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Belize

Energy Assessment and Policy Recommendations

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Executive Summary

Belize is an English-speaking country located in Central America. [1,2,3] Belize has a large diversity of plants and animal life [4]. The country's economy is primarily based on agriculture, oil and tourism [5,6,7,8]. The country is part of the commonwealth and recognize Queen Elizabeth II as their head of state [9]. Belize executive power is divided in 16 ministries, all of them work under the Prime Minister and they all have specific tasks to complete [10, 11]

Belize Electricity Limited (BEL) is Belize's electrical utility and primary distributor of electricity. BEL provides electricity to over 90% of the population who have a total electricity consumption of 552 GWh annually [1]. BEL spent over 33$ USD in capital expenditure in 2017, the majority of which went to grid expansion so that more of the population can be connected [12].

Nearly 58% of the energy produced in Belize is from renewable sources, mainly biogas and hydro, 5% is fossil fuels, and 37% is imported from Mexico and Mexico produces energy primarily through burning fossil fuels [12]. They currently only have one smaller solar installation at the University of Belize that has a 480-kW capacity and they have no wind installations currently [18]. Belize has a great potential for both on and off-shore wind farms due to the high wind speeds along the east coast of the country. The solar potential is lower with only moderate to good solar intensity but is still promising for large-scale installations.

Belize has a very poor transportation sector, there is not a great network of roads within the country and the roads that do exist are in poor condition [19]. Their public transportation primarily consists of old diesel school buses imported from the U.S. and this becomes a major issue due to the tourism sector [19]. Throughout the duration of a year, the population doubles due to tourism who, if they wish to explore the country, must take public transit or rent mopeds and scooters, etc. Belize needs to improve their transportation sector drastically [19].

Belize has a variety of ministries overseeing several operations throughout the country [19]. Some of these ministries could be absorbed by other ministries to avoid an extra step for communication [19]. Other ministries must work congruently to achieve the work that the country needs to accomplish to improve the overall efficiency of the country.

Currently, the country does not have renewable energy specific policies. They have developed in recent years a couple of energy plans, to start promoting more renewable energy investment in the country. Some of these policies have been developed in collaboration with the Caribbean Community and with the Central American Community as well [20,21,22].

Belize has some major barriers that should be worked on before trying to implement new plans. One of the main barriers is lack of education on energy projects that are being developed in the country. As a way to tackle those barriers, the country developed a couple of new policies and in this report new ideas of potential future policies are suggested as well.

Background

Belize is a country located on the eastern coast of Central America. Belize borders on the northwest with Mexico, on the east with the Caribbean Sea, and on the south and west with Guatemala. The total area of the country is 22,800 km^2. Belize is the country with the lowest population density of Central America, with 17.2 people/km^2. Belize has the second highest population growth rate of the region, and one of the highest in the Western Hemisphere with a rate of 1.87% per year [1].

The official language of Belize is English, the second most spoken language in the country is Spanish, and the native people of Belize use the unofficial native language Belizean Creole. They were influenced largely by many foreign countries throughout their development as a country, so they have other recognized languages as well such as German, and Chinese. The Mayan civilization expanded in the area of Belize, many people in the areas of where this civilization settled are descendants from the Mayans and still communicate in Mayan languages such as Q'eqchi', Mopan and Yucatec [2, 3].

Belize has a rich diversity of wildlife for their unique position in Central America, the area has a wide range of climates and habitats for plants and animal life. The country has a large proportion of undistributed land that makes it ideal for over 5,000 species of plants and animals to exist. Belize is a leader in protecting biodiversity and natural resources. Around 37% of the country's land territory falls under protected areas, in comparison Costa Rica has 27% of its territory protected. They also have 13.6% of their territorial waters protected, these are in which the Belize Barrier Reef is located. These protected areas have been proven by multiple studies to be effective when fighting against deforestation rates, non-protected areas present a 0.6%

deforestation rate per year starting from 1980, whereas the protected areas rates are much lower with only 6.4% of the protected forests being deforested in the same period of time [4].

Belize's economy is primarily based on agriculture, agro-based industry, and merchandising, with construction and tourism taking more importance in the last years. The country produces industrial minerals, crude oil and petroleum. As of two years ago, the oil production of the country was of 2,000 barrels per day [5]. Sugar continues to be their principal crop, but the banana industry is the one with the largest number of employees. Numbers from 2015 present raw sugar as being their major source of money by taking 19% of their export's economy, followed by fruit juice with 10%, 15% from bananas, then in smaller percentages is crude petroleum with 4.0% [6].

The second largest industry in the country is tourism. The growth in this sector has positively affect the agriculture, commercial, and finances industries as well as the construction sector. Tourism has increased significantly, in 2012 for the first time in its history, the country recorded almost 1 million tourists in a calendar year [7]. Belize offers options for two major kind of tourists, adventure tourists and eco-tourists. The country has many things to offer such as the Belize Barrier Reef, over 450 offshore cays, safe waters for diverse kind of water sports, rivers for rafting and kayaking, jungle and wildlife reserves for exploring and bird watching as well as great fishing. In 2007, the tourism industry contributed to over 25% of all job in the country, and it made up over 18% of the GDP [8].

