MPUELE 20

ENERGY REPORT

MPUELE
MINISTRY OF PUBLIC UTILITIES, ENERGY, LOGISTICS & E-GOVERNANCE
"Building a green future via Service, Innovation & Transformation!"

ENERGY UNIT

LAIT UP BELIZE!

Funded by the European Union

www.mpuele.gov.bz www.energy.gov.bz

PRESENTED BY MINISTRY OF PUBLIC UTILITIES, ENERGY, LOGISTICS & E-GOVERNANCE

Imprint

September 2024

Citation:
Energy Unit, Government of Belize. (2024). 2023 Belize annual energy report. Ministry of Public Utilities, Energy, Logistics, and E-Governance. Belmopan City, Belize.

Acknowledgements

Prepared by: **Geon C. Hanson and Areli J. Sutherland.**

Designed by: **Bridget Rhys**

Printed by: **The European Union**

The authors and the Ministry extend their gratitude to the Line Ministries and Departments within the Government of Belize, Belize Electricity Limited (BEL), the Public Utilities Commission (PUC), Independent Power Producers (IPPs), Belize Natural Energy Limited (BNE), Farmers Light Plant Corporation (FLPC), the National Gas Company (Belize) Limited, Puma Energy Bahamas S.A. (PUMA Energy), the Statistical Institute of Belize (SIB), and other national energy data providers for their valuable contributions to this publication.

Foreward

The world's energy system continued to experience major changes in 2023 stemming from economic and geopolitical developments and climate change impacts. The urgency for sustainable energy solutions has never been more pronounced, with countries grappling with the predicament of ensuring energy security while accelerating their efforts to combat the impacts of climate change. Having major implications for modern economies, Energy, must be considered central to global climate action.

Notably, human-induced climate change has spurred devastating consequences of recent around the world – infrastructure destruction, loss of livelihood, degradation of ecosystems, and the displacement of populations, which underscores the importance of shifting to a low-carbon economy with full commitment to reducing greenhouse gas emissions. The positive aspect is that governments worldwide are advancing energy sustainability by implementing policies that promote renewable energy as a cost-effective and reliable power source, enhance energy efficiency, decrease reliance on fossil fuels, and stabilize energy supplies to curb inflation. Belize is no exception in this global effort.

Having recognized our vulnerability to the impacts of climate change, Belize has made significant strides to align its national energy policies with international commitments, including the Sustainable Development Goals (SDGs) and the Paris Agreement. The National Energy Policy (2023-2040) underscores our dedication to a sustainable and resilient low-carbon energy pathway as we become a key contributor to global climate action. Belize's journey toward a low-carbon energy future is about more than just meeting targets; it's about embracing a holistic approach to energy sustainability that benefits both its people and the planet.

This Annual Energy Report for 2023 provides a comprehensive overview of Belize's energy sector, examining key trends, statistics, and developments over the past year. It highlights the progress made towards achieving the country's energy goals and the challenges and opportunities that lie ahead. In doing so, it aims to support analysts, policy makers, and the public in making informed decisions that drive sustainable energy initiatives.

I extend my sincere gratitude to the dedicated team within the Ministry of Public Utilities, Energy, Logistics, and E-Governance for their work in producing this report. To our partners and stakeholders who provided invaluable support throughout the process, I thank you! Together, we are actively contributing to advancing Belize's energy agenda and so, shaping a sustainable and resilient energy future for all!

Hon. Michel Chebat

HON. MICHEL CHEBAT, SC.
MINISTER, MINISTRY OF PUBLIC UTILITIES, ENERGY, LOGISTICS & E-GOVERNANCE

Contact Information

The Energy Unit is a subsidiary of the Ministry of Public Utilities, Energy, Logistics, and E-Governance in Belize. Correspondence should be addressed to the main ministry, while personal contact or referrals can be made via the following phone number and email address. Any questions, comments, or suggestions are welcome.

MPUELE
MINISTRY OF PUBLIC UTILITIES, ENERGY, LOGISTICS & E-GOVERNANCE
"Building a green future via Service, Innovation & Transformation!"

ENERGY UNIT

Ministry of Public Utilities, Energy, Logistics, and E-Governance

Second Floor, Toucan Plaza,
7299 George Price Boulevard
Belmopan City, Cayo District
Belize.

Telephone: +501 828-5986
Email: g.hanson@energy.gov.bz
Website: www.energy.gov.bz or www.mpuele.gov.bz

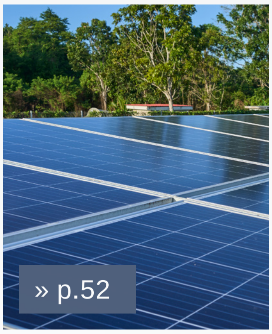
Table of **Contents**


» p.16


» p.24


» p.32


» p.42


» p.52


» p.62

List of **Tables**

List of **Figures**

List of **Figures**


MINISTRY OF PUBLIC UTILITIES, ENERGY
"Building a green future via Service, Innovation & ...
www.energy.gov.bz
THE BELIZE RURAL ELECTRIFICATION PROJECT WAS FINANCED
BY THE ABU DHABI FUND FOR DEVELOPMENT UNDER
THE UAE-CARIBBEAN RENEWABLE ENERGY FUND.
THE PROJECT WAS IMPLEMENTED BY MASDAR IN
COLLABORATION WITH THE UAE MINISTRY OF FOREIGN AFFAIRS,
THE GOVERNMENT OF BELIZE THROUGH THE MINISTRY OF PUBLIC UTILITIES,
ENERGY, LOGISTICS & E-GOVERNANCE AND BELIZE ELECTRICITY LIMITED.
THE PROJECT WAS COMMISSIONED ON OCTOBER 31st, 2022.
MPUELE
MASDAR

Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
BAPCOL	Blair Athol Power Company Limited
BEL	Belize Electricity Limited
BELCOGEN	Belize Co-Generation Energy Limited
BNE	Belize Natural Energy Limited
CCK	Caye Caulker
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CDM	Clean Development Mechanism
CEPAL (Spanish)	Economic Commission for Latin America and the Caribbean
CFE	Comisión Federal de Electricidad (state-owned utility of Mexico)
DG	Distributed Generation
FLPC	Farmer’s Light Plant Corporation
EBT	Energy Balance Table
GDP	Gross Domestic Product
GEF	Grid Emission Factor
GHG	Greenhouse Gas
HDI	Human Development Index
IEA	International Energy Agency
IRENA	International Renewable Energy Agency
IRES	International Recommendations for Energy Statistics
IPP	Independent Power Producer
IPPC	Intergovernmental Panel on Climate Change
LAC	Latin America and Caribbean
LED	Light-Emitting-Diode

LPG	Liquified Petroleum Gas
MER	Mean Electricity Rate
NDC	Nationally Determined Contributions
PPA	Power Purchasing Agreement
PUC	Public Utilities Commission
PUMA	Puma Energy Bahamas S.A.
PV	Photovoltaic
RE	Renewable Energy
SDG	Sustainable Development Goal
SIB	Statistical Institute of Belize
SIDS	Small Island Developing States
SSEL	Santander Sugar Energy Limited
TPES	Total Primary Energy Supply
TJ	Terajoules
UB	University of Belize

Key Findings

Energy Intensity Down

Year-on-Year Improvement

0.170 toe/$1000 USD

In 2022

Total Energy Supply

17,724.8 TJ

In 2023

Hydrocarbon Production

Crude Oil Down 10.1%

Natural Gas Down 27.2%

Crude Oil: Sold locally and exported

70.8% **Energy Import** Share of Total Energy Supply

Imports accounted for 99.5% of total energy trade.

Main Imports: Petroleum products (liquid state)

Production led by **Hydro-electric plants**

38% **Renewable Energy** Share in the Electricity Mix in 2023

Down from 52.9% in 2022

Peak Demand: 127.2 MW

Highest on record

Generation Capacity

In-Country
134.7 MW

Imports (CFE, Mexico)
50 MW

Petroleum Products Prices

$$$ down year-to-year

Energy prices in Belize are consistently highest across all fuel types in comparison with other Central American countries.

Mean Electricity Rate (MER) **$0.402 BZD/kwh** Electricity prices have remained mostly stable

Belize has higher electricity costs compared to most of its Central American counterparts (2022).

Non-Renewable Thermal Plants, are most expensive and price volatile

Largest Share - Final Energy Consumption

By Fuel Type		By Sector	
Gasoline Diesel	Electricity	Transport	Residential

Energy GHG Emissions

Upward Trend - **845.9 Gg CO2eq**

In 2019

Transport Sub-sector: most significant contributor

Introduction

1.1 OVERVIEW OF REPORT

As a critical enabler of social and economic development, energy has played, and will continue to play, a significant role today and for generations to come, serving as the foundation of all modern economies. For Belize, a country with a relatively small economy on the northeastern coast of Central America, energy is a vital component that supports essential services, drives industrial growth and innovation, and enhances the quality of life for its citizens. The tangible benefits of the energy sector for Belizean society are far-reaching and extend across various facets of the economy, including agriculture, production, and transportation, shaping the nation's productivity and competitiveness. Belize's economic stability and growth are heavily dependent on effective energy management and sustainable practices, highlighting the insights in this report as indispensable.

In 2023, Belize's energy sector experienced significant developments and challenges. The continued global energy market fluctuations, deeply influenced by geopolitical tensions and the efforts of governments around the world to implement the Paris Climate Agreement, have had considerable impacts on the Latin American and Caribbean (LAC) region, including Belize.

The 2023 Belize Annual Energy Report provides a comprehensive analysis of the country's energy landscape, offering critical insights and data essential for policymakers, international partners, industry stakeholders, academia, and the public. This fifth edition of the Belize Annual Energy Report builds on previous editions, incorporating the latest developments, trends, and statistics to present a current and accurate picture of Belize's energy sector.

This report highlights key aspects of energy supply, trade, consumption, pricing, and the environmental impact of energy activities. Accordingly, this document aims to:

- Provide essential data to support informed policy decisions and strategic planning.
- Monitor and evaluate the progress and effectiveness of energy policies and initiatives.
- Ensure transparency by making comprehensive data and analysis accessible to all stakeholders.
- Serve as a valuable resource for academics and analysts studying Belize's energy dynamics.

The report is organized into six chapters, each focusing on a specific aspect of the energy sector:

1. **Introduction:** This chapter sets the stage for the report, outlining its scope and structure. It also highlights the Belize Energy Policy Framework, providing context for the strategic direction in the energy sector.

2. **Overview:** This chapter presents Belize's National Energy Balance and key Energy Indicators, offering a high-level summary of the current state of the energy sector, including major trends over the past decade and the past year.

3. **Energy Supply and Final Consumption:** This chapter examines the sources of energy supply and their contribution to the overall energy mix. It also provides an analysis of energy production, trade, and consumption patterns.

4. **Electricity Sector:** This chapter focuses on the electricity market, covering aspects of electricity capacity, generation, sales, and trade data. It also explores the role of renewable energy sources in electricity generation.

5. **Energy Prices:** This chapter offers an analysis of energy prices across different segments, including petroleum products and electricity. It compares Belize's energy prices with regional benchmarks.

6. **Environment and Climate Protection:** This chapter highlights energy sustainability goals, greenhouse gas (GHG) emissions from the energy sector, and initiatives aimed at reducing carbon emissions and enhancing energy efficiency.

The Belize Annual Energy Report aims to provide a clear understanding of the current energy landscape while offering valuable insights for future developments in the sector.

1.2 ENERGY POLICY FRAMEWORK

Energy systems are a powerful tool for sustainable development, but the key challenge is expanding access to affordable, reliable, and adequate energy services while addressing environmental impacts at all levels. To achieve this, significant policy changes are needed within the broader enabling environment (United Nations Development Programme, 2000). As the energy landscape rapidly evolves, there is an urgent need for energy policies that reflect the needs and inputs of various stakeholders to effectively address emerging challenges.

In Belize, the energy policy landscape began in 2012 when the Government of Belize endorsed the National Energy Policy Framework, outlining the country's strategic approach to energy management. This policy aimed to foster sustainable energy development by integrating energy more deeply into Belize's development, enhancing energy security, and promoting energy efficiency and renewable energy sources. The National Energy Policy Framework highlighted the need for energy planning which led to the formulation of the Belize Energy Unit, acting as the administrative agent of the energy sector responsible for planning and policymaking.

Following the National Energy Policy Framework, the National Sustainable Energy Strategy and Action Plan was developed and endorsed in 2015. This strategic policy document outlines a comprehensive approach to achieving energy security, sustainability, and economic development through the increased use of energy efficiency measures and renewable energy sources. The plan details the integration of diverse renewable energy and energy-efficient technologies across key sectors and the promotion of energy conservation practices. It also emphasizes capacity building, regulatory reforms, and international cooperation to support these initiatives, ensuring resilient and sustainable energy system for Belize.

The National Energy Policy Framework, which initiated the national energy agenda in 2012, along with the subsequent energy-related strategies, remains relevant but needs to be updated due to technological advancements and shifting global energy markets. Therefore, it is imperative to develop a new energy policy framework that addresses the current needs of Belize's economy, environment, and citizens.

1.2.1 NATIONAL ENERGY POLICY 2023

The Government of Belize is committed to delivering a sustainable, secure, and affordable energy future for all Belizeans. To reinforce this commitment, the Government of Belize launched the new National Energy Policy 2023-2040 in November 2023 (Figure 1). The policy, approved by the Cabinet, articulates a new energy agenda for the country and seeks to "improve the country's ability to effectively manage the energy sector, stimulate social and economic development through the energy sector and other cross-cutting sectors, and improve the sector's contribution to achieving Belize's updated Nationally Determined Contributions" (Ministry of Public Utilities, Energy, Logistics, and E-Governance (MPUELE), 2023).

The National Energy Policy 2023-2040 aims to transform the energy sector into a driver of sustainable development and economic growth by implementing comprehensive energy strategies, introducing new regulations and investing in energy infrastructure. These efforts will significantly contribute to the country's medium-term development plans and climate commitments. The policy outlines seven key objectives, as detailed below:

1. **Reduce Cost of Energy Services:**
    a. Energy Intensity Reduction: Collaboration among key ministries and stakeholders to lower energy costs through reduced energy intensity.

2. **Increase Indigenous Energy Sources in the Energy Supply Mix:**
    a. Research and Development: Establish mechanisms for research on indigenous energy sources.
    b. Fair Procurement: Implement transparent procurement processes for new investments.
    c. Public-Private Partnerships: Attract investments to boost local energy production and reduce costs.

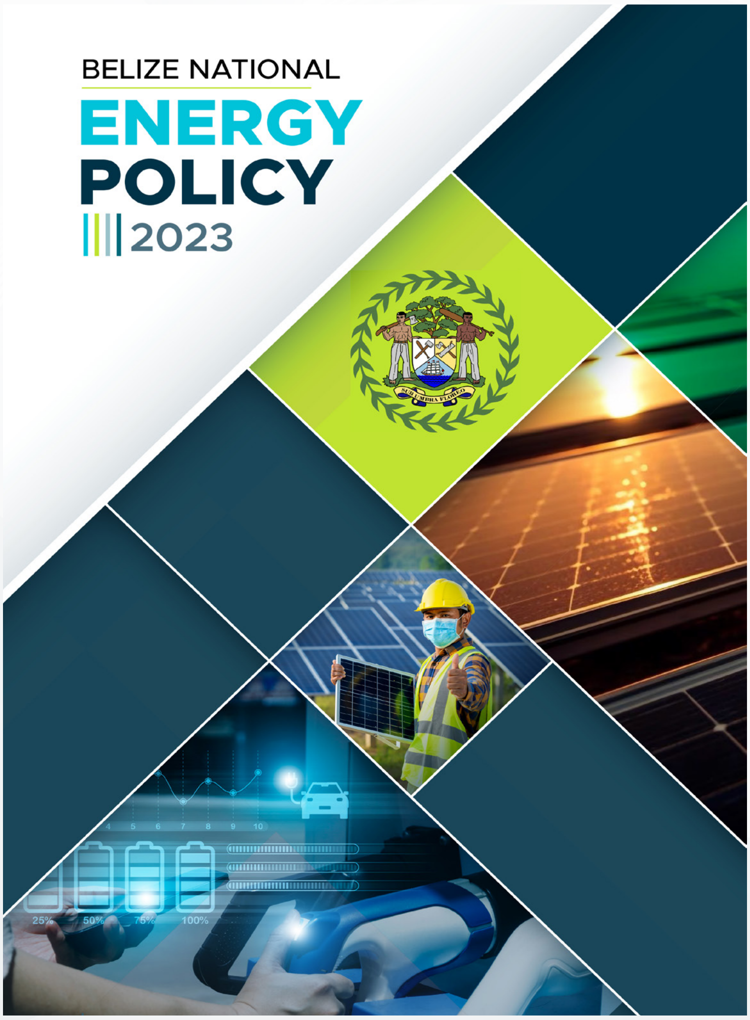
3. **Increase Access to Energy Services:**
    a. Universal Access: Provide universal basic energy services to all citizens and enterprises by 2030.
    b. Grid-Tie and Microgrid Solutions: Support programs utilizing these solutions to ensure comprehensive access.
    c. Clean Energy Access: Create an environment for access to clean and affordable energy services.

4. **Improve Contribution to the Updated National Determined Contributions (NDCs):**
    a. Multi-Sectoral Team: Establish a team to ensure the energy sector meets its NDC targets.

5. **Improving Governance in the Energy Sector:**
   a. Central Governing Body: Establish a central governing body (Department) by law.

6. **Strengthen Energy Management Capabilities:**
   a. Establish an autonomous procurement agency to manage energy infrastructure and services.
   b. Public Utilities Commission (PUC): Strengthen the legislative and operational capacity of the PUC.
   c. National Energy Company: Establish a company to manage government investments in the energy sector.

7. **Increase Access to Energy Information:**
   a. Provide comprehensive and accessible energy information to stakeholders to support informed decision-making.



» Figure 1. Belize National Energy Policy 2023

The policy urges a collaborative approach across various sectors to ensure cohesive and effective implementation. This collaborative approach must be embedded within robust governance and regulatory improvements, as these foundational decisions are crucial for the successful implementation of the policy's strategic objectives. Additionally, the National Energy Policy 2023-2040 underscores the importance of resource mobilization and investment in achieving its energy goals. Overall, the Belize National Energy Policy 2023-2040 serves as a comprehensive and forward-looking guide aimed at transforming Belize's energy market into a resilient, sustainable, and economically vibrant sector, while aligning with global climate commitments and ensuring equitable access to energy services for all Belizeans.

1.2.2 ELECTRICITY REGULATORY REFORM, BYLAWS

A renewables-based energy transition is key to avoiding the worst effects of climate change (International Renewable Energy Agency, 2022). A major component of this transition is the conversion of electricity generation from carbon-derived energy sources to renewable energy solutions. As such, a fast-growing feature of modern electricity systems is the application of distributed generation (DG). DG refers to the generation of electricity from sources, often renewable, located near the point of use, rather than from centralized power plants (US Department of Energy, 2024). Deploying DG offers a multitude of benefits, including diversifying energy production sources, reducing transmission and distribution losses, improving grid stability and resilience, minimizing environmental impact, and decreasing the need for new utility generation capacity investments (Stein, 2024; Greening the Grid, n.d.). Consequently, it is increasingly important to consider sustainable DG options and the challenges of integrating DG into Belize's grid.

Under the PUC, regulator for the electricity sector in Belize, a process for the revision of the "Electricity Licensing and Consent Regulations" was initiated in 2023. According to the PUC, the newly proposed regulations aims to modernize the existing regulatory environment for electricity supply, transmission, distribution, and storage. These regulations represent a transformational shift in the electricity sector by making provisions for the integration of renewable energy sources through the expansion of licensing categories. The proposed range of electricity licensing categories accommodates various energy producers, ranging from small residential generators to large-scale utility projects such as wind and solar farms. Concurrently, an application for a revised tariff schedule that reflects both consumption and production (grid-tied distributed generation and feed-in) was submitted by Belize Electricity Limited (BEL) to the PUC. This application examined demand rates and provisions for selling excess electricity back to the grid. These regulatory changes in the electricity sector represent a significant decision point in Belize's pursuit of a more sustainable and resilient energy future, where distributed energy source integration forms a part of a modern and smart energy system.

