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**ENERGY**UNIT

# BELIZE ANNUAL ENERGY REPORT

Ministry of Public Utilities, Energy & Logistics



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December 2021

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Cover Page Photo: Solar Photovoltaic panels on roof of pier at Ray Caye Island Resort, Belize.  
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Mission Statement Page Photo: Sources of Energy Icons with night and day image of world in hands  
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# Foreword



The coronavirus pandemic unleashed unprecedented and immense global disruption on energy systems and economic markets in 2020. The energy sector has been one of the most severely affected with dramatic impacts on energy supply and demand, which resulted in sharp declines in global energy consumption and greenhouse gas emissions. The lingering effects of the pandemic will undoubtedly affect economic recovery and energy planning scenarios in profound ways. In response to this new paradigm, there is a unique opportunity to redesign the business model and decarbonize the energy sector by investing in customer-centric needs and sustainable energy solutions.

Recognizing the critical role energy plays in combatting the pandemic and catalyzing global climate action, the Government of Belize is committed to low carbon economic development by transitioning to a sustainable energy pathway. In this regard, energy statistics and knowledge management mechanisms will act as the foundation for driving change to meet our energy goals and climatic commitments. Thus, decisions that are data-driven will be a fundamental part of energy planning and can enable appropriate ambition and successful implementation plans while ensuring that cost effectiveness is maximized.

This publication presents an authoritative and official source of annual energy statistics for Belize. The information contained in this report includes numerous topics and concepts on energy matters. This includes energy information on production, trade and balances, conversion, primary and secondary energy, conventional and renewable sources of energy. In addition, energy information on greenhouse gas emissions from the energy sector is presented. In summary, it builds upon, and updates energy statistics and information presented in previous annual reports, serving as a vital instrument in providing a holistic picture of the energy sector in Belize.

I would like to express my sincere gratitude to all contributing stakeholders for their input into the production of this annual energy report. The Ministry of Public Utilities, Energy and Logistics and I hope the information contained in this publication will be useful to decision-makers, planners, academia and for increasing the general public's awareness on energy matters.

This report is available for download: <https://www.energy.gov.bz>

A handwritten signature in black ink, appearing to be 'R. Ferguson', written in a cursive style.

**Hon. Rodwell Ferguson**  
**Minister of Public Utilities, Energy & Logistics**

The background features a hand holding a glowing globe. The globe is surrounded by several circular icons representing different energy sources: a gas pump, a sun, a flame, a wind turbine, a solar panel, an oil rig, and a leaf with a water drop. The overall theme is sustainable energy and development.

## Mission Statement

To plan, promote and effectively manage the production, delivery and use of energy through Energy Efficiency, Renewable Energy, and Cleaner Production interventions for the sustainable development of Belize.

# The Five Pillars



## 01. Renewable Energy

Shift the energy matrix for Electricity, Heat and Mechanical power away from fossil fuels



## 02. Energy Efficiency

Dramatically lower energy intensities compared to business-as-usual in Transport, Industry, Residential, Commercial and Public Buildings



## 03. Clean Energy Production

Upgrade production systems using the output from Agriculture and Forestry for the co-production of Food, Feed, Fibre, Chemicals and Fuel (including electricity and heat)

Solids: Pellets, charcoal

Gas: biogas, Syngas

Liquids: Ethanol, Pyrolysis Liquids, Biodiesel



## 04. Governance

Enhancing National Capacity in Clean Energy and Clean Production



## 05. Infrastructure

Universal access to affordable, modern energy services, including having a resilient grid.

# Contents

<b>Foreword</b> .....	<b>iii</b>
<b>Mission Statement</b> .....	<b>iv</b>
<b>Five Pillars</b> .....	<b>v</b>
<b>List of Tables</b> .....	<b>viii</b>
<b>List of Figures</b> .....	<b>viii</b>
<b>Measurement/Conversion Units</b> .....	<b>ix</b>
<b>Abbreviations</b> .....	<b>xi</b>
<b>Glossary</b> .....	<b>xii</b>
<b>Methodological Notes</b> .....	<b>xiv</b>
<b>1 Introduction</b> .....	<b>16</b>
1.1 The 2020 Annual Energy Report .....	16
1.2 Background .....	17
1.3 The role and impact of energy services in Belize .....	18
1.4 Energy Sector Policy and Legislative Framework .....	20
<b>2 Overview: Energy Balance and Indicators</b> .....	<b>22</b>
2.1 Energy Balance .....	22
2.2 Energy Indicators .....	22
2.2.1 Energy Intensity measure in terms of Primary Energy and GDP .....	22
2.2.2 Energy Import Share of Total Primary Energy Supply (TPES) .....	23
2.2.3 Renewable Energy Share of Total Primary Energy Supply .....	24
2.2.4 Percentage of Renewable Energy in Electricity Mix .....	25
<b>3 Energy Flows</b> .....	<b>28</b>
3.1 Total Energy Supply .....	28
3.1.1 Energy Imports .....	29
3.1.2 Energy Exports .....	29
3.2 Primary Energy .....	29
3.2.1 Primary Energy Supply by Renewable Energy Sources .....	30
3.2.2 Primary Energy Supply by Fossil Fuels .....	30
3.3 Secondary Energy .....	31
3.3.1 Secondary Energy Supply by Type .....	31
3.3.2 Refined Oil Products .....	32
3.4 Electricity Sector .....	33
3.4.1 Installed Electricity Generation Capacity .....	33
3.4.2 Peak Electricity Demand .....	34

3.4.3 Gross Electricity Production .....	34
3.4.4 Electricity Production by fuel type .....	35
3.4.5 Electricity Production by Fuel and Technology Share .....	36
3.4.6 Net Import of Electricity .....	38
3.4.7 Gross electricity consumption by Sector .....	38
3.4.8 Electricity Purchase, Sales and Losses by Distribution Utility .....	39
<b>4 Environment and Climate Protection .....</b>	<b>40</b>
4.1 Climate and Sustainability Goals .....	40
4.1.1 Belize Sustainable Energy Strategy and Action Plan .....	40
4.1.2 Sustainable Development Goal 7 .....	41
4.1.3 Nationally Determined Contributions (NDCs): .....	41
4.2 National Greenhouse Gas Emissions .....	43
4.2.1 Total GHG Emissions for Energy Sector .....	43
4.2.2 Total GHG Emission by Energy Sub-Sectors .....	43
<b>5 Energy Prices .....</b>	<b>45</b>
5.1 Mean Electricity Rate .....	45
5.2 Annual Average Pump Price for Conventional Refined-Petroleum Fuels .....	46
5.3 Annual Average Price for Liquefied Petroleum Gas (LPG) .....	46
Contact Information .....	48
References .....	49

# List of Tables

<b>Table 1.</b> Multiples of energy units .....	x
<b>Table 2.</b> Conversion table for units used in this publication .....	x
<b>Table 3.</b> Belize’s 2020 Energy Balance. (This is for visual representation of the layout of the table) .....	27
<b>Table 4.</b> Power producing plants in Belize in 2020 .....	33
<b>Table 5.</b> Targets established by the Belize Sustainable Energy Strategy and Action Plan.	41
<b>Table 6.</b> Sustainable Development Goal 7: Targets .....	41
<b>Table 7.</b> Energy-related mitigation activities included in Belize’s first NDC .....	42

# List of Figures

<b>Figure 1.</b> Generalized energy services supply chain .....	19
<b>Figure 2.</b> Timeline of Belize’s Key Energy Sector Policies and Legislative Frameworks	21
<b>Figure 3.</b> Historical timeline of Energy Intensity measured in terms of Primary Energy and GDP .....	23
<b>Figure 4.</b> Historical timeline of Energy Import as a Share of Total Primary Energy Supply .....	24
<b>Figure 5.</b> Historical timeline of Renewable Energy Share of Total Primary Energy Supply in Belize .....	25
<b>Figure 6.</b> Historical Timeline of Renewable Energy Share in the Electricity Mix .....	26
<b>Figure 7.</b> Primary Energy Flows within Belize’s National Sector .....	28
<b>Figure 8.</b> Pie chart summarizing total energy imports and exports .....	29
<b>Figure 9.</b> Summary of Belize’s Primary Energy Supply in 2020 .....	30
<b>Figure 10.</b> Historical timeline of fossil fuel production in Belize .....	31
<b>Figure 11.</b> Summary of Belize’s Secondary Energy Supply in 2020 .....	32
<b>Figure 12.</b> Refined Oil Products Imported by Volume in 2020 .....	32
<b>Figure 13.</b> Historical timeline of Peak Power Demand in Belize .....	34
<b>Figure 14.</b> Historical timeline of Gross Electricity Generation in Belize .....	35
<b>Figure 15.</b> Historical Timeline of Electricity production by fuel type .....	36
<b>Figure 16.</b> Electricity Generation mix by supply type in 2020 .....	37
<b>Figure 17.</b> Electricity Generation mix by supply technology in 2020 .....	37
<b>Figure 18.</b> Historical timeline of net Electricity Imports in Belize .....	38
<b>Figure 19.</b> Historical timeline of Electricity Consumption by Sector .....	39
<b>Figure 20.</b> Total Direct GHG Emissions for the Energy Sector over reference years 2012-2019 .....	44
<b>Figure 21.</b> Total GHG emissions (Gg CO <sub>2</sub> eq) by sub-sectors in 2018 and 2019.....	44
<b>Figure 22.</b> Historical timeline of Mean Electricity Rate (MER, \$/KWh) in Belize.....	45
<b>Figure 23.</b> Annual average pump price for conventional refined-petroleum fuels in 2020.	46
<b>Figure 24.</b> Average LPG Retail Prices across Belize in 2020 .....	47

# Measurements / Conversion Units

A summary of units used throughout the 2020 Annual Energy Report composes this section, along with their definitions and derivations (Table 1 and 2). Included are some conversions to the metric system of units. Though Belize has historically made use of both Imperial and American units, recent movements towards an internationally recognized standard has prompted us to incorporate metric-derived systems.

## Economics

All dollars and cents that appear in this report are in Belize dollars (hereinafter, BZD) unless stated otherwise. Each Belize dollar is exchanged at the rate of approximately 0.5 to 1 US dollar. Gross Domestic Product (hereinafter, GDP) is measured in Belize dollars.

## Area

Spatial area, which is used to quantify land and land uses, is measured in km<sup>2</sup>.

## Volume

Instead of the corresponding SI unit of cubic metres (m<sup>3</sup>)/kilolitres (kL) for volume, barrels (bbl) and US gallons (US gal), equivalent to 159 litres and 3.8 litres respectively, are used for the volumetric measurement of liquid fuels such as gasoline and diesel. For gaseous fuels such as natural gas, thousand cubic feet (Mcf) are used.

## Mass

For most solid fuel masses, the SI unit kilotons (kt) or thousand tonnes (10<sup>3</sup> t) are standard. In Belize, the imports and retail of gaseous fuels such as Liquid Petroleum Gas (hereinafter, LPG) is carried out in pounds (lbs), which is equivalent to 0.5 SI kilograms (kg). Quantities of fuels, regardless of their material state, may often be expressed in energy units, as seen below.

## Energy/Power

The standard SI unit of energy, the joule, is key to this report, along with its common multiples the Terajoule (TJ) and Gigajoule (GJ). Also important is the Watt-hour, which measures energy as in the context of electricity, and its multiples the Kilowatt-hour (KWh), Megawatt-hour (MWh) and Gigawatt-hour (GWh). One (1) KWh is equivalent to 0.0036 GJ. Barrels-of-oil-equivalent (boe) are also used to measure energy. Each boe corresponds to 163.5 TJ. Similarly, tons-of-oil-equivalent (toe), equivalent to 172.2 TJ are used.

Power is measured here in Watts and its multiples: Kilowatts, Megawatts, Gigawatts. Electric potential, used to denote the charge-carrying capacity of electric power lines, is measured in kilovolts (kV), an SI unit.

**Table 1.** Multiples of energy units.

<b>Common Multiple</b>	<b>Base Unit Equivalent</b>
<b>Electricity</b>	
<b>Kilowatt</b>	1,000 Watts
<b>Megawatt</b>	1,000,000 Watts
<b>Gigawatt</b>	1,000, 000, 000 Watts
<b>Terawatt</b>	1,000, 000, 000, 000 Watts
<b>Energy</b>	
<b>Kilowatt-hour</b>	1,000 Watt-hours
<b>Megawatt-hour</b>	1,000,000 Watts-hours
<b>Gigawatt-hour</b>	1,000, 000, 000 Watts-hours
<b>Terawatt-hour</b>	1,000, 000, 000, 000 Watts-hours
<b>Kilojoule</b>	1,000 Joules
<b>Megajoule</b>	1,000,000 Joules
<b>Gigajoule</b>	1,000,000,000 Joules
<b>Terajoule</b>	1,000,000,000,000 Joules

**Table 2.** Conversion table for units used in this publication.

<b>Common Unit</b>	<b>Standard/SI Unit</b>
<b>Currency</b>	
<b>1 Belize Dollar</b>	0.5 US Dollars
<b>Volume</b>	
<b>1 Barrel</b>	159 Litres
<b>1 US Gallon</b>	3.8 Litres
<b>Million Cubic Meters</b>	109 Litres
<b>Thousand Cubic Feet</b>	28,317 Litres
<b>Mass</b>	
<b>1 Pound</b>	0.5 Kilograms
<b>1 Metric Kiloton/thousand tonnes</b>	1,000,000 kilograms
<b>Energy</b>	
<b>Kilowatt-hour</b>	3.6 x 10 <sup>-6</sup> Terajoules
<b>Barrels-of-Oil-Equivalent</b>	163.5 Terajoules
<b>Tons-of-Oil-Equivalent</b>	172.2 Terajoules

# Abbreviations

CARICOM	Caribbean Community
CCK	Caye Caulker
CFE	Comisión Federal de Electricidad (state-owned utility of Mexico)
BAPCOL	Blair Athol Power Company Limited
BECOL	Belize Electric Company Limited
BEL	Belize Electricity Limited
BELCOGEN	Belize Co-Generation Energy Limited
BNE	Belize Natural Energy
FLPC	Farmer's Light Plant Corporation
GDP	Gross Domestic Product
GHG	Greenhouse Gases
HDI	Human Development Index
IRES	International Recommendations for Energy Statistics
IPP	Independent Power Producer
IPPC	Intergovernmental Panel on Climate Change
LED	Light-Emitting-Diode
LPG	Liquified Petroleum Gas
MER	Mean Electricity Rate
PUC	Public Utilities Commission
PUMA	Puma Energy Bahamas S.A.
PV	Photovoltaic
RE	Renewable Energy
SSEL	Santander Sugar Energy Limited
TES	Total Energy Supply
UB	University of Belize
USD	United States Dollars

# Glossary

**Biomass:** Organic non-fossil material of biological origin constituting a renewable energy source.

**Energy:** The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy).

**Energy Access:** A household having reliable and affordable access to both clean cooking facilities and to electricity.

**Energy Balance:** An accounting framework for compilation and reconciliation of data on all energy products entering, exiting and used within a country or area during a reference period (in this publication, a year).

**Energy Efficiency:** Refers to the use of technology to reduce the energy needed for a given purpose or service (a ratio of service provided to energy input). Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.

**Energy Indicators:** Are key statistic markers that offers a snapshot of the energy sector.

**Energy Intensity:** A ratio of energy consumption to another metric, typically national gross domestic product in the case of a country's energy intensity.

**Energy Security:** Refers to the uninterrupted availability of energy sources at an affordable price.

**Fossil Fuel:** An energy source formed in the Earth's crust from decayed organic material. The common fossil fuels are petroleum, coal, and natural gas.

**Gross Electricity Production:** The sum of the electrical energy production by all generating units/installations concerned (including pumped storage) measured at the output terminals of the generators. (IRES)

**Hydroelectric/Hydro Power:** The use of flowing water to produce electrical energy.

**Independent power producer:** A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public and that is not an electric utility.

