



# The Energy Sector in Belize

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## **Abstract**

Belize faces declining petroleum production as well as electricity costs that are among the highest in Central America. Although it is dependent on Mexico for over 30 percent of electricity supply, Belize has significant renewable energy resources of its own that can help reduce this need—and the high costs to fill it—and increase energy security. The country also has the opportunity to consume energy more efficiently by using innovative technologies. To realize these opportunities, Belize, with the support of a Sustainable Energy Action Plan developed with technical assistance from the Inter-American Development Bank, has developed an energy policy and a strategic plan for the ministry responsible for energy. Collectively, the policy and strategic plan aim to address the barriers that prevent public and private sector entities from using energy more efficiently, as well as those that restrict the development of renewable energy.

**JEL codes:** O13, Q21, Q31, Q35, Q41, Q42, Q48

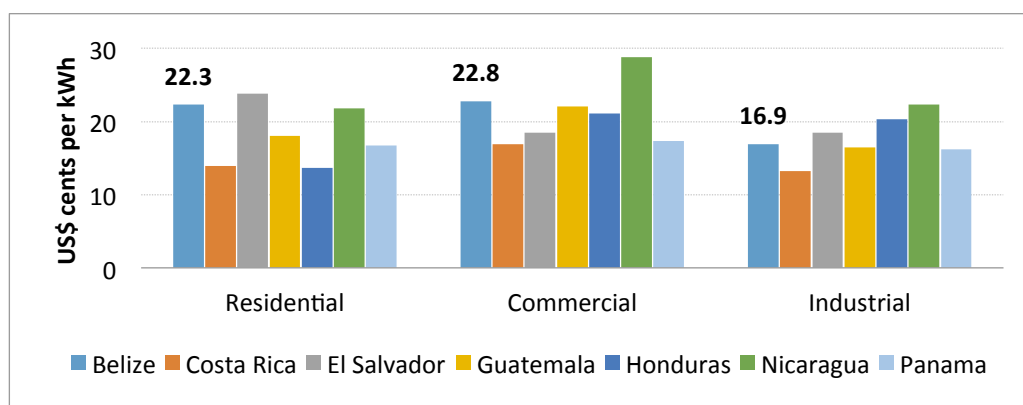
**Keywords:** Alternative energy source, crude oil, electric energy, electric utilities, electricity, energy, energy conservation, energy efficiency, energy sources, energy supply, environment, exhaustible resources, fuel, gas, hydrocarbons, hydropower, natural source

## 1. Justification

Belize's public budget and economy are heavily interlinked with the energy sector. Taxes and royalties from the oil sector accounted for approximately 10 percent of government revenues in fiscal year 2011–12 (Hon. Dean Barrow, 2011). Crude oil is the leading merchandise export, accounting for 26.2 percent of total exports between January and October 2012. In the same period, the imports of mineral fuels and lubricants represented 16.65 percent of the total value of imports. The value of imports for these products increased by 7.9 percent between 2011 and 2012.

Exports of crude oil have dwindled since 2010, when the production of the existing oilfields peaked. Indeed, in the first 10 months of 2012, the volume of crude oil exported fell by 33.7 percent compared to the same period in 2011. Nevertheless, the industry believes that Belize might develop 10 new fields that could offset the reduced productivity of the existing ones (Martina and Manzano, 2010). Energy costs in Belize are among the highest in Central America. In 2011, Belize led the Central American region with the highest gasoline prices and had among the highest electricity tariffs for the residential, commercial<sup>1</sup>, and industrial sectors (US\$0.223/kWh, US\$0.2278/kWh, and US\$0.169/kWh, respectively) (see Figure 1).

**Figure 1. Electricity Tariffs by Sector in Belize, 2011 (US\$ cents/kWh)**



Source: OLADE (2011).

<sup>1</sup> The commercial sector accounted for 54.9 percent of Belize's GDP in 2011. In particular, the tourism sector accounted for 12.5 percent of Belize's GDP, a share similar to Barbados' (12.9 percent) and well above Jamaica's (7.6 percent) and Mexico's (5.6 percent). In fact, Belize is the non-island nation with the highest participation of tourism in its GDP among the 181 countries listed in the World Travel and Tourism Council (WTTC) rankings. (WTTC, 2012).

From 2001 to 2011, 14 percent of total capital inflows to the country were directed to mining (especially to the oil sector) and electricity. These investments included the construction of the Vaca Dam, which expanded hydroelectric generation capacity and investments on the oilfields. However, since 2008 foreign direct investment in the energy sector (and particularly in the electricity subsector) has plunged (Central Bank of Belize, 2011).

To respond to these and other challenges, the government of Belize (hereinafter “the government”) hired consultants in 2011 to develop a National Energy Policy Framework (Tillett, 2011). This document, which was approved by the government in January 2012, sets forth the goals for the sector, which are to (i) foster the sustainable production, distribution, and end use of energy; (ii) minimize the cost of energy in the local economy; (iii) mitigate the impacts of external shocks; and (iv) create a culture of energy efficiency.

Subsequent to the National Energy Policy Framework, in September 2012 the Ministry of Energy, Science, Technology, and Public Utilities (MESTPU) published the National Sustainable Energy Strategy (2012–2033) as part of its Strategic Plan for 2012–2017. The National Sustainable Energy Strategy includes a number of programs and activities to support the development of the country’s non-renewable and renewable energy resources and improve energy efficiency and conservation in order to transform to a low carbon economy by 2033 (MESTPU, 2012).

Between June 2013 and June 2014, the Inter-American Development Bank (IDB) provided technical assistance to MESTPU. This program focused on identifying the energy efficiency and renewable energy potential of Belize, as well as assessing the barriers that prevent that potential from being realized. The technical assistance also included developing recommendations for interventions to overcome the barriers to Belize’s energy efficiency and renewable energy potential and an action plan to implement the recommendations.

Both the National Energy Policy Framework and the National Sustainable Energy Strategy set a precedent for policymaking in the sector, and are a starting point for further government action, supported by the technical assistance to date. However, moving forward with this ambitious agenda will be a challenge for the government, as it will need support in terms of resources and technical expertise. Given the government’s limited resources, it is important to prioritize the interventions in the sector to have a long-lasting and significant impact.

## **2. Assessment**

### **2.1 Status of Belize's Energy Sector**

Although Belize has local fossil fuel resources, 63 percent of the country's energy supply was imported in 2010, mostly in the form of secondary energy either as refined petroleum products or as electricity. Crude oil equivalent to 68 percent of the country's energy supply was exported in 2010, as Belize has no domestic refining capacity (Tillett, 2011). Thirty-seven percent of energy supplied domestically was obtained from local resources such as biomass (firewood and sugar cane products), hydropower, and local fossil fuel resources (petroleum and natural gas). Petroleum products such as liquefied petroleum gas (LPG), gasoline, kerosene, and diesel oil accounted for 93 percent of the total energy imported in 2010, whereas electricity accounted for 7 percent. Belize is the smallest country in Central America by population (332,700) (Central Bank of Belize, 2011) and the second smallest by surface area (20,418 km<sup>2</sup>).

In 2010, the main consumer of energy was the transport sector (46.80 percent of total energy consumption) followed by the industrial sector (27.43 percent of total energy consumption). The residential, commercial, and service sectors were responsible for the remaining 25.77 percent of total energy consumption in 2010 (Tillett, 2011).

All refined oil products (gasoline, diesel, kerosene, and aviation gasoline) are imported from Venezuela under the Petro-Caribe Agreement and transported to Belize via ocean tankers. Gasoline and diesel are also indirectly "imported" into Belize when local vehicles travel across to border cities and towns. Nevertheless, Belize is an oil producer, with a production of around 3,000 barrels a day (BNAmericas, 2012). Most oil production is exported, though some crude oil is combusted directly by the industrial sector.