By leveraging the use of the amended regulations, the aim is to encourage and accelerate the penetration of distributed generation, bringing Belize closer to its renewable energy targets.

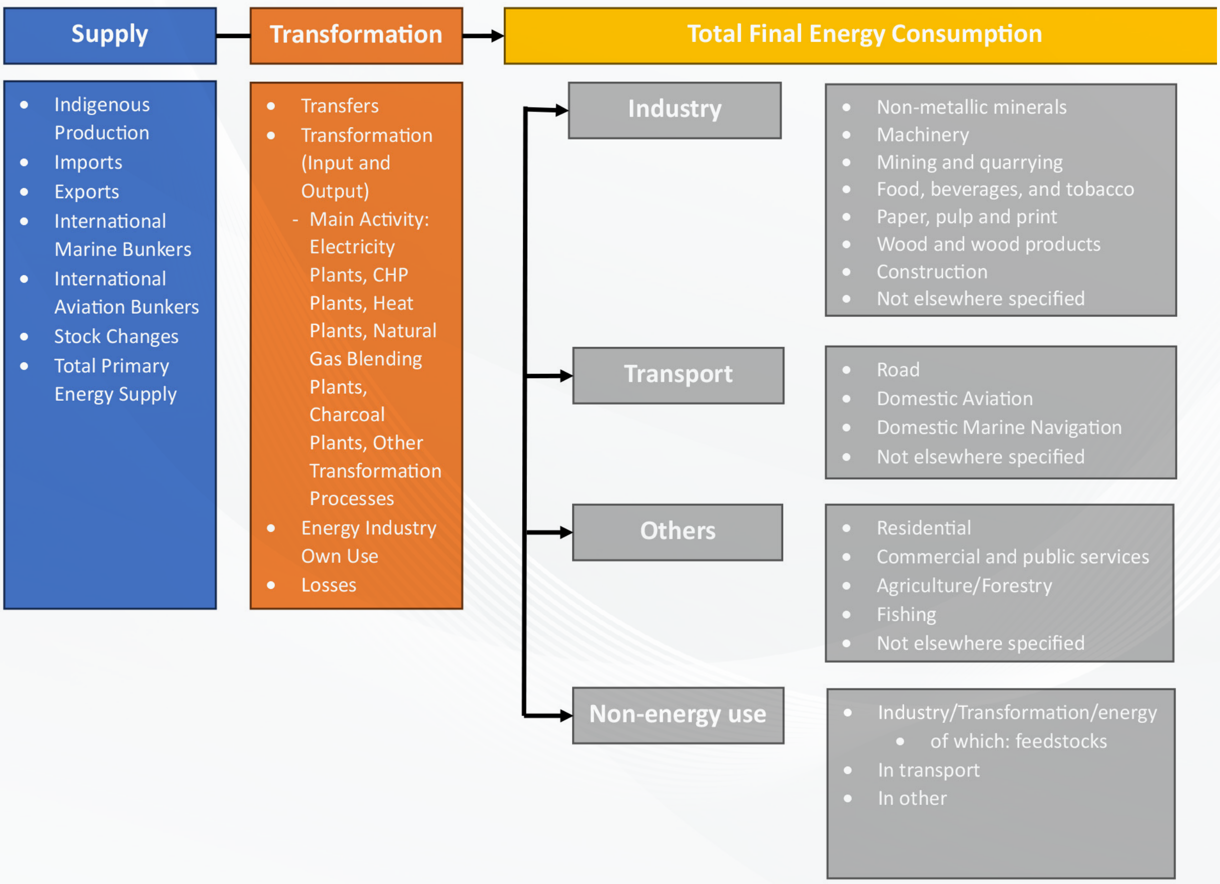
The National Energy Policy aims to enhance the regulatory environment to support DG and Grid Connectivity, ensuring a resilient & sustainable energy infrastructure.

2 OVERVIEW

2.1 ENERGY BALANCE

According to the International Recommendations for Energy Statistics (2017), an energy balance "is an accounting framework for the compilation and reconciliation of data on all energy products entering, exiting, and used within the national territory of a given country during a reference period." Overall, an energy balance acts as a foundational tool for gathering insight into a country's energy dynamics. Consistent and precise reporting is crucial for informed decision-making, effective strategic planning, and fostering a framework to assess the effectiveness of initiatives aimed at attaining both national and global energy and environmental goals.

The energy balance table (EBT) presents the supply-to-demand flow of all energy products (Figure 2). Belize's energy balance for 2023 is presented in Table 1[1], showing energy flows in energy equivalence, terajoules (TJ).



» Figure 2. Energy Flow in the Energy Balance

1 Detailed Energy Balance table can be found in Appendix B, Table 7.

» Table 1. Belize Energy Balance, 2023 (Simplified format)

Energy Flows Energy Products	Crude oil	Natural gas	Oil products1	Hydro	Solar	Biofuels 2,3	Electricity 4,5	Heat	Total
Indigenous Production	917.3	34.2	-	636.1	23.4	4,609.6	-	-	6,220.6
Imports	-	-	11,001.3	-	-	-	1,550.4	-	12,551.7
Exports	-57.9	-	-	-	-	-	-	-	-57.9
International marine bunkers	-	-	-	-	-	-	-	-	0.0
International aviation bunkers	-	-	-1,027.1	-	-	-	-	-	-1,027.1
Stock changes (+/-)	45.2	-	-	-	-	37.5	-	-	82.7
Total Energy Supply (TES)	**904.7**	**34.2**	**9,974.2**	**636.1**	**23.4**	**4,647.1**	**1,550.4**	**0.0**	**17,770.0**
Statistical Difference	11.4	0.0	0.0	0.0	0.0	37.5	3.2	0.0	52.2
Transfers	-	-	-	-	-	-	-	-	0.0
Transformation Processes	-176.4	-	-907.8	-636.1	-23.4	-3,997.8	1,515.3	-	-4,226.2
Energy Industry Own Use	-21.8	0.0	-2.1	0.0	0.0	0.0	-269.6	0.0	-293.5
Losses	-	-34.2	-	-	-	-	-337.7	-	-371.9
Total Final Energy Consumption	695.1	0.0	9,064.4	0.0	0.0	611.8	2,455.1	0.0	12,826.3
Manufacturing Sector	527.0	0.0	0.0	0.0	0.0	0.0	119.8	0.0	**646.8**
Transport	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6,682.2**
Road	-	-	6,476.1	-	-	-	NR	-	6,476.1
Domestic Aviation	-	-	206.1	-	-	-	-	-	206.1
Domestic Marine Navigation	-	-	NR	-	-	-	-	-	0.0
OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5,497.3**
Residential	-	-	2,382.2	-	-	611.8	938.5	-	3,932.5
Commercial and Public services	125.9	-	-	-	-	-	1,396.7	-	1,522.6
Agriculture/Forestry	42.2	-	-	-	-	-	-	-	42.2
NON-ENERGY USE	0.0	0.0	NR	0.0	0.0	-	0.0	0.0	**0.0**

Notation: - = Not Applicable, NR = Data Not Reported | Notes: 1 Oil products: Motor Gasoline, Diesel Oil, Kerosene, Fuel Oil, Aviation Fuels, and Liquified Petroleum Gas. 2 Biofuels: Bagasse and Firewood. 3 Figures exclude distributed generation from renewable sources.

2.2 ENERGY INDICATORS

The energy sector remains a primary driver of climate change, as it is responsible for a significant portion of global CO2 emissions. Therefore, the demand for a global shift toward clean energy is of utmost necessity to mitigate the risks and impacts of climate change. In this context, the United Nations Sustainable Development Goal (SDG) 7 calls for the delivery of affordable, reliable, sustainable, and modern energy for all. In conformity with national objectives, countries aim to develop and use energy indicators to track targets and progress towards the energy transition, with a focus for enhanced actions that will act as levers to accelerate change.

The measurement of progress stemming from sustainable energy actions requires a multifaceted approach, as no single metric can encompass the entire scope of the transition toward clean energy. Nevertheless, energy indicators can break down high-level climate and energy objectives into metrics that assess the current conditions of the energy system at play. Energy indicators provide critical insights to assist policymakers, analysts, and academia in understanding the effectiveness of existing energy policies and in developing energy strategies for sustainable development and an equitable energy transition. Overall, the energy indicators presented here are vital for driving the energy agenda and form a cornerstone of Belize's national energy policy framework.

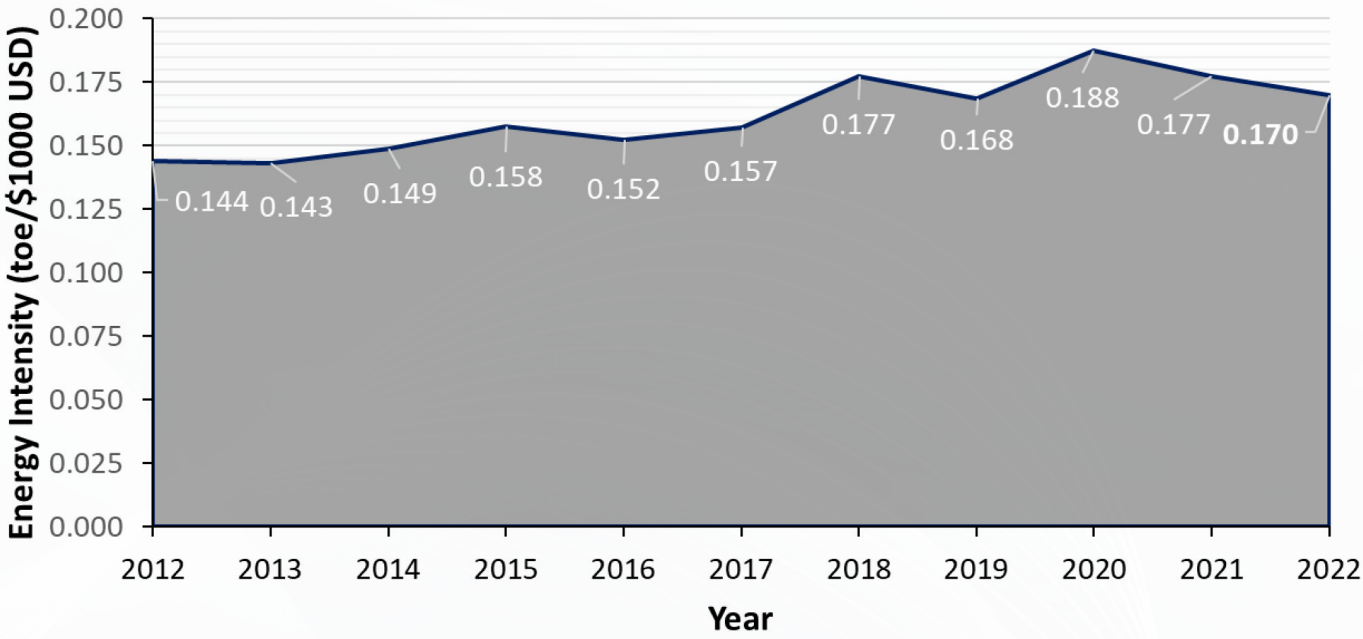
2.2.1 ENERGY INTENSITY MEASURE IN TERMS OF PRIMARY ENERGY AND GDP

Under SDG 7 (Affordable and Clean Energy), Target 7.3 calls for the doubling of the global rate of improvement in energy efficiency by 2030. Energy intensity, which is generally defined as "the amount of energy used to produce a given output or service," is used as the indicator to measure an economy's energy efficiency. For Belize, the energy intensity measure represents "total primary energy supply in tons of oil equivalent (toe) per thousand USD of GDP." In accordance with SDG 7.3.1, this serves as a proxy indicator to track Belize's progress in energy efficiency.

The latest information[2] provides energy intensity levels for Belize over a period of ten years, showing a year-on-year improvement in energy intensity, measuring 0.170 toe/$1000 USD in 2022 (Figure 3). While this trend is positive, more work is needed to accelerate improvements in energy efficiency to meet both national and global goals. Much of the potential for improvement hinges on prioritizing energy efficiency measures within policy frameworks and investments, as well as related avoided energy demand measures. Belize's National Energy Policy 2023-2040 recognizes the critical step of reducing energy intensity across all sectors through collaboration with key governmental and non-governmental entities.

2 Energy intensity levels for 2023 will be produced upon official release of updated GDP data from the Statistical Institute of Belize.

The International Energy Agency (IEA) refers to energy efficiency as the “first fuel,” representing the cleanest, cheapest, and most reliable source of energy, allowing countries to reduce consumption while still providing full energy services to the economy (International Energy Agency, 2022). Thus, energy efficiency important for supporting economic growth and resilience while accelerating the clean energy transition.

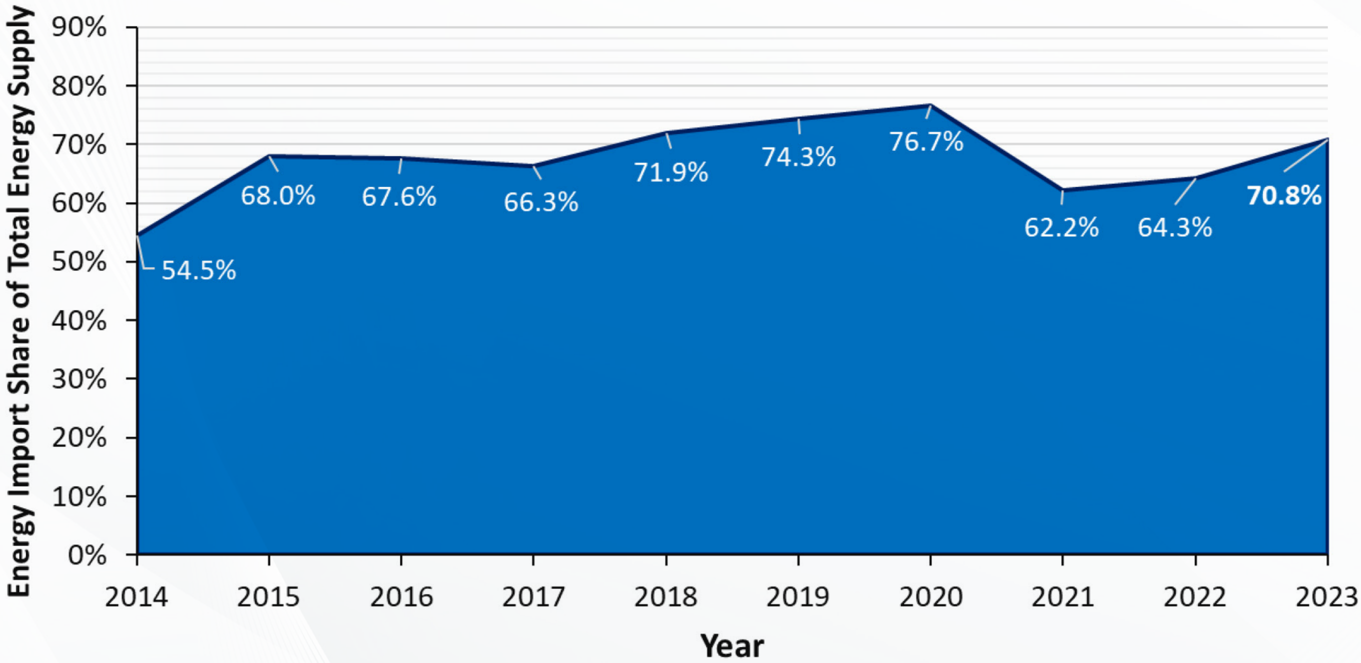


» Figure 3. Historical Timeline of Energy Intensity in Belize

2.2.2 ENERGY IMPORT AS A SHARE OF TOTAL PRIMARY ENERGY SUPPLY (TPES)

Figure 4 reflects the proportion of Belize’s energy needs that are met through energy imports rather than domestic production. In 2023, reliance on imported energy surged to 70.8%, marking a 6.5% increase compared to the previous year’s figures. In 2023, the main imported energy product was petroleum products (in liquid state), accounting for more than three-quarters of all energy imported into Belize. The rise in the share of energy imports was also supplemented by a significant increase in electricity imports compared to the previous year (see section 4.8). This dependence on energy imports exposes the vulnerability of Belize’s energy system to external disruptions, such as current geopolitical risks and price instability.

Belize's dependency on energy imports has long been a point of contention and an important element of energy security, which remains at the top of Belize's energy agenda. Belize's National Energy Policy 2023 – 2040 outlines the need to increase indigenous energy sources within the energy supply mix as a critical step to reducing costs, diversifying the energy supply with a focus on renewable energy, decreasing the demand for foreign currency, developing new infrastructure, and creating employment opportunities (Ministry of Public Utilities, Energy, Logistics, and E-Governance (MPUELE), 2023).



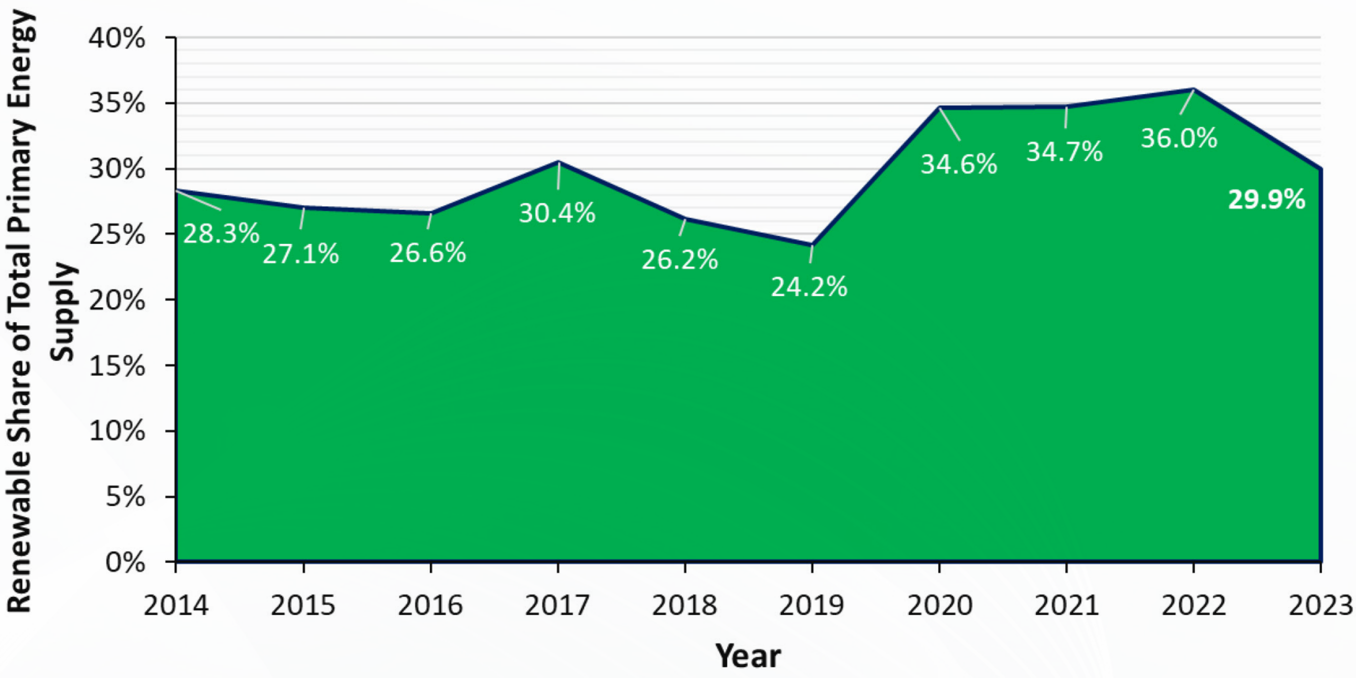
» Figure 4. Energy Import as Share of Total Primary Energy Supply, 2014 – 2023

2.2.3 RENEWABLE ENERGY SHARE OF TOTAL PRIMARY ENERGY SUPPLY

This indicator highlights the contribution of renewable energy sources to total primary energy supply, with renewables including primary energy equivalents of hydro and solar, as well as energy derived from solid biofuels like Bagasse (vegetal waste: sugarcane) and firewood. In 2023, renewable energy sources comprised only 29.9% (5,306.5 TJ) of total primary energy supply, exhibiting a downturn of 6.1 percent (Figure 5). If we examine the trend over time, renewable energy sources in 2023 experienced a slight decline compared to previous years, where they had remained constant. This decline resulted from reduced domestic generation from hydro and biomass during the reporting period.