**Indigenous Energy Production:** Any kind of extraction of energy products from natural sources within the national territory which results in conversion to a usable form.

**Installed Capacity:** Sometimes termed peak installed capacity or rated capacity, means the capacity of the facility (expressed in MW) were it to be operated on a continual basis at the maximum capacity possible without causing damage to it (assuming any source of power used by it to generate electricity was available to it without interruption).

**Mean Electricity Rate:** Annual average unit cost of power sold.

**Nationally Determined Contributions:** Are national climate plans highlighting climate actions, including climate related targets, policies and measures governments aim to implement in response to climate change and as a contribution to global climate action.

**Peak Load Demand:** Is the highest simultaneous demand for electricity satisfied during the year. Note that the electricity supply at the time of peak demand may include demand satisfied by imported electricity, or alternatively, the demand may include exports of electricity. (IRES)

**Primary Energy:** Energy sources as found in their natural state before any transformation to secondary or tertiary forms of energy.

**Refined Petroleum Products:** Products obtained from the processing of crude oil (including lease condensate), natural gas, and other hydrocarbon compounds. Refined petroleum products include but are not limited to gasolines, kerosene, distillates (including No. 2 fuel oil), liquefied petroleum gas, asphalt, lubricating oils, diesel fuels, and residual fuels.

**Renewable energy resources:** Energy resources that are naturally replenishing but flow limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action. (US EIA Glossary)

**Secondary Energy:** Refers to the more convenient forms of energy which are transformed from other, primary, energy sources through energy conversion processes.

**Solar Photovoltaic (PV):** These are arrays of cells containing a material that converts solar radiation into DC electricity.

**Total Energy Supply:** Is defined as flows representing energy entering the national territory for the first time, energy removed from the national territory and stock changes. The entering flows consist of production of primary energy products and imports of both primary and secondary energy products. The flows removing energy from the national territory are exports of primary and secondary energy products and international bunkers.

# Methodological Notes

The information presented below is dedicated to the elucidation of any issues in data quality, coverage, management, methodological treatments, and/or other areas to ensure transparency and visibility for data users. Methodological notes are described below:

## Section 2.1 Energy Balance:

Energy Balance table format for 2020 was restructured in alignment with international recommendations. Prerequisite energy data on final consumption by sectors in Belize is currently not available.

## Section 2.2 Energy Indicators:

Energy Intensity: the unit of measure was changed to tons of oil equivalent per \$1000 USD of GDP as stipulated by the International Energy Agency and the International Atomic Energy Agency (2005).

Energy Import Share of Total Primary Energy Supply (TPES): energy import share of the total primary energy supply was recalculated over the historical timeline.

Renewable Energy Share of Total Primary Energy Supply: Indigenous renewable production and total primary energy supply was recalculated over the historical timeline.

Percentage of Renewable Energy in the Electricity Mix: Indigenous renewable production in the electricity mix was recalculated over the historical timeline.

## Section 3.2 Primary Energy:

The energy supply represented by Belize's consumption of fuelwood or firewood, for 2020 as well as earlier annual energy reports, is not quantified by direct measurement or monitoring, but is instead derived from yearly estimates based on population and labour force survey data published by the Statistical Institute of Belize, for which the baseline is the 2010 national census.

### Section 3.2.2 Primary Energy by Fossil Fuels:

The energy supply represented by fossil fuel production within Belize would typically include petroleum gas flared on-site, along with the unrefined products natural gas and crude oil, according to international energy reporting standards. However, that aspect of fossil fuel energy flows is not reported here.

### **Section 3.4.3 Gross Electricity Production:**

Gross electricity production over the last ten years (historical timeline) was recalculated and may differ from the figures presented in earlier annual energy reports. The recalculation was due to the inclusion of self-generation from biomass (bagasse) power plants that was not captured in the earlier datasets and have now been included. This change will now be incorporated in future annual energy reports.

### **Section 3.4.7 Gross Electricity by Sectors:**

The breakdown of gross electricity consumption by economic sectors is defined by the customer tariff groupings as stipulated by the Belize Electricity Limited. Therefore, its coverage is limited to national grid connected customers and does not include microgrid or mini-grid systems which are present in Belize. It also excludes coverage of privately generated electricity or electricity sourced from distributed generation.

## **Section 4.2 National Greenhouse Gas Emissions:**

For the purpose of the national GHG inventory report, the IPCC Inventory Software\* was utilized as GHG inventory software with the goal of implementing default tier methodologies according to the 2006 Intergovernmental Panel on Climate Change (hereinafter, IPCC) guidelines. The IPCC inventory software enables parties to prepare national GHG inventories in line with the established guidelines and provides standardized formats for reporting tables and worksheets.

All energy sector activity data were disaggregated by reference year and source categories, converted to energy units, and inputted into the IPCC Inventory Software.

No country-specific or plant-specific emissions or emission factors (EFs) were available; hence, emissions were calculated by combining activity data (fuel consumption) with default emission factors from the 2006 IPCC Guidelines/Inventory Software. In addition to emission factors, default global warming potentials were used to calculate carbon dioxide (CO<sub>2</sub>) equivalents. CO<sub>2</sub> equivalent is a measure of how much a gas contributes to global warming, relative to CO<sub>2</sub> (GWP = 1). Global warming potentials (100-year time horizon) from IPCC's Fourth Assessment Report (2007) was used to calculate carbon dioxide (CO<sub>2</sub>) equivalents.

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\* IPCC Inventory Software (Version 2.691 of January 23, 2020). Produced by IPCC Task Force on National Greenhouse Gas Inventories.

# 01

## Introduction

### 1.1 The 2020 Annual Energy Report

The capacity to do work (Energy) is one of the most influential factors as an input for economic development. Given a tangible perspective, it can be said that energy use is the main driver of economic productivity and industrial growth; thus, is considered central to the operation of any modern economy (Asghar, 2008). From a physical viewpoint, energy should be seen beyond dollars and cents with respect placed on socio-economic, political, and environmental factors as well.

Given well-documented impacts and risks associated with climate change, there is a global call for both developed and developing countries to play a role in the transition to a sustainable energy pathway. At the heart of the clean energy transition lies the need for high-quality and timely energy statistics and knowledge management mechanisms that will prioritize data-driven decision making. Decisions that are data-driven are a fundamental part of energy planning and can enable appropriate ambition and successful implementation plans while ensuring that cost effectiveness is maximized. Thus, the Ministry of Public Service, Energy and Public Utilities aims to enhance institutional capacities in energy information and knowledge management by means of improving access to reliable and time-sensitive information in Belize.

The 2020 Annual Energy Report is an authoritative and official source of annual energy statistics for Belize. It builds upon and updates energy statistics and information presented in previous annual reports, which provided a holistic picture of the energy sector. This publication presents numerous topics and concepts on energy matters throughout its various sections. This includes energy information on production, trade and balances, conversion, primary and secondary energy, conventional and renewable sources of energy. In addition, energy information on greenhouse gas (hereinafter, GHG) emissions from the energy sector is presented.

Key data sources include energy statistics reporting from various line Ministries/Departments of the Government of Belize, Belize Electricity Limited (hereinafter, BEL), Public Utilities Commission (hereinafter, PUC), Independent Power Producers (hereinafter, IPPs), Belize Natural Energy Limited (hereinafter, BNE), Puma Energy Bahamas S.A (Belize) and the Statistical Institute of Belize.

The information provided is designed to support policymakers and planners in decision making at various levels, to increase awareness on energy related matters in Belize and to meet reporting purposes. This publication is divided into 5 main sections:

- Introduction: national context and publication information
- Energy Balance and Key Indicators: summary overview of the energy market
- Energy Flows: core energy statistics in 2020
- Environment and Climate: sustainability goals, target setting, GHG emissions
- Energy Prices: cost of energy in 2020

## 1.2 Background

As a top priority, Belize is committed to contributing to global climate action and low-carbon development. The aim is to immediately address the effects of climate change, as increases in global temperatures, sea level, wildfires, drought conditions and changes to precipitation and weather patterns put stress on Belize's energy infrastructure and impacts the way energy is produced and consumed. The consequences and challenges of climate change were upended in 2020 by immense disruption across the globe brought on by the coronavirus (hereinafter, Covid-19) pandemic. The response to the Covid-19 pandemic has led to large economic downturns, both direct and indirect, in many countries across the globe. As a result, there were dramatic impacts on energy markets, which showcased sharp declines in global energy consumption and greenhouse gas emissions in 2020. The climate change issue and the Covid-19 pandemic are a shared global challenge, with Belize's energy sector feeling the consequences immediately. Accordingly, some may be willing to earmark energy statistics associated with the reference year 2020 with some level of variation.

Nonetheless, Belize maintains its strong ambition and leadership to transition to a low carbon economy while strengthening its resilience to climate change through various mitigation and adaption measures. Due to its geographical features, Belize has considerable potential to successfully tap into the opportunities related to the deployment of renewable energy solutions, thereby diversifying its energy matrix even more and reducing its exposure to volatile oil prices. Belize continues to set the trend in the region with its diversified domestic energy portfolio with renewable energy sources making up 89.4% of local energy production in 2020, while the remaining 10.6% is representative of non-renewable energy sources.

Belize's current electricity system is well-managed and reaches 92 percent of the country's population (Bunker, Torbert, & al., 2018). Under its license granted by the PUC, BEL is the primary entity responsible for purchasing, transmitting, and distributing electricity throughout the country of Belize. While BEL employs a few fossil-fuel generating systems, the national electricity grid is mostly supplied by local IPPs using numerous energy sources: hydroelectricity, biomass, solar and petroleum (inclusive of refined petroleum products). 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. 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 and the Spanish Lookout community remain as isolated load centers with their electricity generation needs met using fossil-fuel based generating power plants (diesel and crude oil power plants respectively). 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.

The Belize Natural Energy Limited (hereinafter, BNE) made the first commercial oil discovery in 2005 in the Spanish Lookout community in western Belize. According to the Geology and Petroleum Department (2021), the oil discovered in Spanish Lookout is a light crude oil with an API gravity of 40°. In 2007, BNE made another commercial discovery in the Never Delay area in Belize. Crude oil from Spanish Lookout and Never Delay are trucked from the oilfields to BNE's facility at the Port of Big Creek Port and then exported out of Belize. A portion of the crude oil produced at the Spanish Lookout oilfield is sold on the local market to local industries. The Geology and Petroleum Department administrates and regulates the petroleum industry and supervises and monitors all exploration and production operations (Geology and Petroleum Department, 2021). In Belize, BNE remains the sole oil producer in the country with five companies involved in petroleum exploration activities (Geology and Petroleum Department, 2020).

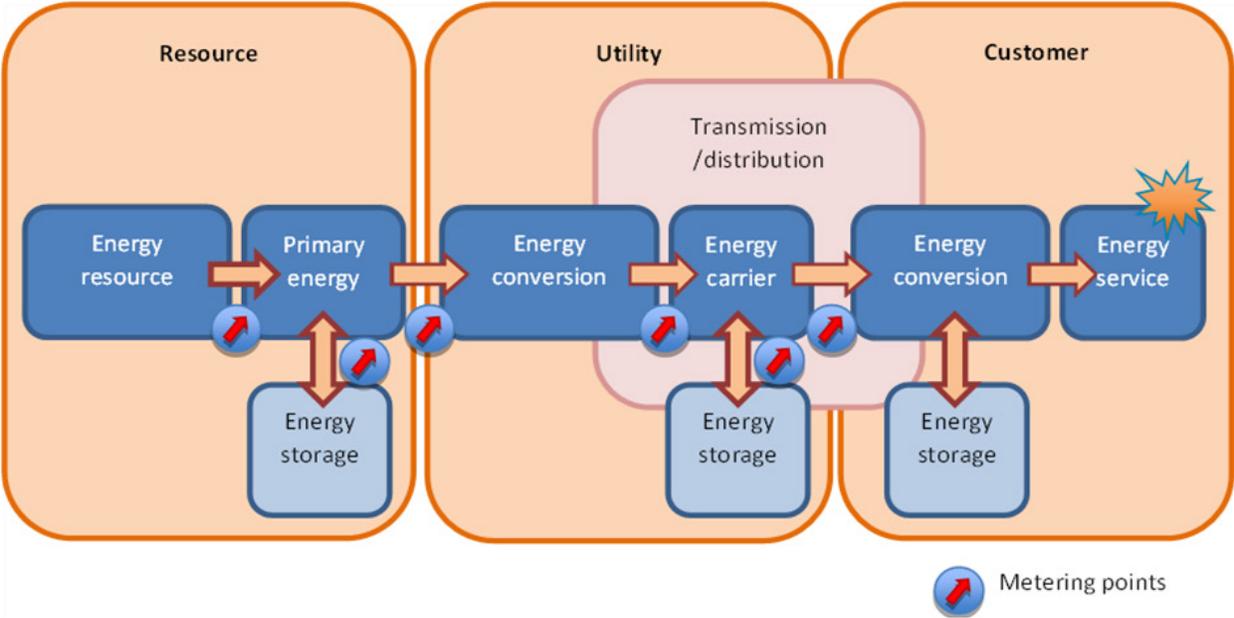
Currently, no local refining of crude oil is taking place in Belize. Hence, petroleum products and secondary fuels are all imported into Belize. PUMA Energy Bahamas S.A (hereinafter, PUMA Energy) is the sole importer of petroleum products in Belize. PUMA Energy currently operates 1 terminal (mooring facility) with a storage capacity of 26,400 m<sup>3</sup> and 15 retail sites across Belize (PUMA Energy Bahamas S.A , 2021). In addition, petroleum products from Puma Energy are sold to other wholesalers and retailers such as SHELL, SOL Belize Limited and UNO Belize. The gaseous fuel market and the quality of such products is regulated by the Belize Bureau of Standards (hereinafter, BBS). The Belize National Gas Company Limited is the sole entity with responsibility to import Liquefied Petroleum Gas (LPG) via its marine terminal at the Port of Big Creek and two regional wholesale depots.

### **1.3 The role and impact of energy services in Belize**

Decarbonization of the energy sector and increased energy resiliency are recurring issues in the transition to a clean energy pathway with implications placed upon Belize's energy sector and that of the wider Latin American and Caribbean region. Given the importance of having access to energy services as a precondition for developing a modern economy, more ambitious financial and policy actions are needed to employ change within the energy sector and to achieve climatic goals. Thus, it is essential for decision-makers and governments to be guided by proper energy planning to implement appropriate policy and regulatory measures that will manage the transition and attract needed investment.

Nonetheless, many countries, especially those found within the low-income bracket, are known to lack energy planning at the national level or at the minimum implement rudimentary energy planning. Currently, energy experts are calling for an integrated energy plan to act as a national policy instrument. An integrated energy plan can provide governments with an outlook on the role the energy sector will play as it relates to economic growth and sustainable development strategies. According to Beare (2018), many governments make decisions around energy policy that are often supply-side focused whereas the demand-side of the energy equation should be denoted as equally important. An integrated energy plan should seek to find an effective balance between energy demand and supply in a bid to limit economic growth constraints.

An energy sector’s potential for development is highly dependent on the creation of energy solutions that are fitted to the needs of the end-user. Adoption of this new approach encourages more emphasis on energy services (demand-side energy planning) and must be cognizant of the entire economy and the differentiating energy needs of various sub-sectors. Due to this, Belize must aim to create a modern economy that incorporates a flexible blend of demand-side principles and mix of supply-side choices, which in the end will deliver fit for purpose energy services. Hence, focus must first be placed on customer-centric interest and needs followed by the determination of the energy supply chains (Figure 1) that will provide the energy services required.