Belize's electricity is supplied mainly through a 115 kV transmission line that covers the entire northern and western sections of the country, and is interconnected with Mexico, currently the most reliable source of energy, according to the newly established MESTPU. The southern areas of the country are partly covered by a 69 kV transmission line.

Belize Electricity Limited (BEL), which was nationalized in 2011, is the primary distributor of electricity in Belize, serving a customer base of approximately 80,363 accounts

(BEL, 2012b). In 2012, 45 percent of the electricity generation output was purchased on the spot market from Mexico's Federal Energy Commission (Comisión Federal de Energía, or CFE). Previously, CFE supplied BEL up to 15 MW of firm capacity and up to 40 MW on an economic basis, but CFE cancelled its firm power agreement with BEL in November 2009. In 2012, the remaining 55 percent of electricity was supplied as follows: Belize Electric Company (BECOL, 38 percent), Belize Co-Generation Energy Limited (BELCOGEN, 12 percent), Hydro Maya (2 percent), BEL's own diesel generation capacity (3 percent), and the Blair Athol Power Company Limited (BAPCOL, 1 percent), the successor company of Belize Aquaculture Limited (BAL) (BEL, 2012a). As population growth is high (2.65 percent per annum) (SIB, 2010), studies estimate that electricity demand will grow by about 4 percent per annum in the coming years (OAS, 2012) in the absence of a demand-side management program or strategy.

Belize's peak energy demand reached 82 MW in 2012, and it is expected to grow despite a recent setback in the period 2010–11. Installed capacity was approximately 156.2 MW in 2012, and is enough to cover peak demand in the near term. Hydroelectric capacity is 54 MW, of which 21 MW come from run-of-the river or low storage capacity hydro plants. BAPCOL's generating capacity is approximately 10 MW, although it only generated power in 2009–10 and again in 2012. BEL owns and operates 28.3 MW of diesel-fired gas turbines. BELCOGEN generates electricity by burning bagasse and has a capacity of 13.5 MW. This capacity is only available when there is an available bagasse resource from sugar processing. BEL's supply from CFE is constrained by a 60MW maximum transfer capacity of the 115 KV transmission line linking the two national systems. Moreover, BEL is currently unable to take more than 50 MW of power from Mexico without experiencing voltage regulation problems.

## **2.2 Potential of Energy Resources**

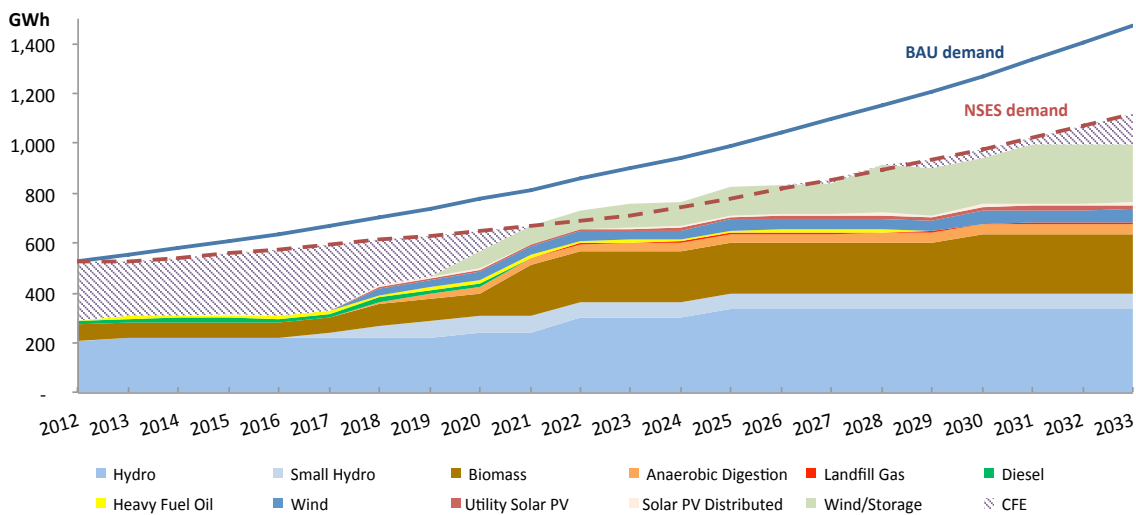
In terms of availability of energy resources, Belize has unexploited potential in both renewable and fossil fuel sources. According to the CIA World Factbook, in 2010 oil reserves were in the order of 6.7 million barrels, although other studies indicate reserves in the order of 20 million (Tillett, 2011). The country has some wind resource potential, both offshore and onshore. The National Renewable Energy Laboratory (NREL) of the United States estimated in 2008 that the country had 737 km<sup>2</sup> of moderate to excellent wind resource potential (class 3–7 wind) at 50 m (NREL, 2008a). A private wind developer has been measuring wind speeds at selected sites



onshore. A study carried out for the government estimated the undeveloped hydroelectric potential of the country to be approximately 75 to 100 MW (Tillett, 2011). Currently, Belize has 54 MW of hydro capacity installed. In terms of biomass, according to BELCOGEN the country has additional bagasse resources that could be used for energy generation purposes (Tillett, 2011).

Figure 2 summarizes Belize’s energy efficiency and renewable energy potential. The “BAU demand” line shows projected growth in electricity consumption in a business-as-usual scenario. The “NSES demand” line shows electricity demand assuming an increasing penetration of energy efficiency technologies. The supply from renewable sources is shown by source beneath the demand lines.

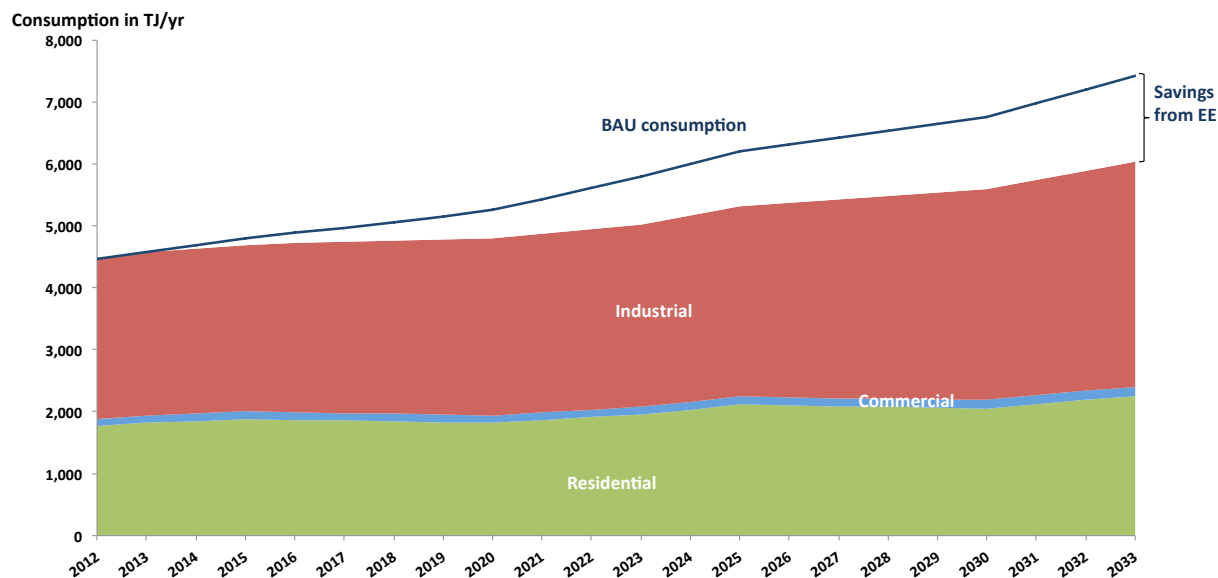
**Figure 2. Belize’s Electric Sector Energy Efficiency and Renewable Energy Potential**



Source: Castalia (2014).