Belize's government operates as a parliamentary representative democratic monarchy, where Queen Elizabeth II serves as head of state and the Prime Minister, Dean Barrow, serves as the head of government, and of a multi-party system. Queen Elizabeth is represented by the Governor-General, Sir Colville Norbert Young, Sr. The executive power is exercised by the

government and the legislative power is vested in both the government and the Parliament of Belize. The party system is dominated by the centre-left People's United Party and the centre-right United Democratic Party. Constitutional safeguards include freedom of speech, press, worship, movement and association. The justice system is independent of the executive and the legislature. Jurisprudence is based on English common law. The National Assembly of Belize is a bicameral body which consists of a House of Representatives and a Senate. The House of Representatives members are elected in a popular election to a maximum of five-year term of office. The Senate members are appointed by the Governor-General with six of them on the advice of the Prime Minister, three of them on the advice of the Leader of the Opposition, one on the advice of the Belize Council of Churches and the Evangelical Association of Churches, one on the advice of the Belize Chamber of Commerce and Industry and the Belize Business Bureau, one on the advice of the National Trade Union Congress of Belize and the Civil Society Steering Committee, and one on the advice of non-governmental organization in good standing. The members of the independent judiciary are appointed. The judicial system includes local magistrates grouped under the Magistrates' Court, the Supreme Court, and the Court of Appeal. The country has as well a system of local government that is comprised of four types of local authorities: city councils, town council, village councils and community councils. City and town councils consist of a mayor and a number of councillors. The mayor and councillors are elected to three-year terms. Village councils consist of a chairperson and six councillors, who are elected by registered villages [9].

Belize has 16 different ministers besides the prime minister, deputy prime minister and the ministers of state. They have ministers of Finance and Economic Development; Natural Resources and Agriculture; Foreign Affairs; Private Sector Development and Consumer Protection; Youth and Sports; Human Development, Social Transformation and Poverty Alleviation; Health;

National Security; Tourism, Culture and Civil Aviation; Works and Transport; Housing and Urban Development; Forestry, Fisheries and Sustainable Development; Labour, Local Government, Rural Development, National Emergency Management Organization (NEMO), Immigration and Nationality; Public Service and Elections and Boundaries; and Energy, Science and Technology and Public Utilities (MESTPU). In this project the MESTPU will be one of the main agencies to consider for policy development. The MESTPU was founded in 2012. It is currently divided into the Department of Geology and Petroleum, the Energy Unit and the Science and Technology Unit. The MESTPU is represented by Senator Joy Grant and CEO Dr. Colin Young. The Department of Geology and Petroleum was established in 1984 as part of the Ministry of Ministry of Natural Resources. In 2012, it got moved to become part of MESTPU. The department is responsible for governance of the petroleum industry in Belize [10]. The Energy Unit was established in 2012 and its responsibility is the governance of the energy sector in the country [11]. The Science and Technology Unit is responsible for the promotion of new science and technology in Belize [11].

Current Generation

Electrical Utility

Belize Electricity Limited (BEL) is Belize's electrical utility company and primary distributor of electricity [12]. BEL services over 94,000 accounts totaling an energy demand of over 552 GWh in 2017 with a peak power demand of roughly 104 MW throughout the year [1]2. BEL has over 1900 miles (roughly 3000 km) of distribution and transmission lines. Unlike Hydro Ottawa who's only shareholder is the City of Ottawa, the Government of Belize (GoB) owns only 32.6% of BEL, 31.2% is owned by the Social Security Board and the remaining 36.2% is owned by other shareholders [12]. The figure below shows the map of Belize's electrical grid transmission lines and connections, with the expansion and increasing load of the

transmission and distribution systems higher voltage lines such as 230 kV instead of 115 kV may be necessary for reliable support. This would be a huge expense for BEL and the GoB but there may not be another option should the population continue to rise.