With a heightened focus on energy security, many governments, including Belize, are promoting renewable energy, recognizing the opportunities a renewable-based economy and society can offer.

As wind and solar technologies advance rapidly, both in terms of technology and cost, Belize can tap into its unused renewable energy potential to replace fossil fuels in its energy mix. According to the Renewables 2022 Global Status Report (2022), countries with higher shares of renewables in their total energy consumption enjoy a greater level of energy independence and security.



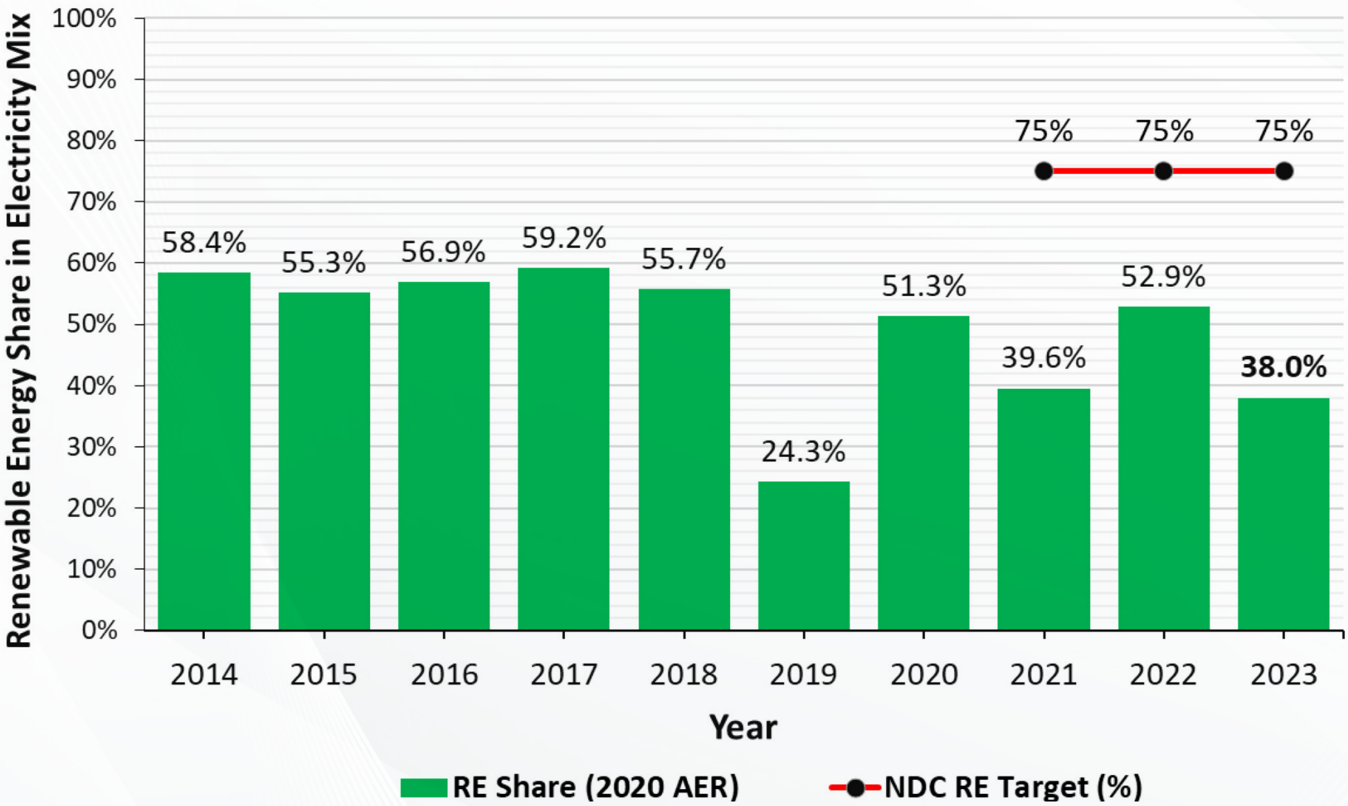
» Figure 5. Renewable Energy Share of Total Primary Energy Supply, 2014-2023

2.2.4 PERCENTAGE OF RENEWABLE ENERGY IN ELECTRICITY MIX

The need to shift our energy systems away from fossil fuels to low carbon energy sources, supports decarbonization and improves resilience. Assessing the percentage of renewable energy in a nation's electricity mix evaluates the progress of the energy system towards sustainability and its role in advancing the reduction of greenhouse gas emissions. Belize's electricity mix encompasses renewable energy sources such as hydro, biofuel (bagasse), and solar PV.

Belize's Nationally Determined Contributions (NDCs) call for a renewable energy target of "75% of gross generation coming from renewable energy sources by 2030" (Government of Belize, 2021). As of 2023, electricity generation from renewable sources experienced a notable decline, dropping from 52.9% in 2022 to 38.0% (Figure 6). Several factors likely contributed to this decline, including unfavourable climatic conditions, particularly precipitation patterns, which affected agricultural productivity and, consequently, renewable energy generation. This, in turn, reduced the renewable share in the electricity mix. Notably, while hydro and biomass production declined, solar PV saw a marginal increase.

As depicted in Figure 6, the sharp decline in 2023 and the trend over recent years underscores the difficulties in sustaining a consistent level of renewable energy in the national electricity mix. This highlights the importance of having a localized and diversified renewable energy portfolio to mitigate such fluctuations. Additionally, it emphasizes the need for infrastructure development and investment in renewable energy projects to make meaningful strides towards Belize's energy transition.



» Figure 6. Renewable Energy Share in the Electricity Mix, 2014-2023

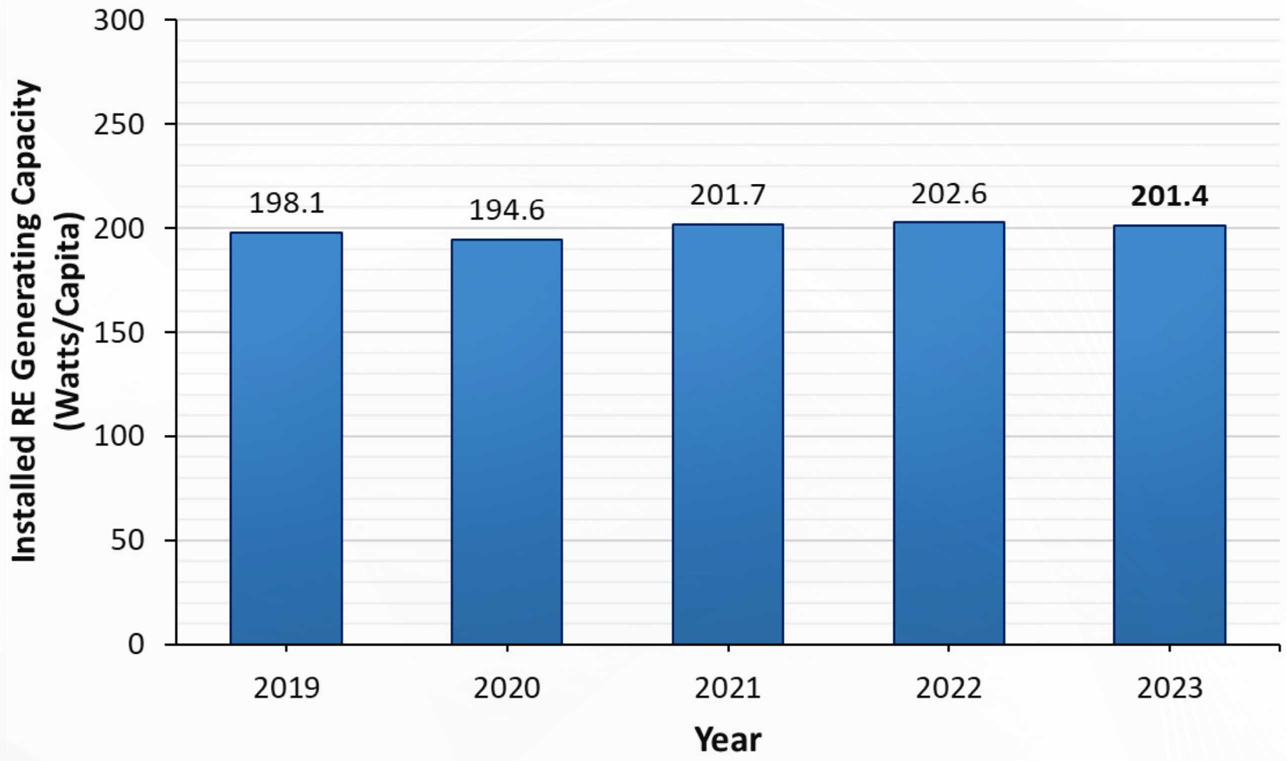
2.2.5 RENEWABLE ENERGY GENERATING CAPACITY

In alignment with SDG indicator 7.b.1/12.a.1, this measure tracks the installation of renewable energy generating capacity in developing countries, expressed in watts per capita. In 2023, Belize installed 201.4 watts per capita of renewable energy generating capacity (Figure 7). Notably, this figure is well below the 2022 average of 293 watts per capita for developing countries, as reported in the Tracking SDG 7: The Energy Progress Report (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; & World Health Organization, 2024).

Over the past five years, the rate of renewable energy generating capacity in Belize has remained relatively stable, with capacity increasing from 198.1 watts per capita in 2019 to 201.4 watts per capita in 2023 (Figure 7).

This steady trend indicates that although investments in renewable infrastructure have continued, the rate of growth has remained modest. This may be due to factors such as regulatory challenges, financial limitations, and some limitations in data coverage related to DG installations across Belize.

In general, the trend underscores the urgent need for greater support and investment to scale up renewable energy generation, both to meet Belize's growing energy demands and to advance its national sustainability goals. The introduction of electricity regulatory reforms, including new license classifications and rate schedules, represents a strategic response to accelerate renewable energy growth in Belize.

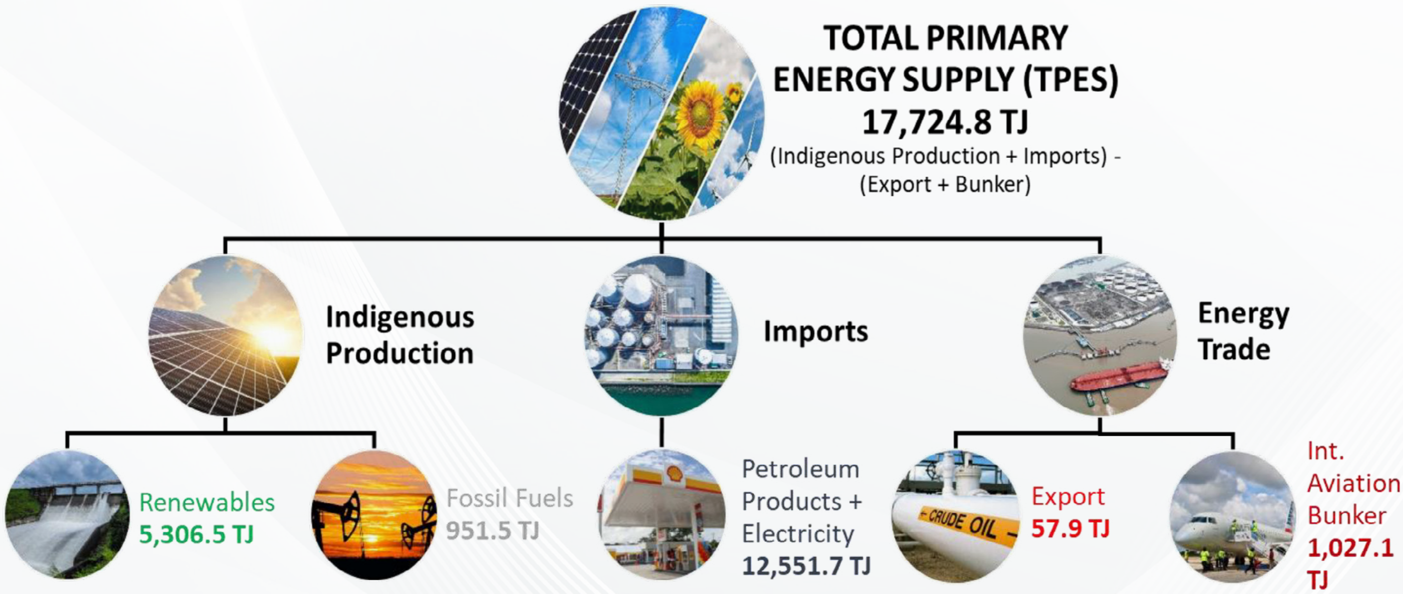


» Figure 7. Renewable Energy Generating Capacity, 2019-2023

3 ENERGY SUPPLY AND FINAL CONSUMPTION

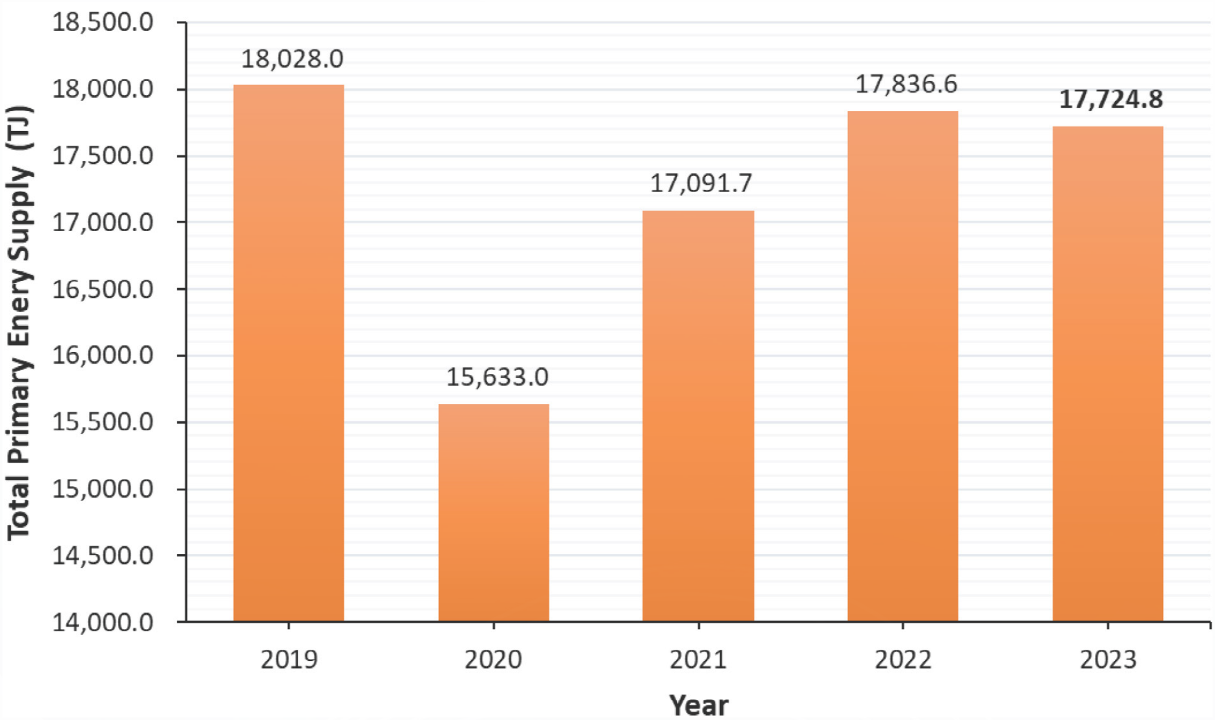
3.1 TOTAL ENERGY SUPPLY

Figure 8 provides a clear and high-level overview of Belize's energy landscape, highlighting the balance between indigenous production and external energy sources. In 2023, Belize's total primary energy supply (TES) was 17,724.8 TJ, representing a decrease of less than 1% from the previous year. Of the total energy supply in 2023, 30% was produced from renewable energy sources, totalling 5,306.5 TJ. Renewable energy supply decreased by 1,118.5 TJ, representing a significant decline of 17.4% compared to the previous year. This reduction contrasts sharply with the increase in energy imports, which rose by 1,081.7 TJ, a 9.4% increase from the previous year. The simultaneous drop in renewable energy supply and rise in energy imports, underscores Belize's dependency on external energy sources to meet its needs and signifies a key area for energy policy focus and implementation.



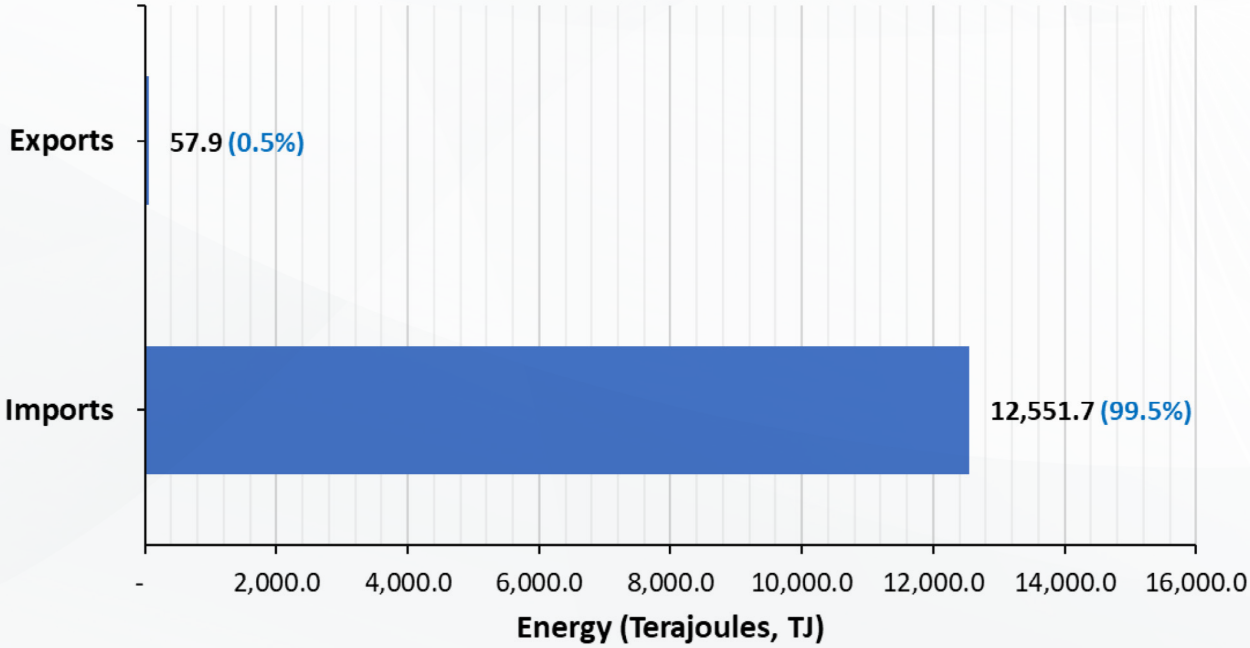
» Figure 8. Total Primary Energy Supply, 2023

While overall total primary energy supply continues to grow to meet demand, driven by the significant rebound of economic activities following the COVID-19 pandemic, it has remained relatively stable over the last two years (Figure 9). Still, Belize's population and GDP are projected to rise over the coming years with expected impacts on energy demand and fuel usage. This anticipated growth requires key consideration of Belize's energy supply mix and the implementation of energy intensity reduction initiatives (Ministry of Public Utilities, Energy, Logistics, and E-Governance (MPUELE), 2023).