Belize can also become more efficient in the stationary fuels sector, as shown in Figure 3.

**Figure 3. Belize’s Stationary Fuel Energy Efficiency Potential**



Source: Castalia (2014).

The benefits of the renewable energy and energy efficiency investments shown above are summarized in Table 1.

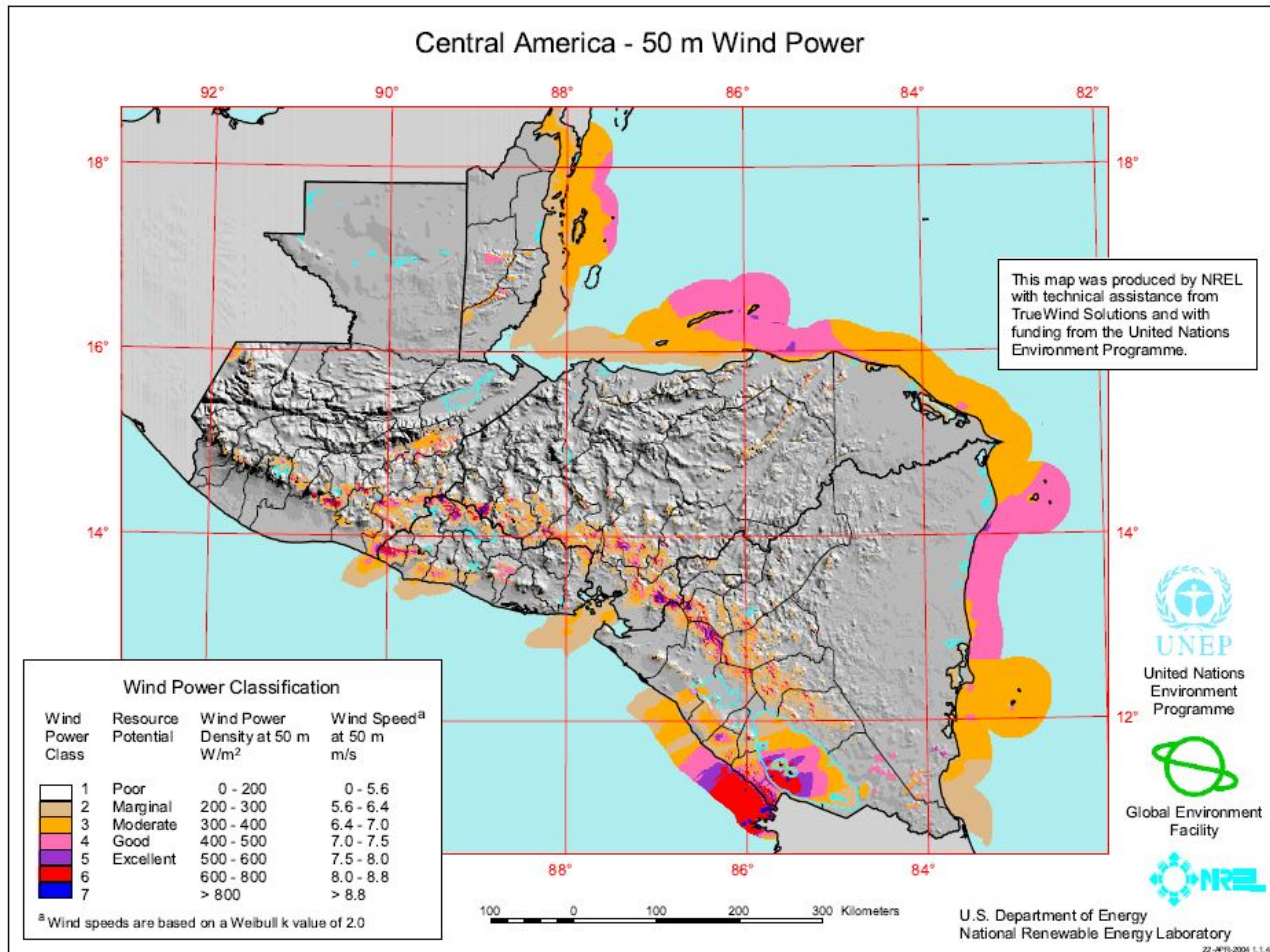
**Table 1. Benefits of Renewable Energy and Energy Efficiency**

Savings/expenditure	Amount (BZ\$)
Capital Expenditures for EE, electricity +stationary fuel use (NPV, 2013–2033)	-BZ\$217 M
Savings from electricity supply (NPV, 2013–2033)	BZ\$459 M
Savings from stationary Fuel Use (NPV, 2013–2033)	BZ\$261 M
<b>Total savings</b>	<b>BZ\$503 M</b>

Source: Castalia (2014).

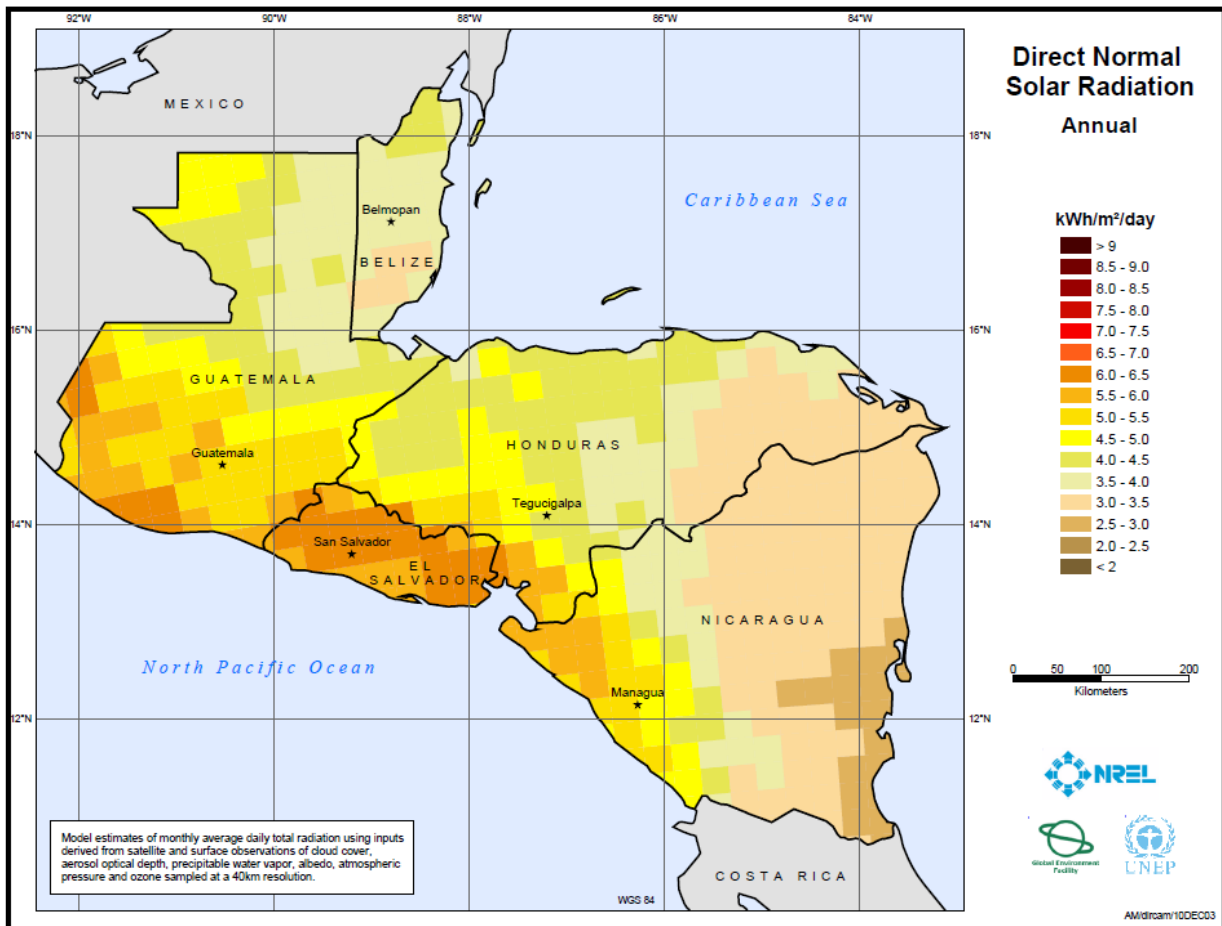
Figures 4 and 5 show the solar and wind resources of Central America.