**Figure 1.** Generalized energy services supply chain.\*

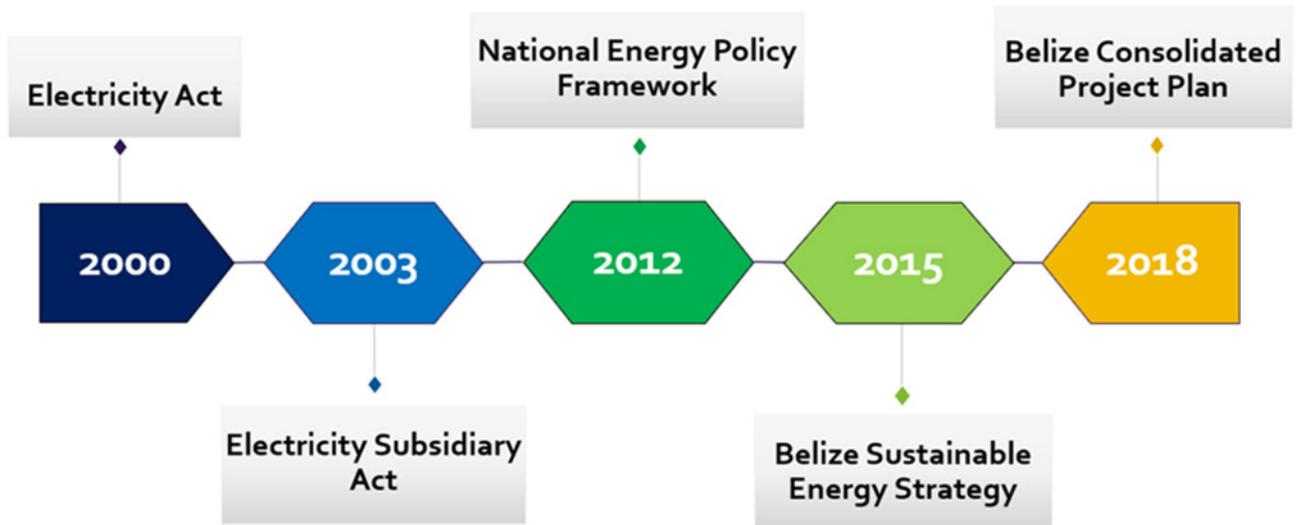
CARICOM member states, including Belize, grapple with the issue of efficient energy use within their economy (Masson, Ehrhardt, & Lizzio, 2020) (see section 2.2.1). The South Trinidad Chamber of Industry and Commerce (2009), noted that “given the fact that the economies of the region tend to be highly energy inefficient the development of a vibrant, commercial and competitive energy services sector in the region will have spill-over effects into improved productivity in the rest of the economy”(p.3). Given this regional context, the energy services approach may provide an advantageous option for Belize that is flexible and enables innovation to drive efficiency and prioritize utilization of sustainable energy service supply chains that are based on local renewable energy resources (promoting energy independence). With governments around the world focused on putting forth ambitious recovery plans to counter the impacts brought on by the Covid-19 pandemic, there is a unique opportunity to redesign the business model and decentralize the energy sector by investing in customer-centric needs and sustainable energy solutions that will bring along affordability, efficiency and improve access to energy services. Essentially, this will require collaboration and commitment from all levels of society.

\* Figure 1 prepared by Mr. Glynn Morris, 2021.

## 1.4 Energy Sector Policy and Legislative Framework

One of the most crucial components of an energy sector is its legal framework, given how expansive and how diverse its considerations can be. The importance of energy policies and proper legislative frameworks are quite apparent with energy planning and forecasting continuing to play ever larger roles in the evolving arena of energy issues. Energy policies guide and shape the development of the sector, while legal structures give definition and formalize the roles and relationships of the sector's key players. In Belize's context, several key instruments have been formulated to streamline and consolidate the country's position on energy (Figure 2), which are summarized below:

- **2000 – Electricity Act:**
  - » Denotes the responsibilities and prerogatives of BEL, establishes BEL's legal freedoms, as well as citizens' rights and redresses, for example: only a proven licence holder can request access to private property for the purposes stipulated under BEL's mandate.
- **2003 – Electricity Subsidiary Act:**
  - » States the powers and responsibilities of the Public Utilities Commission as the oversight of rates, revenue recovery, and the licencing of technicians. Additional incidental provisions were made such as the placement of power lines along roads and in public spaces.
- **2012 – National Energy Policy Framework:**
  - » Explores development options for energy in diverse sectors of society and details energy planning scenarios based on demand or supply side focus or both. Potential discussed for experimental technologies or exploitation of by-products of local enterprises in various industrial contexts. Though specific stated targets for the NEP may currently be considered dated, it still plays a crucial role in guiding and informing energy issues relevant to Belize.
- **2015 – Belize Sustainable Energy Strategy and Action Plan:**
  - » An in-depth analysis of Belize's renewable energy and energy efficiency potential and forms the blueprint for realizing Belize's sustainable energy goals within the electricity sub-sector. In addition, it presents specific activities for implementation, costs breakdown of mitigation actions, and studies of institutional and sectoral barriers to achieving the targeted goals set in the strategy and action plan.
- **2018 – Belize Consolidated Project Plan:**
  - » An examination of the electricity sector that modelled the potential for increased resilience and renewable energy generation, supported by scenario mapping and sensitivity analyses. Recommendations were made across sectors for the incentivization and feasibility of energy efficiency, distributed generation and clean fuels.



**Figure 2.** Timeline of Belize’s Key Energy Sector Policies and Legislative Frameworks.



# Overview: Energy Balance and Indicators

## 2.1 Energy Balance

Globally, energy balances are denoted as a key accounting instrument for the compilation and reconciliation of energy statistics. Energy balances allow users to analyse and understand the role of energy within the national territory of a given country, particularly, the economy, during a reference period of one year (United Nations, 2017). As such energy balances provide an overview of the energy market and can act as a monitoring framework for energy policies. Table 3 presents the overall energy balance of Belize for 2020 and provides an overview of energy supply, transformation, and electricity output. The energy balance is presented in a common energy unit, Terajoules (TJ), and provides a structured matrix, where columns represent energy products (fuels) and the rows represent energy flows. More detailed information on energy input (supply-side) can be found in Section 3: Energy Flows.

## 2.2 Energy Indicators

There is an ever-increasing requirement for countries to assess their progress towards a sustainable energy future. Thus, energy indicators represent an essential statistic tool for communicating to decision-makers and the public a deeper understanding of energy topics related to sustainable development issues. Together these indicators may be used to retrospectively measure and monitor at the national level long-term trends of an energy system. These long-term trends can provide a snapshot of a country's energy scenario and allows for the tracking of progress towards nationally defined objectives, climatic targets, and sustainable development goals. In summary, it is important for policymakers to make informed decisions and to understand the implications and impacts of such decisions in shaping the energy sector. The energy indicators presented below have been prepared in alignment with Belize's country-specific conditions, priorities, and capacities.

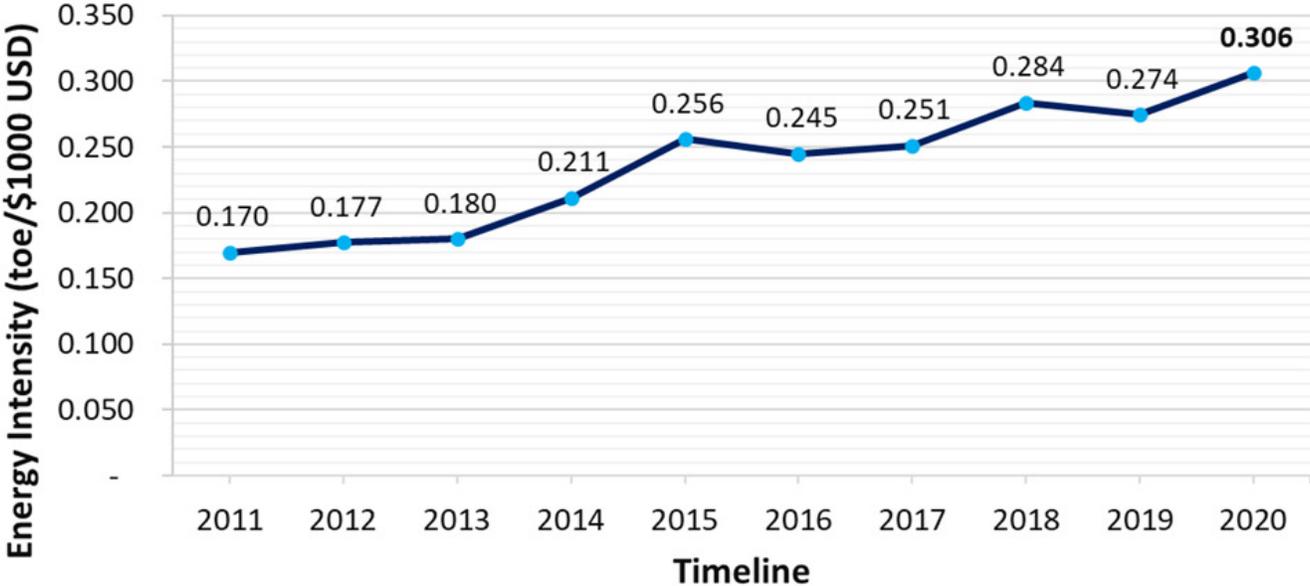
### 2.2.1 Energy Intensity measure in terms of Primary Energy and GDP

This indicator reflects the trends in overall energy use relative to GDP at market prices (nominal), indicating the general relationship of energy use to economic development. According to the United Nations Statistics Division (2021), energy intensity is defined as the energy supplied to the economy per unit value of economic output. Nevertheless, it is important to note that energy intensity is only an imperfect proxy for energy efficiency. It can be affected by several factors,

such as climate, structure of the economy, nature of economic activities, among other variables that are not necessarily linked to pure efficiency.

Figure 3 provides energy intensity information for Belize across a ten-year historical timeline. Looking at Figure 3, Belize’s energy intensity increased in 2020 to 0.306 toe/\$1000 USD in contrast to the dip in energy intensity seen in the previous year\*. Notably, while there was a severe economic recession in 2020 which led to decreased economic activity in Belize, this did not reduce energy consumption to the same extent as was expected. Energy intensity levels and energy efficiency trends and achievements will differ widely across sectors in Belize. While there are slight fluctuations across the historical timeline, evidently there is overall growth in Belize’s energy intensity levels which calls for further energy efficiency policy implementation across major economic sectors.

Given the considerable number of factors that affect energy use, the ratio of total energy use to GDP should not be used alone as an indicator of energy efficiency or sustainability for policy-making purposes. Disaggregation of energy intensity, e.g., by final consumption sectors or end-uses, could provide further insights into progress towards energy efficiency.



**Figure 3.** Historical timeline of Energy Intensity measured in terms of Primary Energy and GDP.

### 2.2.2 Energy Import Share of Total Primary Energy Supply

A country’s fiscal success is typically aligned with timely and reliable energy supply in line with both environmental needs and economic development. In 2020, Belize’s energy imports accounted for 76.7% of total primary energy supply. The latest figures (Figure 4) show the upward trend of energy import proportion in comparison to Belize total energy supply. Belize, like most

\* Energy Intensity unit of measure was changed, thus, energy intensity for 2010-2020 was recalculated.

other countries, particularly, small island developing states (SIDS), still have a substantial share of imported petroleum products within their energy mixes. The International Energy Agency (IEA) notes that “oil is expected to remain a major component of global energy demand for the time being, particularly in the transportation sector”.

According to the CARICOM Energy Policy, the heavy dependence on imported fossil fuels within the region has created significant macro-economic challenges in member states and fuel importing countries. Belize’s dependency on energy imports, specifically refined petroleum products, should be at the forefront of policy concerns for decision-makers who aim to tackle the issue of energy security and supplies. Fortunately, Belize’s partial reliance on imported refined petroleum products (indigenous renewable and non-renewable energy sources) puts the country in a position that is less vulnerable to global oil price fluctuations that have direct and negative impacts on the cost of power (electricity) in comparison with other CARICOM members states and the wider region.

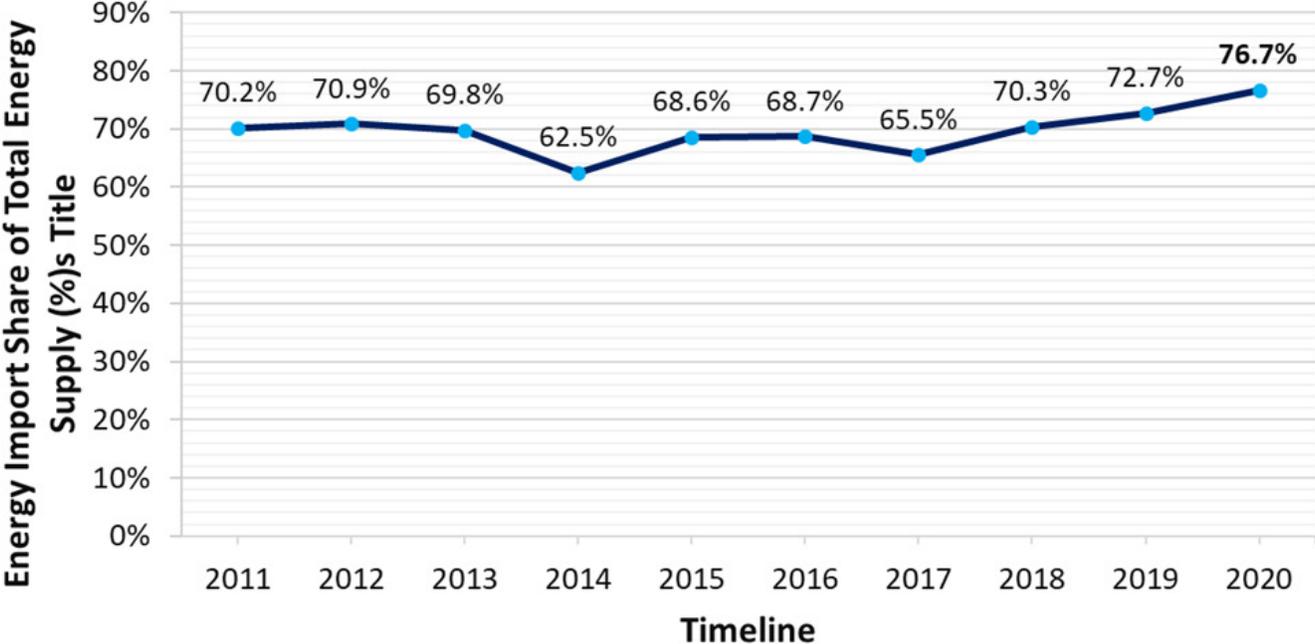


Figure 4. Historical timeline of Energy Import Share of Total Primary Energy Supply.