» Figure 9. Historical Timeline of Total Primary Energy Supply, 2019 – 2023

Following the trend of previous years, energy trade data in 2023 reveals a striking dependency on imports, which accounted for 99.5% of total energy trade, equating to 12,551.7 TJ (Figure 10). This underscores the limited contribution of domestic energy exports in the energy trade balance and highlights the challenges in achieving energy self-sufficiency. These findings emphasize the need for strategic planning to diversify Belize's energy sources and enhance domestic production capabilities.

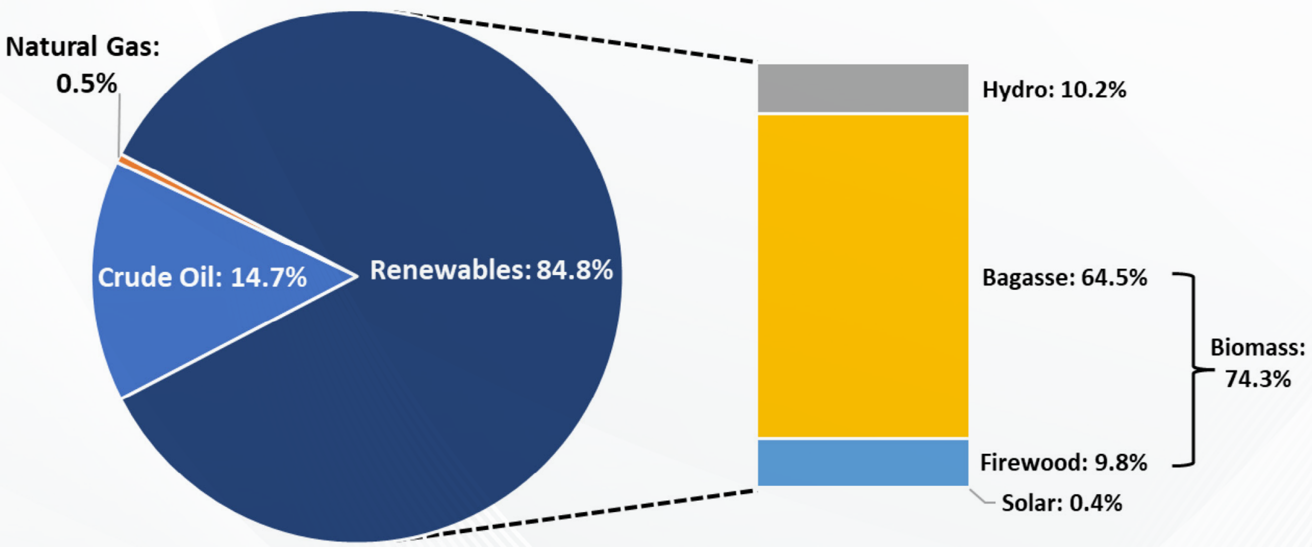


» Figure 10. Overview of Energy Trade Data, 2023

3.3 PRIMARY ENERGY

3.3.1 PRIMARY ENERGY SUPPLY BY FUEL TYPE

Belize sources much of its primary energy from renewable sources, amounting to 84.8% of the total primary energy supply by fuel type (Figure 11). Bagasse, a by-product of a major agricultural industry, is by far the largest renewable energy source, contributing 64.5% of the total, followed by hydro at 10.2%. With firewood used for heating and cooking equating to a share of 9.8%, biomass comprises 74.3% of Belize's renewable primary energy share. Solar energy, by contrast, represents only 0.4% of the total renewable primary energy supply. On the other hand, fossil fuel sources, including crude oil and natural gas, account for 14.7% and 0.5%, respectively. Overall, Belize's primary energy supply composition showcases its efforts in domestic renewable energy production, particularly biomass, while also highlighting the relatively minor role of solar energy and the limited but still significant presence of fossil fuels in the energy mix.

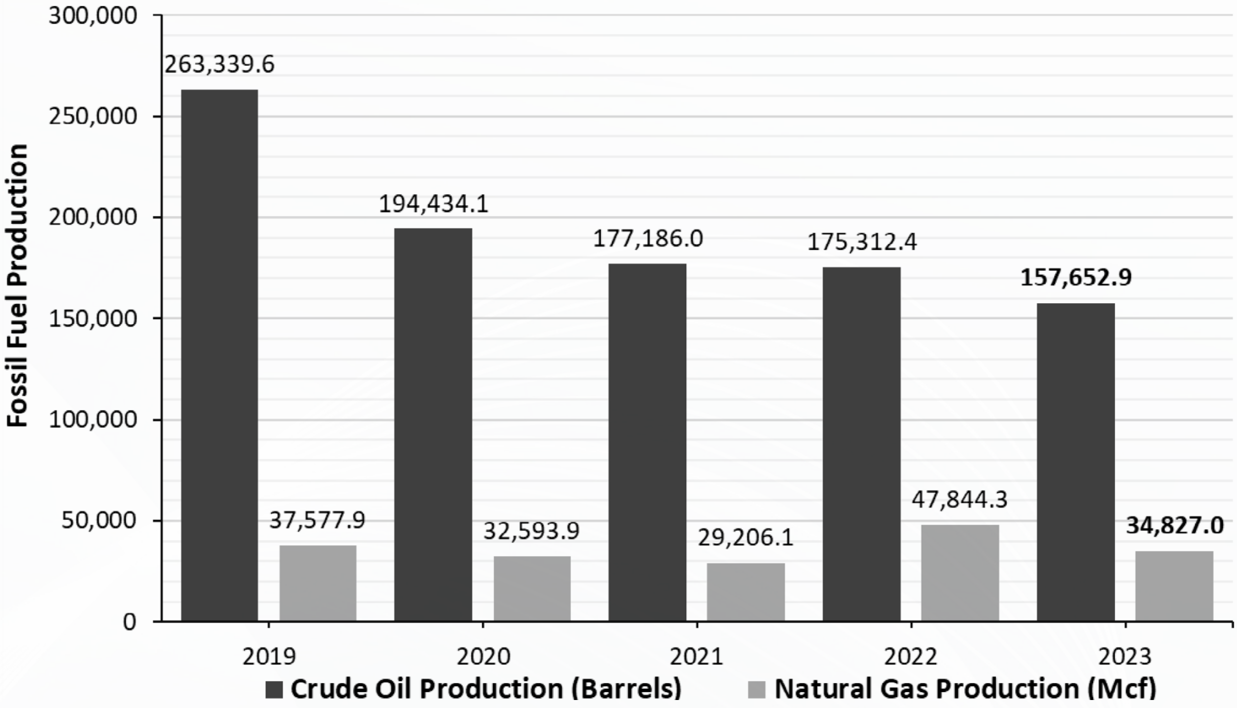


» Figure 11. Belize Primary Energy Supply by Source, 2023

3.3.2 CRUDE OIL AND NATURAL GAS PRODUCTION

In 2005, Belize Natural Energy Limited (BNE) made the first commercial oil discovery in the Spanish Lookout community in Belize, which is currently producing an average of 425 barrels of oil per day. In 2009, a second commercial discovery was made in the Never Delay area in Belize, with current production averaging 7 barrels of oil per day. According to the Geology and Petroleum Department of Belize (2022), oil produced in Belize is sold locally, exported to the US Gulf Coast, and transported overland to Guatemala.

According to Figure 12, Belize's production of crude oil and natural gas reveals a clear downward trend, with output steadily declining each year. The only exception was a spike in natural gas production in 2022, which then returned to consistent levels in 2023. This consistent decrease over time highlights the challenges being faced, whether due to resource depletion, operational constraints, shifting market dynamics, or a combination of these factors.



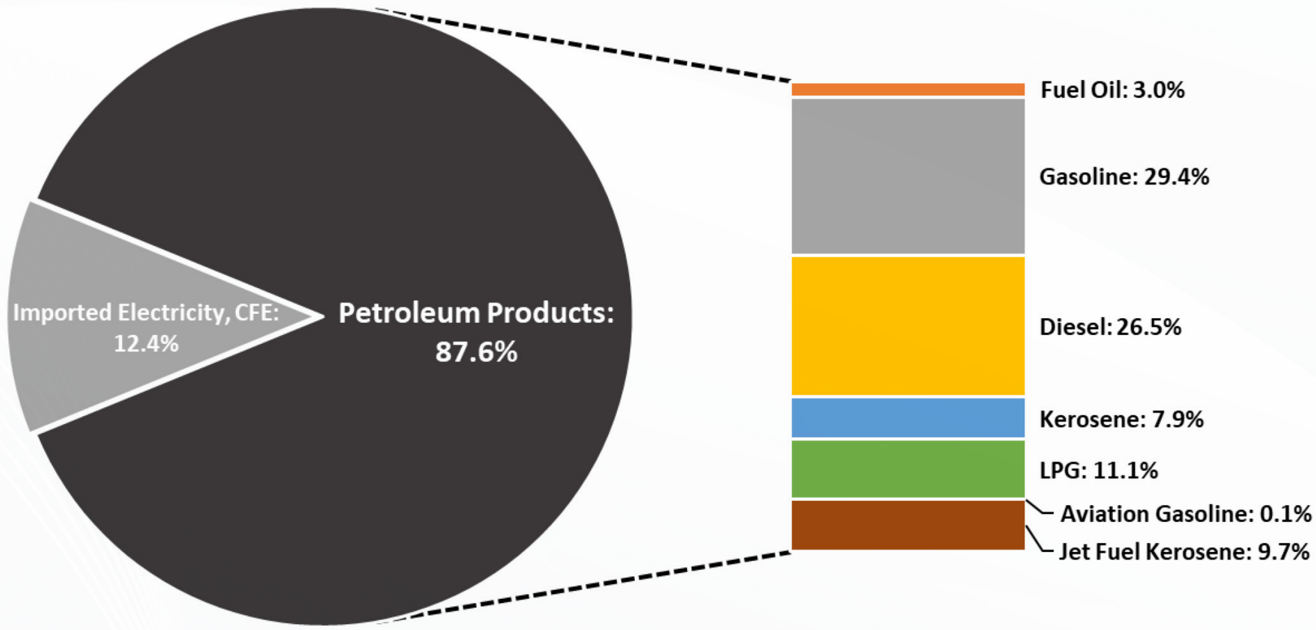
» Figure 12. Historical Timeline of Fossil Fuel Production, 2019 – 2023

3.4 SECONDARY ENERGY

3.4.1 SECONDARY ENERGY SUPPLY BY FUEL TYPE

Belize's secondary energy supply, which includes energy products derived from primary energy sources through transformation processes such as fuel refining or electricity generation, showed a notable increase in 2023, rising by 1,081.7 TJ or 9.4%. Unlike Belize's primary energy sources, its secondary energy supply comprises petroleum products and electricity.

In 2023, secondary energy supply was predominantly driven by petroleum products, which accounted for 87.6% of the total (Figure 13). Among these, gasoline was the largest contributor at 29.4%, followed closely by diesel at 26.5%, LPG at 11.1%, jet fuel kerosene at 9.7%, fuel oil at 3%, and aviation gasoline at 0.1%. The remaining 12.4% of secondary energy came from imported electricity provided by CFE Mexico, highlighting Belize's continued dependence on external energy sources to meet energy needs.



» Figure 13. Secondary Energy Supply, by Fuel Type – 2023

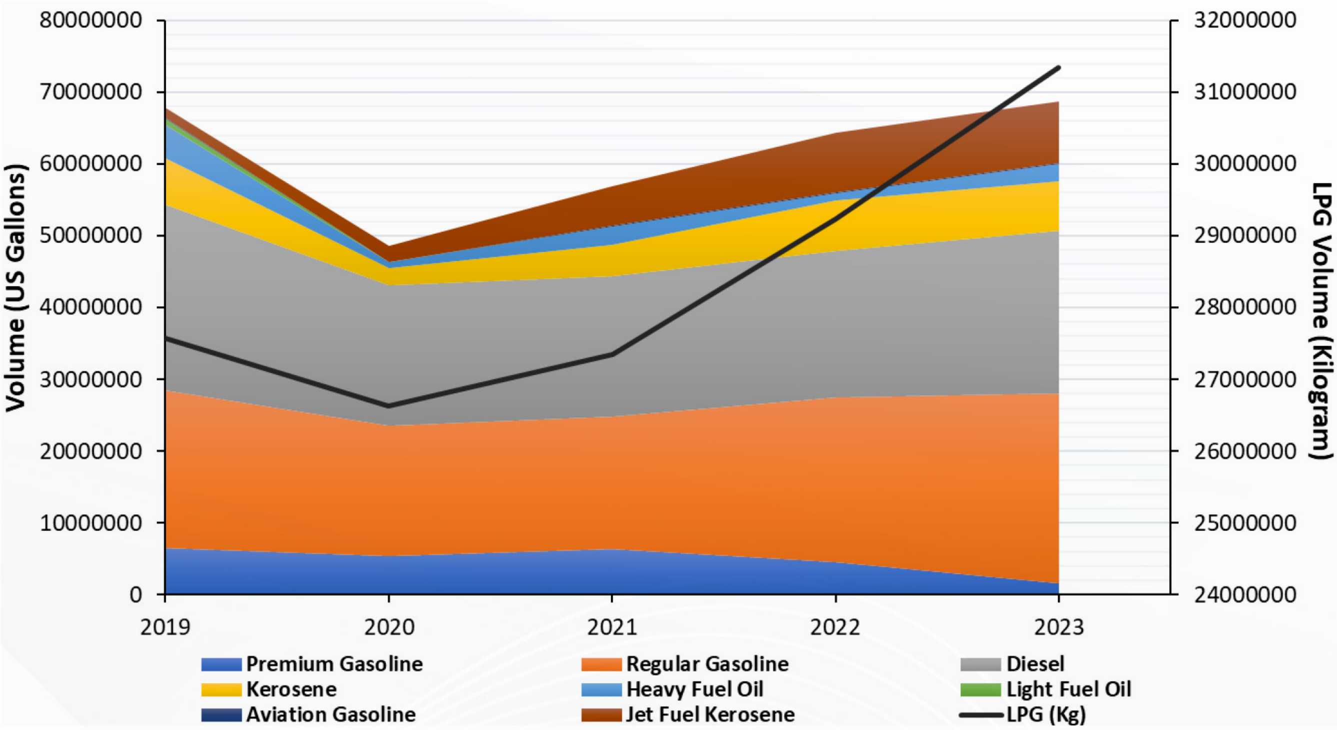
3.4.2 IMPORTS OF PETROLEUM AND GAS PRODUCTS

The use of petroleum products plays a critical role in driving Belize's socio-economic progress, as these products are essential for transportation, agriculture, commercial, and industrial sectors. As highlighted in section 3.2, the nation's demand for these resources is largely met through energy imports.

Over the past five years, the supply of petroleum products in Belize has experienced significant fluctuations across various categories (Figure 14)[3]. Regular gasoline has shown a notable upward trend, rising from 21.9 million gallons in 2019 to 26.4 million gallons in 2023. In contrast, the supply of premium gasoline has drastically declined, possibly indicating a shift in consumer preference toward more cost-effective fuel options or changes in fuel consumption patterns. The supply of diesel has remained relatively stable over the timeline, whilst the supply of kerosene has seen significant growth in recent years. Additionally, the supply of fuel oils used for electricity generation has been highly volatile.

The supply of aviation fuels in Belize remains relatively small in scale compared to the overall supply of petroleum products. However, jet fuel kerosene has shown a significant upward trend, increasing from 1.4 million gallons in 2019 to 8.6 million gallons in 2023, reflecting both the recovery and growth in the aviation sector in Belize.

3 For more detailed information on imports of petroleum products, see Appendix B: Data Table 8.



» Figure 14. Volume of Petroleum Products Imported in 2023

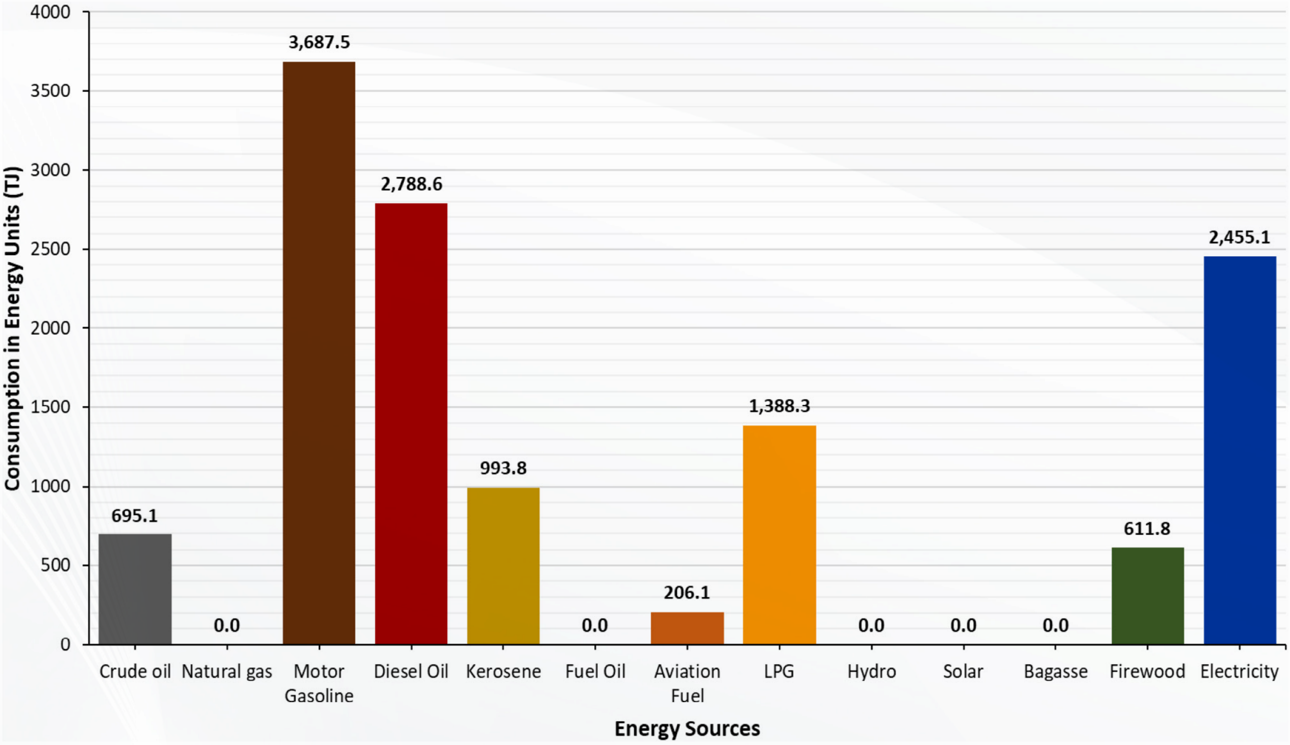
3.5 FINAL CONSUMPTION

Final Energy Consumption is the portion of the energy flow that details the way energy is being harnessed by those who utilize it for their own productive uses, that is, not for reselling or distribution. This includes, for example, the electricity being used to power office appliances, the gasoline bought to operate a lawnmower, or the firewood used to cook a meal. As a broad and detailed sector, final energy consumption is crucial for understanding energy use patterns and addressing the mitigation and adaptation needs for sustainable and ecologically healthy development of our country. Collecting and analysing data within this sector presents a significant challenge, which the Energy Unit continues to tackle while exploring ways to optimize the resources at our disposal.

3.5.1 TOTAL FINAL CONSUMPTION, BY FUEL TYPE

For 2023, Belize's final energy consumption totalled 12,826 TJ – an increase of nearly 3% from the previous year. Figure 15 below shows the breakdown of this 12,826 TJ into its component fuels. Gasoline and diesel being used for transportation purposes dominate Belize's final consumption, followed closely by electricity. To reduce the country's reliance on energy imports and lower global carbon emissions, it is crucial to explore ways for homes and businesses to decrease their consumption of these increasingly expensive and market-volatile commodities[4].