**Figure 4. Central America's Wind Potential**



Source: NREL (2008b).

Figure 5. Central America's Solar Potential



Source: NREL (2008b).

A number of barriers prevent the realization of Belize's energy efficiency potential, most of which are not unique to the country itself. These barriers can be summarized as:

- Agency barriers—in many cases the person who decides what equipment a property should use is not the same person who pays for operating expenses.
- Information barriers—people are familiar with the energy efficiency equipment they could be using, or they mistrust the information that they have received about that equipment.
- Regulatory barriers—in some cases regulations, may inadvertently incentivize inefficient behavior.

- Market barriers—some efficiency equipment may be difficult to find, or may be too expensive.
- Financial barriers—energy consumers may not be able to obtain financing on acceptable terms to invest in energy efficiency equipment.
- Skills barriers—service providers may not have the skills necessary to provide the professional services required to allow efficiency investments to happen.

Regulatory barriers also prevent greater adoption of distributed renewable energy generation. At present, owners of such systems cannot connect them to BEL's grid. Also, the current tariff structure means that increased distributed generation would result in users without distributed systems subsidizing users with distributed systems. The need to inspect distributed systems could also become a barrier in the future.

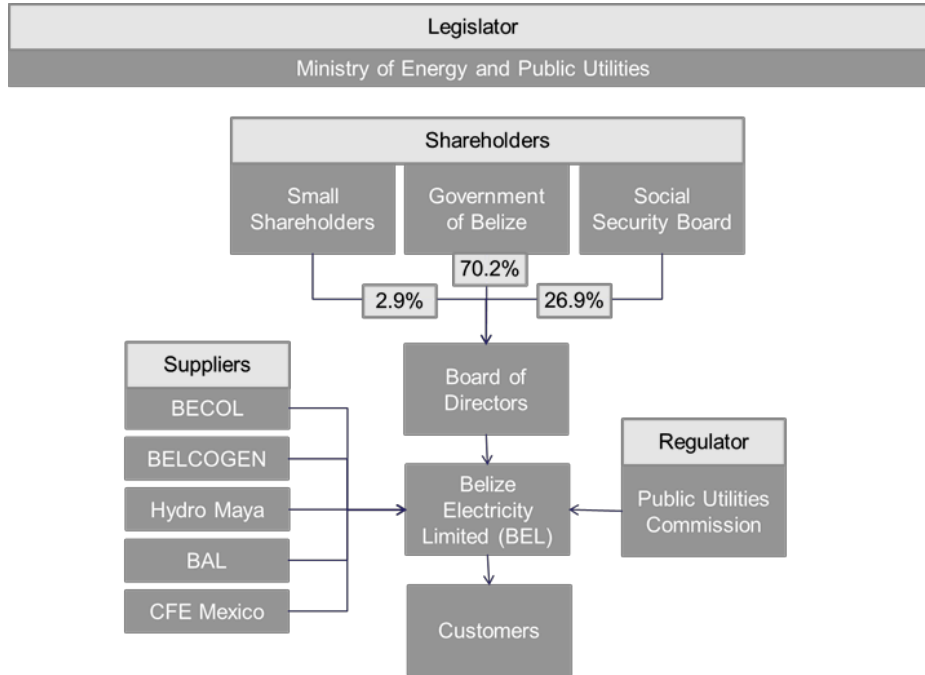
Five types of barriers prevent the realization of Belize's utility scale renewable energy potential:

- Information barriers—there is a lack of information about several key renewable resources, specifically biomass and waste.
- Regulatory barriers—the regulations governing how to access and develop renewable energy sites are unclear; the procurement process could also be clearer.
- Financial barriers—some financiers may demand higher returns because of perceived lack of security in the Belizean electricity sector.
- Technical/skills barriers—Belize's power sector workforce is not familiar with operating and integrating generation from intermittent sources.

### 2.3 Institutional Framework

Figure 6 presents an overview of the key entities in Belize’s electricity sector.

**Figure 6. Key Entities in the Electricity Sector**



Source: Based on Castalia (2014).

In March 2012, the government created the Ministry of Energy, Science, Technology, and Public Utilities (MESTPU). Among the main responsibilities of its energy portfolio, the Ministry is envisioned to be in charge of the electricity and gas and petroleum (hydrocarbons) subsectors. Previously, the Ministry of Public Utilities, Transport, Communications, and National Emergency Management regulated the electricity subsector. The Ministry of Natural Resources and the Environment governed the renewable resources (i.e., biofuels). Oil exploration was also under the Ministry of Natural Resources and the Environment, but the Ministry of Finance regulated oil products. Policymaking in the oil sector had for a long time been dispersed among various government bodies, in particular, the Ministry of Natural Resources and the Environment for oil exploration and the Ministry of Finance for regulation of oil products (Martin and Manzano, 2010). The Ministry of Natural Resources and the

Environment was responsible for integrating environmental safeguards into the development of energy projects.

Belize Electricity Limited (BEL) has a monopoly on transmission and distribution. The national grid connects all the districts and is interconnected with Mexico. The national grid does not reach all parts of the districts: in some remote locations, such as in the more remote cays, electricity consumers self-generate. Until recently, Belize's electricity market was liberalized and the government limited itself to regulating it. BEL served the distribution/transmission market. However, in June 2011, the government nationalized BEL, acquiring 70 percent of its shares. Currently, BEL is the sole buyer of electricity from public and private generators and the only supplier of electricity to final users. BEL's capital investment projection for the four-year 2012–15 cycle is estimated at BZ\$145 million (US\$74 million) (Barrow, 2011). The Public Utilities Commission (PUC), created in 1999, regulates tariffs and the quality of the electricity service and grants licenses for generation, transmission, and distribution. According to the Electricity Act, the primary duty of the PUC is to ensure that utilities provide satisfactory service at a reasonable price. The PUC has the power to issue bylaws for the electricity sector relating to the methodology and process for the determination of tariffs, charges, and fees for the transmission or supply of electricity. It also has the power to determine and prescribe the standards that must be maintained in relation to these services. In addition, the PUC is responsible for the awarding of licenses and for monitoring and enforcement. In 2012, the PUC reduced electricity prices by 7 percent. However, a rate increase of 16.87 percent was imposed in early 2013.