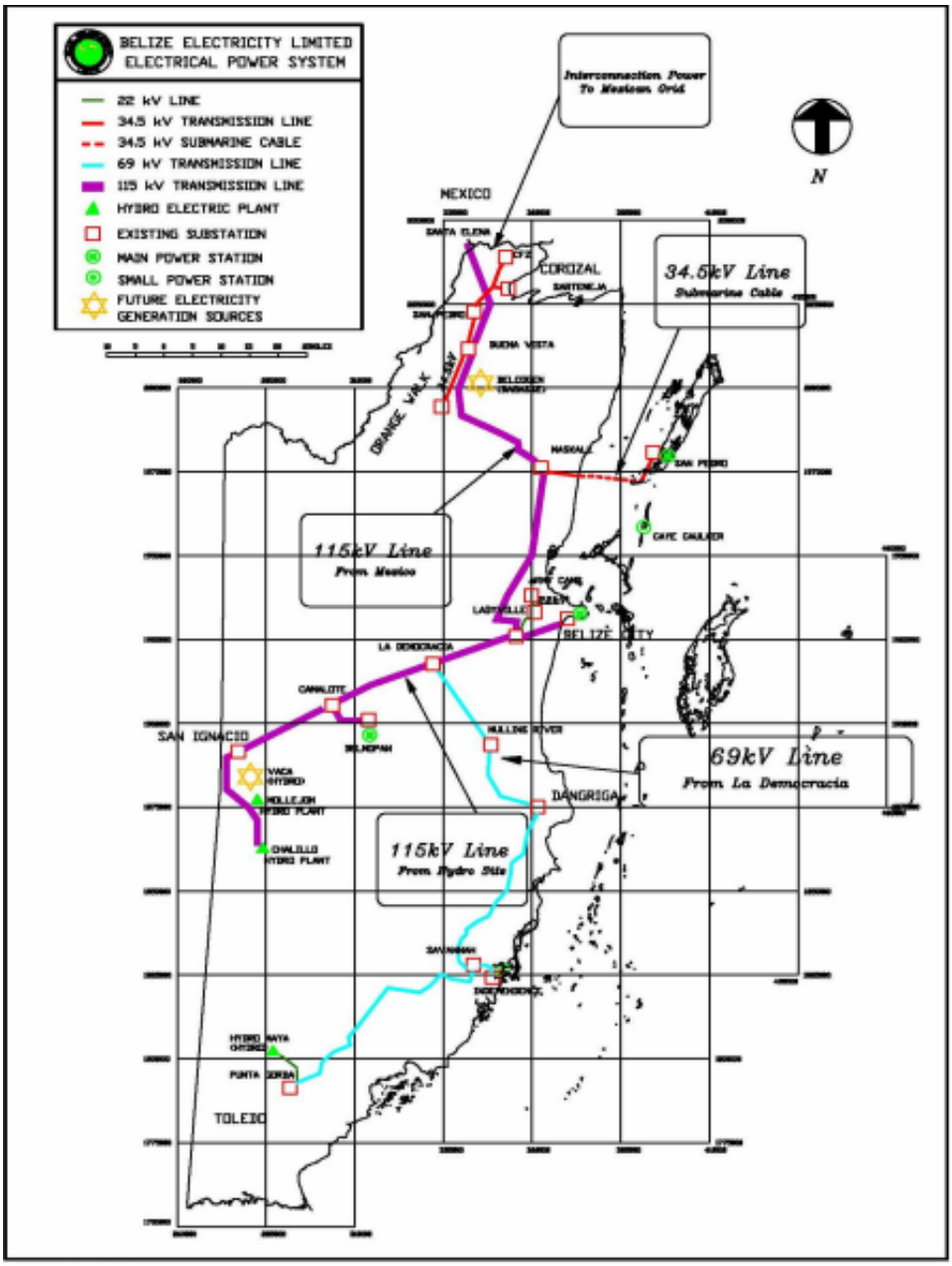

Figure 1: Belize Transmission and Distribution System [17]

BEL has managed to keep the mean electricity rate below a competitive rate of 0.39$/kWh, however; from 2016 to 2017 against the efforts of the company, there was a 13%

increase in electricity cost [12]. The increase in electricity prices was not due to the country's own energy stability, but a 50% increase in the average unit price from the Comisión Federal De Electricidad (CFE from Mexico) [12]. This was caused by delays in Mexico's natural gas pipeline projects, although the CFE still remains as the cheapest supplier of the BEL [12].

BEL spent over $33 million in capital expenditure, widely due to their commitment to connecting 98% of Belizean households to the grid by 2020 from 91.2% in 2016 [12,13]. BEL has managed to increase grid reliability by 16.4% but has had a system loss increase of 11.9% from 11.6% in 2016 due to the grid expansion which was expected [12].

Energy Generation

Belize currently runs off 58% renewable energy, 5% non-renewable sources and 37% of the country's energy is imported from surroundings jurisdictions, mainly Mexico [12].

Table 1: Belize Energy Generation by Source 2017 [12]

Source	**Net Generation (MWh)**	**% of Total Generation**
Net Diesel Generation*	15,514	2.462
BECOL*	267,650	42.483
Hydro Maya*	14,509	2.384
BAL/BAPCOL*	19,436	3.084
Belcogen*	63,939	10.146
CFE**	248,539	39.441
TOTAL	**630,159**	**100**

*Local Generation
**Imported

Net Diesel Generation – standby diesel generators for energy intermittency from renewable sources
BECOL – Belize Electric Company
BAL/BAPCOL – Belize Aquaculture Limited/Blair Athol Power Company Limited

BECOL operates the Mollejon, Chalilli and Vaca hydroelectric generating facilities which have a total installed capacity of 51 MW, making it the largest renewable energy supplier in the country [14]. Hydro Maya is a much smaller hydroelectric facility in Belize with an installed capacity of

only 3MW. Belcogen is a sugar-cane based biofuel plant with an installed capacity 31.5MW [15]. Not listed above is the solar power plant at the University of Belize which generates 480 kW of power [15]. In 2012, the multi-million-dollar project was funded by the Japanese International Cooperation Agency (JICA) and was considered a great asset for furthering research and development of renewable energy technologies within the country [16].

The graph below depicts Belize's energy generation for 2018 [15].

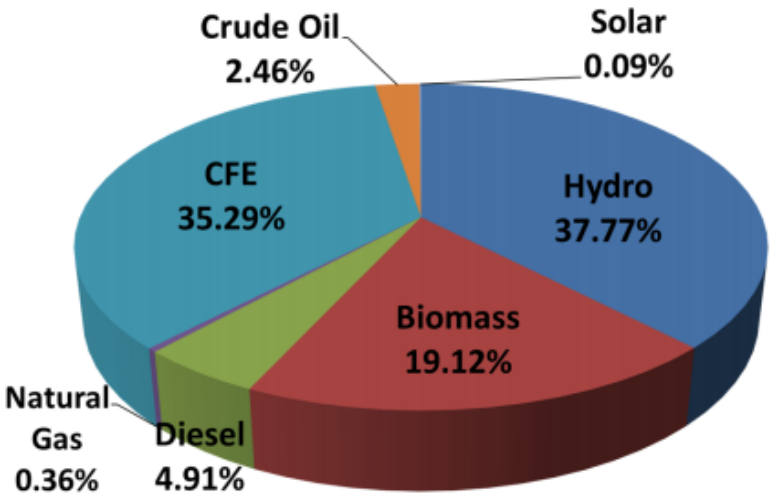

Figure 2: Belize Energy Generation by Source [15]

The majority of generation from the CFE is from non-renewable sources which allows for Belize to increase its renewable energy generation by decreasing the amount of imported energy. As stated above, this would require larger transmission lines capable of higher voltages to provide reliable service for both an increase in energy generation and an increase in population.

