

2018



*Empowering Belizean
Communities*

Belize - Annual Energy Statistics Report

ENERGY UNIT
Ministry of Public Service, Energy and Public Utilities
2nd Floor, West Block Building
Belmopan City, Cayo
Belize, C.A.



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Overview

Fundamental changes are taking place in the global energy system which will affect almost all countries and will have wide-ranging geopolitical consequences. Notably, Renewable Energy (RE) has become the principal focal area within the global energy landscape. Technological advances in combination with cost-competitive solutions (decreasing up-front cost) have made renewables grow faster than any other energy source across the globe.

The shift within the energy system in Belize is currently following the global trend leaning towards Renewable Energy (RE) sources and the need for energy security and increased efficiency. The transformational shift is being driven mainly by persistent volatility of world oil prices and growing concerns over climate change risks and impacts. Table 1 below presents General Information on Belize and Table 2 represents a summary of Belize's Energy Sector in 2018.

Table 1. General Information

BELIZE		
General Information 2018		
Indicator	Unit	Total
Population	thousand inhab.	398,050
Area	km ²	22,970
Population Density	inhab./km ²	17
Urban Population	%	44.76
GDP USD 2017 (at Market Prices)	MUSD	1,404,727
GDP per capita	MUSD 2017/inhab.	7,243.12
GDP Growth Rate (2017)	%	1.4
Human Development Index (HDI)	HDI Value (UNDP)	0.708

Table 2. Summary of Belize's Energy Sector in 2018.

Parameters	Volume for 2018
Electricity - Production	651,123.75 (MWh)
Electricity - Consumption	556,491.23 (MWh)
Electricity - Importation	235,100.38 (MWh) (36.11%)
Electricity - from fossil fuel (%)	71,901.08 (MWh) (11.04%)
Electricity - from hydroelectric plants (%)	249,695.55 (MWh) (38.35%)
Electricity - from renewables (%)	344,122.30 (MWh) (52.85%)
Crude Oil - Production (barrels/day)	301,473.3 barrels
Refined Petroleum Products - Importation	53,068,249 US gallons

Energy Supply

Total Primary Energy Supply (TPES)

Figure 1 captures Belize's energy content of its Total Primary Energy Supply (TPES), including production and trade in energy. Total primary energy supplied in Belize for 2018 amounted to **16,270 Tera joules (TJ)**. Within Belize's Total Primary Energy Supply, Indigenous Fossil Fuels (Crude oil and Petroleum Gas) accounted for 1786 TJ of which 1,236 TJ was exported as International Crude Oil sale. Indigenous Renewables accounted for 4,246 TJ of Belize's Total Primary Energy Supply. Domestic energy production accounted for 6,032 TJ of the TPES. On the other side of the trade account, 9,529 TJ of energy was imported in the form of refined petroleum products and electricity from Mexico's Comisión Federal de Electricidad (state-owned electric utility of Mexico, widely known as CFE).