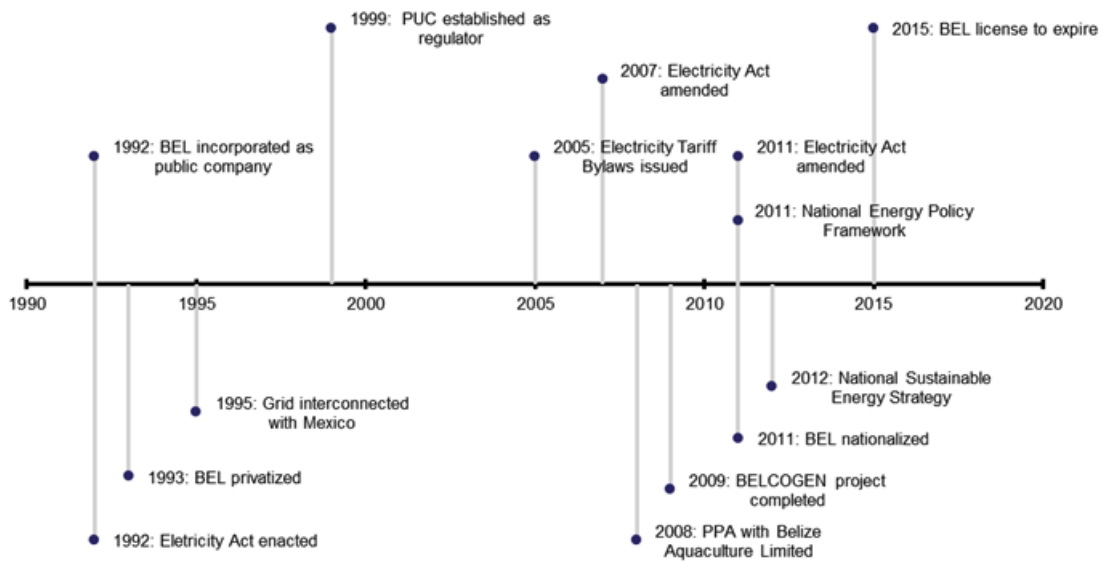
## **2.4 Regulatory Framework**

The main law that frames activities of the hydrocarbons sector is the 1991 Petroleum Act, which vested all property relating to, and control over, petroleum and petroleum products in Belize's government. Under the act, the government can contractually cede these property rights to a private economic agent (Martin and Manzano, 2010).

The Electricity Act (1992), its amendments (1999 and 2007), and the Electricity Bylaws (2005) are the main pieces of legislation that provide the legal framework for the PUC to carry out its duties and functions in the electricity subsector. The bylaws govern the tariffs, rates, charges, and fees for the transmission and supply of electricity and for existing and new services to be charged by a licensee to consumers in Belize. In addition, the bylaws establish the

mechanisms, formulas, and procedures for calculating and determining these tariffs, rates, charges, and fees, as well as the methodology for periodic review proceedings. Further, the bylaws govern the quality of service (service reliability standards).

**Figure 7. Timeline of Electric Sector Regulation**



Source: Tillett (2013).

The Electricity Act requires the PUC to ensure that all reasonable electricity needs are met, ensure that license holders are able to finance the business for which they are licensed, and protect the interests of consumers in general and, in particular, in rural areas. The PUC is responsible for the economic regulation, quality and continuity of service, and security and safety of the electricity sector. It is mandated to enforce the Electricity Act and any related regulations.

The Electricity Act allows the PUC to establish regulations and bylaws on any matters in the industry, including the methodologies that license holders may use to charge their customers. The Act does not define any such methodology. The PUC has, however, established a tariff and rate-setting methodology in Statutory Instrument 60 of 2001. The services for which fees can be charged are transmission, distribution and supply, installations, rentals, and removals. The PUC can also facilitate the resolution of disputes between participants in the electricity industry. The Electricity Act allows auto-generation, but it does not allow interconnection of auto-generation



systems. The supply of electricity is exempted from the sales tax, as it is considered an input for the production of goods and services. The Electricity Act does not include any other system of tax incentives and it does not distinguish by source of energy.

## **2.5 Sector Challenges and Opportunities**

### ***2.5.1 Energy Planning***

Implementing the National Energy Policy (NEP) and the National Sustainable Energy Strategy will be a challenge given the need for reliable baseline data to develop concrete action plans and the need to carefully prioritize sector interventions in accordance with institutional capacities.

### ***2.5.2 System Expansion***

To meet the growing demand for electricity, the PUC issued a request for proposals (RFP) for new generation capacity in the fourth quarter of 2013 (PUC interview, 2013). The RFP called for the addition of 50MW of firm generation capacity (biomass, hydro, or fossil fuel) and 15MW of intermittent renewable generation (most likely wind or solar) to be installed in Belize between 2013 and 2023. The objectives of the tender are to reduce dependence on imported electricity from CFE and decrease the relative share of fossil fuels in the country.

### ***2.5.3 Sustainability of Indigenous Petroleum***

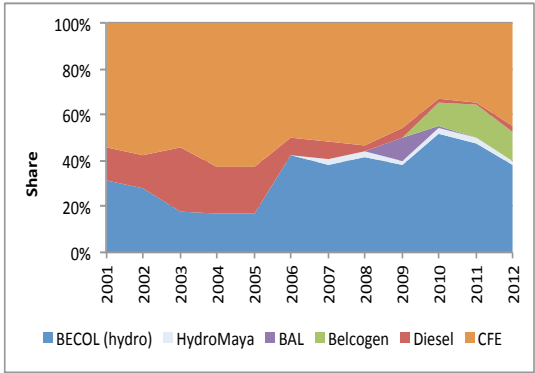
Official figures of proven reserves are estimated at 7 million barrels (Martin and Manzano, 2010). This means that at the current production rate, there are about five years of indigenous oil remaining, if no further finds are made. What is more, production levels fell significantly in 2012 from highs of nearly 5,000 barrels per day in 2010. Local firm Belize Natural Energy (BNE) is the country's sole oil producer, with production of only 3,000 barrels per day from 11 wells in the Spanish Lookout field and 300 barrels per day from five wells in the Never Delay field in 2012 (BNEL, 2012). Perenco, an independent oil producer in the UK, and Treaty Energy, based in New Orleans, are also drilling in Belize; however, neither has production in place (BNAmericans, 2012).

### ***2.5.4. Electricity Prices***

Electricity prices are high in Belize by Latin America standards (although low by Caribbean standards). The average electricity tariff was stable from 2007 to 2012 at around 0.221 US\$/kWh

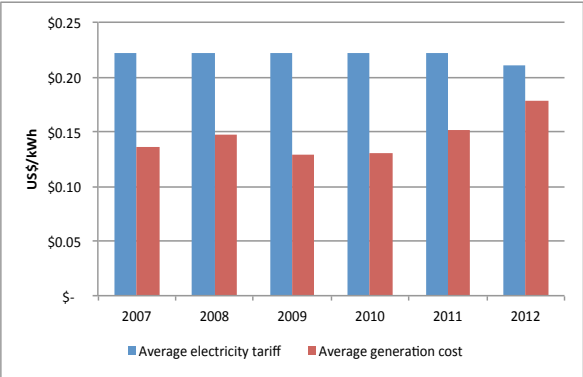
(exchange rate of 1.89 BLZ per 1 USD) (BEL, 2011); it was reduced in 2012, and then increased in early 2013 to 0.244 US\$/kWh (exchange rate of 1.98 BLZ per 1 USD) (PUC, 2013). The price is mainly determined by generation costs, which averaged 0.18 US\$/kWh in 2012 (exchange rate of 1.98 BLZ per 1 USD) (BEL, 2012), and BEL’s transmission and distribution costs, which included taxes. Generation costs are determined by the electricity generation mix, which in 2012 mainly comprised CFE’s imports and low-cost hydroelectric energy (see Figure 8). However, these hydro resources are highly variable, as they depend on rainfall, and the electricity imported from Mexico (CFE) is tied to the international price of crude oil. This makes the system highly vulnerable to oil price volatility (since CFE energy is bought on the spot market) and climatic conditions (see Figure 9).