Future Generation

Belize has already demonstrated their ability to generate using renewable energy as well as their commitment to future production of renewables. The biogas facilities along with the large amount of hydro generation and the new small solar plant at the nation's university show promise for future renewable energy. With regards to the resources available, the following figures show the resources available for both solar and wind which Belize currently has no installations.

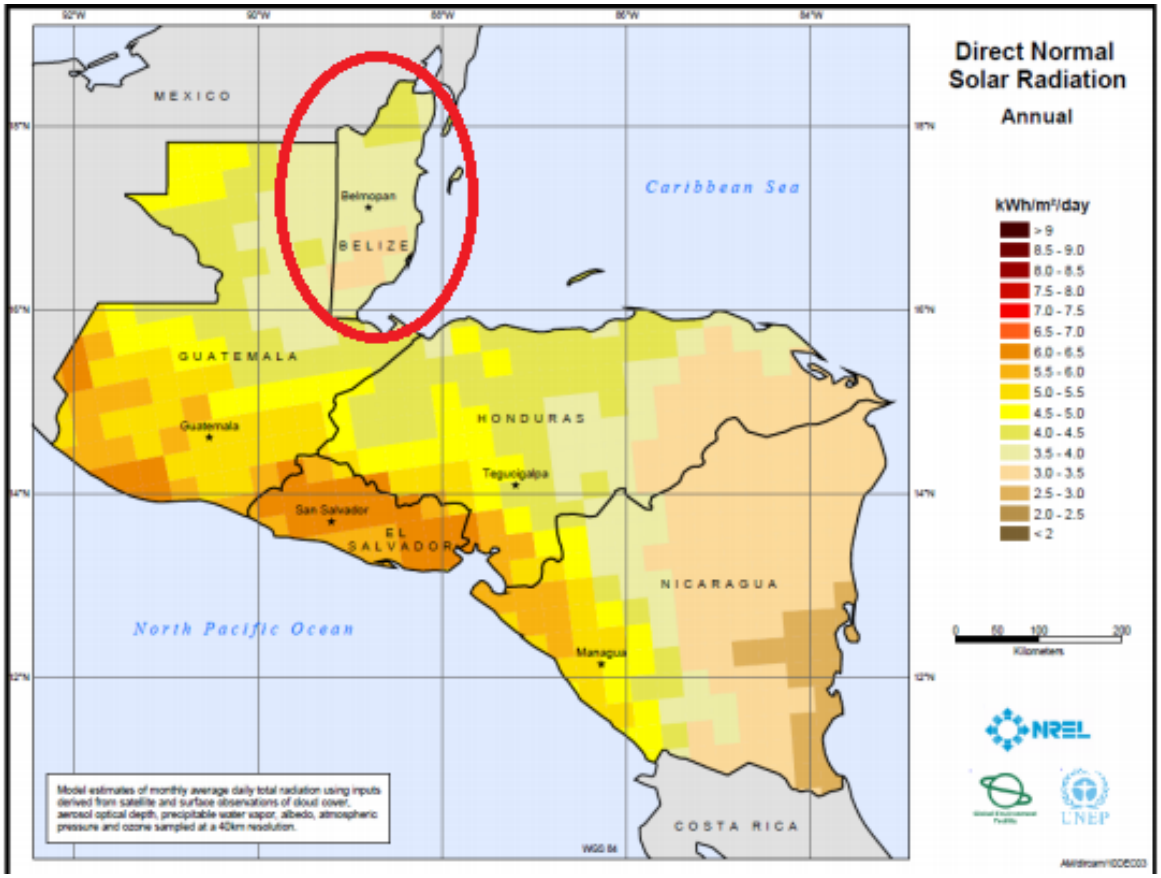

Figure 3: Belize Solar Potential – Direct Normal Solar Radiation [18]

Belize has low to moderate solar irradiance ranging from 3-6 kWh/m^2/day which is promising for solar developments, potentially on the rooftops of existing buildings, and within the upcoming years, windows will also be capable of generating electricity, at a much higher efficiency, through transparent photovoltaic cells. The University of Belize has shown promise in development of the solar sector and continues to strive for new opportunities to implement solar throughout the

campus. The GoB should consult the university, along with the JICA of the small-scale project to determine the best placement of solar within the country, whether that be solar farms strategically placed in either rural or urban areas or on the rooftops of existing buildings. Due to the fact that Belize's housing and building infrastructure is sub-par, it may prove to be difficult in implementing rooftop solar installations [18]. A feasibility study must be jointly conducted by the GoB and BEL to determine where the projects have potential for grid connection through existing and planned expanding transformers and substations.