4 See Chapter 5: Energy Prices for local and international pricing trends.



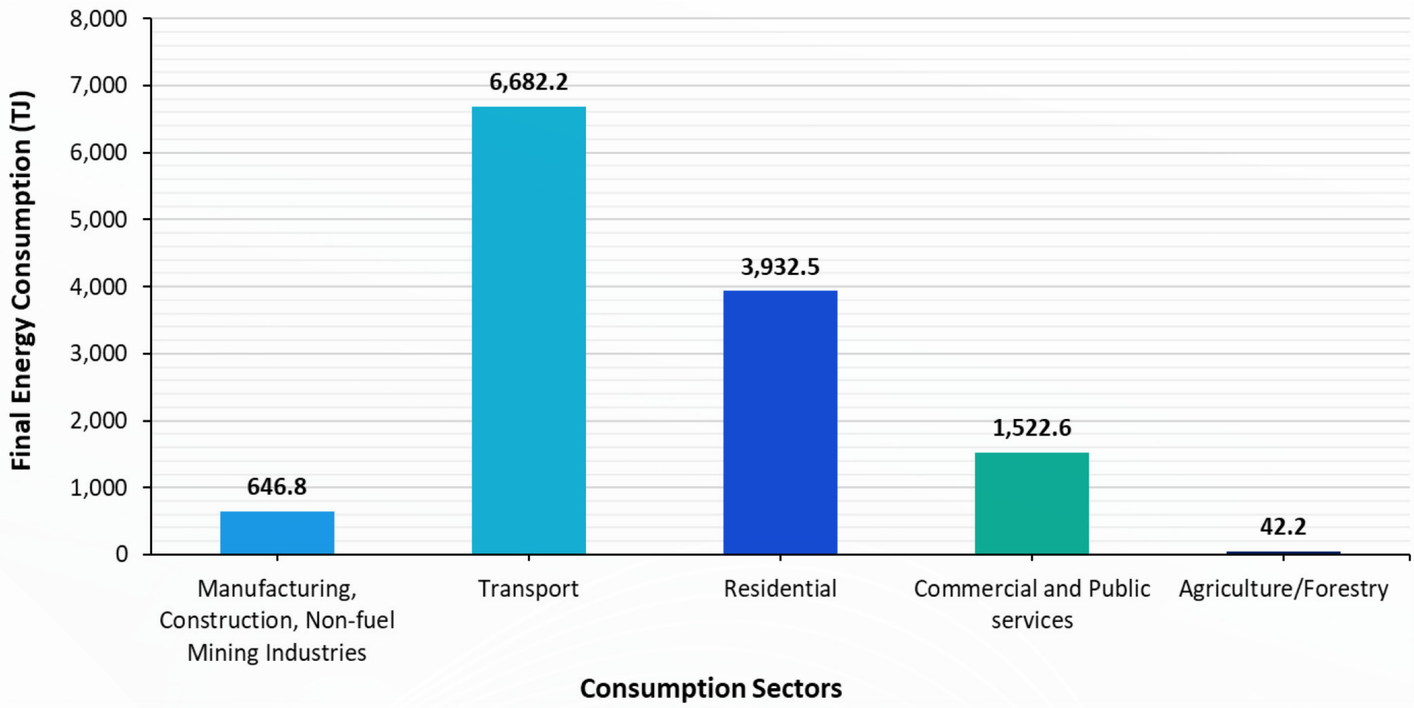
» Figure 15. Final Energy Consumption for 2023, Disaggregated by Fuel Type

3.5.2 TOTAL FINAL CONSUMPTION, BY SECTOR

Figure 16[5,6] shows a different breakdown of the same 12,826 TJ of final energy consumption by specific usage sectors. The largest sector, Transport, is nearly twice as the large as the second-largest sector, Residential. This aligns with the predominance of gasoline and diesel shown in the previous figure. Although limitations in data coverage prevent us from making definitive statements about energy allocations within the Manufacturing, Agriculture and Commercial sectors, the Energy Unit believes that the overall picture accurately reflects reality. Thus, the Transport, Residential, and Commercial sectors should be the primary focus for energy efficiency and conservation efforts.

[5] The consumption sector named 'Manufacturing, Construction, Non-fuel Mining Industries' follows the IRES classification and includes the further classifications: 'Non-metallic minerals', 'Machinery', 'Mining and quarrying', 'Food and tobacco', 'Paper pulp and print', 'Wood and wood products', 'Construction', and 'Not elsewhere specified.'

[6] The consumption sector named 'Transport' follows the IRES classification and includes further classifications: 'Road', 'Domestic Aviation', 'Domestic Marine Navigation' and 'Not elsewhere specified.'

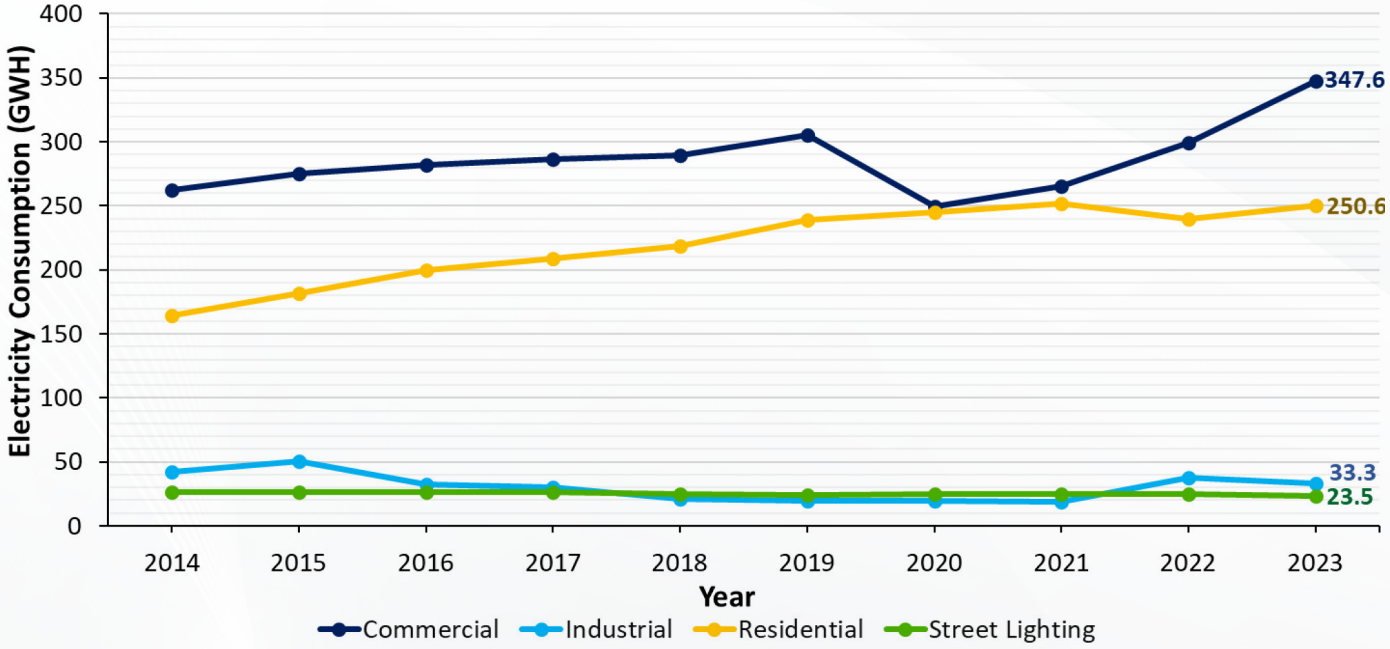


» Figure 16. Final Energy Consumption for 2023, Disaggregated by Consumption Sectors

3.5.3 GROSS ELECTRICITY CONSUMPTION, BY SECTOR

Focusing on final energy consumption in the electricity sector, Figure 17 below shows the historical changes in consumption sectors over the past 10 years. It reflects electricity consumption within BEL's national grid and is based on BEL's customer tariff groupings, with the 'Social' tariff group aggregated into the 'Residential' category. It is interesting to note that the Commercial sector, more so than the Residential sector, has experienced a significant increase in electrical demand over the past 2-3 years, possibly due to a rebound from COVID-19 economic slump. Given that demand is expected to rise with increases in ambient temperatures (Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, 2021) and population growth, mitigating electrical consumption will become increasingly crucial, especially in the commercial sector.

It is also important to note electricity consumption occurring outside the jurisdiction of BEL's grid. The Spanish Lookout's Farmers' Light Plant Corporation, which maintains and supplies its own community microgrid, reports that it sold 5.9 GWh to residential customers and 14 GWh to commercial customers. Additionally, this report does not cover data from other community microgrids or any off-grid consumption, such as distributed generation.



» Figure 17. Electricity Consumption Timeline Across Sectors for National Utility

4 ELECTRICITY SECTOR

4.1 ELECTRICITY PURCHASE AND SALES

As the national utility company, Belize Electricity Limited (BEL) is licensed by the Public Utilities Commission (PUC) to supply and distribute electricity to Belizean consumers. BEL generates some electricity from power plants they own and operate, but they also buy electricity from Independent Power Producers (IPPs). Additionally, BEL imports a significant quantity of electricity from the Comisión Federal de Electricidad (CFE), the Mexican utility company. They then manage the distribution and sales of this combined electricity supply to customers connected to their grid through metered connections. In 2023, BEL sold a total of 659 GWh of electricity to their customers, spread out across its customers, distributed across different tariff groups (See section 3.5.3 for breakdown). These are their recorded sales after accounting for Transmission and Distribution losses (see section 4.9 for analysis).

Another company that supplies and distributes electricity at a smaller scale is the Farmer's Light Plant Corporation, which caters to the community of Spanish Lookout in the Cayo District. Farmer's Light Plant Corporation reports total sales of 19.9 GWh for 2023.

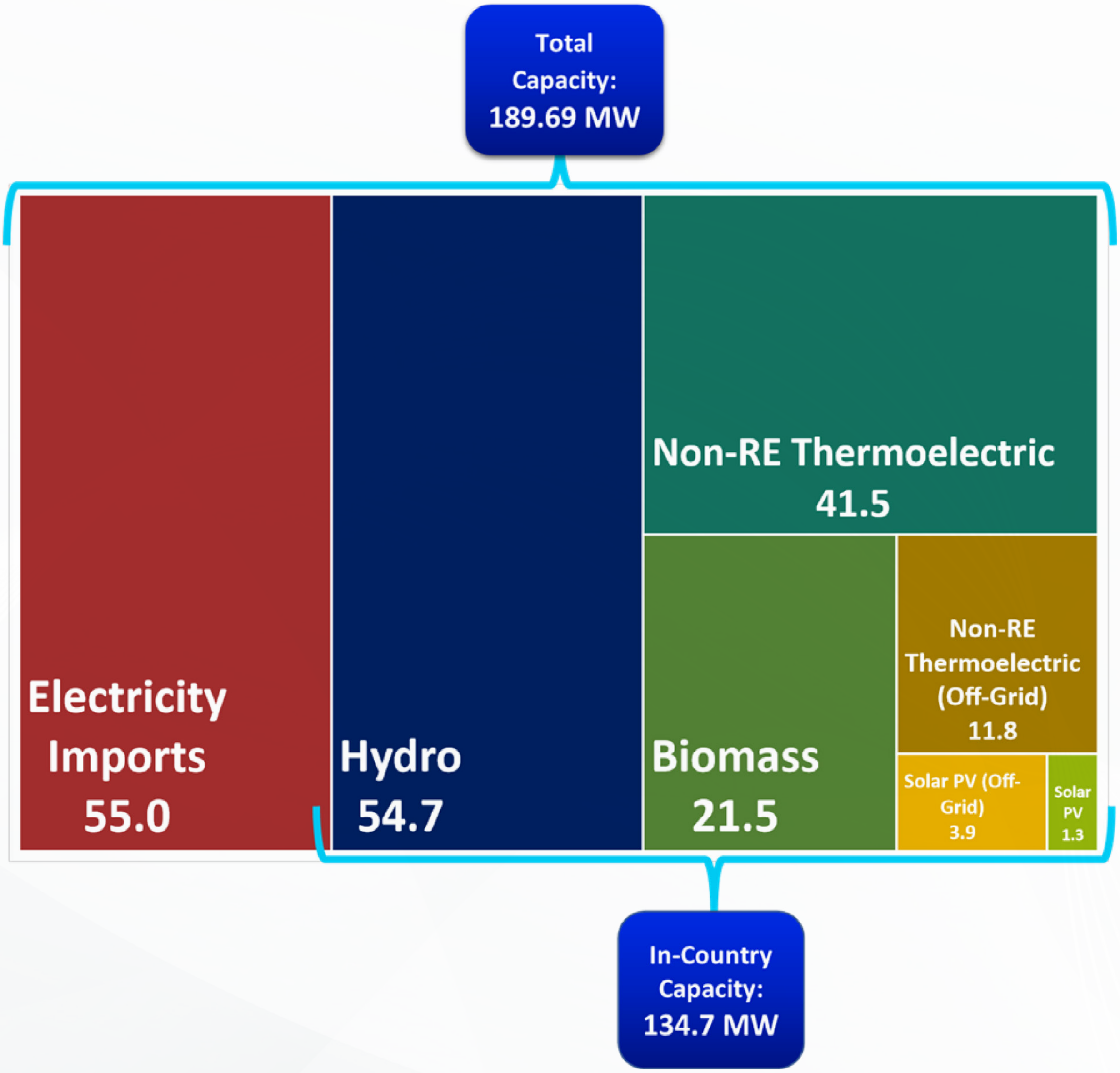
Data is not yet available on sales within recently created rural microgrids such as La Gracia and Indian Creek.

4.2 INSTALLED ELECTRICITY GENERATION CAPACITY

Figure 18 below depicts the composition of the available electricity sources that feed Belize's electricity supply, totalling 189.7 MW. The 55 MW 'Electricity Imports' represents the capacity supplied by our connection to CFE and Mexico. The remaining chart area represents in-country capacity, most of which is connected to BEL's national grid; a total of 134.7 MW. The portion labelled 'Non-RE Thermoelectric' (41.5 MW) includes generation sourced from diesel and fuel oil plants, which are connected to BEL's grid. The Blair Athol Power Company (BAPCOL) is an Independent Power Producer (IPP) that contributes mainly to this portion, along with BEL's own generation plants. The Hydropower and Biomass portions also feed BEL's supply. The IPPs Fortis Belize and Hydro Maya contribute to the Hydro capacity, while Belcogen and Santander Sugar contribute to the Biomass portion. The smallest portion represents the only Solar PV systems connected to the grid which are managed by the University of Belize and Paradise Shrimp Farms. Generation systems owned by FLPC are classified under 'Off-grid.'

It should be noted here that, as part of the focus on energy access and bringing power to underserved rural communities, several Solar PV microgrids have been funded and developed in partnerships with international funding agencies.

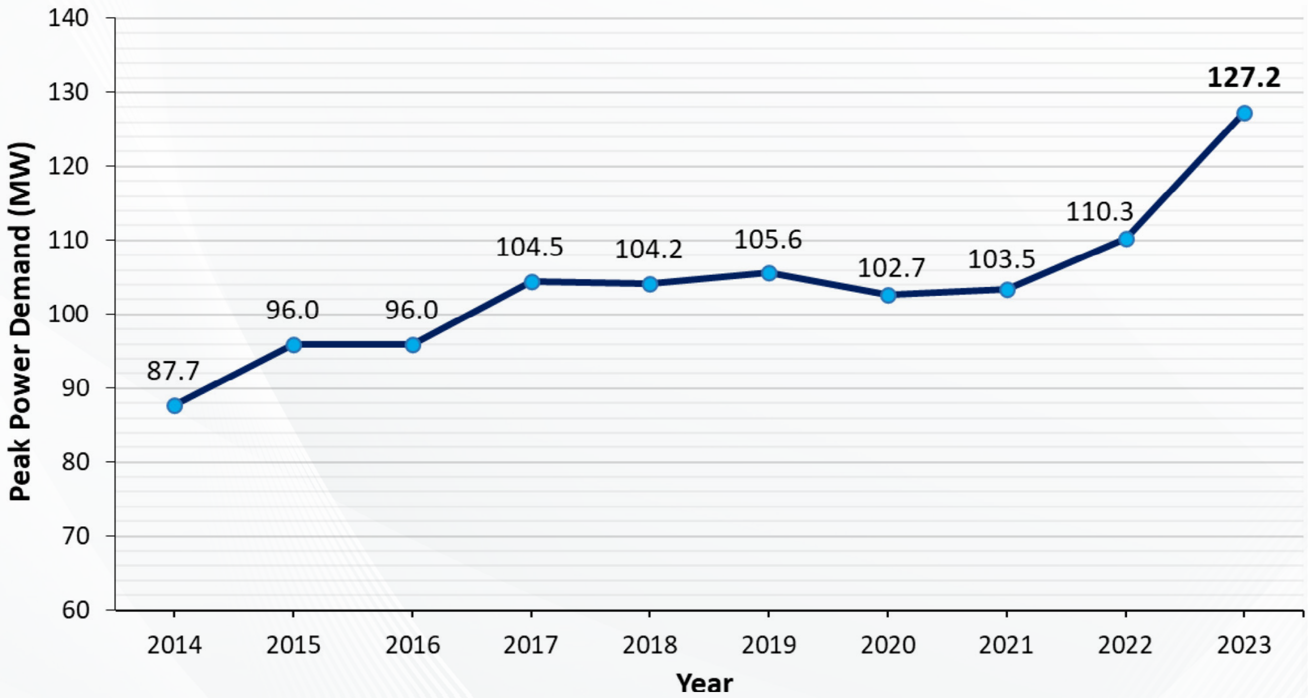
These include completed systems that service La Gracia, Indian Creek, Golden Stream, and Medina Bank villages, with a total combined capacity of 0.4 MW. Additionally, similar systems are under development to serve Corazon Creek, San Benito Poite, and Jalacte villages, with an expected total capacity of 0.79 MW. These small systems are not included in Figure 18 below.