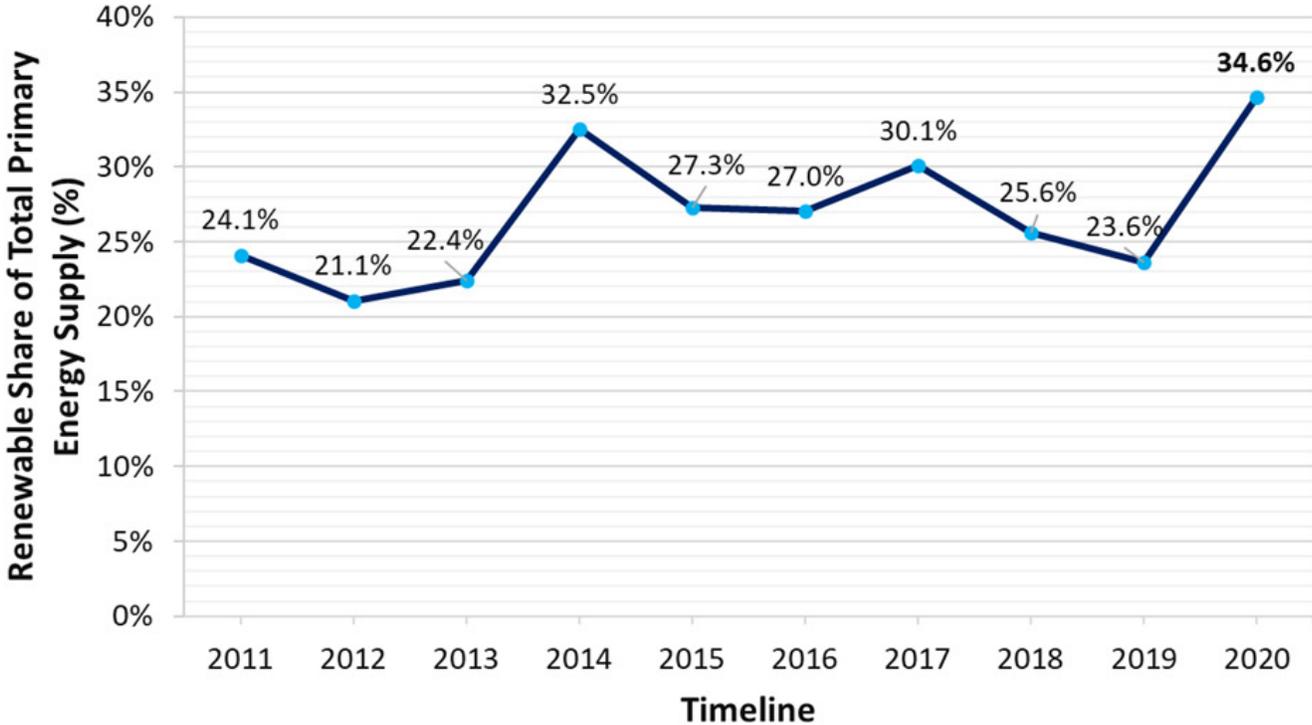
**2.2.3 Renewable Energy Share of Total Primary Energy Supply**

The renewable energy share in total final energy supply is the percentage of total energy supply that is derived from renewable resources\*. Renewable energy sources include wind power, solar power (thermal, photovoltaic, and concentrated), hydro power, tidal power, geothermal energy, ambient heat captured by heat pumps, biofuels, and the renewable part of waste. In Belize, hydro, solar photovoltaic, and biofuels are actively being used. The use of renewable energy sources is seen as a key element in energy policy, reducing the dependence on fuel importation,

\* Indigenous renewable production and total primary energy supply was recalculated over the historical timeline.

reducing emissions from fossil fuel sources and decoupling energy costs from oil prices.

As shown in Figure 5, Belize’s renewable energy share in total final energy supply exhibited a significant increase in 2020 when compared with the previous two years which showcased a downward trend. The upward trend in 2020 can be attributed to more favourable climatic conditions, specifically, precipitation patterns, which had positive impacts within the energy sector related to indigenous energy supply (hydro and biomass production). Furthermore, with the decline in electricity demand in 2020, this allowed for an upward trend (growth in share) in indigenous electricity generation from renewable energy sources and presented the opportunity for greater energy independence within the electricity sector. This in turn helps to strengthen and stabilize Belize’s energy sector.



**Figure 5.** Historical timeline of Renewable Energy Share of Total Primary Energy Supply in Belize.

### 2.2.4 Percentage of Renewable Energy in Electricity Mix

This indicator measures the share of renewable energy\* used in the generation of electricity. The elements comprising this indicator are renewable resources, non-renewable resources, and imports of electricity from Mexico. The promotion of a clean energy pathway, specifically, electricity generation from renewable sources, is a high priority for sustainable development initiatives. In alignment with climatic targets, shares of renewable energy in the electricity mix relates directly with diversification and security of energy supply and has major implications on both environmental and human health.

\* Renewable energy includes both combustible and non-combustible renewables.

Figure 6 illustrates the historical timeline of renewable energy share in the electricity mix from 2011 to 2020. According to Figure 6, renewable sources represented over 50% of the electricity supply mix between 2012 to 2018. In contrast, Figure 6 also demonstrates that renewable sources in the electricity sector in 2019 declined significantly and was attributed to consistent and severe drought conditions which created a shortage in supply from hydroelectric and biomass plants. Fast forward to 2020, the renewable energy share within the electricity mix has rebounded to over 50% share, equating to 51.3%. The renewable energy share in the electricity mix in 2020 is now consistent with the renewable energy share figures that remained constant over the period of years before abruptly changing in 2019. Therefore, projecting Belize as an example in the region for its continuous transition from fossil fuels to cleaner sources of energy.

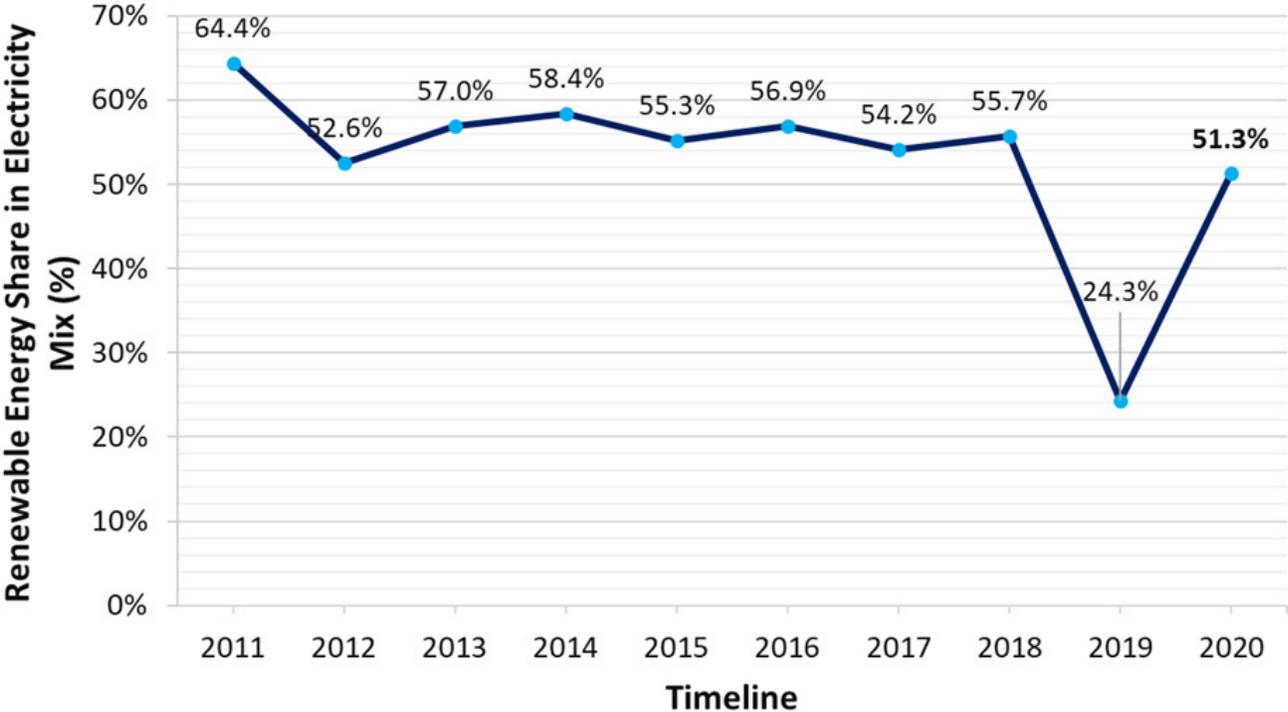


Figure 6. Historical Timeline of Renewable Energy Share in the Electricity Mix.

Table 3. Belize's 2020 Energy Balance.

ENERGY FLOW	BELIZE ENERGY BALANCE - 2020 (in TJ)															
	Primary Energy Sources							SECONDARY ENERGY SOURCES								
	Petroleum		Direct Energy			Biomass and Residues		Electricity		Oil and Natural Gas Products			TOTAL			
Crude Oil	Natural Gas	Hydro	Solar (Photovoltaic)	Wind	Firewood	Bagasse	Electricity	LPG	Gasoline	Kerosene	Diesel	Fuel Oil	Aviation Gasoline	Jet Fuel	Kerosene	TOTAL
Production	1,131	32	872	2	0	679	3,862	8	0	0	0	0	0	0	0	6,586
Import (+)	0	0	0	0	0	0	0	1,211	3,098	343	2,876	119	129	747	0	9,495
Export (-)	-440	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-440
International Marine Bunkers (+)*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
International Civil Aviation (-)*	0	0	0	0	0	0	0	0	0	0	0	0	-17	-2,478	0	-2,495
Stock Change (+/-)	92	0	0	0	0	0	282	0	0	0	0	0	0	0	0	374
<b>TOTAL PRIMARY ENERGY SUPPLY</b>	<b>783</b>	<b>32</b>	<b>872</b>	<b>2</b>	<b>0</b>	<b>679</b>	<b>4,144</b>	<b>1,219</b>	<b>3,098</b>	<b>343</b>	<b>2,876</b>	<b>119</b>	<b>111</b>	<b>-1,731</b>	<b>0</b>	<b>13,520</b>
<i>Electricity Sector</i>																
Electricity Producers	0	0	-872	-2	0	0	0	0	0	0	0	-34	-42	0	0	-34
CHP Producers	-62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-62
Electricity Autoproducers	-28	0	0	0	0	0	0	-16	0	0	0	0	0	0	0	-44
CHP Autoproducers	0	0	0	0	0	0	-2,427	0	0	0	0	0	0	0	0	-2,427
<i>Petroleum Sector</i>																
Oil Refineries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Producers	0	-13	0	0	0	0	0	0	0	0	0	0	0	0	0	-13
Energy Industry Own Use (-)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-251
Total Losses (-)	0	-22	0	0	0	0	0	0	0	0	0	0	0	0	0	-282
<b>TOTAL TRANSFORMATION</b>	<b>-90</b>	<b>-35</b>	<b>-872</b>	<b>-2</b>	<b>0</b>	<b>0</b>	<b>-2,427</b>	<b>-16</b>	<b>0</b>	<b>0</b>	<b>-34</b>	<b>-42</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-4,029</b>
<i>Electric Utility</i>																
Independent Power Producers (IPPs)	17,342	0	242,133	578	0	0	149,536	270,239	0	0	0	11,644	0	0	0	9,388
Self-Generators	1,912	306	0	0	0	0	0	423	0	0	0	0	0	0	0	11,644
<b>TOTAL ELECTRICITY SUPPLY (MWh)</b>	<b>19,254</b>	<b>306</b>	<b>242,133</b>	<b>578</b>	<b>0</b>	<b>0</b>	<b>149,536</b>	<b>270,239</b>	<b>423</b>	<b>0</b>	<b>0</b>	<b>11,644</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>703,501</b>

# 03

## Energy Flows

### 3.1 Total Energy Supply

Belize’s Total Energy Supply (hereinafter, TES) is inclusive of all energy imported and produced locally in Belize (Figure 7). In 2020, Belize’s TES totalled 15,633 TJ: which is a 13.3% decrease from the energy supplied in 2019 (18,028 TJ). This is attributed in large part to decreased energy demand across all consumption sectors caused by the impacts of the Covid-19 pandemic (lockdowns, curfews, reduced commuting, working from home, and decreased tourism activities among others) felt across the global and specifically in Belize. Energy consumption which does not occur within Belize’s national territory, specifically, fossil fuel exports and international fuel bunkers, have been deducted from the TES\*.

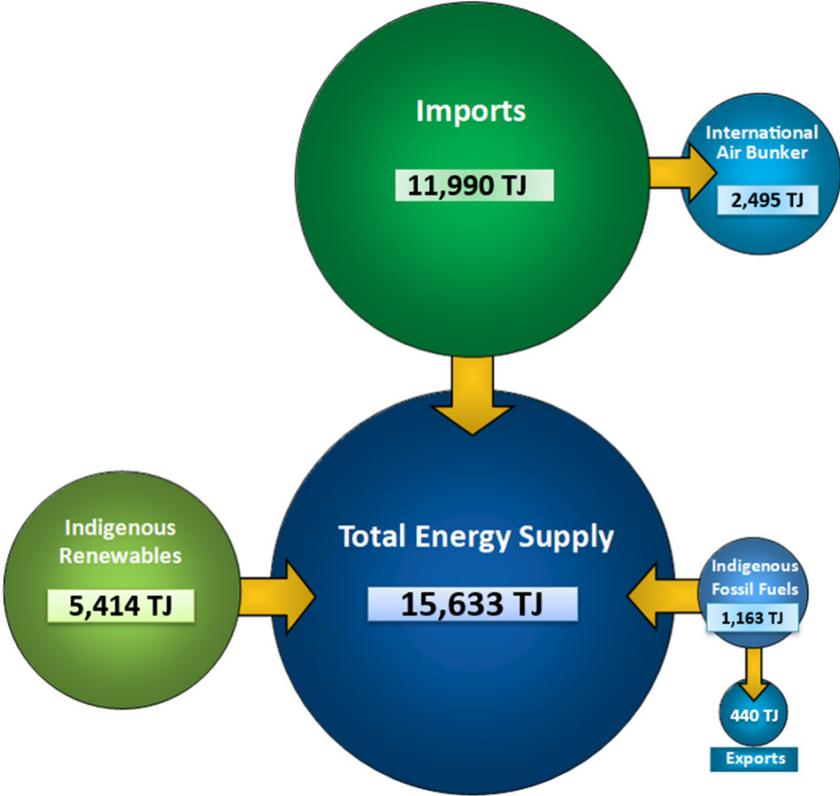


Figure 7. Primary energy flows within Belize’s Energy Sector.

\* Marine Fuel Bunkers not disaggregated here but would form a part of energy imports.

### 3.1.1 Energy Imports

National energy imports consist of electricity from Mexico’s state utility, Comisión Federal de Electricidad (hereinafter, CFE) and refined oil products from PUMA Energy, BEL and the National Gas Company Limited. Out of the total 11,990 TJ of imported energy, 972.9 TJ were contributed from CFE, while 11,017.1 TJ worth of refined oil products were imports, consisting of Diesel, Gasoline (premium and regular), Kerosene, Liquid Petroleum Gas (LPG), Light Fuel Oil (LFO), Heavy Fuel Oil (HFO), Aviation Gasoline, and Jet Fuel Kerosene.

### 3.1.2 Energy Exports

Belize’s primary energy export is representative of locally produced crude oil, amounting to 440 TJ or 75,535.4 barrels in 2020, which represents an overall decrease in crude exports of more than 60% in comparison to 2019 crude exports of 1303 TJ. Similarly, international aviation fuel bunkers equated to 2,495 TJ in energy content, comprising of 105,000 US gallons of aviation gasoline and 2 million US gallons of jet fuel kerosene. Figure 8 showcases the share of total energy imports and exports in Belize in 2020.