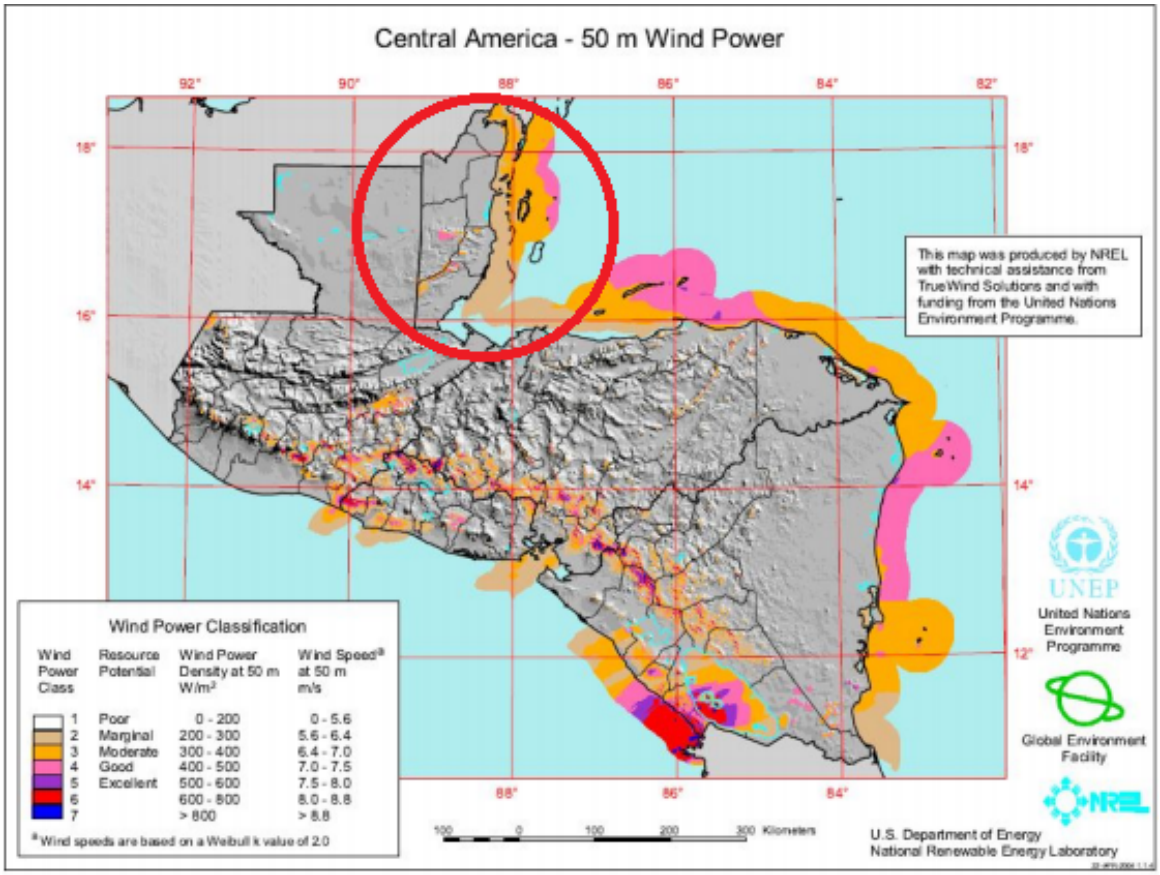

Figure 4: Wind Potential in Belize [18]

As shown above, Belize has a vast wind resource that could be taken advantage of both on and offshore with moderate to excellent wind speeds and conditions at a 50-meter elevation [18]. Offshore wind installations are costly due to offshore and onshore substations needed to transmit the power to the grid, along with the fact that the tourism sector occupies a large portion of the

coastal region of the country. The intermittency issues can be resolved with storage technology and energy conservation tactics but still remains a challenge with financial barriers regarding energy security within the country inhibiting private sector funding [18].

When it comes to the actual installation of wind and solar, it is important to have precise and abundant data collected over at least 1 year in order to accurately determine the viability of a project. This will determine the risk associated with the investment and thus whether or not the project will have to be funded privately or if the public sector can afford the burden.

The GoB has prioritized wind and solar projects for power generation and has tasked MESTPU with promoting the existing and emerging technologies into the energy mix [18]. In order to achieve the desire to increase renewable generation, a substantial amount of time and planning must be completed by the MESTPU which has already begun. It has been proven that simply setting targets for renewable energy generation are ineffective when it comes to actually installing the technologies. Belize must implement legislative mandates for renewables which include penalties and tariffs for non-compliance [21]. The GoB is unlikely to enforce these financial penalties given that they own 32.6% of BEL and more often than not the financial responsibilities become a burden of the LDCs and utilities. Therefore, the government needs to be held responsible by the population and justice system to ensure that these policies are enforced. Set standards that include a requirement for certain renewables, based off of resource capacity, to be a certain percentage of the electricity generation and not installed capacity [21]. One method of obtaining long-term positive results and also broadening policy goals is to combine renewable energy policy with federal production tax credits which is what the U.S. has proven to be effective[21].

