportunities in Barbados;

- establish a Working Group including members of educational institutions and energy sector to ensure ongoing relevance of the education system in the changing energy context; and
- establish demonstration projects that illustrate ‘innovation’ and commercialization of energy projects.

Energy and the Cross-Cutting Sectors

The energy sector has a significant impact on all aspects of Barbados socio-economic life. It touches all the critical sectors of production and consumption. It is important that this policy harmonizes with identified goals and policy objectives of the other sectors stated below:

- Energy and the agricultural sector;
- Tourism and services;
- Energy and the industrial sector;
- Waste management in the energy sector;
- Water and Energy;
- Health Safety and the Environment issues;
- Development planning; and
- Youth and Energy.

Agriculture is critical because there are potential uses of land for crops to produce biofuels. Animal waste from farms can also be used for production of biogas. In addition, the agricultural sector is a major consumer of energy in the process of food cultivation and production. A sustainable agriculture sector will play a major role in safeguarding the sustainability of the entire energy sector in the long term.

The tourism sector is a major economic sector for Barbados. The industry relies on the maintenance of the natural environment in

terms of the marine and coastal resources along with associated air and water quality. A programme that highlights the importance of protection of these resources both from the perspective of citizens and visitors to the island will be beneficial. Energy conservation, efficiency and promotion of renewable energy are key elements in these activities relating to overall energy policy.

Over the last decade the Barbados economy has expanded in the industrial sectors with an increase in manufacturing. The expansion in this sector has meant a concomitant increase in both peak demand for energy and total energy consumption. The price of energy for the industrial sector has often been higher than the cost of service, as the rates of domestic customers are kept at a lower level due to social considerations. The higher cost of energy for industrial users affects the cost of production for both manufactured goods and services. This means that the price that goods are sold at in wholesale and retail levels are also higher. At times this high price affects the competitiveness of businesses from an international perspective; especially when compared to the neighbouring island of Trinidad, where the cost of fossil fuel based energy products is much lower. Energy policy and regulation will need to address the cost of such energy products for the industrial sectors, to ensure that businesses remain competitive and costs of services to consumers remain reasonable.

In small island states such as Barbados, the issue of waste management is critical; especially because the availability of land for use as landfills is limited. The impact of waste materials such as non-biodegradable plastics on the natural environment can also be significant. There is potential for more recycling of products, with a development of an effective waste separation system. Alternative ways of waste disposal have been considered in Barbados, including incineration. Options such as these will have an impact on energy consumption which will in turn affect the cost of waste management.

However, in addition to the impacts on waste management of consumption, there are opportunities for using various waste

products as fuel sources. Bagasse obtained from the sugar cane industry is an example of a waste product that has been used to generate electricity. Other options using gasification of other organic waste have been considered in recent times. These wastes to energy options could represent solutions for reducing the amount of waste entering the landfill as well as in increasing the use of indigenous energy resources within Barbados.

Protection and maintenance of a good quality and supply of water resources has also become a source of concern recently. Barbados is supplied entirely by ground water aquifers, although there has been activity to develop a desalination plant as well. The energy required to pump and distribute water across Barbados is significant, and the Barbados Water Authority (BWA) is the customer with the highest usage of electricity from BL&P in the country. As a result, BWA has explored renewable energy options such as solar and wind energy for generation of electricity within its premises.

It is important that within this policy, the link between water conservation and efficiency and energy efficiency is emphasized. There is also a need to consider specific renewable energy technologies that could be developed for the water sector. It should be noted that there may be a regulatory impact if BWA decides to pursue an energy source that is separate from the grid. The loss of BWA as a customer to BL&P could lead to the need for increased tariffs for customers that stay on the grid. BL&P in this situation would still be required to meet its cost of service requirements. Any future policy and regulatory measures should take this into account.

Health and environmental issues related to the energy sector also need to be considered. The environmental factors associated with energy production are discussed elsewhere in the document. The main one that has got global attention is the link to climate change which leads to rising sea levels that can severely impact small islands.