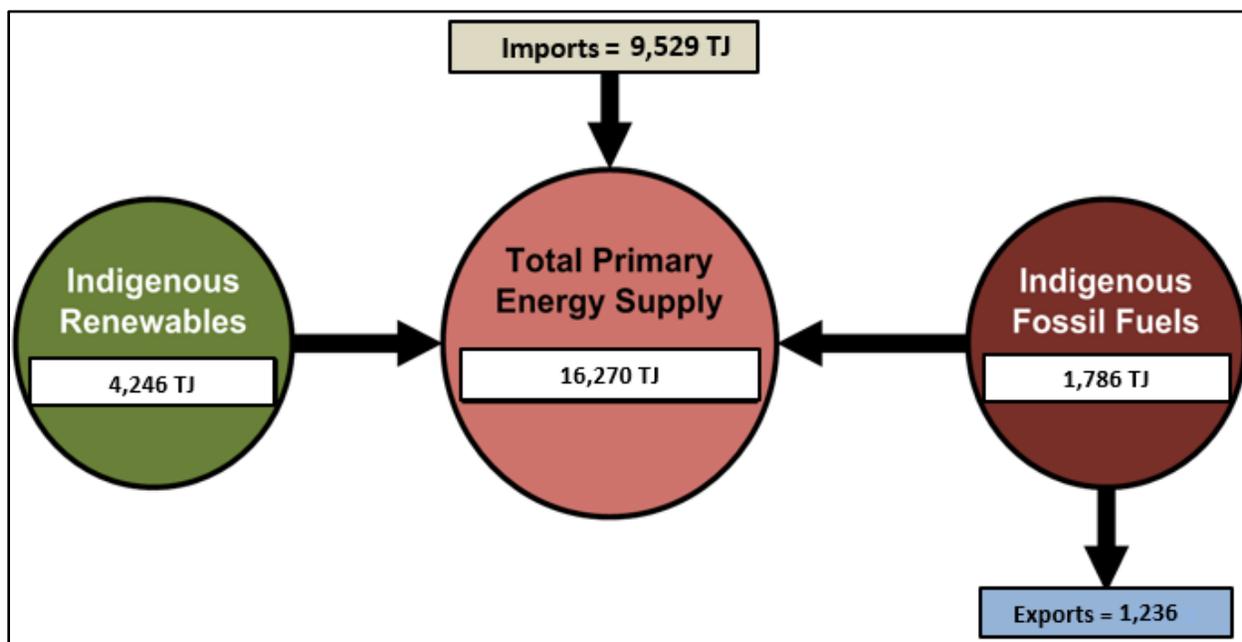


Figure 1. Total Primary Energy Supply for Belize 2018.

Primary Energy Supply¹

Figure 2 depicts the indigenous energy supply in Belize by primary energy content. In 2018, Crude Oil accounted for 10.4% (498.78 TJ) of indigenous energy production and Petroleum Gas accounted for 1.1% (51.48 TJ). Renewables made up the remaining 88.44% of primary energy

¹ Primary energy refers to energy sources as found in their natural state.

supply, consisting of Biomass at 49% (2350.47 TJ), Solid Biofuel (firewood) at 20.7% (994.88 TJ), Hydro at 18.7% (898.90 TJ) and Solar² at 0.04% (2.13 TJ).

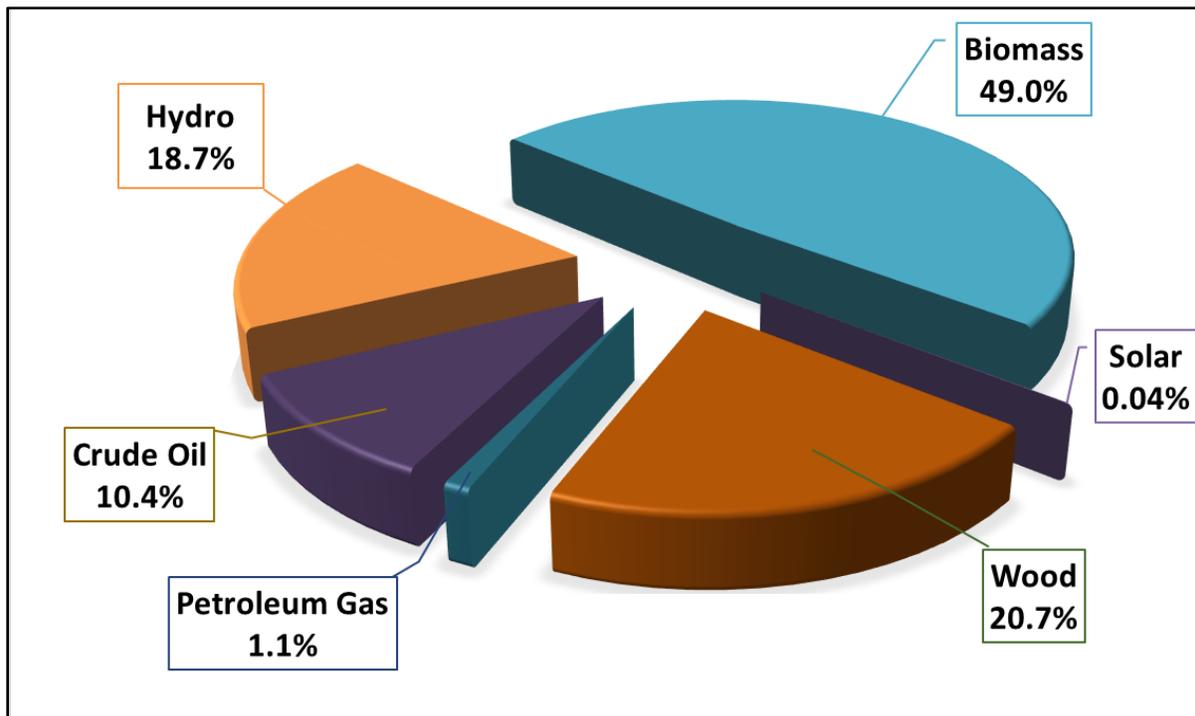


Figure 2. Belize's Indigenous Energy Production by Primary Energy Content in 2018.

Secondary Energy Supply

Belize imports majority of the secondary energy that it consumes, including electricity from the interconnection with Mexico's CFE. Belize's secondary energy supply was evidently dominated by imported oil products (Figure 3). Gasoline (Premium and Regular) accounted for 36.2%, Diesel accounted for 31%, LPG accounted for 13.9%³ and imported electricity accounted for 8.9% of the secondary energy supply. Other secondary energy supply sources imported included: Kerosene, Light Fuel Oil and Heavy Fuel Oil.