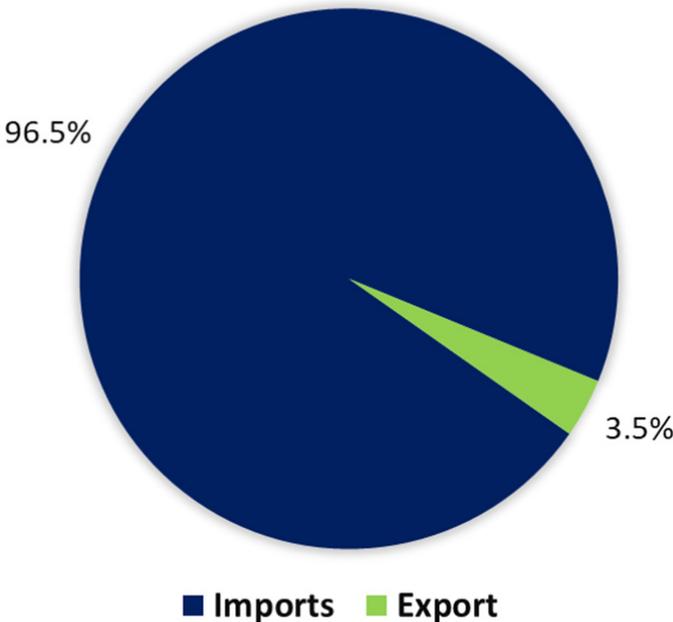
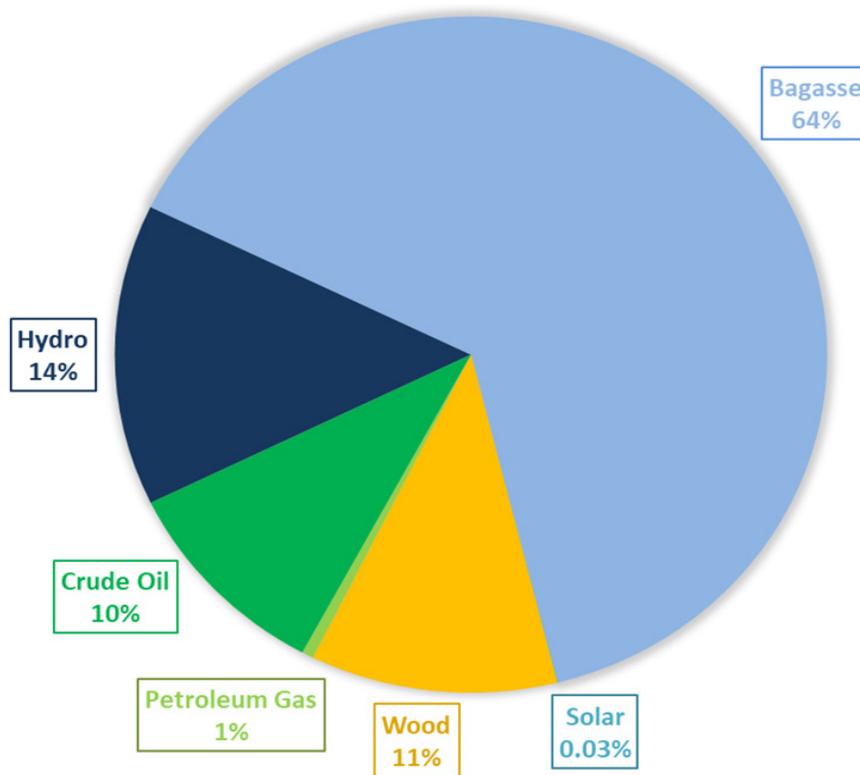


Figure 8. Share of Belize total energy imports and exports in 2020.

### 3.2 Primary Energy

A nation’s primary energy is that which can be found within its borders in a raw and unprocessed form, precluding any conversion to more usable or convenient forms. In Belize, primary energy is found as combustible fuelwood, renewable generation sources: hydro, solar, and bagasse, alongside crude oil and natural gas from the Spanish Lookout and Never Delay oilfields. Collectively, primary energy supply equated to 6,046 TJ, which are further elaborated below by energy sources (Figure 9).



**Figure 9.** Summary of Belize’s Primary Energy Supply in 2020.

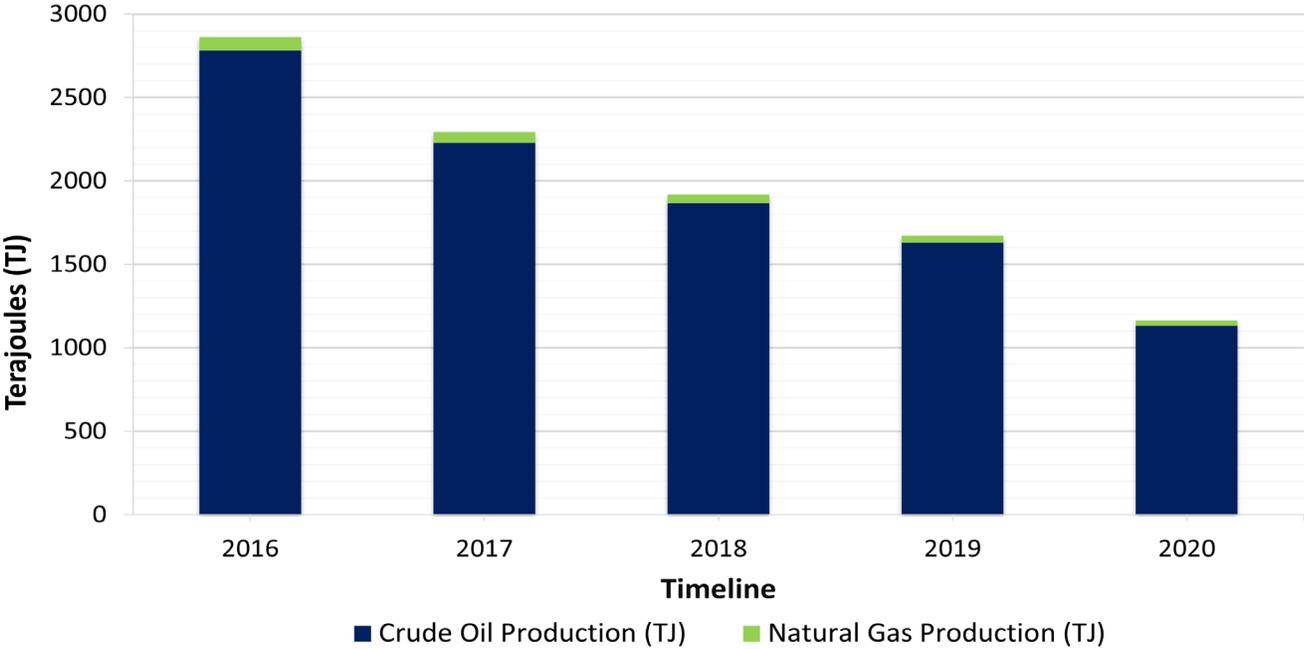
### 3.2.1 Primary Energy Supply by Renewable Energy Sources

Belize’s renewable primary energy sources consists of those which can be replenished, whether combusted directly such as wood, or used to produce electricity, such as hydropower. In 2020, renewable primary sources contributed to our energy supply in the following breakdown: Biomass at 3,861.5 TJ, hydro at 871.7 TJ, and solar at 2.1 TJ. It should be noted that both fuelwood consumed for ‘fire-hearths’ and wood stoves, and the sugar cane processing by-product bagasse fall under the classification of ‘biomass’. Furthermore, fuelwood consumption figures are not quantified by direct measurement or monitoring, but is instead derived through statistical analysis, incurring notable uncertainty, which is further heightened by the fact that charcoal would also qualify as ‘biomass’ type energy source.

### 3.2.2 Primary Energy Supply by Fossil Fuels

In 2020, 1,131.4 TJ or 194,434.1 bbl. of crude oil were produced from the Spanish Lookout and Never Delay oilfields, along with 32.0 TJ or 32,593.9 Mcf of natural gas. All in country fossil fuel production is conducted by BNE, with 440 TJ of crude oil exported out of Belize. The remaining crude oil is utilized for electricity production with the purpose of powering BNE’s operational activities. Furthermore, a portion of the natural gas produced from the oil and gas exploration activities, some 13.0 TJ, is used for LPG production with the LPG utilized for electricity production. As shown in Figure 10, production has been on a steady decline over the last 5 years, as the oil reservoirs gradually deplete overtime. Presently, the Spanish Lookout Oilfield produced

approximately 532.7 barrels of oil per day in 2020 in comparison to roughly 4,130 barrels of crude oil per day from the Spanish Lookout oilfield in 2010 (Energy Unit, 2021).



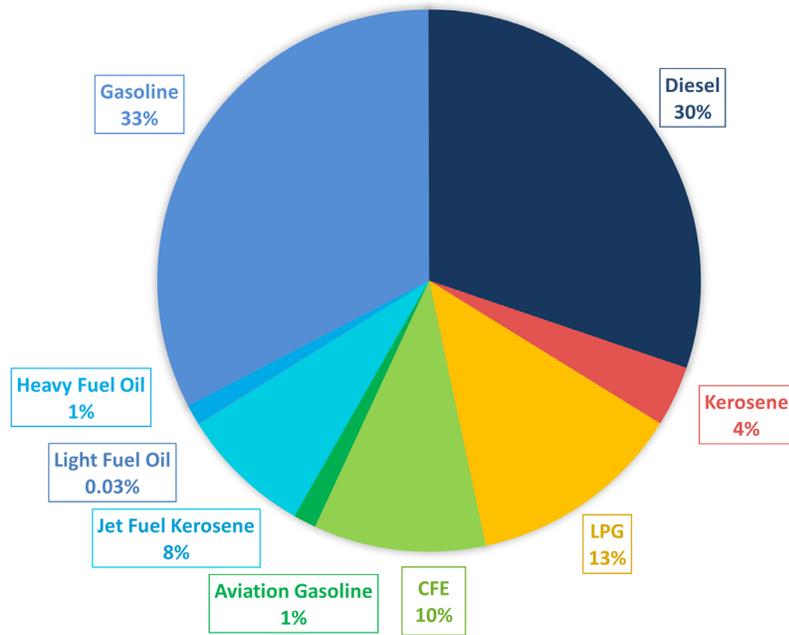
**Figure 10.** Historical timeline of fossil fuel production in Belize.

### 3.3 Secondary Energy

Belize’s secondary energy is largely supplied by the importation of electricity and refined petroleum products, with indigenous electricity production and a very small amount of Liquefied Petroleum Gas (LPG) being produced in-country within the oil and gas extraction sector.

#### 3.3.1 Secondary Energy Supply by Type

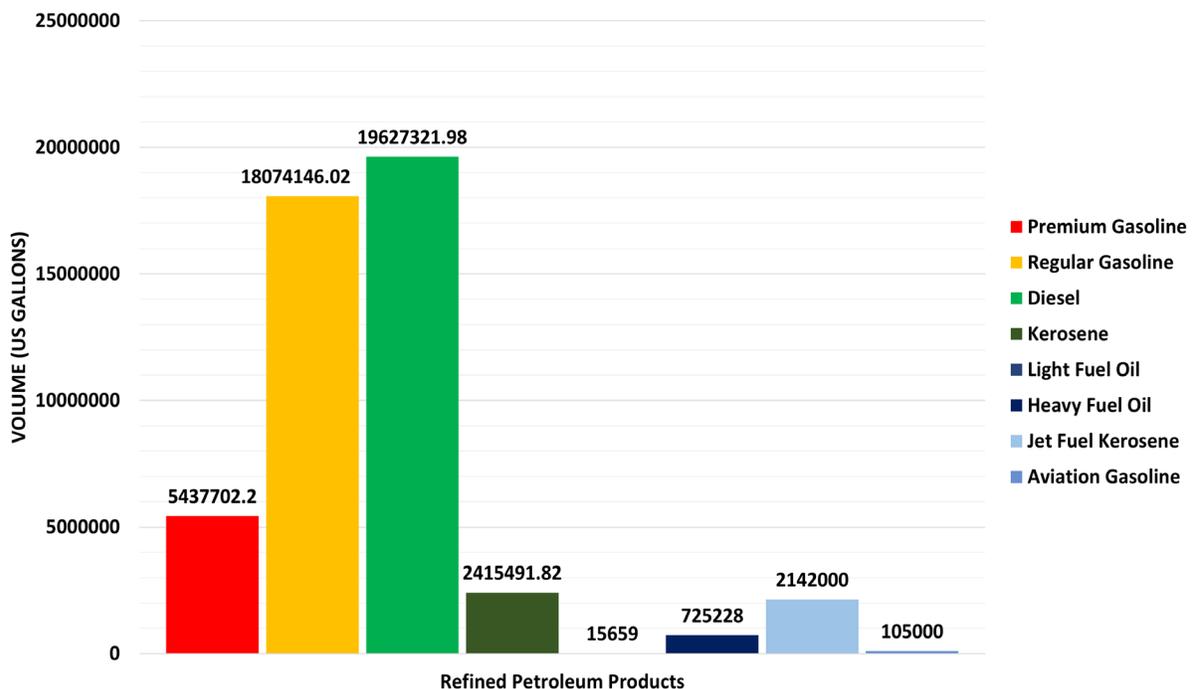
With the transportation sub-sector responsible for a significant portion of energy consumption, majority of the imported energy sources took the form of refined petroleum products (Figure 11). Imported energy sources equated to 3,097.9 TJ of Gasoline, 2,875.8 TJ of Diesel, 1,219.1 TJ of LPG, 747.1 TJ of Jet Fuel Kerosene, 128.6 TJ of Aviation Gasoline, 343.5 TJ of Kerosene, 116.3 TJ of Heavy Fuel Oil (HFO) and 2.5 TJ of Light Fuel Oil (LFO). Additionally, 972.9 TJ of electricity were imported from CFE, Mexico’s state-run utility. All refined petroleum products are imported through PUMA Energy, except for fuel oils imported by BEL and for the purpose of electricity generation. It should be noted that a large portion of aviation fuel is sold at the international airport and is considered an international air bunker, which is not included in the national energy supply totals.



**Figure 11.** Summary of Belize's Secondary Energy Supply in 2020.

### 3.3.2 Refined Oil Products

Representing a significant share of energy consumption in Belize, refined petroleum products are ubiquitous across broad sectors of society from transport to lighting to electricity generation. They also represent a key portion of both national and public expenditure. As would be expected, diesel and gasolines dominated the share of energy imports, even in a country with such short travel distances as Belize. Across the board, the overall quantities of refined petroleum product importation decreased by 28.5% in comparison to 2019 figures, which is intuitively attributed to the effects of the Covid-19 pandemic control measures which led to decreased consumption patterns.



**Figure 12.** Refined Oil Products Imported by Volume in 2020.

### 3.4 Electricity Sector

#### 3.4.1 Installed Electricity Generation Capacity

The total installed capacity for Belize totalled 131.7 MW in 2020. This total comprises of 76.5 MW (58%) of renewable energy and 55.3 MW (42%) of non-renewable generation. Aside from the 8 Mile Gas Turbine and the Caye Caulker Diesel Plant, both of which are fossil-fuel generators owned by BEL, the remaining power plants are owned and operated by private companies (Independent Power Producers) contracted to supply grid power through Power Purchasing Agreements (PPAs). Table 4 presents a summary of Belize’s power producing plants inclusive of name, type, and capacity. The total capacity figure of 131.8 MW does not include generating capacity for imported electricity to Belize from Mexico’s (CFE).

**Table 4.** Power producing plants in Belize in 2020.

<b>ON-GRID</b>			
<b>Plant Name</b>	<b>Ownership</b>	<b>Technology</b>	<b>Capacity (MW)</b>
<b>HYDRO</b>			<b>54.5</b>
<b>BECOL - Mollejon</b>	IPP	Hydro	25.2
<b>BECOL - Chalillo</b>	IPP	Hydro	7
<b>BECOL - Vaca</b>	IPP	Hydro	19
<b>Hydro Maya</b>	IPP	Hydro	3.3
<b>BIOMASS</b>			<b>21.5</b>
<b>BELCOGEN</b>	IPP	Biomass	13.5
<b>SS Energy Limited</b>	IPP	Biomass	8
<b>SOLAR PV</b>			<b>0.48</b>
<b>UB Solar (JICA)</b>	IPP	Solar	0.48
<b>NON-RE THERMAL</b>			<b>43.6</b>
<b>BAPCOL</b>	IPP	Fossil Fuel	23.6
<b>Westlake Sub Gas Turbine</b>	BEL	Fossil Fuel	20
<b>OFF-GRID</b>			
<b>NON-RE THERMAL</b>			<b>11.7</b>
<b>Caye Caulker</b>	BEL	Fossil Fuel	4
<b>Farmers Light Plant Corporation (FLPC)</b>	IPP	Fossil Fuel	7.7
<b>ELECTRICITY IMPORTS</b>			
<b>Imported Electricity from Mexico</b>			<b>55</b>
<b>CFE</b>	IPP	Mixed	55
<b>TOTAL</b>			<b>131.8</b>

### 3.4.2 Peak Electricity Demand

Belize’s peak power demand has been increasing steadily over time as the population increases and economic activities widens, despite incidental variability over the years, as shown in the historical timeline (Figure 13). In 2020, Belize electricity demand peaked at 102.7 MW which represents a decline of 2.7 % from the peak electricity demand recorded in the previous year (Belize Electricity Limited, 2021). Notably, the decline in peak electricity demand in 2020 is the most significant decline over the last decade. In line with decreasing global consumption patterns in 2020, it is intuitive to conclude that the decrease in peak electricity demand in Belize is largely related to the change in consumption patterns brought on by the impacts of the COVID-19 pandemic.