» Figure 18. Belize's Available Electricity Generation Capacity – Breakdown in Megawatts (MW)

4.3 PEAK ELECTRICITY DEMAND

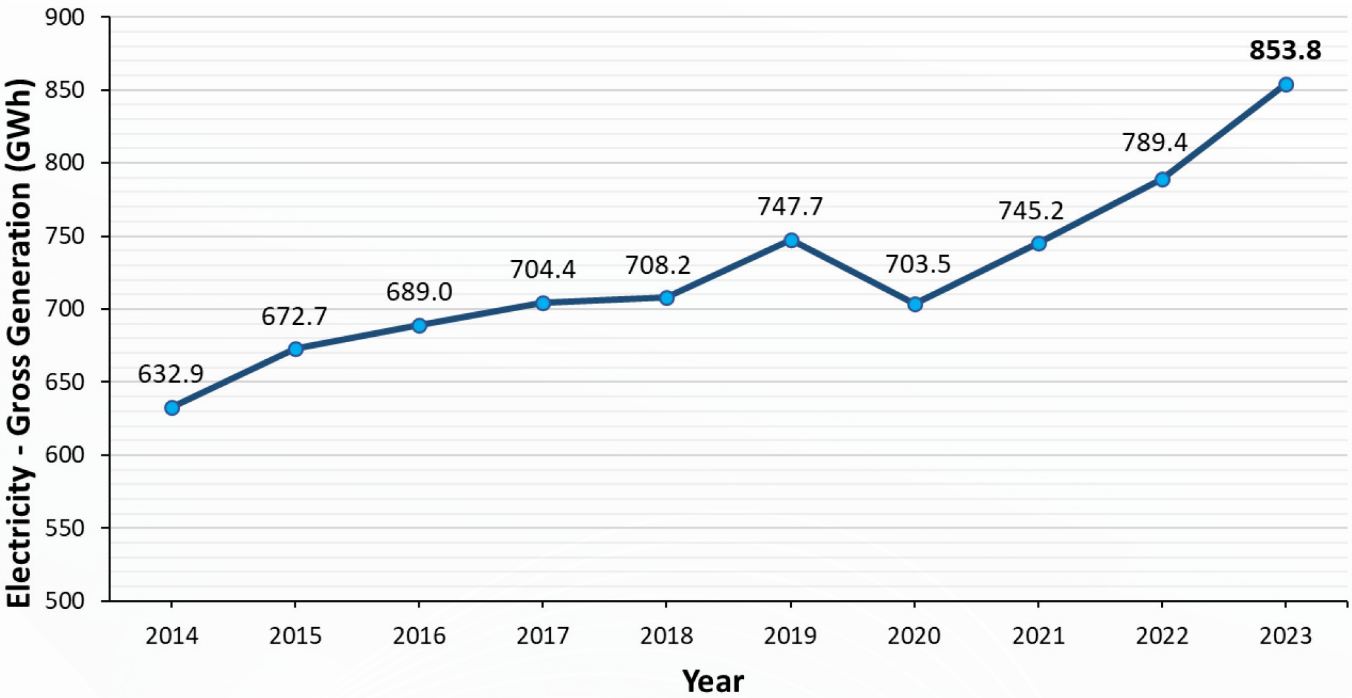
The peak power demand, or peak electricity demand, is a metric that indicates how much load a system's supply capacity must be able to meet at a given point in time. It is the highest demand value achieved within the referenced timeframe and is used to analyse whether existing power capacity is sufficient. As the US Energy Information Administration (EIA) states, "Electric power systems must match generation and load in real time, with tight tolerances," (U.S. Energy Information Administration (EIA), 2011). Given that the total generation capacity in 2023 was 189.7 MW, as discussed in the previous section, the 2023 peak demand of 127.2 MW should have been easily met (Figure 19). However, as the graph clearly shows, with the upward trend in recent years, the country's capacity must increase as well to keep pace with growing demand.



» Figure 19. Peak Power Demand for BEL's Grid: Historical Timeline

4.4 GROSS ELECTRICITY PRODUCTION

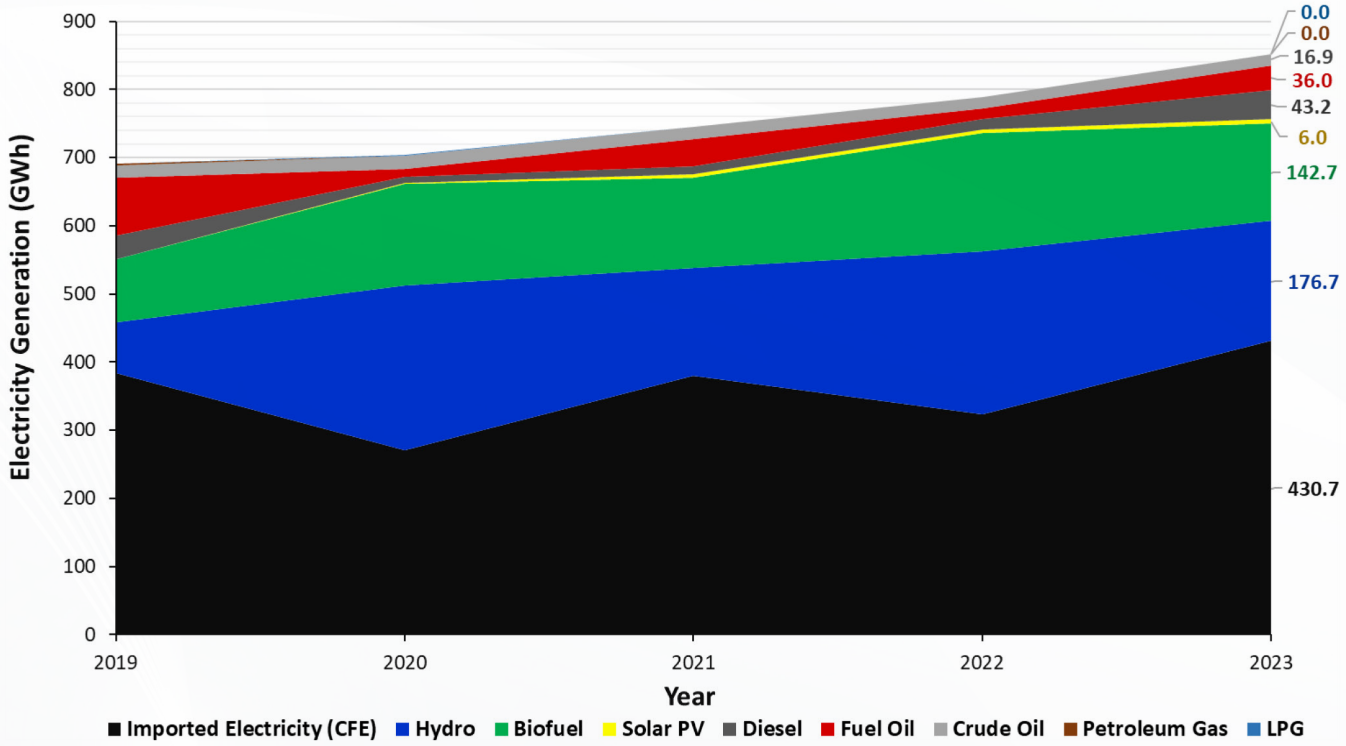
In the first analysis of this chapter that references energy instead of power, Figure 20 shows a steady increase in the quantity of electricity generated by BEL from year to year, closely mirroring the increasing demand discussed in the previous section. The sudden drop seen in 2020 can be attributed to the activity slowdowns of the COVID-19 pandemic, a trend also reflected in global electricity usage patterns (International Energy Agency (IEA), 2020). The graph shows that the rebound from COVID-19 has not only continued the historical generation growth but has also begun to accelerate at a slightly faster rate than before the pandemic, further highlighting the need for future demand planning in Belize.



» Figure 20. Historical Timeline of Gross Electricity Generation, 2014-2023

4.5 ELECTRICITY PRODUCTION BY FUEL TYPE

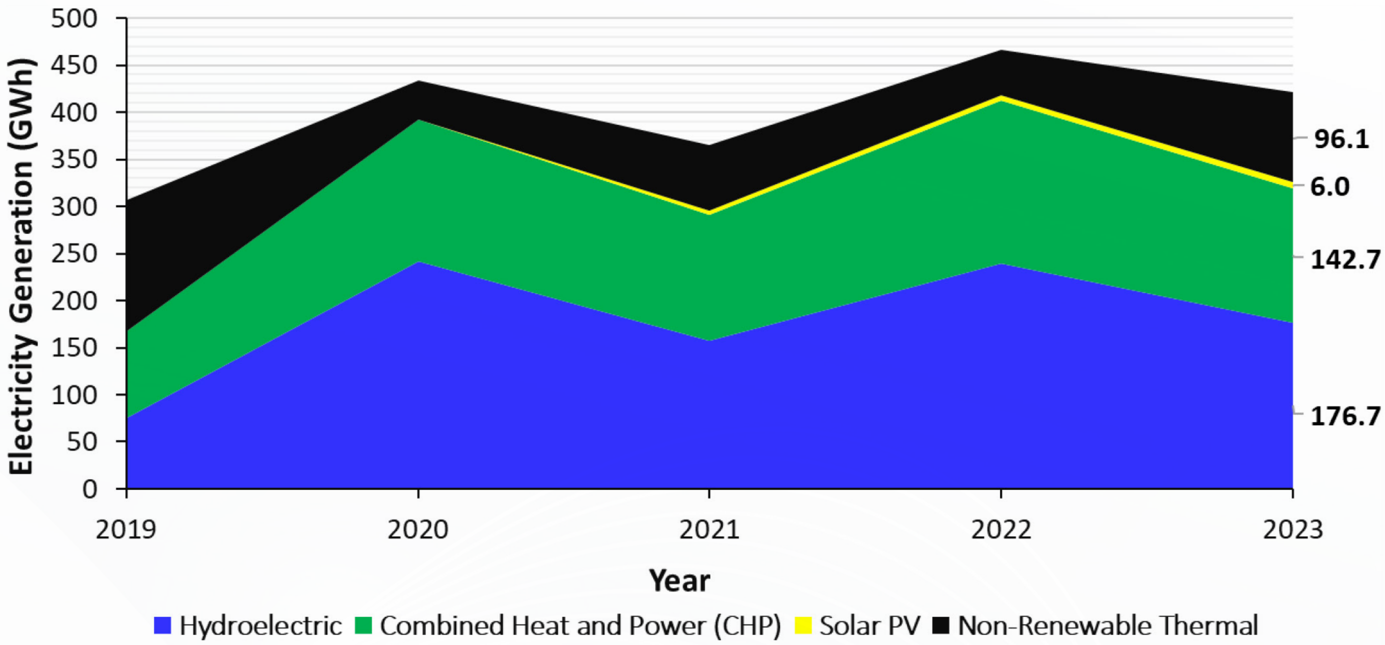
Meeting rising demand is one challenge, but managing the supply mix is another, particularly considering the need to limit fossil fuel generation and achieve national targets for renewable energy. In its 2021 Nationally Determined Contribution, Belize committed to "Avoiding 44 KtCO2e in the national electricity supply by 2030 through the introduction of expanded capacity from renewable energy sources" (Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, 2022). Figure 21 below shows fluctuations in fuel composition of the electricity mix over the past five years. If not for our significant reliance on CFE's electricity (depicted in black), Belize would have had an almost entirely 'green' electricity mix, meaning it would be drawn from renewable sources, represented by the blue, green, and yellow areas. As it is, CFE's electricity is largely powered by gas turbines and coal (Comisión Federal de Electricidad, 2023) and cannot be considered a renewable source. This is in addition to the sustainability-of-supply issue: CFE must prioritize its own population during times of high demand, reducing the supply available to Belize. Interestingly, the chart shows a supplementary relationship between CFE and in-country renewables. We import more electricity in the years when hydro and biomass production fall. Therefore, while increasing in-country generation is a key strategy for building Belize's energy independence, it is also evident that climate conditions that affect the productivity of renewables must also be considered.



» Figure 21. Electricity Generation by Fuel Type: 2019-2023

4.6 ELECTRICITY PRODUCTION BY PLANT TYPE

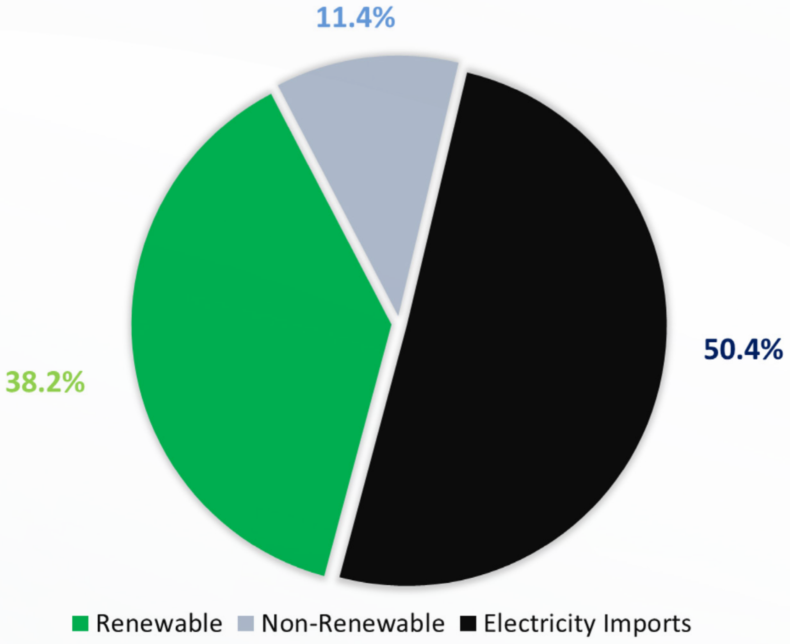
By excluding CFE, Figure 22 highlights the role of hydropower and biomass (Combined Heat and Power) in the country's national grid mix. The variability of the overall in-country supply is mainly attributed to changes in hydropower production – peaks and dips in one cause peaks and dips in the other – emphasizing Belize's vulnerability to rainfall patterns, droughts, and climate shocks. The proportion of renewables is also sensitive to the variability in hydropower. It is Notably that the non-renewables (shown in black) have larger representation in years when hydropower is reduced. It is clear, then, that while increasing our clean energy portfolio is our stated goal (Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, 2022), diversity within the renewable sector is also crucial for building resilience and reducing impacts that can be attributed to specific climate disturbances. Belize's Updated NDC states that "Projected climate change impacts for Belize include a rise in temperature of between 2°C and 4°C by 2100, a 7-8% decrease in the length of the rainy season, a 6-8% increase in the length of the dry season and a 20% increase in the intensity of rainfall in very short periods.it is fair to assume that climate vulnerabilities are a crucial consideration of power sector planning as we move forward" (Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, 2022). Concurrently, Belize needs careful planning to stabilize the current variability and address the increasing challenges we are likely to face in the future.



» Figure 22. Electricity Generation by Plant Type: 2019-2023

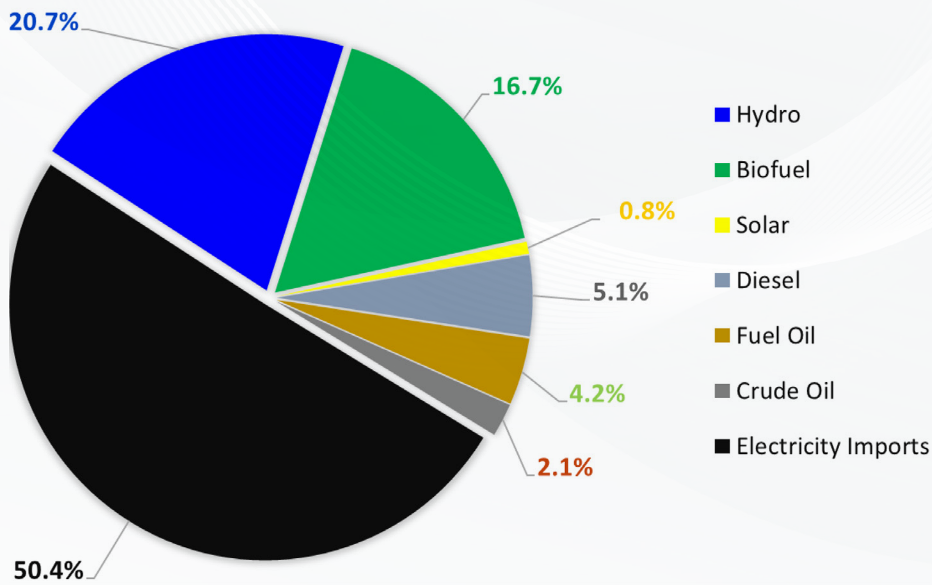
4.7 SHARE OF ELECTRICITY PRODUCTION BY SOURCE AND FUEL TYPE

Figure 23 highlights the breakdown of electricity supply sources at their most basic classification. In 2023, electricity imports provided nearly half of our power supply, increasing by approximately a third from 323 GWh in 2022 and expanding and expanding its share of the total by about 10%. Conversely, Belize's renewable electricity decreased its share by about 15% from 2022. Based on the analysis from sections 4.5 and 4.6, it clear that 2023 was a year in which the productivity of renewables was challenged, with climate conditions being the most likely cause. The entire Latin American and Caribbean region was strained by high heat, droughts, wildfires, and other extreme events that were intensified by the 2023 El Niño effect (World Meteorological Organization, 2024). This highlights the challenge of achieving and maintaining the country's target of 75% renewable generation (Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, 2022), even if met, faces the challenge of stability in the prospect of climate extremes.



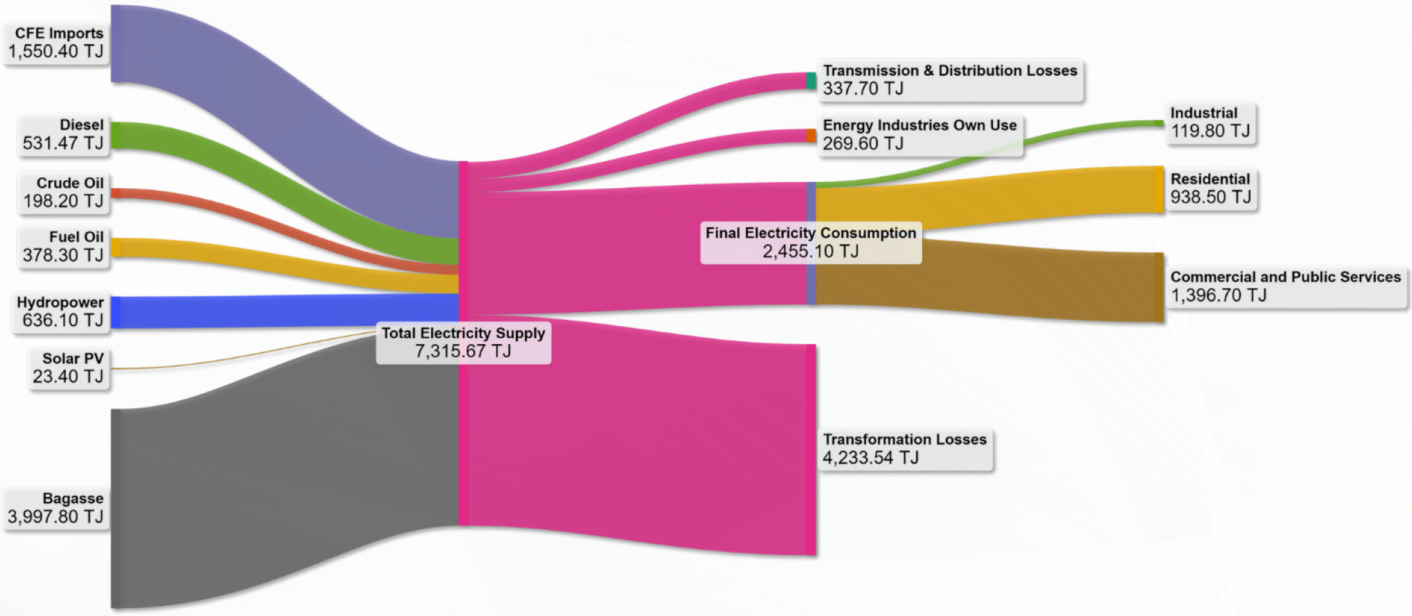
» Figure 23. Share of Electricity Supply Sources by Type, 2023

Figure 24 below depicts the same data ’as in Figure 23, but with the in-country generation sources now broken down into constituent fuels. This shows us that ‘renewables’ largely refer to hydropower and bagasse generation, with a small component so far of Solar PV, and that ‘non-renewables’, on the other hand, consist mostly of diesel and fuel oil generation. Stability is considered one of the main challenges in transitioning to ‘green’ or climate-friendly energy (Harvey, 2020). Together with the 50% electricity imports, the non-renewables in Belize have historically played a key role in stabilizing the variances in supply caused by renewables. They can be bought on demand – at least for now – which is why national targets like Belize’s NDC focus more on reducing dependence on fossil fuels and imports, rather than on fully phasing them out.



» Figure 24. Share of Electricity Supply by Source Fuel, 2023

The flowchart in Figure 25 below illustrates the processes and transitions of Belize's electrical energy, showing the flow from source fuels (on the left) to the electricity consumed at the economic sector level (on the right). While the other charts have highlighted the energy proportions by type—such as renewable versus non-renewable or imported versus exported—this chart highlights the relative amounts of energy in the starting fuels compared to those that are finally utilized by consumers. That is, it shows how much energy is lost in transformation and distribution processes. As indicated by the pink portions that do not extend to the endpoint, more than half of Belize's starting energy is lost, particularly in electricity 'transformation.' This loss is typical, and largely due to the portion of the supply mix derived from thermal fuel combustion (including Diesel, Crude, Fuel Oil, and Bagasse), which has historically had an efficiency rate of 33%, though modern technology has improved this to 44% (Kirk, 2022). Other losses are attributed to transmission and distribution processes – a small but pervasive component of national electricity losses[7].