² There are a few small scale solar and wind energy installations across the country by private generators; however, the primary energy supplied is very negligible.

³ It is also produced locally by Belize Natural Energy (BNE) from a mixture of butane and methane that is associated with the production of crude oil.

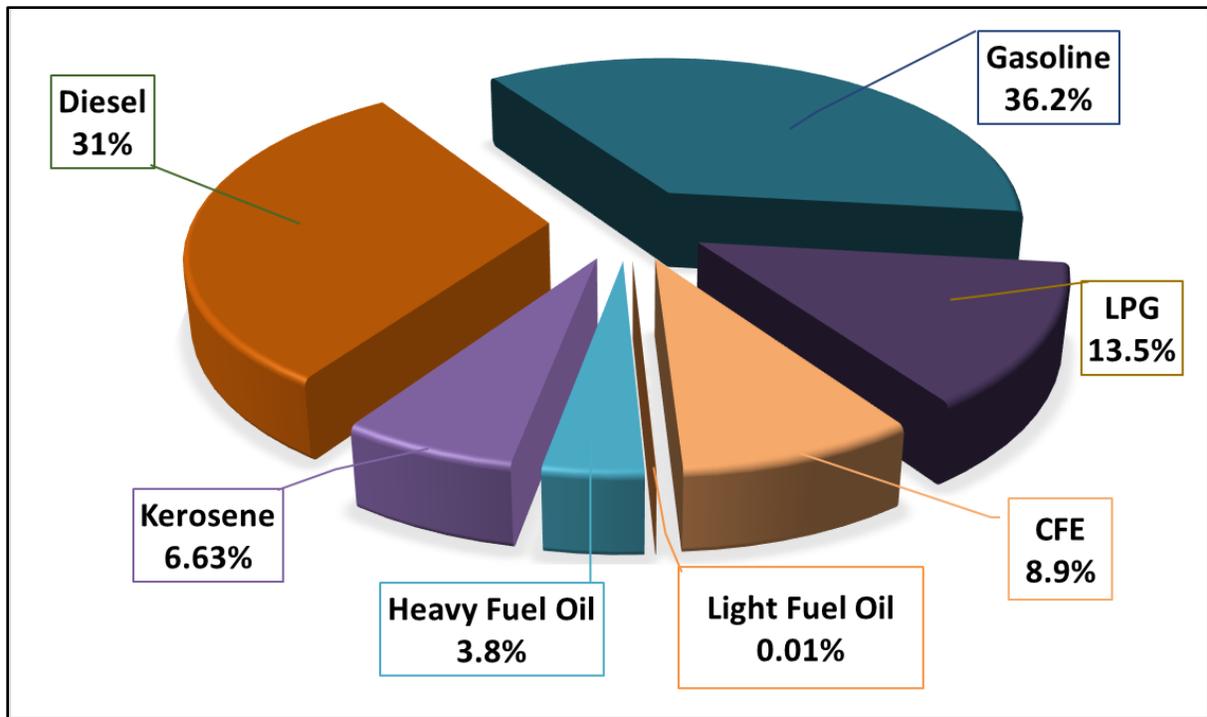


Figure 3. Belize's Secondary Energy Supply in 2018.

Electricity Sub-Sector

Under its license granted by the Public Utilities Commission (PUC), Belize Electricity Limited (BEL) is the sole entity responsible for generating, purchasing, transmitting and supplying electricity throughout the country of Belize. Aggregated energy sales grew by **0.4%** to **554.4** gigawatt hours (GWh) in comparison to 2017. In 2018, BEL served a customer base of approximately **97,714** accounts with a peak power demand of **104** megawatts (MW).

Transmission and Distribution

All major load centers across Belize are connected to BEL's national grid system. BEL operates a transmission line backbone running generally from the north to the south of Belize, being interconnected with the Mexican national electricity grid in the north as shown in Figure 4. Particularly, the 115 kV transmission line covers the entire northern and western zone of Belize with the southern half of Belize fed via a 69 kV transmission line. There are 34.5 kV circuits feeding-off the 115 kV backbone to Corozal, Orange walk and San Pedro.

Currently, Caye Caulker remains the lone isolated load center and its electricity generation needs are met from a diesel power plant. According to the Statistical Institute of Belize's (SIB) 2017 Labour Force Survey, 91.3% of the total households in the country are connected to an electricity

supply, of which, 98.9% are urban households and 85.2% are rural households⁴. In other remote rural areas and cayes where there are no connections to the national grid, households, communities and other entities use a mix of diesel gensets, small scale photovoltaic systems or small scale wind turbines to supply electricity for their own needs.