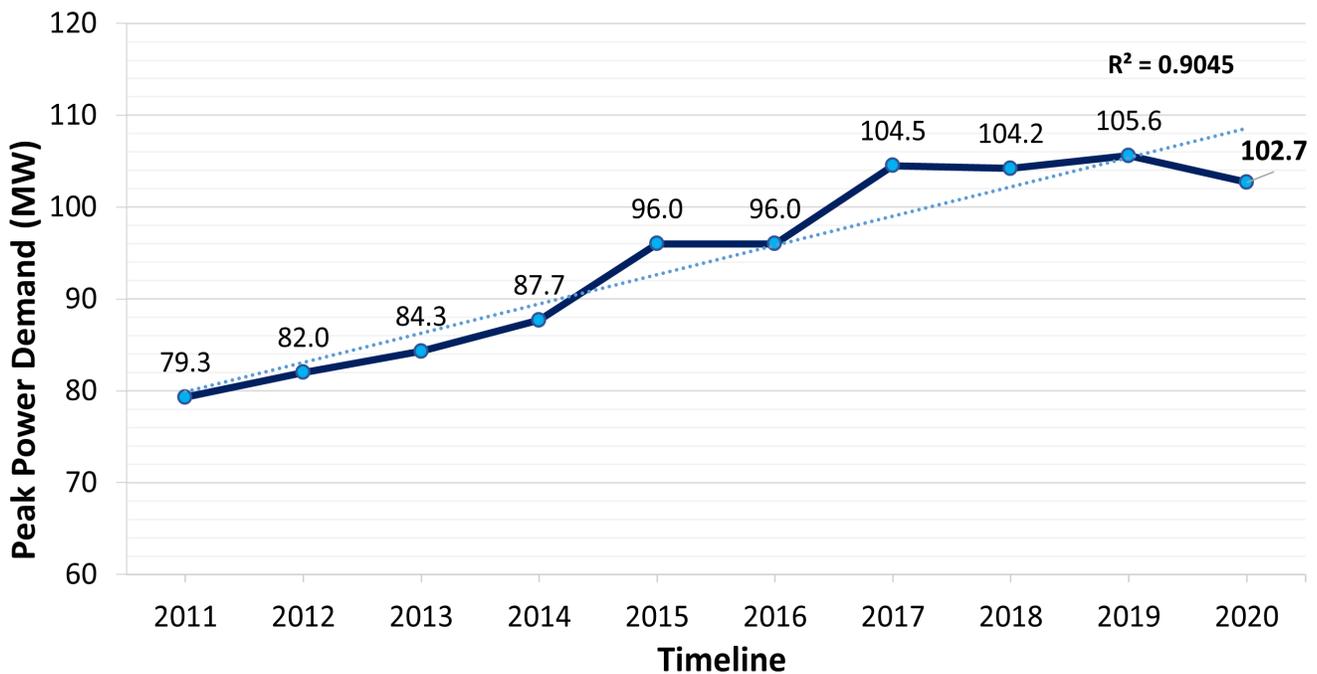
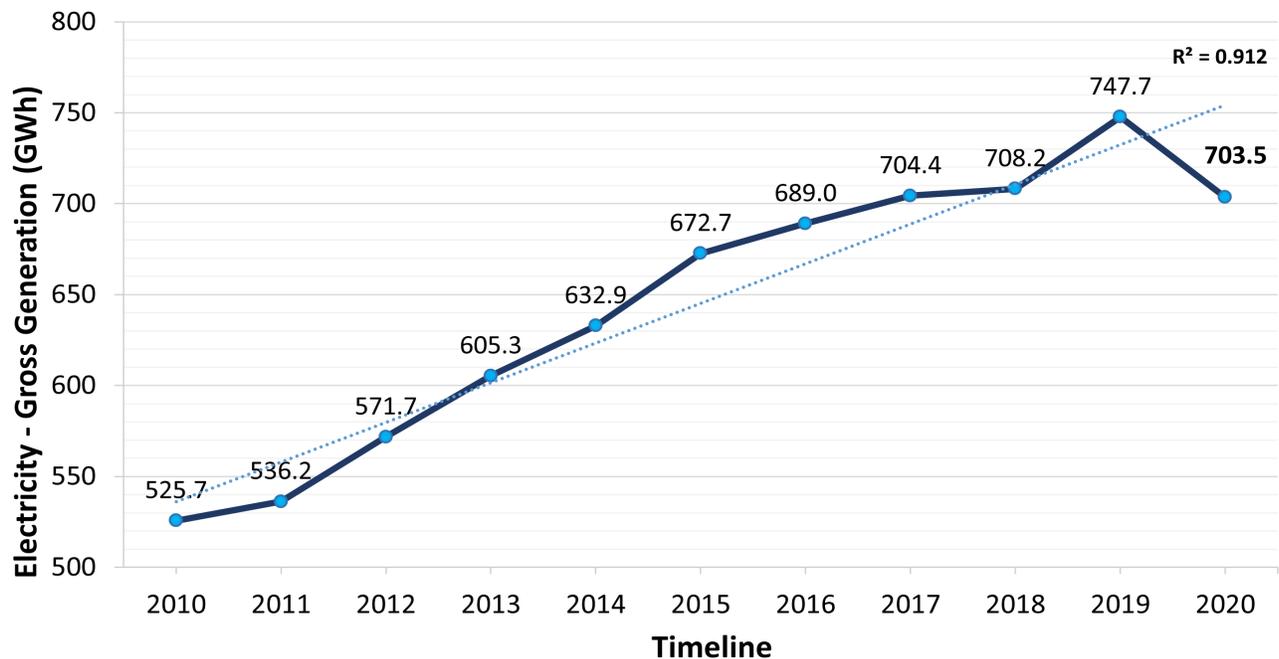


Figure 13. Historical timeline of Peak Power Demand in Belize.

### 3.4.3 Gross Electricity Production

Figure 14 depicts a historical timeline of gross electricity generation in Belize for reference years 2011 to 2020. Gross electricity generated in Belize for the year 2020 totalled 703.5 GWh. As shown in Figure 14, gross electricity production has been steadily increasing for the past decade\*. Given that electricity generation is tied to the installed capacity, which in turn is driven by the country’s power demand, the displayed increase in gross electricity production is anticipated. In alignment with the decreased consumption patterns displayed by the aforementioned statistical variables, the marked drop in gross electricity production from 747.7 GWh in the previous year to 703.5 GWh in 2020 can be considered indicative of the change in consumer consumption patterns attributed to the impacts of the Covid-19 pandemic.

\* Gross electricity generation numbers from 2010 – 2019 were re-calculated in 2021.

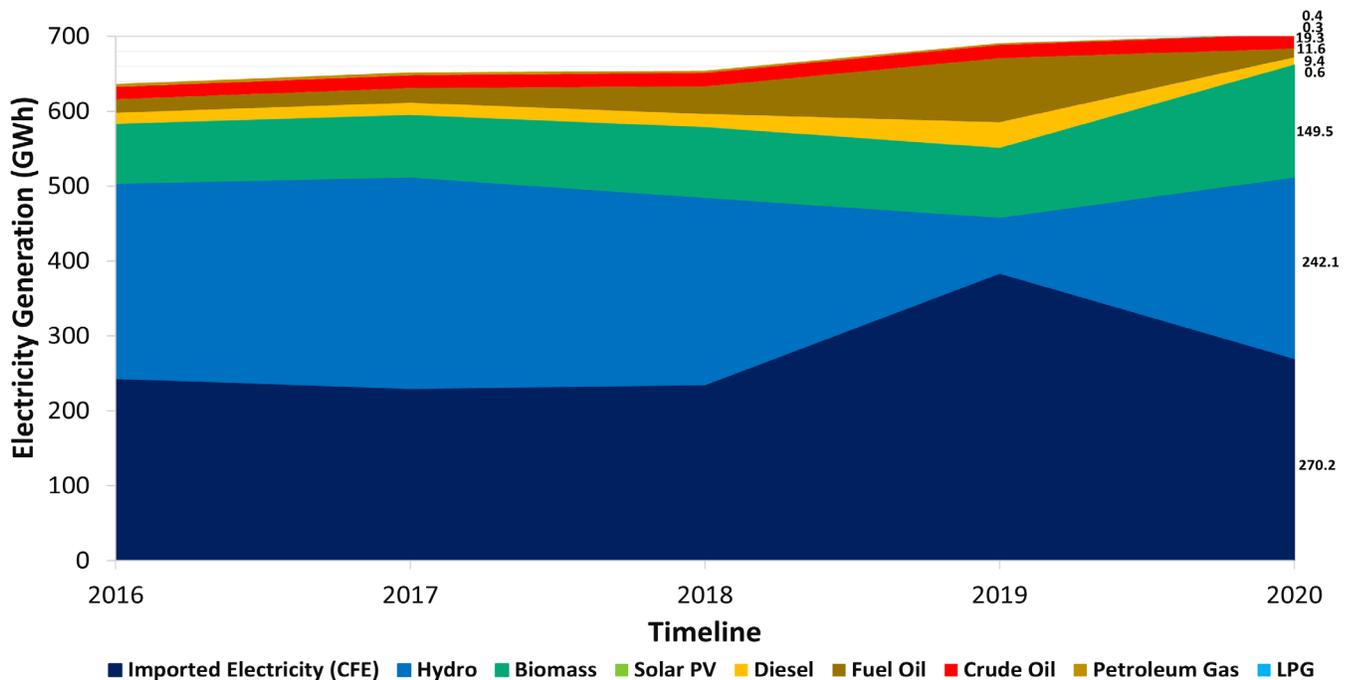


**Figure 14.** Historical timeline of Gross Electricity Generation in Belize.

### 3.4.4 Electricity Production by fuel type

Figure 15 displays a historical timeline of Belize’s electricity generation by fuel type for reference years 2016 to 2020. Though imports of electricity from Mexico have fallen significantly from their 2019 peak, it remains the largest single supplier at 270.2 GWh, followed closely by hydropower at 242.1 GWh. It is a notable contrast with the drought affected 2019, in which CFE and biomass dominated the mix, compensating for the loss of hydropower resources. This year, biomass is the third largest electricity supplier at 149.5 GWh, since hydropower has largely rebounded along with changing climatic conditions, specifically increases in precipitation. Evidently, electricity production by fuel type within the historical timeline displayed significant deviations which was the result of climate change impacts, specifically severe drought conditions experiences in 2019. Otherwise, electricity production by different fuel types remained stable over the historical timeline (Figure 15).

Other contributors to the electricity generation mix are Solar Photovoltaic with 0.6 GWh, Diesel at 9.4 GWh, Fuel Oil at 11.6 GWh, Crude Oil with 19.3 GWh, Natural or Petroleum Gas at 0.3 GWh, and LPG at 0.4 GWh.

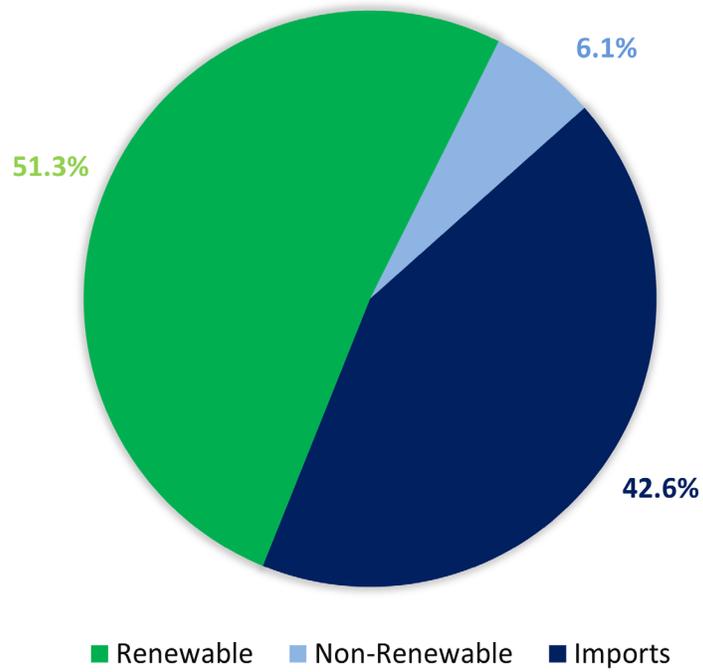


**Figure 15.** Historical Timeline of Electricity production by fuel type.

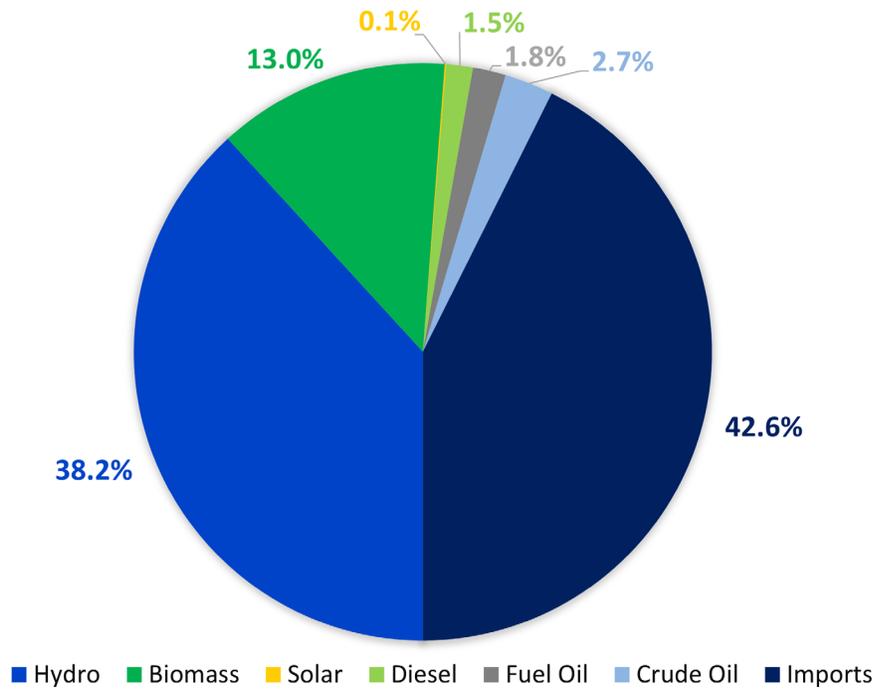
### 3.4.5 Electricity Production by Fuel and Technology Share

Figure 16 and 17 displays a summary breakdown of electricity generation sources by share percentage. As shown in Figure 16, renewable energy, non-renewable energy and electricity imports share equated to 51.3, 6.1% and 42.6% respectively. Fossil fuel generation presents a minority share in Belize’s electricity mix, with indigenous renewable energy sources dominating the electricity mix overall. This is in alignment with Belize’s policy and strategic commitments which aim to guide and facilitate a sustainable energy pathway. Notably, Belize remains a net-importer of electricity from Mexico, which represents a large share of Belize’s electricity mix. As a result, imported electricity from CFE remain indispensable to Belize’s energy mix and can have varying impacts on energy prices. This is an important consideration when decision and policy makers examine key energy issues such energy security and independence.

Figure 17 displays electricity generation disaggregated by supply technology in 2020. Supply technology includes renewable energy sources: hydro, biomass, and solar, which totalled respective shares of 38.2%, 13%, and 0.09% of total electricity generation. Fossil fuel sources included: Diesel, Fuel Oil and Crude Oil totalling a share of 1.5%, 1.8%, and 2.7% respectively. Lastly, electricity imports from Mexico represented 42.6% of Belize’s electricity mix by supply technology.