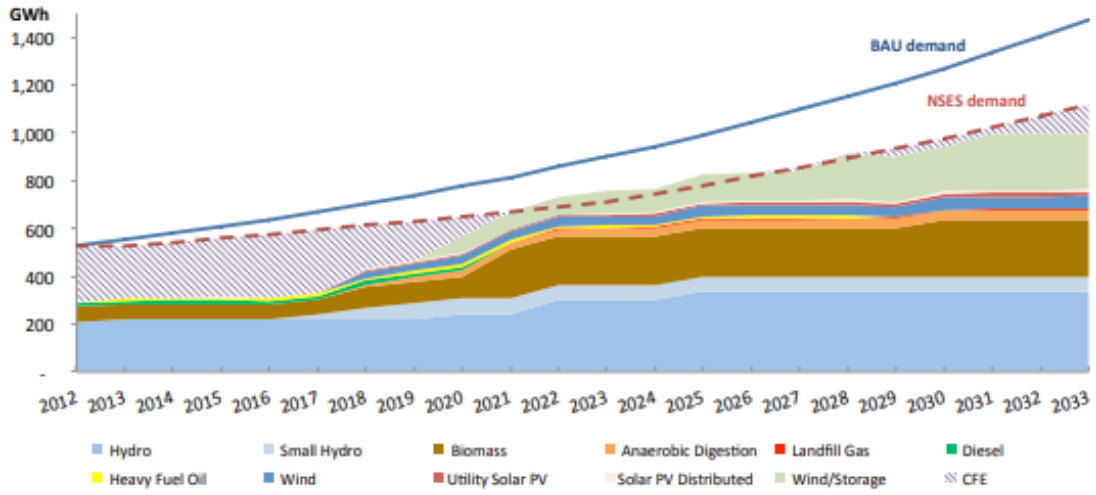

Figure 5: Belize Future Generation Curves with Business-as-Usual (BAU) and Demand Management and Energy Conservation (NSES Demand) [18]

Figure 5 depicts the projected energy production up until 2033 which shows that renewables are expected to be nearly 100% of the future generation mix and that the energy imported energy from CFE will be non-existent [18]. If Belize is able to accomplish this, the renewable sector would continue to thrive due primarily to increasing energy security allowing for more private sector funding, as well as other barriers being overcome in the process.

Transportation

Belize's transportation sector consumes over 46% the country's annual energy. The existing transportation infrastructure is not overly effective, reliable or efficient but is seen to have a great potential. The issues associated with the sector were realized by the GoB and in 2018, the country received a grant from the Inter-American Development Bank (IDB) to develop a Comprehensive National Transportation Master Plan (CNTMP) [19]. This extensive report is extremely detailed and describes the steps that need to be taken by the country to improve the limited transportation sector. Table 2 show predictions for increases in each type of transport by

the year 2035 and every category and mode transport are expected to almost double. This is why Belize needs to make intensive improvements to their transportation infrastructure to support these growths.

Table 2: Daily Transportation Forecasts (weekly average) [19]

	2017 (passengers)	**2025 (passengers)**	**2035 (passengers)**
Private Road Vehicle	64,530	83,908	109,884
Public Transport	42,459	58,793	76,390
Water Taxi	2,113	2,812	3,780
Domestic Aviation	2,433	2,950	3,441
Tourists	385,583	527,412	782,517

Not only are there a lack of roads, but the roads that exist are of poor condition with 27% said to be of poor condition, 69% fair and a low 4% in good condition [19]. The network of roads when compared to the rest of the world is below average with little road access and a lack of capacity of the roads that do exist. Regarding public transport, Belize does not currently have a great foundation which is why the framework developed promotes the growth of bus routes and terminals starting with all major cities within the country [19]. The majority of public transport buses are actually old school buses that are imported from the United States and 80% of them are diesel engines [19]. The buses are not electric but would reduce the number of personal vehicles on the road reducing the overall carbon footprint. It is not clear the magnitude of impact this would have on carbon emissions but since the transportation sector uses almost half of the country's energy demand, it is expected to be large.

Ministries

One of the barriers that Belize's faces internally in the transportation sector is that although the Ministry of Transport (MOT) is responsible for managing and establishing the policies that govern road use and the guidelines for vehicles, Belize's Ministry of Works (MOW)

is responsible for the physical maintenance and construction of the roads [19]. Although these two entities work in unison on most fronts, it would be beneficial to merge the two ministries to remove the unnecessary communication between them to get the work done more efficiently and effectively. The Ministry of Economic Development, Petroleum, Investment, Trade and Commerce is responsible for foreign trade and international trade negotiations and thus has a tremendous influence on the countries budget [19]. The Ministry of Finance (MOF) controls the allocation of all resources within the public sector. This means that the development of road infrastructure is heavily dependent on the support of both ministries. The MOW, MOT and MOF must work closely together for the successful development of the country's transportation infrastructure. The CNTMP implies that with the support of the GoB alone, the infrastructure expenditures exceed the available funding [19]. This is why alternative funding is required and could be procured through transportation tariffs and other potential investors.

Transportation Development Priorities

Belize should first consider expanding their public transportation as one of the first steps towards a greener country. The next major upgrade to the country's transportation sector would be road expansion which would have many associated benefits including working symbiotically with the expansion of public transportation. Having a larger network of road access would also allow the importation of good from other countries and the exportation of domestic products from Belize. Belize simply needs to put up the capital to cover the road expansion with reasonable targets for the capacity determined by the financers.

Electric Vehicles

Belize currently has no electric vehicles in the country and has not shown initiative in development EV programs [19]. EVs should not be the current focus of the country as they have more prominent and promising opportunities for financial commitments and program development. This does not mean that electric vehicles shouldn't be considered in the future as an alternative to the current diesel-prominent transportation that the country currently enables. Belize is encouraged to launch an EV pilot program on the island of San Pedro as they currently have several issues with urban transport [19]. This would be used to test the viability of electric vehicles for the country as a whole and might peak interest from the population in potentially purchasing EVs. In conjunction with the Ministry of Economic Development, Petroleum, Investment, Trade and Commerce, the pilot program could be launched with a small amount of funding either internally, or from the private sector if there is enough interest.