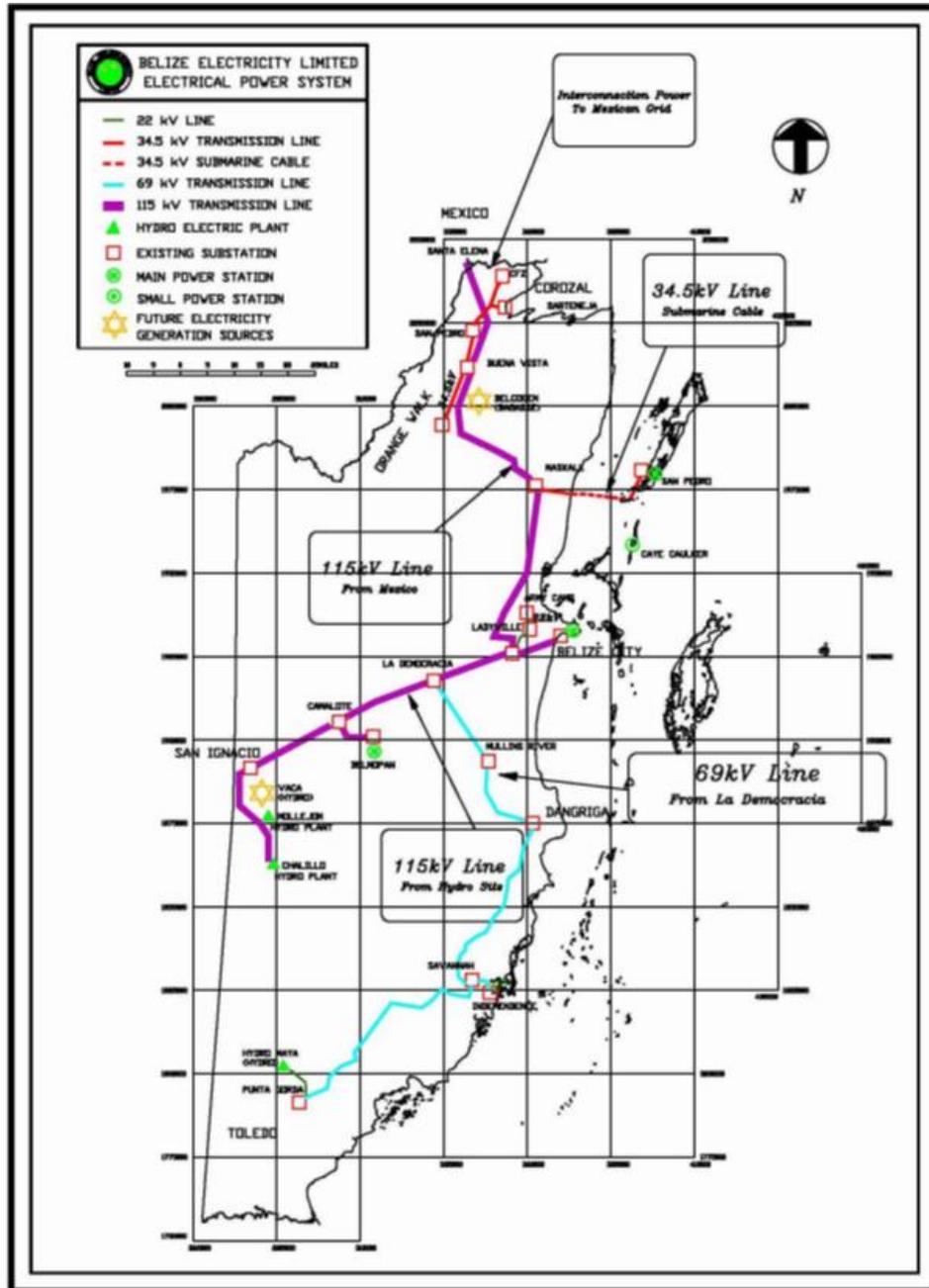


Figure 4. Belize Electricity Limited Transmission Network.

⁴ Selected Development Indicators for Belize: http://sib.org.bz/wp-content/uploads/Selected-Development-Indicators_2018-06-1024x768.jpg

Installed Capacity

In 2018, 27% (4,379.45 TJ) of the total primary energy supply was converted into 651,123.75 MWh of electricity produced. The total installed capacity of licensed power producers was 119.98 MW in 2018, consisting of:

- Mollejon Hydroelectric Plant, equipped with 3 x 8.4 MW Francis turbines, located on the Macal River, having a typical output of 8 MW during dry season and 21 MW during wet season (**21MW**)
- Chalillo Hydroelectric Dam and Plant, with an installed capacity of 2 x 3.65 MW (**7.3 MW**);
- Vaca Hydroelectric Plant outfitted with 2 x 9.0 MW and 1 x 1.0 MW turbines (**20 MW**);
- Hydro Maya Limited (HML) has units of 1 x 2.4 MW and 1 x 0.6 MW housed in its run-of-the-river hydroelectric facility (**3 MW**);
- BEL owns a diesel-fired gas turbine rated at 22.5 MW, but its actual output is typically 20.0 MW. In addition the utility deploys 6 x 1.1 MW mobile high-speed diesel units at different nodes in their network (overall installed capacity of **24MW**);
- Belize Co-Generation Energy Limited (BELCOGEN) generates electricity burning bagasse and heavy fuel oil using two-(2) 90 ton/hr boilers (high-pressure steam @64bar/480°C) expanding into 1 x 12.5 MW (back-pressure) and 15 MW (condensing/extraction) turbines nominally exporting (**13.5 MW**) into the national grid;
- Santander Sugar Energy Limited (S.S. Energy Limited) generates electricity by burning bagasse and other fuel source exporting up to 16 MW of electricity into the national grid (Currently at a capacity of **8MW**);
- Belize Aquaculture Limited (BAL) owns a power plant that operates 3 x 7.5 MW Wartsila medium-speed diesel units. The facility was initially a self-generator for its aquaculture operations; but it's currently an IPP having contracted (**15MW**) on a standby arrangement to BEL;
- Farmer's Light Plant Corporation operates five (5) diesel generators with rated capacities of 2 x 2.2 MW and 3 x 1.1 MW that run on crude oil (**7.7 MW**);
- University of Belize Solar Farm- There is a solar installation at the University of Belize that has a rated capacity of (**.48 MW**). This system is connected to the National Grid;
- Belize Water Services has a 70 KW Solar Plant installed on their Caye Caulker, Reverse Osmosis Plant to reduce the amount of electricity they draw from the island grid.

Electricity Generation

In 2018, a total of **651,123.73 MWh** of electricity was produced with a total of **556,491.23 MWh** of electricity being consumed. Figure 5 illustrates the breakdown of gross electricity generation in Belize by fuel source in 2018. It can be seen that Hydro accounts for the majority of electricity generated in 2018 with 249,696 MWh of electricity produced. Hydro was closely followed by imported electricity from Mexico's CFE who was responsible for 235,100 MWh of electricity produced. Other fuel sources which contributed to electricity generation in Belize for 2018 included: Biomass (93,834 MWh), Diesel (73,156 MWh), Fuel Oil (71,901 MWh), Crude Oil (17,807 MWh), Petroleum Gas (2,828 MWh) and Solar PV (593 MWh). Overall, it is crucial to note the integral role that BECOL and CFE plays when it comes to sustainability and Belize's energy security within the electricity subsector.

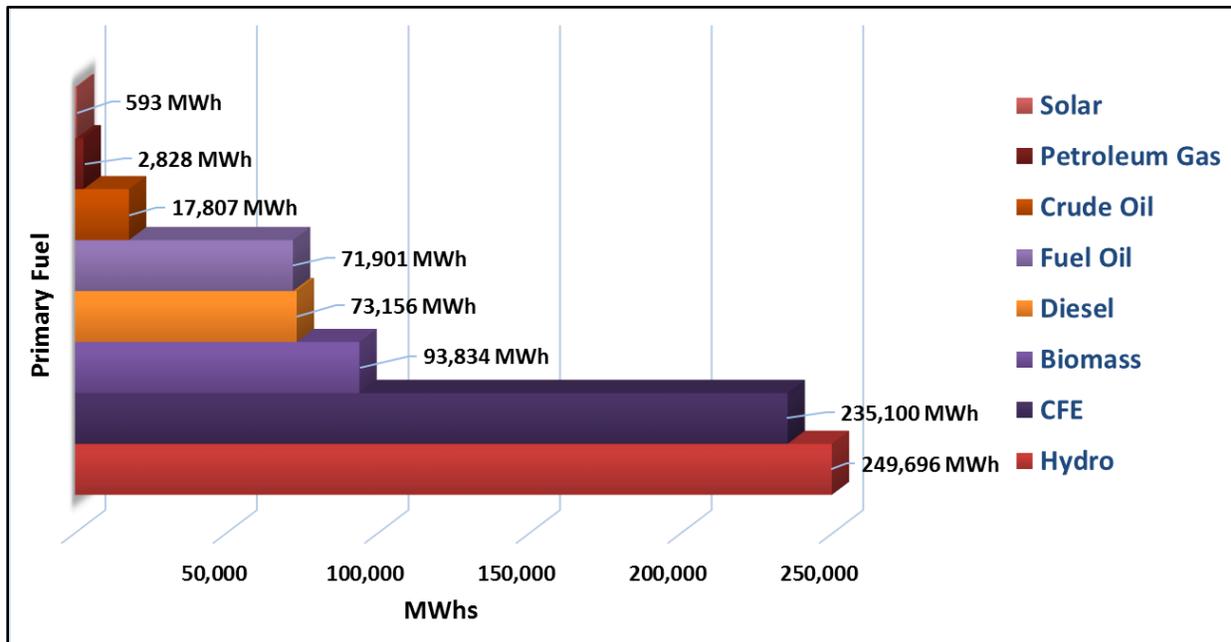


Figure 5. Belize's Gross Electricity Generation by Fuel Source in 2018.