**Figure 8. Share of Electricity Generation by Source**



Source: BEL (2012a).

**Figure 9. Average Tariffs vs. BEL’s Generation Costs**



Source: BEL (2012a).

In early 2011, inadequate rainfall lowered the water level behind hydroelectric dams and reduced the supply of hydroelectricity. The Belcogen plant had to close for several weeks in February and March 2011 to repair two steam turbines. The resulting shortfall had to be made up by increased imports from CFE, and the increased dependence on CFE coincided with significantly higher crude oil prices. As a result, average generation costs increased 16 percent from 2010 to 2011, reducing the gap between the average electricity tariff and generation costs.

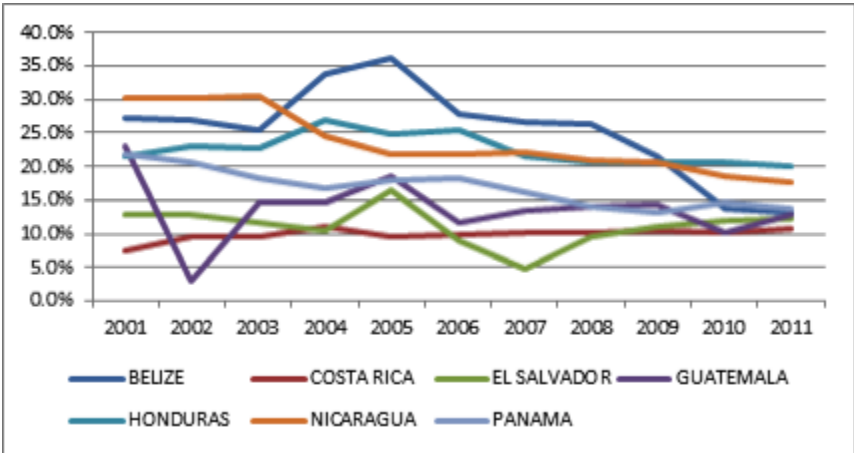
Similarly, in 2012, low rainfall reduced hydroelectric output, and biomass generation was lower than in previous years. This resulted in an increase in high-cost power purchased from Mexico, raising the average cost of power in 2012 to US\$0.18 per kWh (BEL, 2012a).<sup>2</sup>

**2.5.5 Sustainability of the Electricity Subsector**

Before June 2011, Belize’s electricity market was liberalized and regulated. Vertical integration was allowed, but the regulator was mandated to encourage competition in generation. The distribution/transmission market was dominated by BEL, which by law provided transmission facilities to any generator capable of paying its fees.

Since 2007, BEL’s profits have decreased significantly as a result of increased operating expenses, depreciation, amortization, finance charges, and increased corporate taxes. Nevertheless, the proportion of earnings before interest, taxes, depreciation, and amortization (EBITDA) versus sales revenue is currently among the best of the region’s public utilities, at around 16 percent. Compared with the region, Belize’s system losses are not substantial (see Figure 10), although technical losses could be reduced (OAS, 2011).

**Figure 10. Transmission and Distribution Losses**

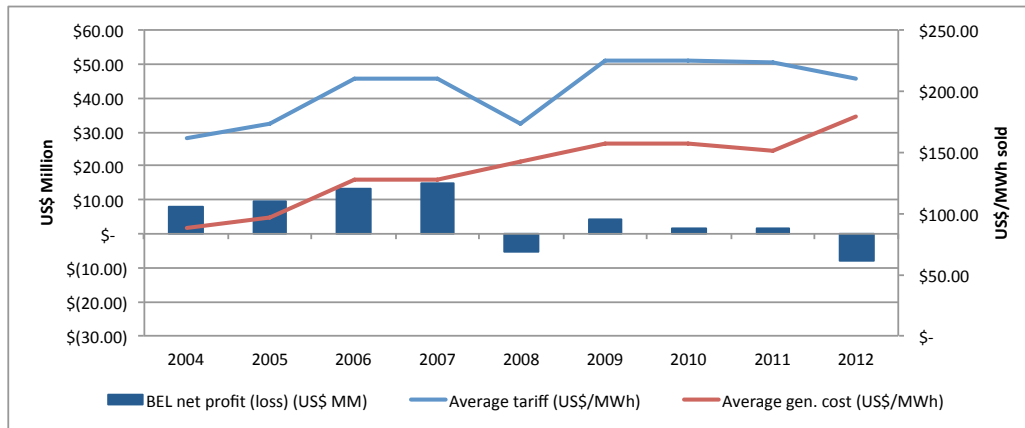


Source: OLADE (2013).

<sup>2</sup> The exchange rate was 1.98 BLZ per US\$.

As shown in Figure 11, although BEL seems to be operating at acceptable levels, it could improve its financial and operational (technical) performance. In addition, Belize could foster private investment in the electricity subsector in order to achieve competitive generation costs and lower average tariffs.

**Figure 11: Evolution of Generation Cost and Tariff Revenue in Belize<sup>3</sup>**



Source: BEL Annual Reports, 2004–12.

### 2.5.6 Electricity Coverage

Electricity coverage in Belize is estimated at 90 percent. Remoteness and high grid connection cost are the primary reasons that some communities do not have electricity. Even though Belize is making an effort to electrify its rural communities, contributing to an estimated 5 percent rise in electricity demand per year, there are still many households without electricity services. Electrification is expected to expand in line with an expected rise in electricity demand. Some of the rural communities that lack electricity are situated in areas that are not easily accessible to the transmission network. Off-grid solutions should be studied as potentially cost-effective solutions for these communities.

<sup>3</sup> The average tariff was calculated as the ratio of energy revenues (BZ\$) to energy sales (MWh). Average generation cost was calculated as the ratio of cost of power (BZ\$) to energy sales (MWh). Values were calculated using an exchange rate of 1.98 BLZ per US\$.

### **2.5.7 Regional Integration**

Belize's interconnection with Mexico could be expanded and the procurement terms of its supply option could be further improved. In addition, the government is considering an interconnection to the Central American Electric Interconnection System (Sistema de Interconexión Eléctrica de los Países de América Central, or SIEPAC) as an opportunity to enhance a reliable power supply network in the country, as well as an interesting prospect for exporting electricity by promoting new generation capacity in Belize if cost-effective generation potential is found and deployed. In 2014, BEL and the government signed an agreement with Mexico to allow sales of Belizean electricity on the Mexican spot market (interview with Derek Davis, October 2014). The price of sale remains to be set between the two parties.

## **3. Existing Policies**

### **3.1 National Energy Policy**

In 2011, the government developed the National Energy Policy (NEP), which contained an extensive list of policy recommendations to address the problems of the energy sector in Belize (Tillett, 2011). Although this document was approved and disseminated to the relevant government authorities and various energy stakeholders for their review, input, correction, and discussion, the NEP could be further developed.

The NEP sets four goals for Belize's energy sector: (i) foster sustainable production and distribution of energy; (ii) minimize the cost of energy in the local economy; (iii) mitigate the impacts of external shocks; and (iv) create a national culture of energy efficiency. To achieve these goals the NEP proposes the following strategies:

- Elevate and promote the importance of planning for energy efficiency in all sectors of the economy.
- Promote and support the production of energy from indigenous renewable resources in order to promote sustainability, increase resilience, and engender local participation in the energy industry.
- Preserve, develop, and manage the agriculture, agro-processing, and forestry sectors as a major source of biomass feedstock for energy production.