**Figure 16.** Electricity Generation mix by supply type in 2020.



**Figure 17.** Electricity Generation mix by supply technology in 2020.

### 3.4.6 Net Import of Electricity

Figure 18 displays the historical timeline of electricity imports in Belize for reference years 2011 to 2020. In 2020, electricity imports decreased to 270.2 GWh in comparison to 2019 which showcased a substantial increase in electricity imports due to the impact of drought-related conditions that hindered local electricity generation. Despite the steady rise of electricity generation in Belize, the quantity of electricity imported has remained constant over the decade, except for the anomalous 2019 year, implying that increasing demand has historically been met by increasing the capacity of local generation sources.

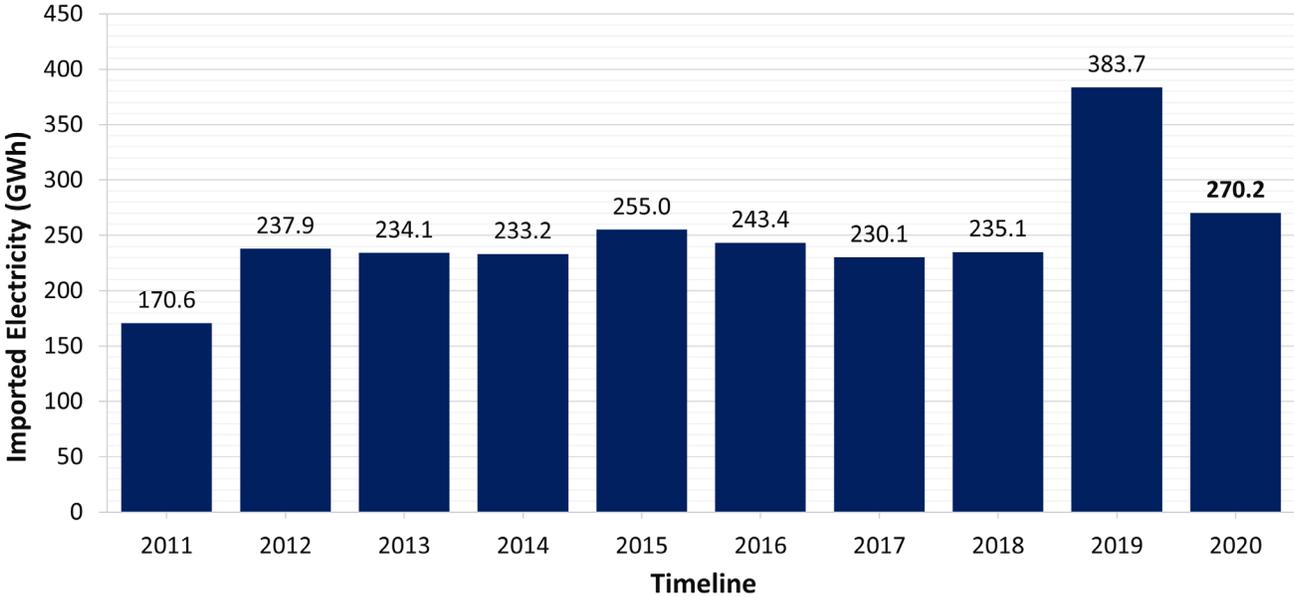


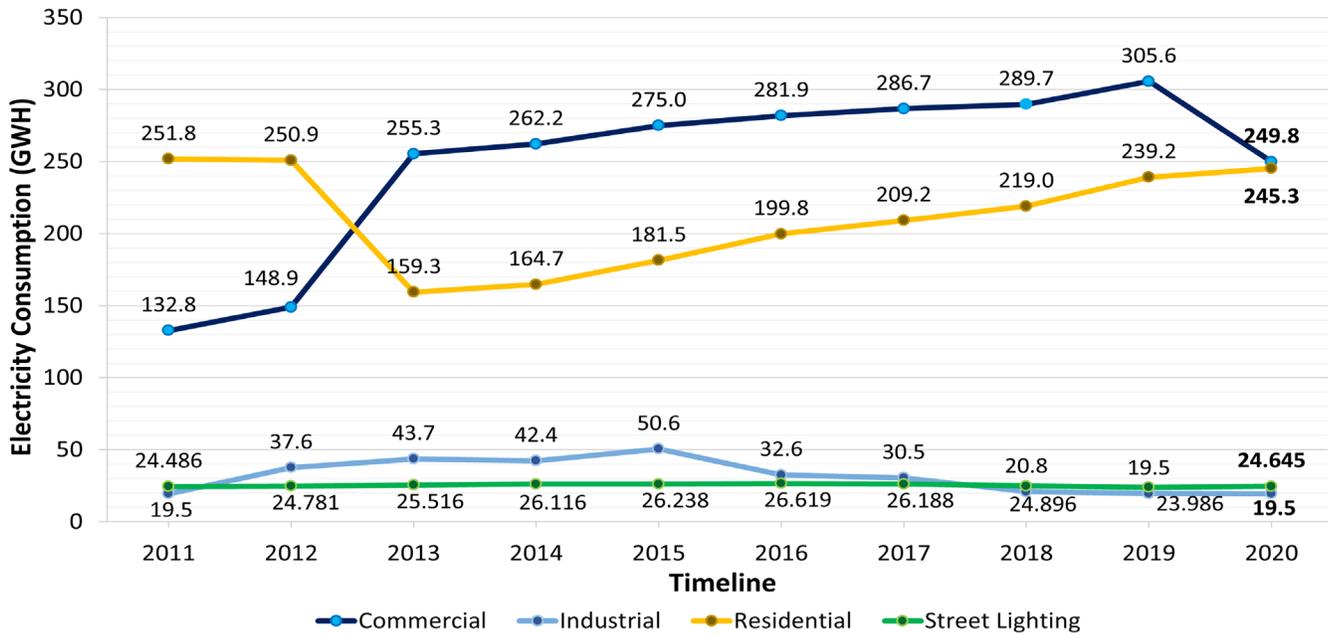
Figure 18. Historical timeline of net Electricity Imports in Belize.

### 3.4.7 Gross electricity consumption by Sector

Figure 19 illustrates electricity consumption in 2020 across 4 main sectors\*. The breakdown of gross electricity consumption by economic sectors is defined by the customer tariff groupings as stipulated by the Belize Electricity Limited. These sectors are Residential, Commercial, Industrial, and Street Lighting. The Commercial sector which encompasses the larger proportion of businesses, manufacturers, and hospitality services in Belize, was responsible for the greatest share of gross electricity consumption, totalling 249.8 GWh in 2020. However, this was a notable deviation from the historical trend, and largely credited to decreased economic activity due to COVID-19 restrictions. Following closely behind is the Residential sector with 245.3 GWh, which has shown steady increases in gross electricity consumption over the historical timeline. Unlike other economic sector, the Residential sector demonstrated an increase in gross electricity consumption in 2020 due to the Covid-19 pandemic. With people spending more time at home due to lockdown measures and a major shift to work from home, combined with an increase in the number of unemployed workers, have driven a surge in residential electricity consumption

\* Sectoral electricity consumption is linked to consumers connected to BEL's national electricity grid.

in 2020. The much smaller Street Lighting and Industrial sectors consumed 24.6 GWh and 19.5 GWh respectively, with the latter sector being representative of a few of the largest single-consumers in Belize. The Street Lighting sector saw an increase in gross electricity consumption as BEL continues its investment in system expansion, thus, increasing the need for more street lights throughout the country.



**Figure 19.** Historical timeline of Electricity Consumption by Sector.

### 3.4.8 Electricity Purchase, Sales and Losses by Distribution Utility

BEL, the national utility, experienced a significant reduction in total electricity sales in 2020. According to BEL (2021), “electricity sales contracted in 2020 by 8.3% to 539.3 giga-watt hours (GWh) from 588.4 GWh in 2019 primarily due to the impact of COVID-19 mitigation measures on commercial activity in Belize”. The total electricity purchased by BEL from various IPPs amounted to 613.7 GWh in 2020, a decrease of 8.3% from 2019 total purchases of 669.2 GWh.

BEL reports that the total Transmission and Distribution losses for the grid add up to 11.8%, disaggregated into 5.5% and 6.3% respectively (Belize Electricity Limited, 2021). It should be noted there is little historical variance for transmission and distribution losses and that these percentages can be considered typical.

# 04

## Environment and Climate Protection

### 4.1 Climate and Sustainability Goals

It is evident that the global climate is changing; thus, presenting increasingly severe risks and impacts to human health and environmental quality. While shifting climate patterns can be considered a natural phenomenon, the main driver behind the recent and rapid shift in the earth's climatic conditions can be linked to anthropogenic activities which have considerably increased the concentration of greenhouse gases within the Earth's atmosphere. In 2015, all parties to the United Nations Framework Convention on Climate Change (hereinafter, UNFCCC), came together to agree upon a set of principles on how to curb greenhouse gas emissions and tackle climate change impacts head on. This was called the "Paris Agreement". With the signing of the Paris Agreement, the stage was set for a paradigm shift where both developed and developing countries pledged to reduce greenhouse gas emissions and adapt to the impacts of climate change (low-carbon and climate-resilient pathway). The overall goal of the Paris Agreement is to "limit global warming to well below 2° Celsius, preferably to 1.5° Celsius, compared to pre-industrial levels" (United Nations Framework Convention on Climate Change, 2021).

The IPCC has issued the dire warning to the international community that a failure to produce a united global effort to curb greenhouse gas emissions will lead to extreme climate risks and impacts on humans, environment, and economic activities (Intergovernmental Panel on Climate Change, 2021). Climate change risks and impacts are already significantly impacting Belize's population and its key economic sectors. As a result, Belize is extremely committed to play its part in the global effort to combat climate change and supports the ambitious goals of the Paris Agreement.

The Government of Belize recognizes the integral role of the energy sector in combating climate change impacts and risk. In this regard, the Government of Belize is committed to increasing emissions reduction by transitioning to a low-carbon sustainable energy pathway. This initiative is backed by numerous policy and strategic documents that outline Belize's energy-related climate and sustainability goals. These include:

#### 4.1.1 Belize Sustainable Energy Strategy and Action Plan

The strategy and action plan which was created in 2015 identified energy efficiency and renewable energy potential for Belize and forms the blueprint for realizing Belize's sustainable energy goals within the electricity sub-sector. The report highlighted Belize's potential and targets based on

a Business-as-usual scenario (BAU) versus a national sustainable energy strategy (NSES) scenario for Belize. Table 5 lists energy-related targets found within the Belize Sustainable Energy Strategy and Action Plan.

**Table 5.** Targets established by the Belize Sustainable Energy Strategy and Action Plan.

Category	Target
Renewable Energy	Renewable energy could represent 89% of supply by 2033.
Electricity Consumption	Improve Energy Efficiency and Conservation by at least 24% by 2033.

**4.1.2 Sustainable Development Goal 7**

In 2015, the 2030 Agenda for Sustainable Development was adopted by the United Nations general assembly. At the core of the agenda lies its Sustainable Development Goals (hereinafter, SDGs) which outline a set of targets and indicators to guide global efforts to end poverty and ensure prosperity for all people while tackling climate change and working to preserve our environment (United Nations, 2017). Of the 17 SDGs created, lies a dedicated and stand-alone goal on Energy, known as SDG 7 – Affordable and Clean Energy. SDG 7’s overall goal is to “ensure access to affordable, reliable, sustainable and modern energy for all”. Under SDG 7, there are 5 energy-related targets (Table 6).

**Table 6.** Sustainable Development Goal 7: Targets.

Title	Target
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	By 2030, double the global rate of improvement in energy efficiency
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support

**4.1.3 Nationally Determined Contributions (NDCs):**

In 2016, Belize presented its first Nationally Determined Contributions (hereinafter, NDCs). Belize’s first NDCs was guided by its Growth and Sustainable Development Strategy (hereinafter, GSDS) and the overarching goal of transitioning to a low carbon development economy while

strengthening its resilience to climate change risks and impacts (Government of Belize, 2016). Within Belize’s first NDCs, mitigation plans and its associated targets were considered action-based and covered multiple sectors. Table 7 showcases energy-related mitigation activities and targets submitted as part of Belize first NDC document.

**Table 7.** Energy-related mitigation activities included in Belize’s first NDC.

<b>Activity</b>	<b>Description</b>	<b>Objective</b>	<b>Projected Reduction</b>	<b>Emission</b>
<b>Fuel wood consumption</b>	Emissions savings potential of efficient cook stoves comes from a reduction of wood used for the same result.	Reduction of fuel wood consumption by 27%-66%, depending on the technology, the duration of cooking and the replacement technology.	2.1 Gg CO <sub>2</sub> per year in 2020 and 12.4Gg CO <sub>2</sub> by 2030. Expected cumulative reduction would be up to 118 Gg CO <sub>2</sub> between 2020 and 2030 (dependent on population growth).	
<b>Transport Sector</b>	Development of a domestic transportation policy and implement the National Transportation Master Plan.	Achieve at least a 20% reduction in conventional transportation fuel use by 2030 and promote energy efficiency in the transport sector through appropriate policies and investments.	No projected emission reduction submitted for this action.	
<b>Sustainable Energy Action Plan</b>	To improve energy efficiency and conservation in order to transform to a low carbon economy by 2033. The plan envisions a reduction in energy intensity per capita at least by 30% by 2033 and to reduce fuels imports dependency by 50% by 2020 using renewable energy.	85% renewable energy by 2030 by implementing hydropower, solar, wind and biomass. Reduction in transmission and distribution losses from 12% to 7% by 2030 resulting in electricity savings.	Reduction in emissions through hydropower projects by 2,514 Gg CO <sub>2</sub> until 2030 or 168 Gg CO <sub>2</sub> per year. Reduction in emission by enhancement of the grid infrastructure would be in the range of 160 - 273Gg CO <sub>2</sub> e until 2030. Reduction in emissions from solar PV projects would be around 518 Gg CO <sub>2</sub> until 2030. Reduction in emissions from bagasse would be 947 Gg CO <sub>2</sub> by 2030.	