Electricity Generation by Energy Type

Within Belize's generation mix in 2018, RE was the dominant fuel source type, accounting for 52.85% of electricity generation (Figure 6). RE fuel sources in Belize included: Hydro, Biomass, and Solar PV. Imported electricity accounted for 36.11% while Non-renewable fuel sources such as Crude Oil and Diesel accounted for only 11.04% of electricity generation. Belize's commitment to decreasing greenhouse gas emissions and combatting climate change has seen a steady increase in employed RE technology over recent years. Importantly, not counting the imported electricity from Mexico's CFE illustrates that Belize reached an **82.72%** RE penetration within its indigenous electricity production. As a result, Belize is leading the way among CARICOM member

states in the transformational shift towards the use of clean energy solutions (RE) for electricity generation.

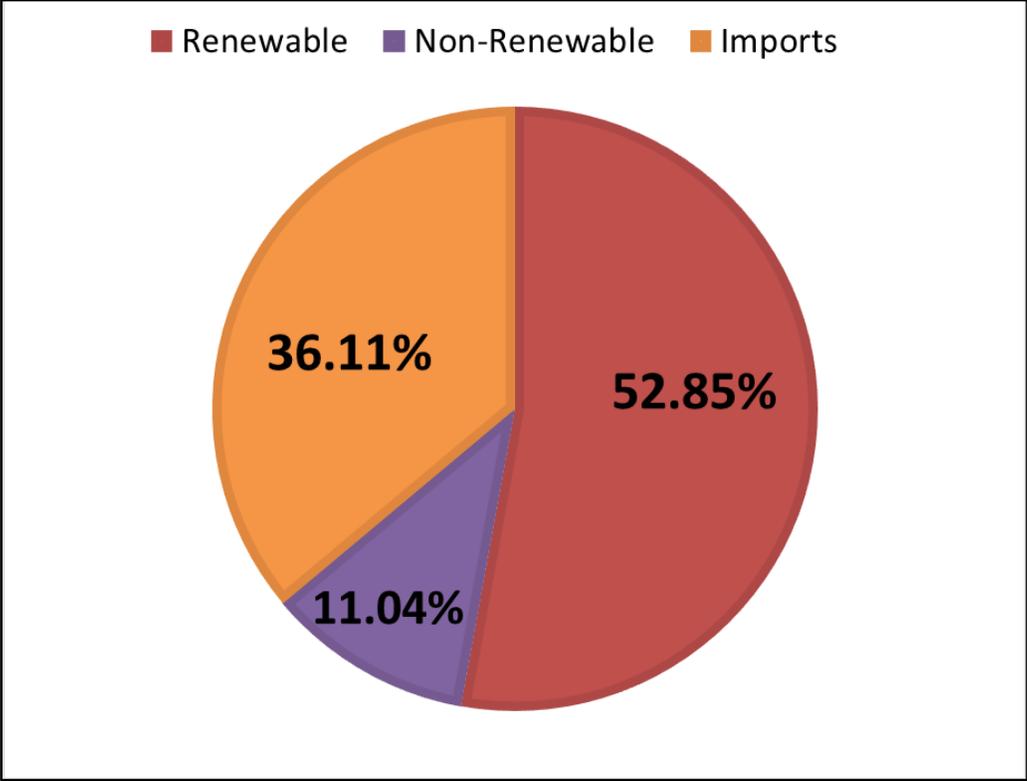


Figure 6. Electricity generation by Energy Type in 2018.

Electricity Consumption by Sectors

Figure 7 highlights Belize’s electricity consumption across varying sectors in 2018. Electricity consumption was compared among 4 sectors, which comprised: Commercial, Industrial, Residential and Street Lighting Sector. The commercial and residential sector were responsible for majority of the electricity consumption in Belize by a significant margin compared to the other two sectors. The commercial sector equated to 289,712 MWh of electricity consumption whereas the residential sector was second with 218,989 MWh of electricity consumption. In stark contrast, the industrial sector only consumed 20,836 MWh of electricity while street lighting was only responsible for 24,896 MWh of electricity consumption. Street lighting is likely to decrease over the next few years due to BEL’s LED Street Light programme where by old inefficient street lights are being replaced by new and efficient LED street lights. This will decrease the electricity consumption of street lights in Belize overtime.