However, there are other environmental factors that can have an impact on health as well. Nitrous and sulphur oxides associated with burning fossil fuels involved in generating electricity are linked to respiratory ailments. In addition emissions from gasoline and diesel vehicles can have a similar impact. MTBE that is used in unleaded gasoline vehicles as an anti-knock agent is also carcinogenic. It is partially for this reason, that replacement of MTBE by ethanol or gasohol has been explored as an alternative. There are also impacts that need to be taken into consideration from a safety perspective, especially when it comes to interconnection of renewable energy technologies to the grid. For example, there are dangers of electrocution to technicians on lines for distributed renewable energy generation flowing back through to the centralized grid. For stand-alone systems, batteries that are not properly maintained and stored can create risks of explosion. The policy will need to ensure that appropriate protocols of standards, maintenance, permits and inspections are maintained.

It is also important that energy development is made in such a way that it closely connects with overall national development in Barbados. Goals in terms of overall infra structure, education and health should be considered and addressed as part of the long term energy policy and strategy. An essential part of this social development is in the area of youth. In order for the change to a more renewable and sustainable energy paradigm to be successful, the younger members of society will have to be fully involved in promoting the changes and being the technology developers and entrepreneurs within the new energy industry.

This section focuses on the objectives and possible measures for the tourism, agriculture, waste management, water, health safety and environment, development and planning, and youth and energy.

Tourism Sector Specific Objectives

A sector that:

- Integrates EVs and other renewable vehicles within rental car business and other tourism related services; and
- develops an education program for hotel guests and tourists to Barbados emphasizing the importance of energy efficiency and environmental conservation.

Agriculture Sector Specific Objectives

A sector that:

- maximises the use of bagasse from the sugar cane industry to generate some of the electricity within the industry and to the local grid;
- has efficient production of sugar and associated products in the industry.
- maximises the use of waste heat produced in agriculture for cogeneration;
- makes use of available land to maximize production using energy technologies to improve yields and variety of products;
- has increased commercial viability of sugar cane and agriculture industry through improving all round efficiencies in the sector;
- uses biomass (possibly river tamarind) as an off-season fuel to be used as a complement to the bagasse fuel production;
- has a higher percentage of use of biofuels, bagasse and biomass in order to produce greater price stability;
- has increased use of electricity for production of services such as cooking to create more applications for renewable energy;
- includes the use of ethanol from sugar cane for use in the transportation sector to replace MTBE;

- establish a museum to demonstrate the aspects of the sugar industry and various linkages relating to energy and sustainability; and
- increases the use of biomass in the manufacture of plastics to replace fossil fuel based plastics.

Industrial Sector Specific Objectives

A sector that:

- maintains electricity tariffs at levels that encourage entrepreneurship and maintain competitiveness; and
- makes use of renewable energy technologies available to improve overall sustainability.

Key Policy Measures for Industrial Sector

To achieve the objectives that will lead to a significant improvement in the industrial sector Barbados will:

- consider time of use rates for the Industrial sector in order improves overall efficiency; and
- seek to establish programmes to highlight the possibilities of use of renewable energy technologies in the industrial sector (grid tied and off grid options).

Waste Management Sector Specific Objectives

A sector that:

- maximizes the use of waste resources in industrial process for generation of electricity with the industry and to the grid; and

- provides a clear assessment of the potential of identified waste products in generation of electricity based on availability and energy calorific content.

Water Sector Specific Objectives

A sector that

- promotes production and consumption of water resources to the greatest extent possible; and
- includes the use of renewable energy technology to reduce the overall demand of the sector in terms of energy.