## 4.2 National Greenhouse Gas Emissions

Like most economies, anthropogenic activities are largely dependent on the combustion of fossil fuels, which represents the main source of human-induced greenhouse gas emissions. According to the International Energy Agency (2021), the energy sector accounts for two-thirds of total greenhouse gas emissions globally. Thus, forming an integral part of greenhouse gas emission inventories and placing the energy sector at the heart of any initiative to combat climate change. The most recent GHG Inventory report covers reference years 2018 and 2019 and is the first sector specific inventory prepared directly by the Energy Unit, within the Ministry of Public Utilities, Energy and Logistics\*. In summary, the energy sector GHG inventory report snapshot can be found below:

### 4.2.1 Total GHG Emissions for Energy Sector

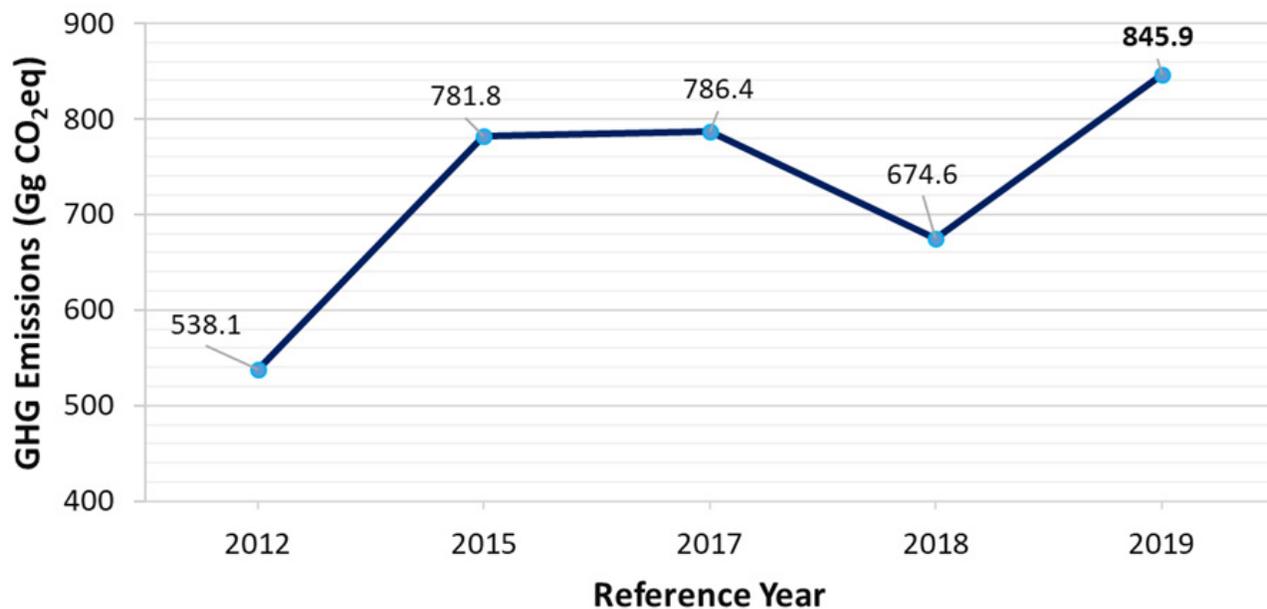
The global warming potential-weighted emissions of direct greenhouse gases in the energy sector in Belize are presented in terms of equivalent emissions of carbon dioxide (CO<sub>2</sub>), using units of gigagrams of carbon dioxide equivalents (Gg CO<sub>2</sub> eq). As Figure 20 indicates, there was a decline in total gross GHG emissions in 2018 amounting to 674.6 Gg CO<sub>2</sub> eq which represents a decrease of 14.21% in comparison to the previous reference year. Following the decline in 2018, total gross GHG emissions in Belize's energy sector rose sharply to 845.9 Gg CO<sub>2</sub> eq representing an increase of 20.3% in comparison to the previous reference year. With Belize experiencing severe drought conditions in 2019, the electric utility, BEL, was forced to supply renewable generation shortfall with fossil fuels and increased electricity imports. For this reason, electricity generated from fossil fuels displayed substantial increases leading to significant increases in GHG emission from electricity generation in 2019 compared to 2018 and previous reference years.

### 4.2.2 Total GHG Emission by Energy Sub-Sectors

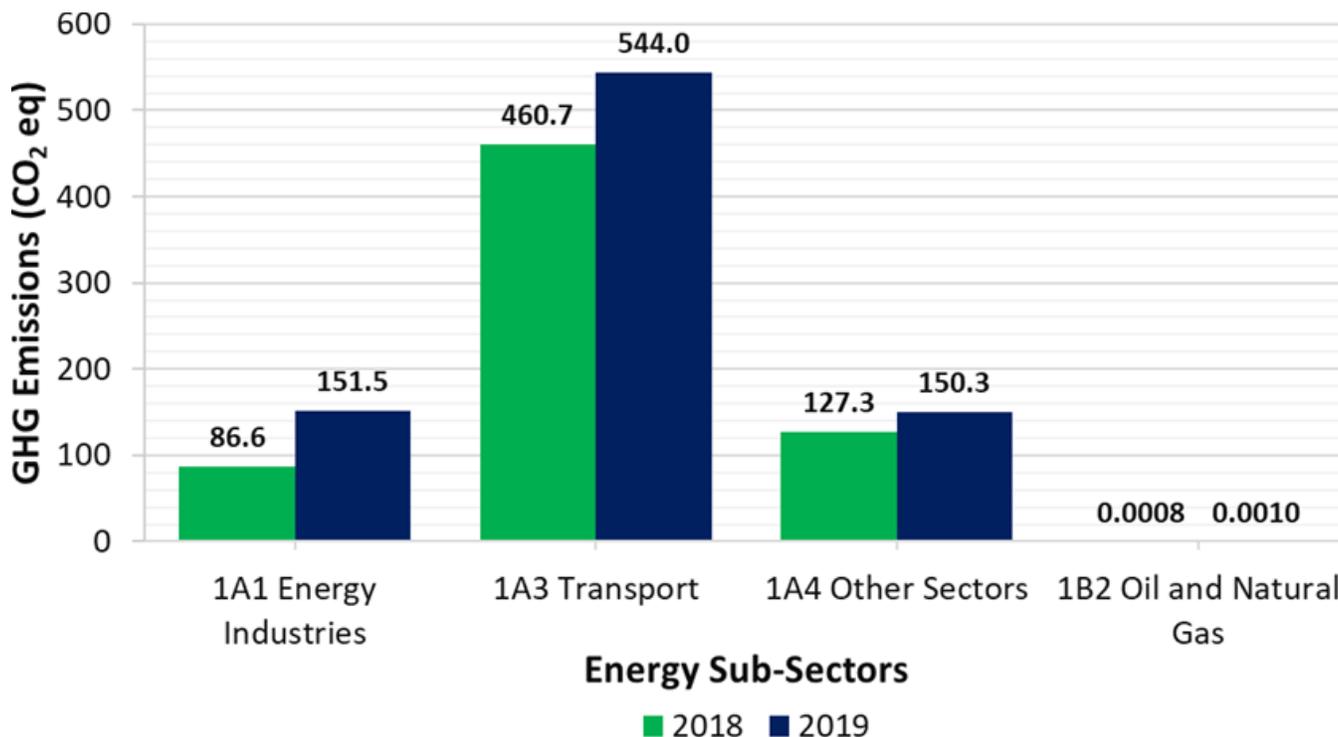
Figure 21 indicates the proportion that each energy sub-sector contributed to Belize's gross GHG emissions. Within the energy sector, the transport sub-category represents the largest source of emissions by a sizable margin equating to 460.7 and 544.0 (Gg CO<sub>2</sub> eq) in 2018 and 2019, respectively. The transport sub-sector was followed by other sectors, energy industries and fugitive emissions. All other sub-sectors displayed steady increases in emissions over the timeline, with the energy industries sub-sector showing the largest growth in emissions between 2018 and 2019. The fugitive emission sub-sector is being reported for the first time; however, it produced comparatively small amounts of GHGs compared to the other sub-sectors.

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\* GHG Energy Sector Report (2018 – 2019) - pending approval by the National Climate Change Office.



**Figure 20.** Total Direct GHG Emissions for the Energy Sector over reference years 2012-2019.\*



**Figure 21.** Total GHG emissions (Gg CO<sub>2</sub> eq) by sub-sectors in 2018 and 2019.

\* Data for reference years 2012, 2015 and 2017 taken from Belize's fourth GHG Inventory Report.

# 05

## Energy Prices

### 5.1 Mean Electricity Rate

The annual tariff review process carried out by the Public Utilities Commission resulted in the Mean Electricity Rate (hereinafter, MER) increasing slightly from 0.421 BZD/KWh in 2019 to 0.422 BZD/KWh in 2020, becoming effective since January 1, 2020. The annual average cost of power sold in 2020 was 0.220 BZD/KWh, a significant decrease from the 0.319 BZD/KWh of 2019. As shown in Figure 22, variable rates of the past decade have been more stable in the last two years.

The effects of the 2018-2019 drought have largely been mitigated in terms of renewable energy generation, resulting in a decreased dependence on electricity imports from Mexico's CFE as well as from local fossil fuel generating plants. The reduced cost of power in Belize was further impacted by decreases in CFE's energy price brought on by plunging global oil prices as a result of reduced demand for oil due to the Covid-19 pandemic (Belize Electricity Limited, 2021). This aided in the overall decrease in the annual average cost of power in 2020.

Changes in national demand caused by the Covid-19 pandemic have resulted in incidental revenue volatility for BEL, thus, providing justification for the PUC-approved rate increase seen in the MER.

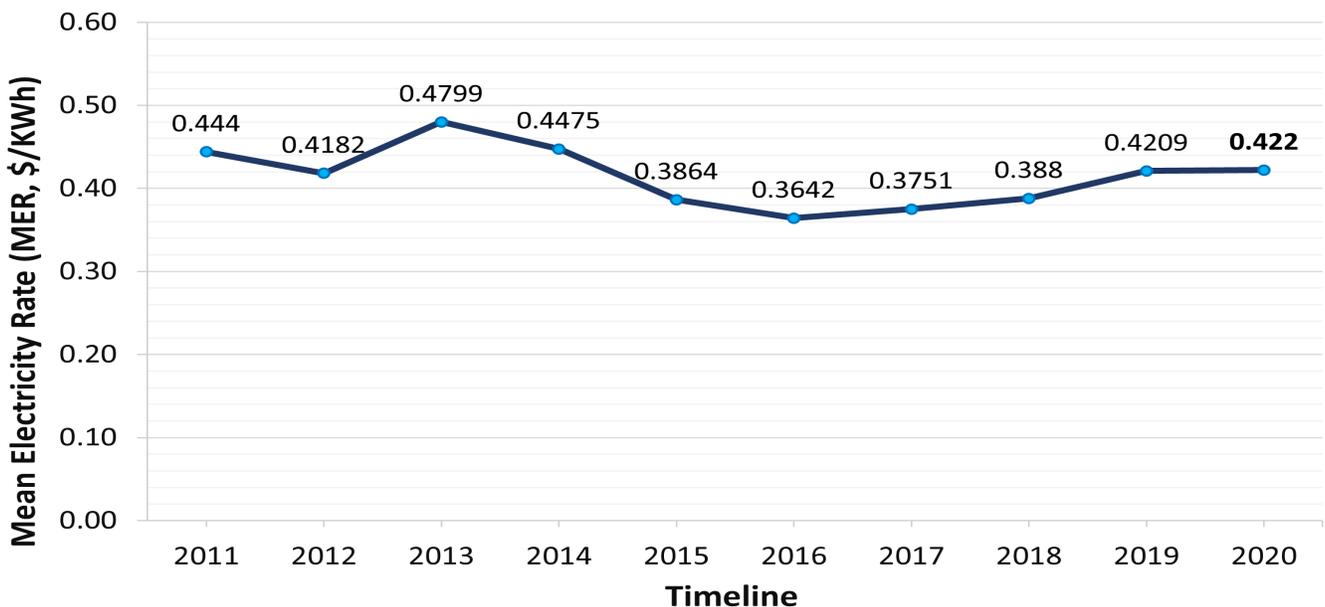


Figure 22. Historical timeline of Mean Electricity Rate (MER, \$/KWh) in Belize.

## 5.2 Annual Average Pump Price for Conventional Refined-Petroleum Fuels

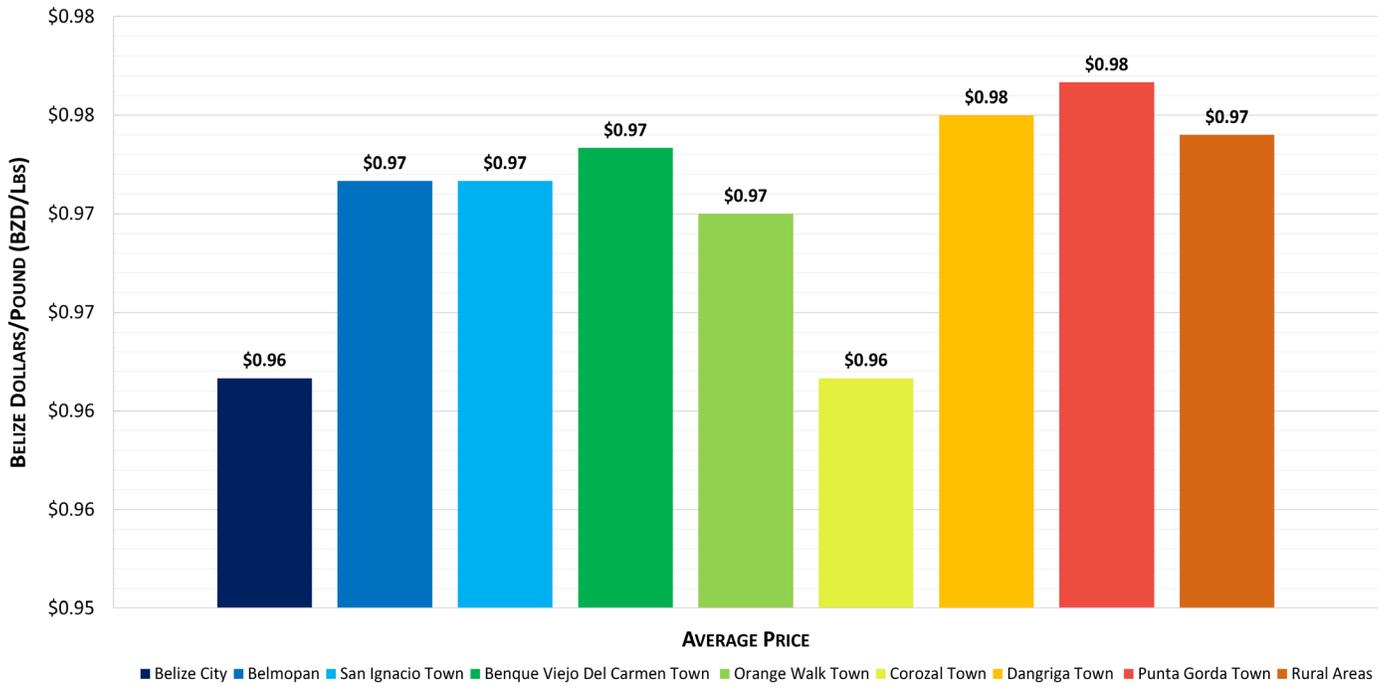
For the purpose of this report, conventional transportation fuels are said to include premium gasoline, regular gasoline, and diesel. Figure 23 displays the average pump price of premium gasoline, regular gasoline, and diesel in 2020. For premium gasoline, the lowest pump price in 2020 was \$8.23 BZD per gallon, with the highest pump price totalling \$10.99 BZD (the highest pump price among all conventional transportation fuel prices in 2020). In 2020, premium gasoline had an annual average pump price of \$10.00 BZD per gallon. In 2020, annual pump prices for regular gasoline ranged between \$7.26 - \$10.28 BZD, with an annual average pump price of \$9.08 BZD per gallon. The pump price of diesel varied in 2020 between \$7.28 and \$10.29 BZD, averaging at \$8.59 BZD per gallon.



**Figure 23.** Annual average pump price for conventional refined-petroleum fuels in 2020.

## 5.3 Annual Average Price for Liquefied Petroleum Gas (LPG)

LPG is largely consumed as a cooking fuel across all sectors, and more uncommonly, as a transport fuel for butane-adapted vehicles. Figure 24 displays average LPG retail prices across Belize in 2020. For the retail price of LPG, the average 2020 price was \$0.97 BZD per pound in the inland municipalities of San Ignacio-Santa Elena, Benque Viejo, Orange Walk, and Belmopan. In the border/entry municipalities of Belize City and Corozal Town, the average price was lower overall at \$0.96 BZD per pound. In the outlying municipalities, the average price was higher at \$0.98 in Dangriga and Punta Gorda Town. The average price in rural areas, which includes all locales outside of the aforementioned municipalities, totalled \$0.97 BZD per pound. These prices are standardized by the Government of Belize and enforced by the Belize Bureau of Standards.



**Figure 24.** Average LPG Retail Prices across Belize in 2020.

# Contact Information

The Energy Unit is a subsidiary of the Ministry of Public Utilities, Energy and Logistics. Postages are sent to the main ministry, while personal contact or referral can be accessed through the following phone and email addresses. The Energy Unit finds it imperative to make efforts to continuously improve these publications (both content and design) with the assistance of energy stakeholders and user feedback. Thus, any feedback by way of comments and suggestions would be greatly appreciated!



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# BELIZE ANNUAL ENERGY REPORT

Ministry of Public Utilities, Energy & Logistics