- Pursue both resource and geographic diversity of the supply mix in order to maximize the resilience of the energy sector.
- Develop an energy-for-export industry aimed at supplying the regional and other foreign markets over the long term.
- Build a modern and robust electricity distribution infrastructure to foster greater energy efficiency and resilience and provide infrastructure support for the electricity-for-export industry.
- Nurture the crude oil industry as a for-export industry.
- Put in place measures to maximize the production of non-crude oil products from petroleum extraction activities.
- Develop a local electricity micro-generation market where small producers, such as individual households, communities, commercial establishments, and even small industrial participants, can sell electricity to local distribution systems and the national grid.
- Promote and support local participation in the energy supply industry in order to build support for renewable energy initiatives, increase local input and control over the local petroleum industry, and generate employment and economic opportunities locally.
- Provide access to cleaner and more versatile energy carriers<sup>4</sup> in rural areas and populations living on the margins of the socio-economic fabric as part of broader initiatives of the government and NGOs to improve the standard of living and productivity in these areas.
- Promote the adoption of energy efficiency and conservation measures in energy applications throughout all sectors of the economy.
- Promote the adoption of energy-efficient equipment and devices in all sectors of the economy.
- Institute a price on carbon in line with binding covenants such as the Kyoto Protocol and in harmony with the evolution of the global carbon market.

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<sup>4</sup> As defined in the NEP, energy carriers are secondary energy forms that “carry” energy from the primary source to the final end users.

### 3.2 Strategic Plan 2012–2017

In 2012, the MESTPU released its 2012–2017 Strategic Plan. The Plan’s objective is to integrate energy, science, and technology into national development planning and decision making to catalyze sustainable development (MESTPU, 2012). It outlines steps to transition Belize to a low-carbon economy, reliant on renewable and domestic energy sources.

The Plan contains two parts. Part I of the Strategic Plan builds on the National Sustainable Energy Strategy (NSES) by specifying five core strategies to achieve a low carbon economy by 2033. The core strategies specify the ways and the time frame in which the goals of the NEP will be accomplished. The five core strategies are:

- (i) Improve energy efficiency and conservation across all sectors: transport, industry, and commercial and residential buildings. The goal is to achieve a minimum reduction in per capita energy intensity of at least 30 percent by 2033, using energy utilization and GDP generated in 2011 as the baseline.
- (ii) Reduce the country’s dependence on imported fuels by 50 percent by 2020, from one million barrels to one-half million barrels, by increasing the production of modern energy carriers from domestic renewable energy resources, coupled with improving energy efficiency and conservation.
- (iii) Triple the amount of modern energy carriers derived from waste material. Depending on the technology choices, electricity, liquid fuels, and gaseous fuels could be produced.
- (iv) Turn Belize into a net electricity exporter by 2020.
- (v) Build the Ministry of Energy, Science, Technology, and Public Utilities institutional capacity to accomplish its mandate (MESTPU, 2012).

Part II of the Strategic Plan recommends science, technology, and innovation promotion strategies. These strategies are organized into five strategic options to meet the needs of the government, the MESTPU, and key stakeholders. The five strategic options are:

- (i) Introduce a capacity building program to strengthen the MESTPU.
- (ii) Promote science, technology, and innovation as a key to economic growth.
- (iii) Encourage microenterprise development for rural populations.
- (iv) Generate information and communications technologies to spur the development of a knowledge economy.
- (v) Build the organizational capacity of the MESTPU (MESTPU, 2012).

## **4. Policy Options**

The NEP recommends several policies to the government for implementing the NEP strategies and ultimately achieving the NEP goals. This policy note summarizes these actions in six policies in an effort to identify those that are most relevant for Belize.

### **4.1 Energy Planning**

The government has committed itself to the creation of a National Energy and Electricity Planning Institute (NEEPI) with responsibility for formulating energy plans and policies in coordination with relevant stakeholders. One of the most important tasks of the NEEPI is the creation of an Energy Sector Planning Framework. This task could be undertaken by the MESTPU. Energy efficiency would be incorporated in energy planning. The government plans to stimulate consumer investment in energy efficient appliances as well as influence end-use energy consumption patterns. To evaluate the potential contribution of indigenous renewable energy resources in the energy matrix, the country's resources must first be assessed. The government has prioritized wind and hydro resources as the first ones to assess for electricity generation purposes.

### **4.2 Sustainability of Indigenous Petroleum**

The NEP focuses on improving royalty management in order to maximize the exploitation of local hydrocarbon resources and on establishing environmental safeguards to protect other natural resources.

### **4.3 Energy Pricing**

In addition to a rural electricity pricing mechanism, a new pricing methodology is also proposed that will differentiate consumers. BEL reclassified its customer categories for the reporting year 2013.



#### **4.4 Transmission and Distribution**

The government has focused on the transmission component of the electricity grid in order to strengthen the grid, reduce technical losses, and adjust the grid code to accommodate variable power and micro-generation sources.

#### **4.5 Electricity Coverage**

Low-energy density distribution areas will be set up, demarcated, and declared rural in order to promote rural electrification.

#### **4.6 Regional Integration**

The government has identified regional integration as a key policy to promote a for-export industry and improve the sustainability of the electricity subsector. The NEP sets the task of investigating the technical and economic feasibility of upgrading the interconnection with Mexico, but also limits the maximum amount of total foreign electricity imports. It also recommends seeking membership or direct involvement in SIEPAC.

### **5. Policy Recommendations for Belize**

In an effort to identify the most relevant alternatives to achieve Belize's energy policy goals, this document focuses its analysis on the six NEP policies mentioned above.<sup>5</sup>

#### **5.1 Energy Planning and Implementation of the NEP**

Proper energy planning is crucial both to use scarce public resources in the most cost-efficient way and to foster private investment in the sector. Energy planning should also be geared toward achieving energy security in a country highly vulnerable to fluctuations in oil prices and climate change. Energy security does not necessarily mean energy independence; therefore, the evaluation of regional integration options (i.e., electrical connections with other countries and regional networks such as SIEPAC) is advisable. In addition, the MESTPU and eventually the proposed planning institute can also be responsible for assessing energy resource studies, energy

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<sup>5</sup> The fiscal implications of pursuing these policies will be quantified through a cost-benefit analysis under technical cooperation RG-T1886 (Assessment of the Potential for Distributed Generation using Renewable Energy and Energy Efficiency – Support for the Sustainable Energy Strategy of Belize).

demand forecasts, managing concessions, and energy (electricity) master plans, amongst other studies.

The preparation of detailed strategic and action plans derived from the NEP is a required further step. These plans should be based on comprehensive and reliable baseline data that must be assessed and/or generated if they are not available. Clean and sustainable energy alternatives would be preferred. These plans should further complement the NEP in providing a baseline, milestones and a realistic target for the government to improve, in a sustainable manner, the country's energy sector.

## **5.2 Energy Efficiency**

In line with any of the interventions mentioned above, energy efficiency should be promoted across the entire sector and among customers. The government's role in this area should be to foster efficiency investments from the private sector and to promote energy efficiency measures in public buildings and street lighting,<sup>6</sup> as such measures can promote fiscal sustainability and free up fiscal space from energy savings. Some investments can be undertaken by the utility and can serve as an example for the private sector. As with renewable energy development, any intervention should be preceded by a study that assesses the potential and identifies the least-cost alternatives (technologies and solutions) for reducing energy consumption or increasing the rational use of energy.

The government of Belize should invest in energy efficiency to save money and free up fiscal space. Based on a preliminary estimate, standard energy efficiency measures across the government's building stock could save approximately US\$4 million per year on average, and a total of approximately US\$90 million in net present value terms over the life of the projects.<sup>7</sup> This estimate is based on a forward-looking model that, using 2014 as a base year, projects savings into the future over the life of the projects (between 15 to 20 years, depending on the type of project). The model assumes that energy efficiency measures are phased in over a 12-year period, beginning in 2014, across all government buildings. The estimate is based on energy savings and implementation costs for four key energy efficiency measures:

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<sup>6</sup> Energy efficiency measures in public buildings and street lighting will be assessed under the technical cooperation RG-T1886.