Health and Safety and Environment Sector Specific Objectives

A sector that:

- has a Health and Safety sector with clear standards and protocols for establishment and maintenance of new renewable energy systems; and
- Establishes studies that quantify in a comprehensive manner the link between energy use and various health ailments observed in Barbados

Development and Planning Sector Specific Objectives

A sector that:

- establishes national development policy in a manner that is consistent with energy policy objectives and measures

Youth and Energy Sector Specific Objectives

A sector that:

- promotes education and awareness activities in renewable energy management, sustainability and entrepreneurship to facilitate the new sustainable energy technology sector.

To achieve the objectives that will ensure that energy sector positively impact the socio-economic life Barbados will:

- promote balanced land use for energy and food production;
- promote energy efficiency for irrigation and animal production;
- encourage the use of agricultural and fisheries waste as viable feedstocks for bioenergy production;
- promote energy efficiency within the industrial sector by employing internationally recognized efficiency standards;
- promote the use of industrial waste to produce energy where feasible;
- promote increased employment within the energy sector by utilizing technical and vocational training in energy related disciplines and skills;
- target students from primary and secondary schools to promote sustainable energy via life style change, and the advancement of science technology, engineering and mathematics (STEM) subject areas; and
- establish legislation and regulation to encourage the safe disposal of waste from the energy sector.

Disaster Management:

Barbados as an island state is susceptible to natural and man- made disasters, especially related to hurricanes and other extreme weather related events.

Consequently, disaster management and mitigation is a very important component of any plan of action within the energy sector. This 2017 energy policy will speak to the following disaster management issues:

- Energy and Fuel reserves/stocks management;
- Renewable energy use as a mitigation tool of disaster management;
- Oil spill management and mitigation planning;
- Electricity restoration management;
- Petroleum fuel transport disaster mitigation; and
- Disaster management and natural gas distribution

Sector Specific Objectives Disaster Management

The development of a disaster management programme will create an energy sector that:

- ensures safety of renewable energy systems in the event of a natural disaster;
- makes renewable energy resources available to contribute to relief in the wake of a natural disaster;
- develops the capabilities and resources to respond rapidly to manage disasters; and
- requires by law that all participants adhere to the principle of zero harm to people and the environment in pursuit of energy production, transportation and distribution.

Key Policy Measures:

To ensure the achievement of the objective to mitigate and manage disaster within the energy sector Barbados will:

- develop standards to ensure safety of renewable energy systems in event of a natural disaster;

- establish renewable energy resources that can be a source of relief in the wake of a natural disaster;
- establish protocols to manage disaster incidents in service stations and charging stations with renewable energy infrastructure;
- develop an energy sector disaster response plan; and
- review legislation within the energy sector to enshrine the principle of zero harm.

Trade in Goods and Services within the Energy Sector

The continued development of the energy sector makes it necessary to develop an enabling environment that promotes the capacity of Barbadian companies to provide goods and services competitively. Although maximum growth in renewable energy and sustainable energy as a whole will depend to a large extent on the international funding available for the technology, there will also be a significant need for local investment and entrepreneurship.

To this extent facilitation of business and trade within the local energy sector will be a key component of this 2017 policy. Local trade is also important in making sure that the industry has long term sustainability and that the economic benefits of development are also shared in the local business community

At the moment, there are a number of local enterprises that are supplying renewable energy products and services in Barbados. The energy policy will provide for the implementation of a course of action that will promote the active participation of local enterprises in all aspect of the energy sector.

- Development and implementation of an enabling environment to facilitate local content for exploration and production of oil and gas offshore in Barbados; and

- Development and implementation of an enabling environment to facilitate local content for renewable energy operations.

Trade in Energy Goods and Services Objectives

The improvement of trade in energy goods and services requires a sector that:

- addresses the barriers to entry to participate in emerging renewable energy markets;
- offers financial terms to encourage small business entry in the renewable energy market;
- offers local investors opportunities to be involved in local oil and gas exploration projects;
- allows the flow of information to empower investment and the flow of financial resources; and
- has a strong local content supporting the exploration and production of oil and gas.