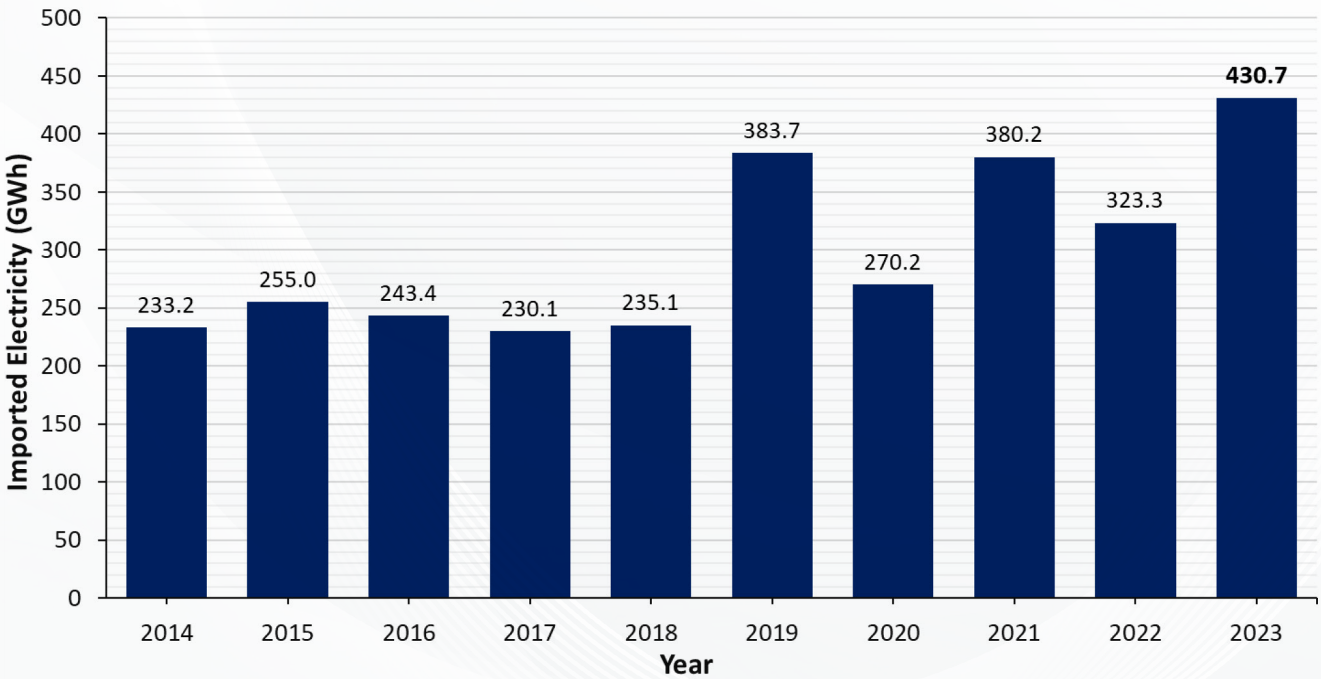
» Figure 25. Electricity Flows from Sources to End-Consumption: Sankey Flowchart

[7] Note: Both Losses and Sector Consumptions indicated in this chart include both BEL and FLPC figures. No comparable data is currently available on smaller isolated microgrids or distributed generation.

4.8 ELECTRICITY EXPORT AND IMPORT

Figure 26 below depicts the changes in total electricity imports to Belize over the past ten years. This presentation emphasizes the fluctuation and volatility in electricity imports over the last five years – the causes of which have been discussed earlier in this chapter – in contrast to the relative stability of the previous five years, during which similar quantities were imported annually. Whether the pattern of high-import years, beginning in 2019, will persist remains to be seen. What is clear, however, is that 2023 has had the largest importation value for the decade – 12% higher than the second-highest value in 2019, and an 85% increase since 2014, ten years ago. In addition to supply volatility, this rising trend demonstrates the gravity of our increasing reliance on Mexico's electric grid and the pressing need for its mitigation.

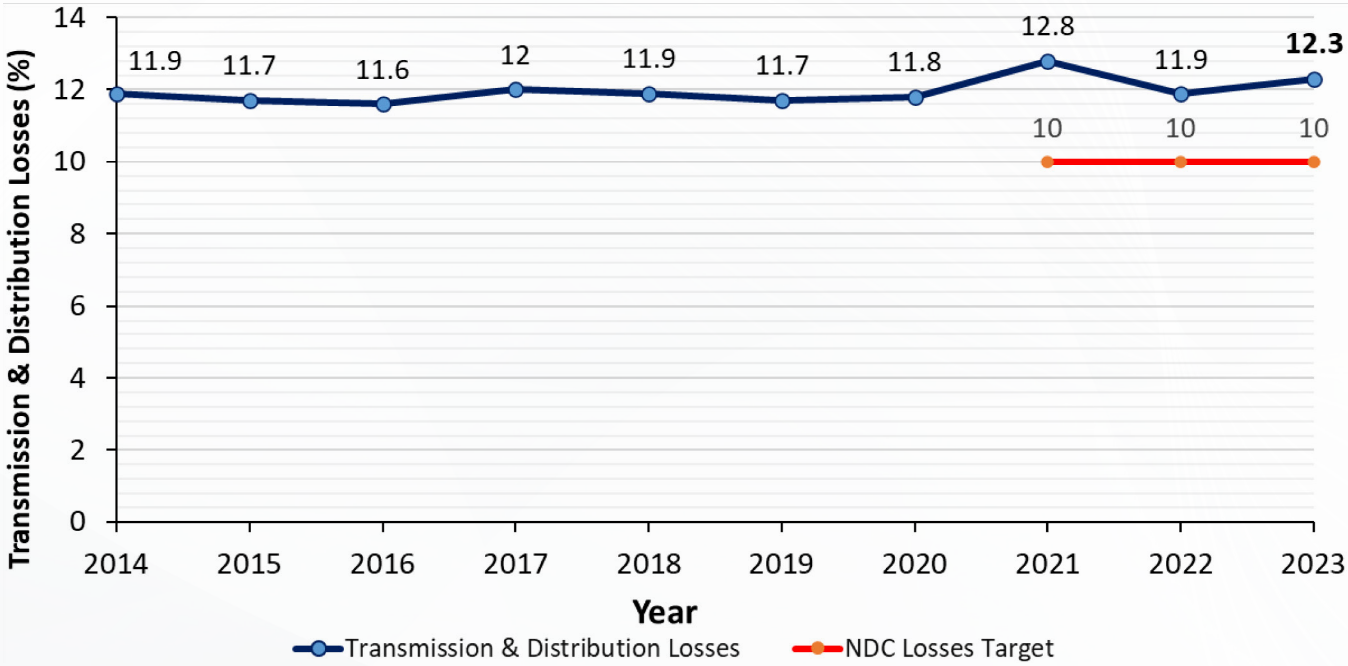
As of 2023, Belize is not exporting any electricity across its borders.



» Figure 26. Electricity Imports to the National Grid: Historical Timeline

4.9 ELECTRICITY LOSSES

Figure 27 details the historical progression in Transmission and Distribution (T&D) losses for Belize Electricity Limited in particular. T&D losses are an amalgamation of technical losses - such as line and transformer losses - and non-technical losses caused by meter errors or unmetered consumption. These losses not only represent power wastage and unnecessary emissions, but also unbenefited costs to the producers (Jiménez, Serebrisky, & Mercado, 2014, p. 39) and ultimately, the consumers. Though constrained to a certain extent by systemic and physical laws (Shenzhen CLOU Electronics Co., 2022), T & D losses can be partially mitigated by infrastructure updates and maintenance. Figure 27 also shows the NDC target for T & D efficiency that Belize is committed to achieving by 2030. The trend shows only the slightest variances over the past decade, with 2023 being the second-highest year for losses. There is a need for a national strategy to assess potential loss reductions and maintain the loss rate at a realistic minimum.

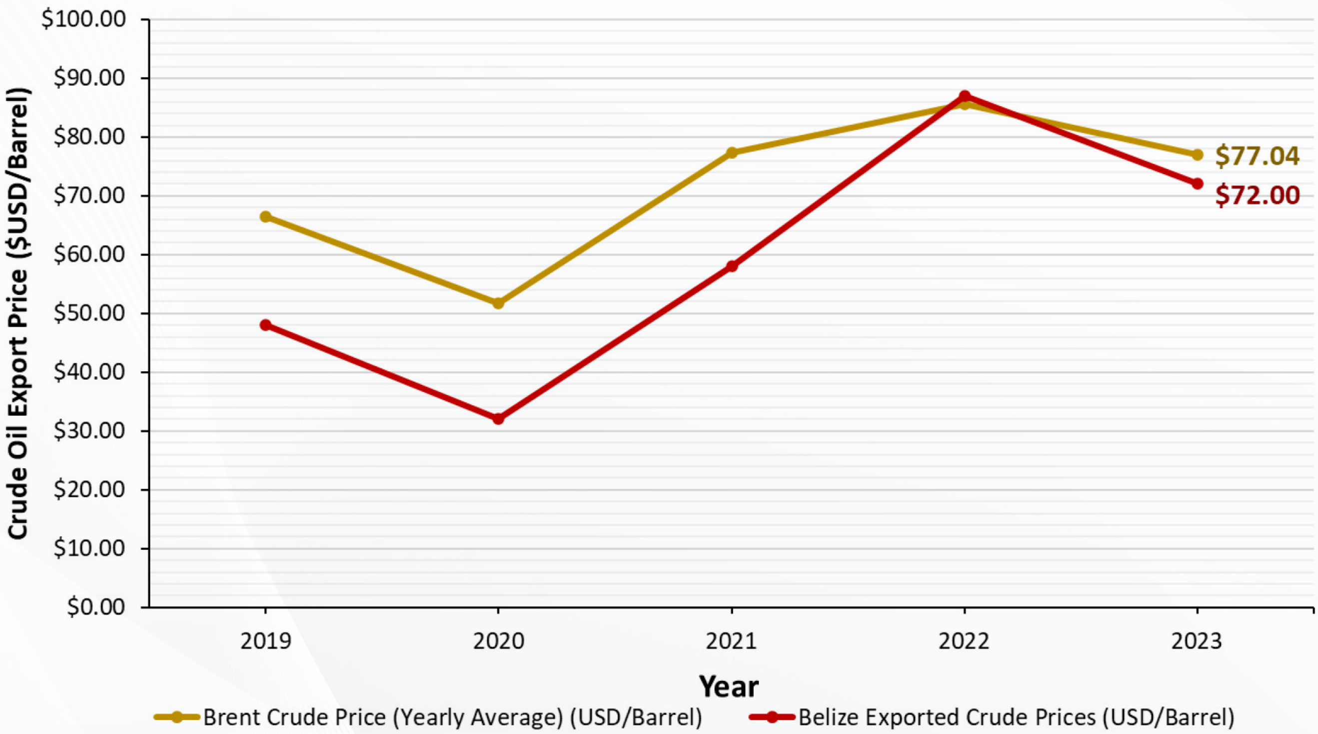


» Figure 27. Transmission & Distribution Losses for BEL's National Grid, 2014-2023

5 ENERGY PRICES

5.1 CRUDE OIL PRICES

The declining production of crude oil is the only energy source currently being exported by Belize. Figure 28 shows the average price at which Belize's crude has been sold internationally over the past five years, compared to the average prices in the international crude market, known as Brent Crude, over the same period. Clearly, Belize has been able to sell crude at a price that roughly but consistently imitates those at the global scale. According to the IEA, there was a surplus of global crude production, especially from the US, Brazil, Guyana, and Iran. This forced the global price to fall somewhat for 2023 (International Energy Agency (IEA), 2023). Despite relatively high prices for two of the past five years, the Statistical Institute of Belize (2024) reports that total crude export revenues have declined by half since 2022, which reflects the decreasing volumes of crude being exported. It is therefore arguable that the impact of market fluctuations on Belize will continue to diminish unless plans are developed and implemented to revitalize crude production. Environmental and policy challenges have historically made expansion of this sector generally difficult to support, partly by design, as Belize's policies continue to push toward the energy transition (Manzano M. & Vernon, 2018).



» Figure 28. Crude Oil Prices – Local Vs. International: 2019-2023

5.2 PETROLEUM PRODUCTS PRICE

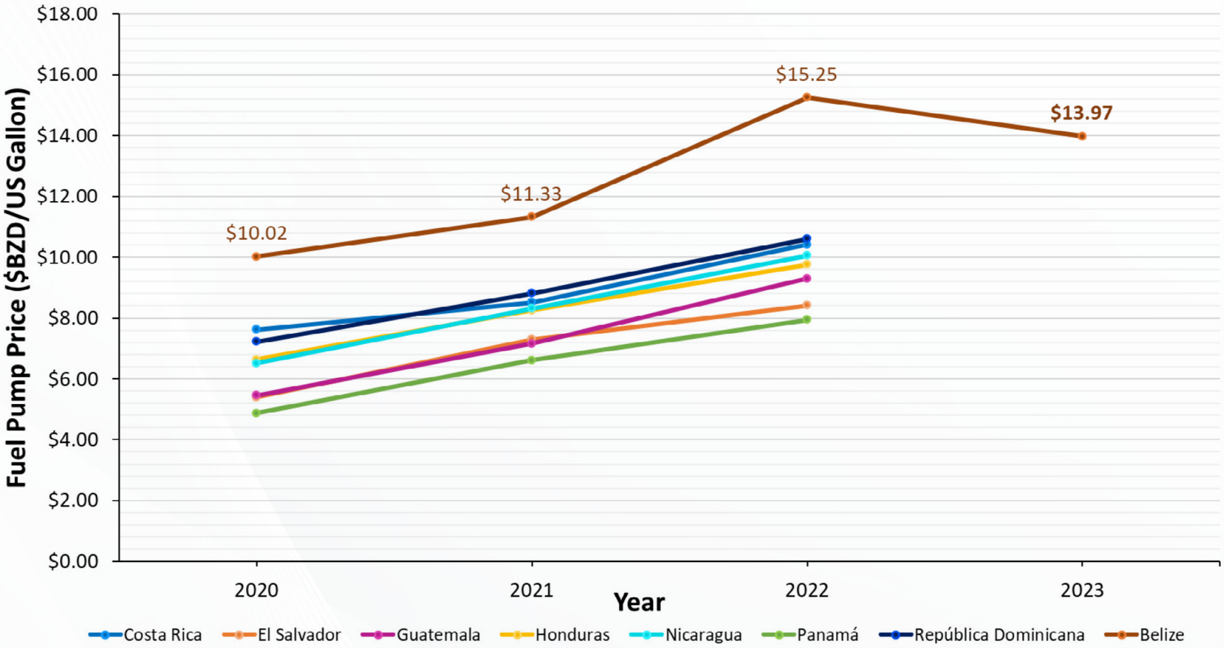
The refined petroleum products commonly used in Belize, all of which are imported, include motor gasoline (Premium and Regular), diesel, kerosene, and liquified petroleum gas. While fuel oils, lubricants, and aviation fuels are also imported for specific sectors, this chapter will focus on the pricing and trends of fuels commonly used by the general Belizean public.

5.2.1 AVERAGE PUMP PRICE FOR REFINED PETROLEUM FUELS

Figure 29 summarizes fuel prices typically found at gas stations by averaging pump prices throughout 2023 and arranging them in descending order. Although Premium gasoline is usually the most expensive, it is also the least imported fuel by volume, with only about one-twentieth of the quantity of Regular gasoline imported in 2023. Of interest to most Belizeans is that the average price of Regular gasoline decreased by about 4.5% from 2022. Unsurprisingly, Regular gasoline remains the most imported fuel by volume, followed by diesel. Diesel's average price has decreased by a stunning 22% compared to 2022. Kerosene averaged the same price as diesel in 2023, but its price decreased by 9.5% compared to last year. While these figures may challenge the joke that prices only ever go up, they bring welcome relief to our wallets—at least for 2023.

» Figure 29. Comparative Prices for Imported Refined Fuels: 2023 Average Prices

Figure 30 illustrates the historical trend in Premium gasoline prices over the past four years, comparing these trends with those in other Central American countries for years in which data was available. It is evident that, like Belize, neighbouring countries experienced continuous price increases from 2020 to 2022. Whether they also saw a decrease in 2023, as Belize did, will be confirmed when updated data becomes available. However, it is clear that prices in Belize have consistently been higher—by about 30% during the earlier part of the trend, and even more in 2022. The Energy Unit at present does not employ economic experts, so a definitive analysis is beyond our scope. However, it is worth noting that many Central American governments use fuel subsidies to make prices more affordable for their populations (Marchán, Espinasa, & Yépez-García, 2017; Wirtz, 2024).

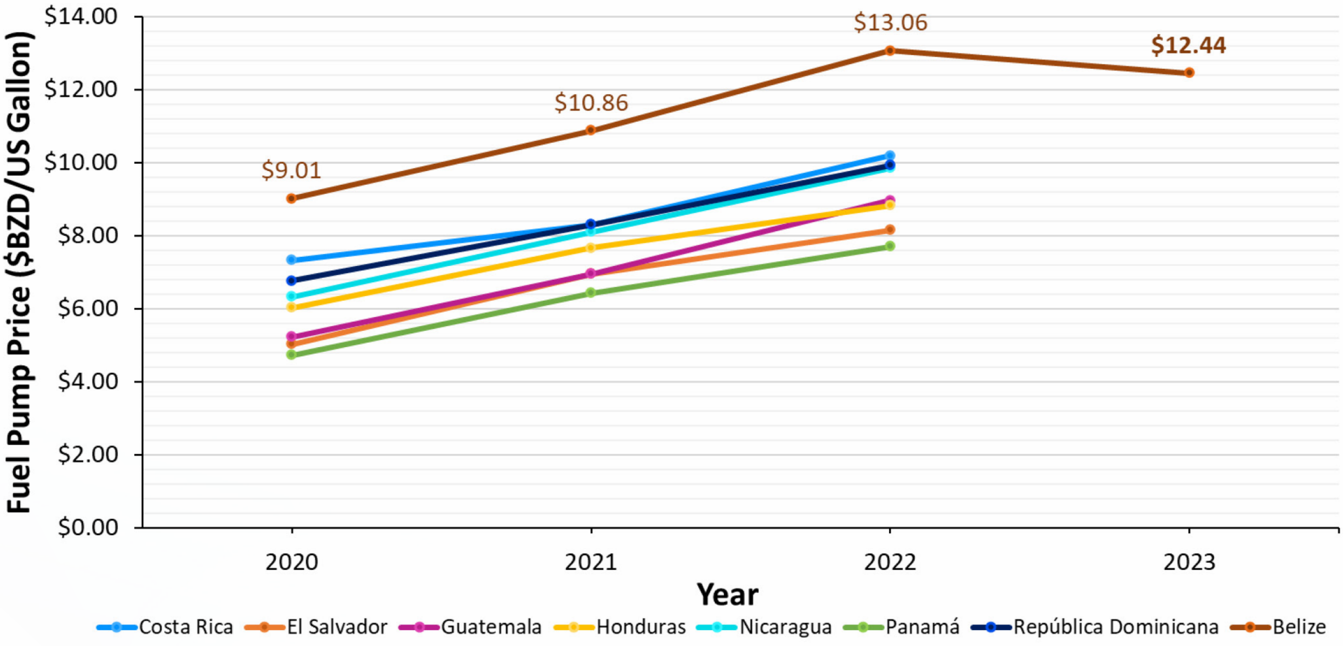


» Figure 30. Regional Prices for Premium Gasoline: 2020-2023

Similarly, Figure 31 illustrates the historical trend for Regular gasoline, comparing Belize's changes with those with that of other Central American nations. The trend shows comparable movements – recent rises across the board from 2020-2022, with a decrease for Belize in 2023 and consistently higher prices in Belize compared to its neighbours. The main difference is that Regular gasoline prices are slightly lower than Premium across the board. It is interesting to speculate whether a larger portion of the public in neighbouring countries can afford Premium gasoline more easily than many Belizeans, possibly due to government subsidies. To broaden the picture of regional comparisons, it is worth noting that in the Organisation of Eastern Caribbean States[8], a gallon[9] of gasoline averaged EC$15.82 in 2023, or about BZ$11.71 (Eastern Caribbean Central Bank, 2024; Forbes Advisor, 2024).