<sup>7</sup> Based on a model of a financing facility developed by Castalia as part of their technical assistance contract.

- Replacement of inefficient fluorescent lighting. The government could replace existing light fixtures with lighting that is 25 percent more efficient.
- Replacement of inefficient window air conditioning units. The government could replace existing window air conditioning units with models that are 25 percent more efficient.
- Installation of efficient window glazing. The government could replace inefficient, single-pane window glass (“glazing”) with glazing that reduces the need for air conditioning.
- Replacement of inefficient streetlights. Existing streetlights could be replaced with high-efficiency LED models capable of offering the same light output at half the wattage.

### ***5.2.1 Renewable Energy***

The development of indigenous renewable energy resources for electricity generation, transport, and other uses appears to be a sensible strategy for Belize. However, any intervention should be preceded by a resource potential study that gives priority to low (competitive) cost and firm energy options in the case of electricity generation. This should be accompanied by an energy efficiency strategy and the development of the MESTPU and/or a proposed energy planning institute. Heat demand (e.g., hot water) for industrial and commercial activities (e.g., tourism) could be covered by indigenous renewable sources, such as solar.

### ***5.2.2 Hydrocarbon Strategy***

The fundamental challenge in the Belize hydrocarbon subsector is related to the relative newness of the oil industry and the scale of production in the country. Therefore, the main task for the government in the oil sector is to set up a solid institutional and regulatory framework to attract investors and ensure proper management and implementation of environmental safeguards, mitigating risks that may arise with the exploitation of the resource (particularly in offshore drilling) (Martin and Manzano, 2010).

## **5.3 Pricing Policy**

A review of tariff-setting mechanisms would ensure that tariff-pricing mechanisms reflect actual costs. For this reason, studying the current electricity tariff-setting methodology employed by the PUC is a priority. It is advisable to implement a new electricity tariff-setting methodology.

Affordable rates for rural communities may require special treatment as long as inefficiencies and distortions are minimized.

#### **5.4 Belize Electricity Limited**

BEL should focus its efforts on the following:

- Improving corporate governance and financial stability as well as promoting the efficiency of its own generation and of the transmission and distribution system. This could help BEL reduce its operating costs.
- Securing lower-cost power in order to reduce tariffs.
- Promoting energy efficiency, renewable energy, and regional integration in order to ensure the sustainability of the electricity subsector in Belize. (BEL has begun developing an energy audit team to aid customers in improving their energy efficiency (Interview with Sean Fuller, 2013).

#### **5.5 Electricity Coverage**

Planning is a key activity to increase electricity coverage. For this reason it is important first to set up, demarcate, and declare rural or low-energy density distribution areas before undertaking any intervention. Micro-generation solutions, including hybrid systems using renewable energy, should be taken into account, mainly as a solution for electrification in remote rural areas where the cost of extending the grid is higher than this alternative.

#### **5.6 Regional Integration**

The task of assessing the technical and economic features and characteristics of the interconnection with Mexico is extremely important to ensure the sustainability of the electricity subsector. However, this should not hinder the Government in seeking membership or direct involvement in other regional integration efforts (e.g., SIEPAC) as this could foster low-cost imports by stimulating competition between Mexico and Central America and could also promote investment in generation for export.

## **6. Next Steps: a National Sustainable Energy Action Plan**

To turn the many analyses and policy initiatives into real changes that will improve Belize's electricity sector, MESTPU (with the support of the IDB) is engaged in the design and implementation of a National Sustainable Energy Action Plan. This plan builds on recent efforts to provide a concise, coherent guide to the tasks needed, the entity responsible for each task, and the timing and sequencing of those tasks to ensure an effective critical path. The Plan's five components will guide actions coordinated among MESTPU, the PUC, BEL, and the private sector with the following objectives:

- (i) Promote large-scale renewable energy generation. Belize can further expand its large-scale renewable energy potential, particularly hydro, biomass, waste, wind, and solar resources. The tasks that need to be undertaken in order to accomplish this include: providing transaction advisors to evaluate bids submitted as part of competitive tendering for utility scale renewable generation and negotiating with preferred bidders to help the utility procure generation from the most qualified offers at least cost and under reasonable contractual conditions (key tools for this would be standard heads of terms for power purchase agreements for firm and non-firm power); developing a complete licensing regime, building on the case-by-case approach used to license independent power producers (IPPs) to date; developing resource assessments for biomass and municipal solid waste for power generation, to provide investment-grade information for unexploited clean generation potential; completing a full grid integration/impact study and transmission reinforcement study for incorporating intermittent generation in the system, building on the initial study recently commissioned by the utility (this study will also inform the eligibility for grid-connected distributed renewable generation, discussed below); and updating the grid code to allow easy and efficient integration of intermittent generation while preserving system stability and reliability of service (this will also inform the standard interconnection agreement described below).
- (ii) Prepare for distributed renewable energy generation. As prices of distributed renewable generation technologies continue to decrease, they will become viable in Belize. A regime needs to be ready in time to integrate them in a way that is beneficial for consumers, does not increase the cost of service for non-participating customers, and is

viable for the utility. The tasks needed for doing so include: designing a standard offer contract for distributed renewable generation, building on the PUC's efforts; drafting a standard interconnection agreement for customers to interconnect in a safe and easy way and to be annexed to the standard offer contract; and setting up financing mechanisms to support the purchase and installation of distributed renewable systems.

- (iii) Build a more efficient and enabling electric utility. BEL has started helping its customers be more energy efficient and is a relatively efficient utility compared to its peers. To build on these strengths and maximize BEL's own efficiency on the supply side, as well as its ability to make its customers more efficient on the demand side, and purchase their excess renewable generation while continuing to provide backup and standby services (and being adequately compensated), the right rules and incentives need to be in place. Tasks needed for doing so include: improving the tariff structure to enable distributed generation and increase incentives for energy efficiency, in particular disaggregating charges for energy, backup and standby, and connection to the grid; implementing a more effective system to decouple BEL's revenues purely from energy sales, allowing it to earn a reasonable return as its customers become more efficient; and carrying out a cost-of-service study finalized to enable increased efficiency and distributed renewable generation (and updating as necessary BEL's expansion plan).
- (iv) Help households, businesses, and the Government become more energy efficient. Belize has major unrealized potential for energy efficiency. The scope for retrofitting existing facilities is large, and the case for ensuring that new ones are built according to best practices is strong. Tasks required for doing so include: designing a building code that enables energy efficiency and predisposition for distributed generation and solar thermal generation, focused on new buildings; designing, capitalizing, and operationalizing financial mechanisms to support energy efficiency and small-scale renewable projects of households, businesses, and the government (ideally, one mechanism for the private sector and one for the public sector, and focusing on leveraging private financing as much as possible, particularly through performance-based contracting); designing and delivering effective awareness tools and initiatives on sustainable energy; adopting standards and labeling for energy efficient equipment within a regional approach,

building on the efforts of neighboring countries; and focusing fiscal and customs incentives so to avoid discrimination against clean energy equipment and material.

- (v) Increase human capabilities and skills. The human factor is key to the success of all components described above, as appropriate know-how is needed for implementing them at all levels. Tasks required for doing so include: upgrading curricula and infrastructures for primary, secondary, and tertiary education; strengthening vocational training curricula; adopting certification schemes for professionals providing sustainable energy services (assessment, design and engineering, installation, operation, and maintenance); providing technical assistance to local financial institutions to accompany the financial measures and ensure they are used well; and strengthening the capacity and capabilities of key entities (MESTPU, PUC, BEL, Bureau of Standards, and others) to allow them to play their role to its full potential.

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