Commercial and Industrial Energy Use

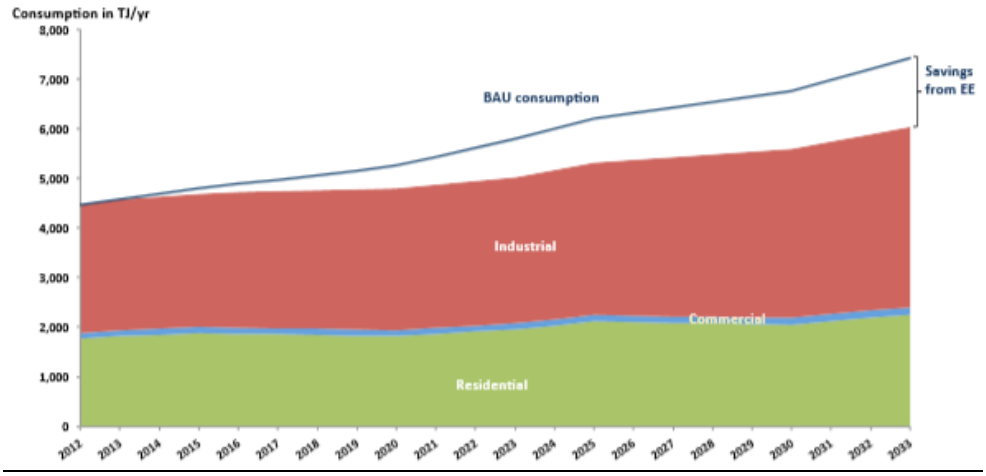

Figure 6 - Belize Energy Consumption by Sector [18]

Figure 6 shows the current and projected energy use for industrial, commercial and residential sectors. The energy consumption per year is primarily dominated by the industrial sector which thrives due to tourism and organic processing mainly consisting of sugar, citrus and banana products [20]. The industrial and service sectors employed almost 90% of the population in 2009 [20]. There is very little information pertaining to energy use of the industrial sector and it is therefore difficult to analyze and make recommendations to improve the sustainability. A speculation can be made about the industrial sector however, to increase conservation to the maximum potential within the sector through simple conservation tactics such as: retrofitting to LED bulbs instead of incandescent and fluorescent bulbs, installing timers and motion sensors on illuminated areas, using more efficient machinery and systems where possible, weather-stripping refrigeration units to lower cooling loads, using smart power bars, etc. Another free way to lower energy consumption is through educating the workforce on conservation and demand management to have a more in depth understanding on the impact they can have to achieve the goals set by management for reducing consumption. This can also be implemented in the education system throughout the country so that children, who are the future of the country, can be more aware and seek out opportunities to save energy.

Energy Infrastructure

Belize currently has most of their electrical power being generated by hydropower and biomass. The rest of the energy is produced by fossil fuels or it is imported from Mexico. The country has great capacity for other kind of renewables besides biomass and hydro, such as wind and solar energy. The country should start investing money in creating their own electrical energy because it would bring a reduction of their expenses, instead of having to import the energy from

abroad. Currently, around 90% of the total households in the country have electricity. Electrification is a process that takes a long time, and even though most of the country already counts with accessibility to the electricity, the rural areas that do not are waiting for the projects to expand towards them. One of the main reasons that places do not have access to electricity is because they are not easily accessible to the transmission network. A great solution for this problem would be to incorporate off the grid houses in those communities or install a micro-grid system for the community [22].

In 2004, a national energy plan for the country was presented. It included an analysis of the country's energy sector and some policy recommendations. The recommendations included the incorporation of sustainable energy. Unfortunately, 15 years have passed, and no further significant renewable-specific policies have been developed. Even though no specific policies have developed, the investment in renewables has started. The government of Belize started a national renewable energy education and awareness program that its aim is to teach people about the goals of the government with the renewable energy projects, and to teach the people a basic understanding of how the systems that they want to implement work [22].

Belize currently does not have an energy efficiency law or an entity in charge of creating policies and programs related to the topic. The government has been looking into implementing an energy-efficiency training program targeted towards professionals. The government is also in the works of revising all building codes to include the potential energy saving design features and they also want to perform a study throughout all sectors on energy end-use practices. Belize is a long-time member of the Caribbean Community through different groups such as de Caribbean Renewable Energy Development Project, and the Caribbean Energy Information System. They also have sustainable development partnerships with Caribbean Community (CARICOM)

Sustainable Development Task Force, The Caribbean Planning for Adaptation to Global Climate Change (CPACC), the Caribbean Association of Electrical Utilities (CARILEC) and the Alliance of Small Island States (AOSIS). The country has pursued integration within the Caribbean community more than with their neighboring countries in Central America. Belize is part of the Caribbean Renewable Energy Development Programme (CREDP) which aims to remove all policy and financial barriers from renewable energy use in the region [22].

A recommendation for the future of the country if they want to continue with expanding their green energy projects would be to create an agency that oversees the promotion of sustainable energy. The agency could be in charge of promoting renewable energy investments for big players in the country, they could also sponsor or execute feasibility studies for the renewable energy projects within the country. The new agency could also provide suggestions of policy to be implemented in the country in the near future. The agency could be part of the MESTPU or a subdivision of the Public Utilities Commission (PUC).

Currently all of the electricity industry inspection and regulation is the responsibility of the PUC. Their main obligation is to set the electricity price, the prices are well regulated and codified by legislation. The laws that discuss the pricing and codes about the energy sector are the Amended 1992 Electricity Act, the Public Utilities Commission Act of 1999, and the Electricity Tariffs, Charges and Quality of Services Standards By-Laws of 2001. The new agency that is suggested in here, could probably analyze all these legislations and make sure they are up to date to keep up the country's development goals. All the legal framework for the PUC to follow when doing their functions related to the energy sector can be found in the previously mentioned acts and in the by-laws. The by-laws govern all the tariffs, rates, charges and fees that are charged to supply and transmission of energy to consumers, the by-laws also foresees all the mechanisms,

formulas and procedures in which all these are calculated. The by-laws also indicate the services standards for the already existing and new services, as well as all the methodology to perform Review Proceedings [22].