Policy Measures Energy Trade

To accomplish an enabling environment that will lead to a more desirable trade environment Barbados will:

- strengthen networks between businesses involved in renewable energy to foster greater collaboration;
- develop a database showing potential local projects in renewable and non-renewable energy and investment and skills needed;
- remove all barriers to entering the renewable energy market;

- promote the enabling infrastructure that will encourage the establishment of financial mechanisms to fund renewable energy;
- conduct a diagnosis of the suppliers of goods and services to identify the readiness and need of local firms to meet the standards of supply for the offshore oil and gas sector;
- review and adjust the regulatory and operational framework of government to allow the enabling environment for local companies to acquire the standards of supply; and
- establish legislation and regulation to govern the modes of supply for electricity from renewable energy sources.

Energy and Climate Change

Although Barbados is not a significant contributor to climate change and sea level rise, as an island state, it is among those countries, small island developing states (SIDS) which are most vulnerable to climate change impacts. Contamination of groundwater, damage to coral reefs, destruction of coastlines and more frequent extreme weather events are just a few of the impacts that could severely impact Barbados' economy and those of other small island states.

It's therefore in Barbados and other small islands' interest to lead the way internationally in promoting mitigation of climate change.

The policy will speak to the following:

- Climate Change Financing;
- Carbon Pricing and Trading;
- Moving the international energy sector towards a climate change neutrality;
- Information flow;
- Implementation of the Nationally Appropriate Mitigation Action;

Climate Change Sector Specific Objectives

Climate Change mitigation will require a sector that:

- contributes to the CO₂ emission reduction by promoting the use of clean energy and renewable energy;
- fosters collaboration and cooperation amongst all stakeholders to reduce CO₂ emissions;
- works with international investors and agencies to finance climate change mitigation initiatives;
- establishes a baseline database for level of greenhouse gases associated with economic and developmental activities in various sector.

Policy Measures for Climate Change

To achieve success in the reduction of CO₂ emissions within the energy sector Barbados will:

- establish a mechanism to cap and trade CO₂ emissions within the Barbados Energy Sector;
- establish a trade facility that allow holders of CO₂ emissions permits to trade with other emitters of CO₂;
- establish strong rules for capping CO₂ emissions;
- establish a clear international agenda for the acquisition of climate change funding.

Energy Access and Infrastructure

Barbados has over the years successfully ensured that its population has access to energy. However, over the next twenty years the challenge will be to provide affordable energy as traditional sources of energy will become more difficult and expensive to acquire. The policy will tackle following:

- affordable energy for all citizens;
- access to clean and renewable energy;

Energy Access and infrastructure Sector Objectives

Barbados will ensure that its transition to a society that is powered by renewable and clean energy by creating a sector that:

- ensures that access to electricity is extended and maintained for all citizens of Barbados; and
- has a developed electricity and energy infrastructure that allows for a greater degree of distributed generation where financially and economically feasible.

Policy Measures for Energy Access and Infrastructure

To accomplish an enabling environment through improved energy access and infrastructure Barbados will:

- establish an energy mix that promotes affordable energy prices;
- establish legislative and regulatory requirements within the energy sector to contain excessive pricing;
- promote market structures that encourage transparent, competitive and stable energy pricing; and
- establish a lifeline rate for persons unable to afford cost of basis energy services.

Energy Investment and Financing

Investment management will determine the success or failure achieved within the sector and its growth in the future. A policy that recognizes the magnitude of investment required will establish the enabling environment to allow investment to flow. The energy policy will establish a course of action to address the following:

- Investment Sources:
 - Private Sector Investment
 - Public Sector Investment
 - Foreign Direct Investment
- Investment Structure:
 - Debt
 - Equity
 - Grant
- Resource requirements for energy sector development;
- Information mobilization and investment; and
- Investment Scheduling.

Investment and Financing Sector Objectives

Sound energy investment and financing will see the emergence of an energy sector that:

- has an optimum level of mix of private and public sector investment for development of energy projects in Barbados; and
- has an optimum mix of foreign and local investment for development of energy projects in Barbados.