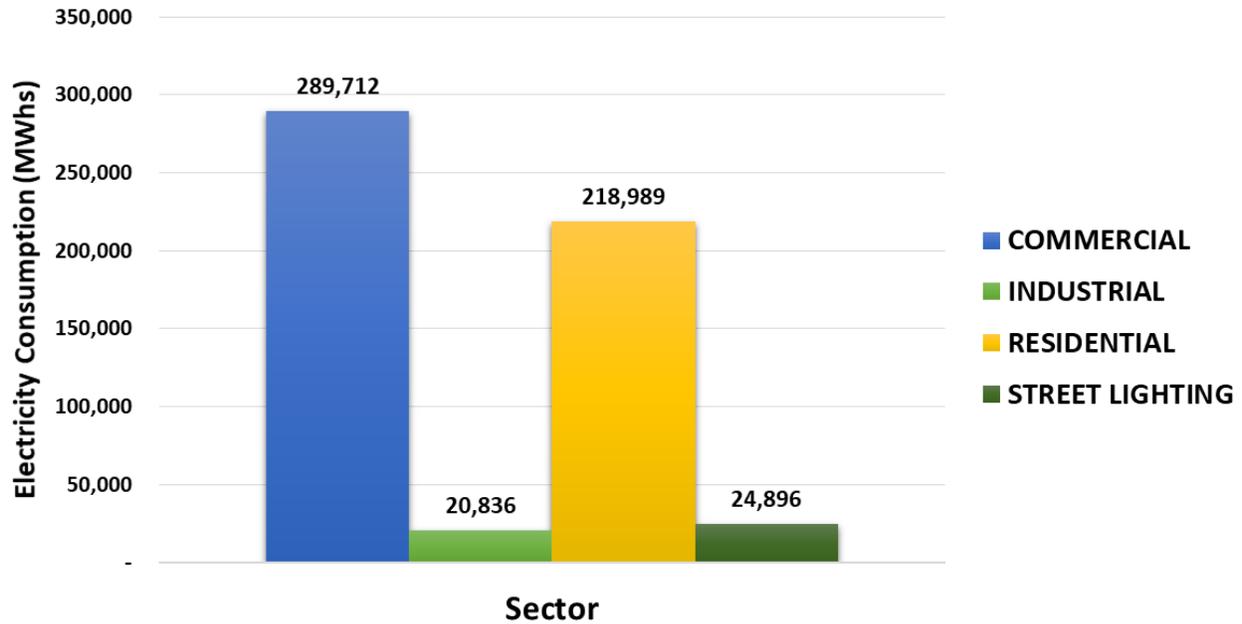


Figure 7. Sectoral Electricity Consumption in 2018.

Hydrocarbon Sector

Crude Oil and Gas Extraction

In Belize, Belize Natural energy (BNE) remains the sole oil producer in the country. BNE was extracting roughly 4,130 barrels of crude oil per day from its Spanish Lookout field in 2010; this has fallen to approximately **825** barrels per day in 2018. As far as can be determined, no local refining of crude oil is taking place.

The gas associated with crude oil extraction at the Spanish Lookout site is processed by BNE into three output streams: (i) a natural gas mixture of methane and ethane, (ii) LPG (propane and butane), and (iii) heavier hydro-carbons. Firstly, the natural gas mixture is used to fuel a 1 MW gas turbine that generates about 75% of BNE's electricity needs. Secondly, the LPG is stored and sold in the local market as cooking fuel. In 2018, a total of **1,931,974.22 lbs** of LPG was sold on the local market in Belize. This only equates to a mere 3.32% of current LPG consumption used for cooking in Belize. Thirdly, the heavier hydrocarbons (occurring mainly as pentane, hexane, heptane and octane) are re-injected back into the crude oil production train.

Refined Oil Products

Given the fact that there are no local refineries in Belize, all refined oil products are imported into the country via a sole importer, PUMA Energy Limited. Imported refined products include: Gasoline (Premium and Regular), Diesel, Kerosene, and Fuel Oil (Light and Heavy Fuel Oil). As

shown in Figure 8, Gasoline (Premium and Regular) holds the largest share of imported oil product at 26,202,243 US gallons in 2018. Diesel also constitutes a large share of the imported oil products at 20,181,770 US gallons in 2018. Due to the volume of refined oil products entering the country, the transportation sector is responsible for a large share of Belize’s energy use and greenhouse gas emissions.