Barriers and How to Overcome Them

The country currently has many barriers that impedes it from achieving their goals towards a greener future. One of the main problems is that there is a low public awareness on renewable energy technologies, with the incorporation of the education program sponsored by the government this will be no longer a problem. Another barrier is the fact that the renewable energy technology market in the country is still immature, the fact that there aren't big investors in this kind of technology in the area has slowed down the process of incorporation of newer and better technology. A possible solution to this issue would be for the country to get international entities to invest in projects in the country that later on the government could keep and continue developing. Allowing for international investors to gain money by investing in energy, and the country can gain from by incorporating the new technologies that could improve their grid. One of the biggest barriers is the lack of policies, government incentives and specialized and skilled people in renewable energy management. A solution to this problem would be to develop, as previously discussed, an agency that oversees everything related with renewable energies. The agency could make recommendations on new policy and possible incentives to make people want to take part in changing into a greener future [22].

Existing Energy Policy

In 2011, the government of Belize released the National Energy Policy (NEP). The policy includes a list of recommendations to address the energy sector problems. The NEP sets four main goals for the energy sector. The first goal is to foster sustainable production and distribution of energy; the second is to minimize the cost of energy in the local economy; third is to mitigate the impacts of external shocks; and fourth to create a national culture of energy efficiency.

At the time, various strategies to achieve these goals were presented. Some of them included:

- Promotion of the importance of energy efficiency in all sectors of the economy.
- Promote the production of energy from indigenous renewable resources and increase local participation in the energy industry.
- Use the agriculture, agro-processing, and forestry sectors as a main source of biomass for energy production.
- Build a modern electricity distribution infrastructure to achieve greater energy efficiency and resilience to the energy sector.
- Nurture the crude oil industry to become a major exporter.
- 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.

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Many other strategies were given, and they can be found in the NEP.

In 2012, the MESTPU released its 2012-2017 Strategic Plan. It outlines steps to transition Belize to a low-carbon economy, reliant on renewable and domestic energy sources. The plan consisted of two different parts. The first part built on the National Sustainable Energy Strategy (NSES) by describing five core strategies to achieve a low carbon economy by 2033. These are:

i. Improve energy efficiency and conservation across all sectors: transport, industry, and commercial and residential buildings.
ii. Reduce the country's dependence on imported fuels by 50 percent by 2020.
iii. Triple the amount of modern energy carriers derived from waste material.
iv. Turn the country into a net electricity exporter.
v. Build the Ministry of Energy, Science, Technology, and Public Utilities institutional capacity to accomplish its mandate (MESTPU).

The second part of the plan recommended strategies for the promotion of science, technology and innovation. These strategies are organized into five strategic options, these 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.

Recommended Policy for Belize

In order for Belize to achieve the goals they have set for the coming years, multiple recommendations to their policies can be made. In order to achieve the goals, set in the NEP, proper energy planning is crucial. Both to use the reduced public resources in the most cost-efficient way and to incentivize private investment in the sector. Energy planning should also aim to achieve energy security. The country currently has highly vulnerable fluctuations in oil prices and climate change. The preparation of such plan is required to be able to achieve the goals in a reasonable timeframe [22,23,24].

Another policy that should be pushed for, is a policy that promotes energy efficiency across the entire sector and among final users. The government can play a role on this one with fostering private investments and promoting energy efficiency measures in public buildings and street lighting. Renewable energy can come play a role in here as well, as feasibility studies can be performed to find the least-cost options to reduce energy consumption. Energy efficiency labels can be implemented in the country as well. These have been in use in North America and Europe for a good period of time and they have helped final users understand what options are the most energy efficient, and how much they could save by going towards the energy efficient options. Modifying building codes such that all buildings are required to have certain percentage of LED lighting, and therefore reduce the use of fluorescent and incandescent lighting. The government could potentially provide incentives for people interested in doing the switch. Another modification could be to aim for placement of windows and window glazing, the right placement of these can bring great savings because it would mean that the Heating, Ventilation and Air Conditioning (HVAC) systems would have to put in less work [23, 24].

Policies for renewable energy needs to be incorporated as well. Belize's neighboring country Guatemala has been compared in here with their renewable energy policies. Guatemala offers tax exemption and incentives for renewable energy projects. The way these work is that once a feasibility study has been performed, the project is sent to the Ministerio de Energía y Minas, who are equivalent to the MESTPU in Belize, which after receiving the project they evaluate it and decide if it complies with all the requirements to be eligible for the exemption and incentives. The tax exemption is towards the import tax on the machinery and equipment used. The person in charge of the project will have to prove that such equipment is going to be used only for the renewable energy project in order to be eligible. The exemptions and incentives are offered for a period of 10 years after the project has been given the thumbs up by the ministry. If at any point during that period the person in charge wants to sell the equipment or machinery that was exempt from taxes, first they will have to pay the taxes and then they are eligible to sell it. Belize could make a tax exemption and incentives policy based on the Guatemalan one, it doesn't entail a big expense for the government, and it can help fostering private and international investments in the country on renewable energy projects [24,25,26].

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