Policy Measures Energy Investment and Financing

To encourage sound, practical and timely investment in the energy sector Barbados will:

- establish rules to guide local and overseas developers on requirements for investing in Barbados' oil and gas sector;
- establish a local content programme for the upstream petroleum sector;
- establish local investment and ownership within the renewable energy sub-sector where feasible;
- promote foreign/local partnerships for investment within the energy sector;
- establish a business enabling framework that allows for timely and easy establishment of operations; and
- improve the flow of information within the energy sector to ensure access to all available source of financing (equity, debt and grant).

Implementation, Governance and Regulatory Framework

It is apparent that in spite of the technology developments and increase in business activities in new and traditional energy activities, there is a need for clearly defined regulatory frameworks.

Such certainty in regulation and decision making helps to give confidence to potential investors and reduce the risk for all the players involved.

In some cases legislation and regulations are in place but there are no clear rules or procedures to ensure implementation. In other cases there are contradictions in the provisions of the existing legislation and this creates a level of ambiguity in interpretation.

In relation to the governance and regulatory framework this 2017 policy seeks to:

- Amend existing legislation and regulation or promulgate new ones where necessary to ensure responsible market behaviour and industrial harmonization;
- Rationalise the number of existing acts governing the sector through the introduction of new modern industry legislation;
- Review on an ongoing basis the existing legal framework for performance, strengths, weaknesses and lessons learnt to formulate and implement programmes of legal reform; and
- Develop regimes for pricing of electricity and petroleum products that will balance requirements for competitiveness with the long-term viability of the sector.

Governance and Regulatory Framework Objectives

The government of Barbados will seek to establish a sector that:

- establishes clarity in identifying the specific legislation governing the business activities in both the renewable and oil and gas sectors in Barbados; and
- establishes and identifies the specific agencies with responsibility for governance of the business activities in the renewable energy and oil and gas sectors

Policy Measures- Governance and Regulatory Framework

To accomplish an enabling environment that will lead to a more desirable governance and regulatory framework Barbados will:

- conduct a project to establish procedural rules to support all of the existing legislation governing the renewable energy and oil and gas sectors;
- conduct sensitization and awareness programmes for all agencies involved in the enforcement of legislation and governance of activities within the energy sector.

4. Policy Targets and Scenarios

Given the objectives and measures identified in the previous Section, a number of associated targets will be developed and discussed in an 'Annex' Section.

These objectives and targets will be discussed within the context of a 'Business as Usual' scenario and then explored for possibilities of a sector with 50% and 75% (renewable energy and natural gas) energy mix.

The 'Annex' goes on to assess the policy measures under the 'business as usual' scenario and then discusses the overall impact on the economy, government and the society of the policy measures given future targets of 50% transition to renewable energy and

natural gas and another scenario of 75% transition to energy based on renewable energy and natural gas.

In developing possibilities under the 'business as usual', 50% (renewable energy and natural gas) and 75 % (renewable energy and natural gas scenarios, factors such as economic deficits, level of taxation, GDP, oil prices and costs of tradeable and non-tradeable goods will be considered.

Development of Indicators and Monitoring System

An important next step will be the development of appropriate indicators to measure the policy in the short, medium and long term. These will include economic indicators that assess the cost related to various policy measures. Indicators that relate to aspects of energy efficiency will also be included. For example changes in 'energy intensity' overall and within individual consumption sectors may be useful in assessing the success of current measures. Other indicators that relate to the natural environment and social development will also be considered in the short, medium and long term.

Establishing of the appropriate indicators will be critical in determining an effective system of monitoring that will allow the policy to be updated and revised on a timely basis to ensure continuous improvement.

The measures emerging from this 2017 national energy policy will form the basis of the "Action/Implementation Plan" that is expected to follow from this policy. This will identify more specific programmes and determine strategies and the roles and responsibilities of various agencies in achieving these.

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