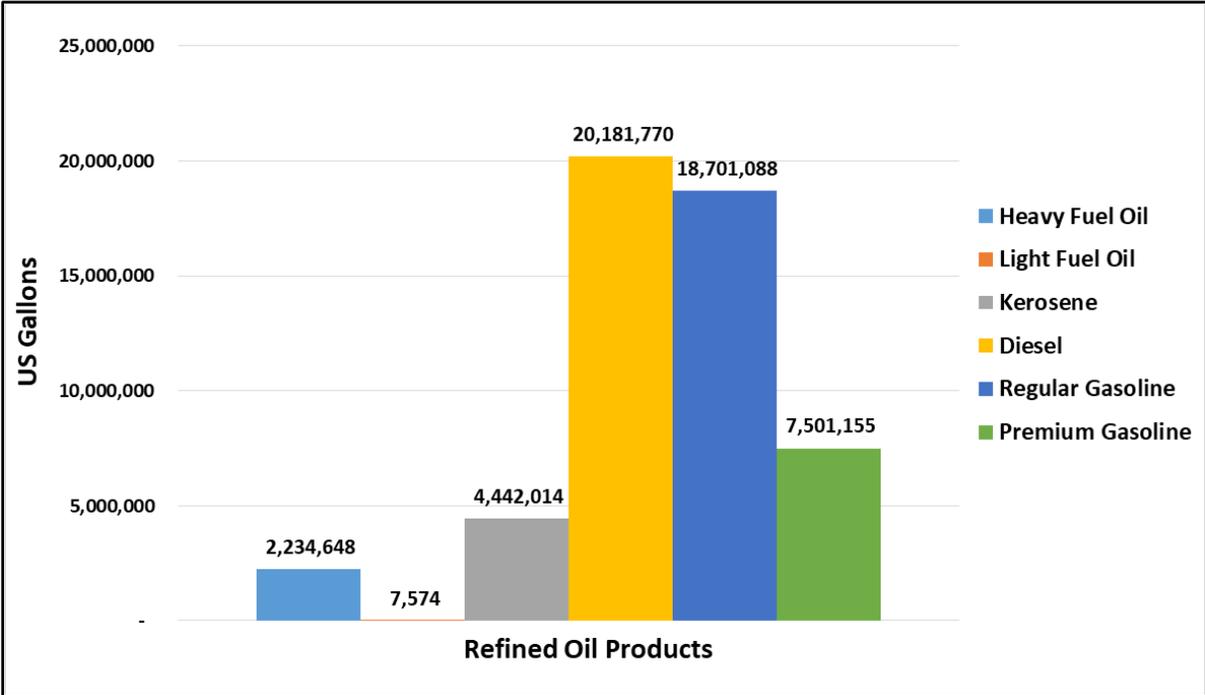


Figure 8. Refined Fuel Products imported into Belize in 2018.

Energy Balance 2018

The definition of the main activities and energy sources of Belize are presented in Belize’s Energy Balance⁵ (Table 3). In general, it is observed that Belize counts with indigenous non-renewable and renewable primary energy sources. In contrast, most of the secondary energy sources are imported, including electricity.

⁵ The energy balance calculated by the Energy Unit under the Ministry of Public Service, Energy and Public Utilities is available in Tera joules (TJ).

Table 3. Belize's 2018 Energy Balance.

SUMMARY ENERGY BALANCE - 2018 (in TJ)								
	Petroleum	Petro-fuels	Bio-fuels	Hydro	Wind	Other RE	Electricity	TOTAL
Energy Supply	550	8,682	3,345	899	0	2	846	14,325
<i>Indigenous Supply</i>	1,786	0	3,345	899	0	2	0	6,032
<i>Import</i>	0	8,682	0	0	0	0	846	9,529
<i>Export</i>	-1,236	0	0	0	0	0	0	-1,236
<i>Production Loss</i>	0	0	0	0	0	0	0	0
Transformation Sector	-380	-66	-1,747	-899	0	-2	846	-2,248
Electricity Sector	-358	-66	-1,747	-899	0	-2	846	-2,226
<i>Utilities</i>	0	-66	0	0	0	0	0	-66
<i>IPPs</i>	0	0	-1,747	-899	0	-2	846	-1,802
<i>Self-Generators</i>	-358	0	0	0	0	0	0	-358
Petroleum Sector	-22	0	0	0	0	0	0	-22
<i>Oil Refineries</i>	0	0	0	0	0	0	0	0
<i>NGL Producers</i>	-22	0	0	0	0	0	0	-22
Distribution Loss	0	0	0	0	0	0	0	0
Electricity Output (MWh)	20,635	55,349	93,834	249,696	0	593	235,100	655,206
<i>Utilities</i>	0	17,043	0	0	0	0	0	17,043
<i>IPPs</i>	0	37,051	93,834	249,696	0	0	0	380,580
<i>Self-Generators</i>	20,635	1,254		0	0	0	0	21,890