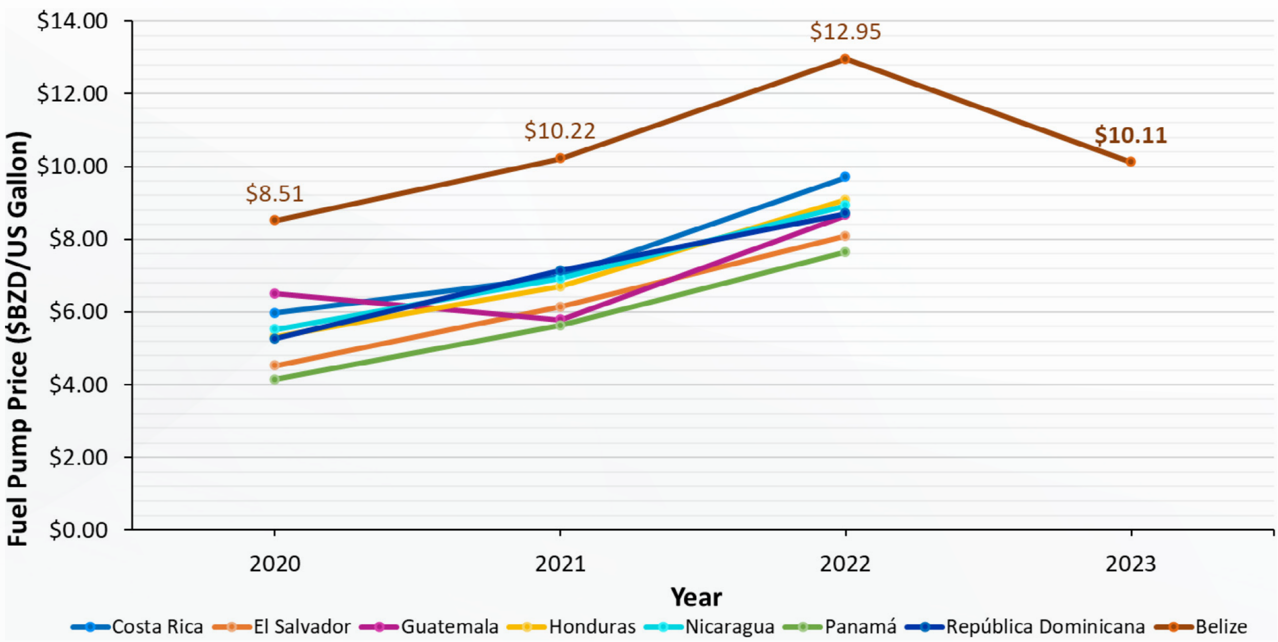
[8] Note: The Organisation of Eastern Caribbean States (OECS) integration region includes the nation states of Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, plus the following overseas territories: Anguilla, The British Virgin Islands, Martinique, Guadeloupe, Montserrat.

[9] The Eastern Caribbean Central Bank reports in Imperial Gallons, which are about 15% volumetrically smaller than the US Gallons used in Belize and Central America. (Eastern Caribbean Central Bank, 2024)



» Figure 31. Regional Prices for Regular Gasoline: 2020-2023

We conclude our pump price analysis with Figure 32. Diesel differs from the other fuels in this lineup in that it is consistently cheaper over time and across regions, and it experienced the greatest price drop—at least in Belize. As noted before, future data analyses will reveal whether other regions experienced the same price decreases as Belize in 2023. In the Eastern Caribbean, the average price for a gallon of diesel in 2023 was EC$15.93 (Eastern Caribbean Central Bank, 2024) or BZ$11.79 (Forbes Advisor, 2024), which is costlier than in Belize but not comparable to Central American countries at this time. While the Energy Unit continues to work to provide relevant and timely statisitics and plans to develop historical trends for regional comparisons, it is notable that all three pump fuels have demonstrated contiguous price increases across Central America in the years for which data is available. This supports the view that Belize's prices align with international trends.

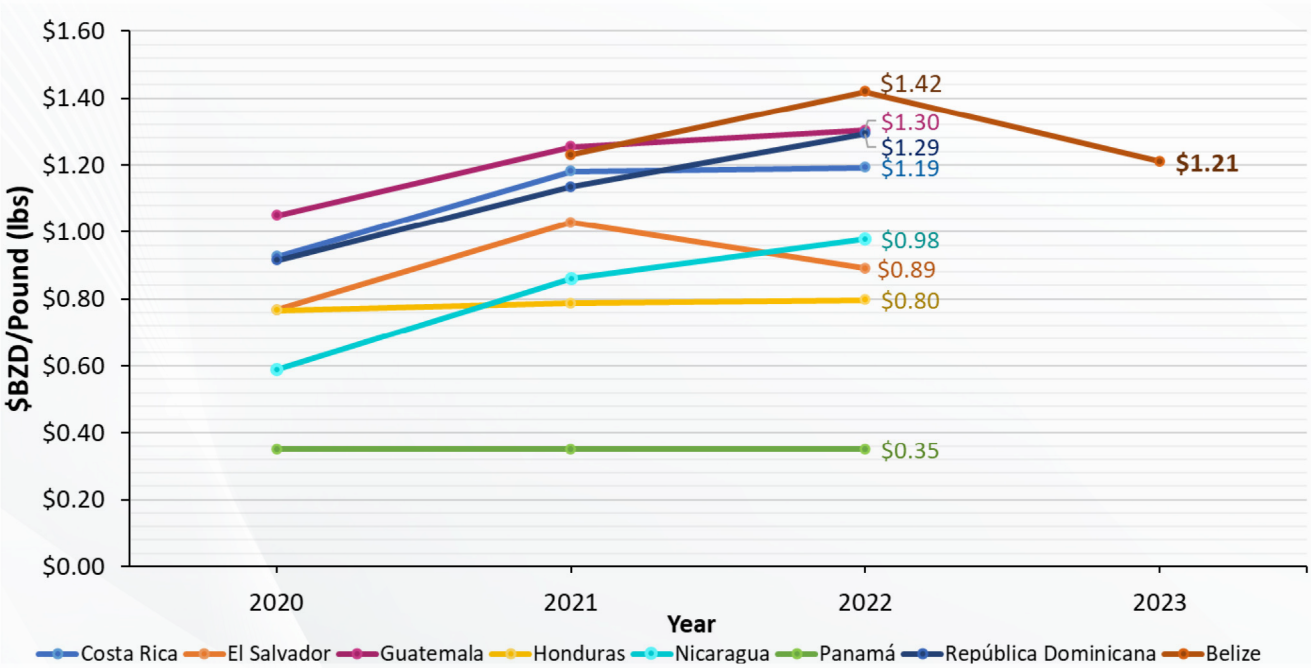


» Figure 32. Regional Prices for Diesel: 2020-2023

5.2.2 ANNUAL AVERAGE PRICE FOR LIQUIFIED PETROLEUM GAS (LPG)

Moving from pump fuels to LPG, Figure 33 shows historical changes in the average price for LPG in Belize over the past three years, along with regional average prices from 2020 to 2022 Belize's average LPG price has decreased notably since last year, falling by 15%, bringing it closer to the 2021 value of $1.23 per pound compared to 2023's $1.42. Central American companies have also experienced price increases in recent years; however, in 2022, Belize was once again at the top of the price scale. Interestingly, while Belize currently does not share established government fuel subsidies with its neighbours, LPG prices are regulated by the Supplies Control Unit within the Ministry of Agriculture. This should be considered when assessing the comparability of regional prices.

In the OECS countries, the price of LPG in 2023 was stated as EC$38.69 for a 20-lb tank and EC$202.31 for a 100-lb tank. (Eastern Caribbean Central Bank, 2024). This converts to BZ$28.63 and BZ$179.72, respectively (Forbes Advisor, 2024). For comparison, based on the 2023 average LPG price, a Belizean would pay BZ$24.20 for a 20-lb tank and BZ$121.00 for a 100-lb tank. Generally, LPG prices are more regionally competitive for Belizeans compared to other refined fuels.

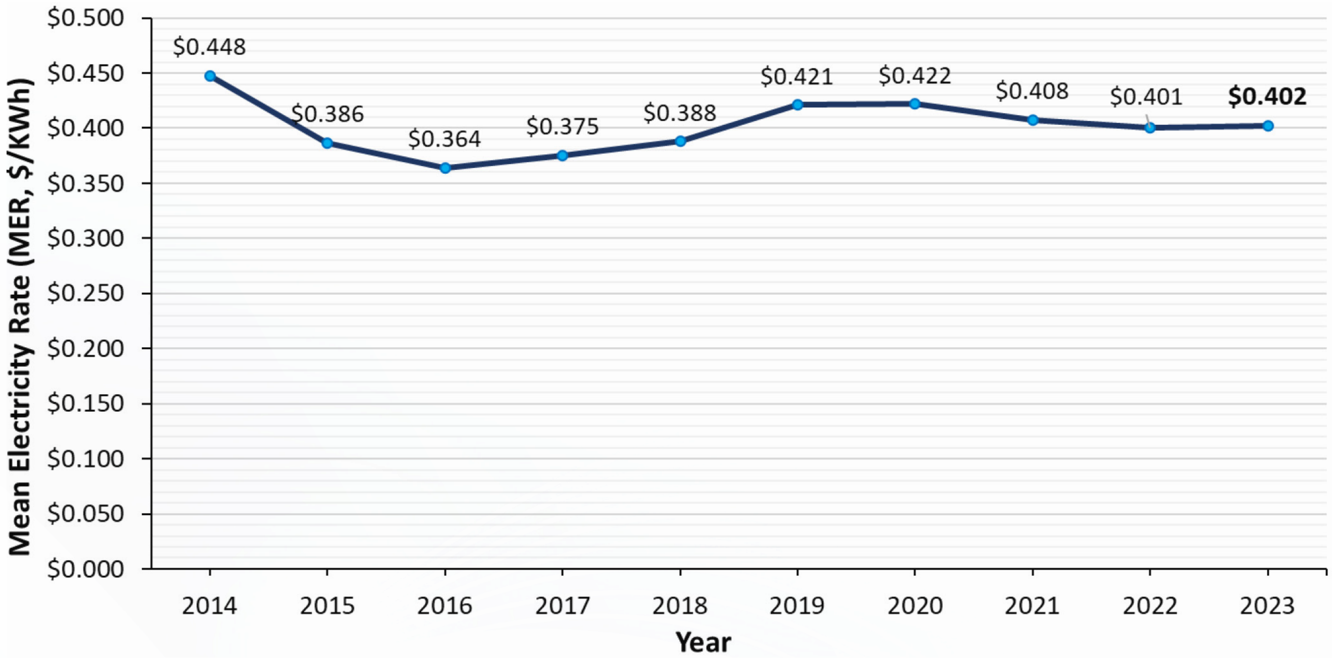


» Figure 33. Regional Prices for Liquified Petroleum Gas (LPG): 2020-2023

In the first section of this chapter, the analysis of global crude prices showed that prices peaked in 2022 over the past five years. As the source fuel for all other refined fuels, this can influence their market prices downstream and may explain why 2022 saw peak prices for all refined fuels analysed in this section.

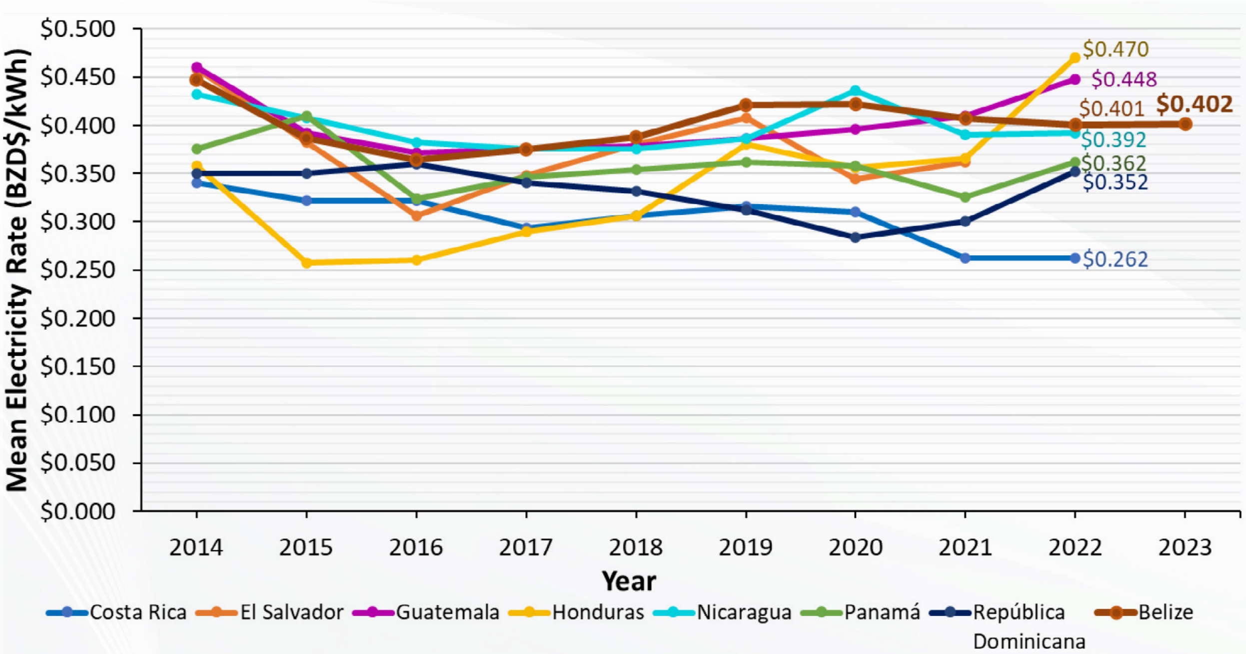
5.3 MEAN ELECTRICITY RATE

The mean electricity rate (MER) is a metric published by BEL that combines all the customer tariffs and incorporates their relative contributions. It can be treated as a proxy for the average electricity rate paid by Belizeans. Figure 34 illustrates changes in the MER over the past ten years. These changes have been gradual, with no significant peaks or sudden dips, indicating that electricity prices in Belize have remained mostly stable. However, consumers will note that while the most recent price highs in 2019 and 2020 have decreased, any return to the lower 2016-2017 prices will take longer. Even the significant volatility of supply that was seen in 2019, partly stemming from the need to import large amounts of power from Mexico, and which can drive the MER upward, did not surpass the decade's maximum of $0.448 in 2014.



» Figure 34. Mean Electricity Rate for Belize Electricity Limited (BEL): 2014-2023

The data from the chart above has been supplemented with comparable prices from across Central America, as shown in Figure 35 below, for the years where data is currently available. In the most recent comparable year, 2022, the MER was lowest in Costa Rica—a country with a high penetration of renewables (International Energy Agency (IEA), 2022), —and highest in Honduras—also a country with a notable share of renewables and very few electricity imports (International Energy Agency (IEA), 2021). To understand the factors that might cause the MER—an indicator of the nation's cost of energy—to decrease, a deeper analysis is needed, as it cannot be attributed solely to the generation mix.

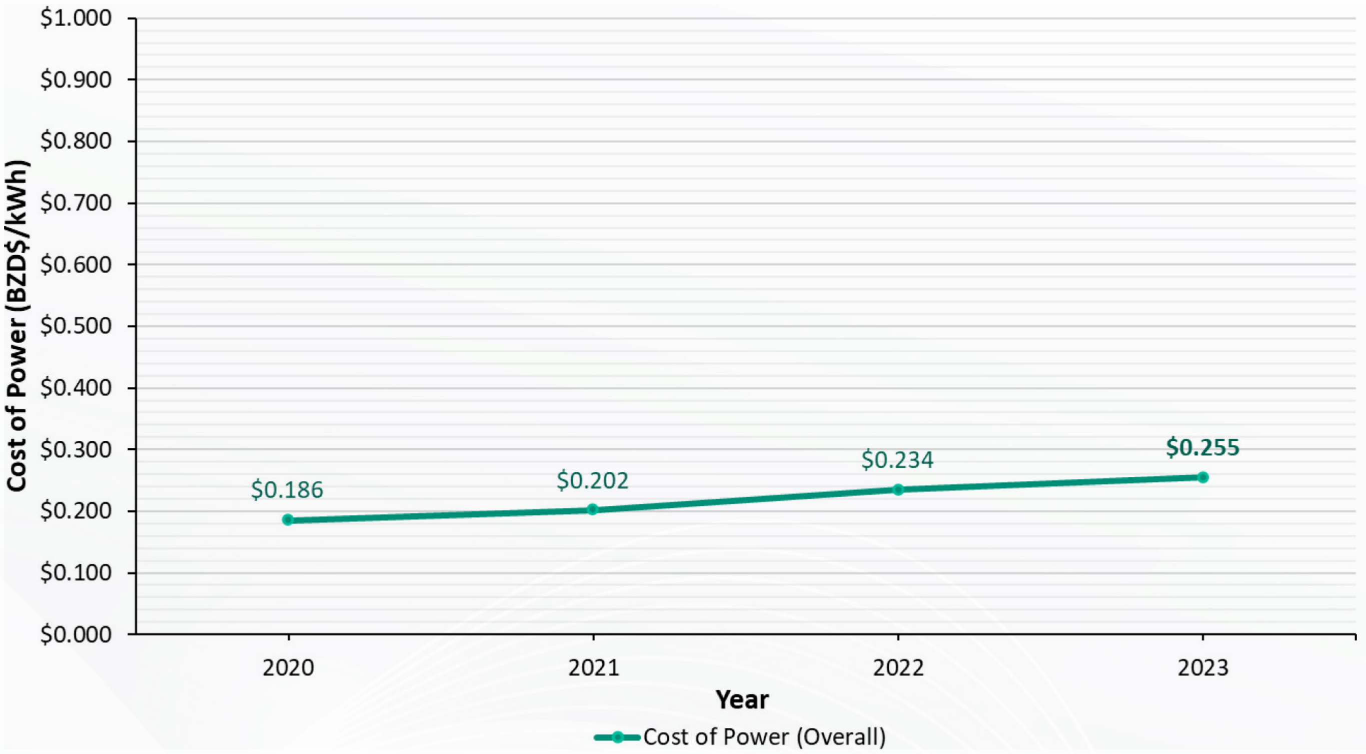


» Figure 35. Regional Comparison of Mean Electricity Rates: 2014-2023

5.4 AVERAGE COST OF POWER

5.4.1 AVERAGE COST OF POWER

The average cost of power metric is an amalgam of costs paid by the national utility for electricity, either bought from IPPs for redistribution or produced at its own expense for distribution. Figure 36 shows the trend in BEL's average cost of power for the past four years, presented in BZD$/kWh. It can be roughly stated that for every kWh that the consumer buys (at an average of $0.402, according to the 2023 MER), BEL has paid an average of $0.255 to produce (in 2023). Of course, the remainder of this cost must be apportioned to BEL's other expenses, such as building and maintenance of transmission and distribution infrastructure, damages from natural events such as lighting, storms, and fires, employee salaries and other operational costs. Figure 36 shows that the average cost of power has been slowly increasing each year. Based on this trend, it seems incumbent to expect the MER to increase gradually as well; however, the MER trend over the past four years does not reflect this growth. Part of the reason for this is that electricity prices are regulated by the PUC.

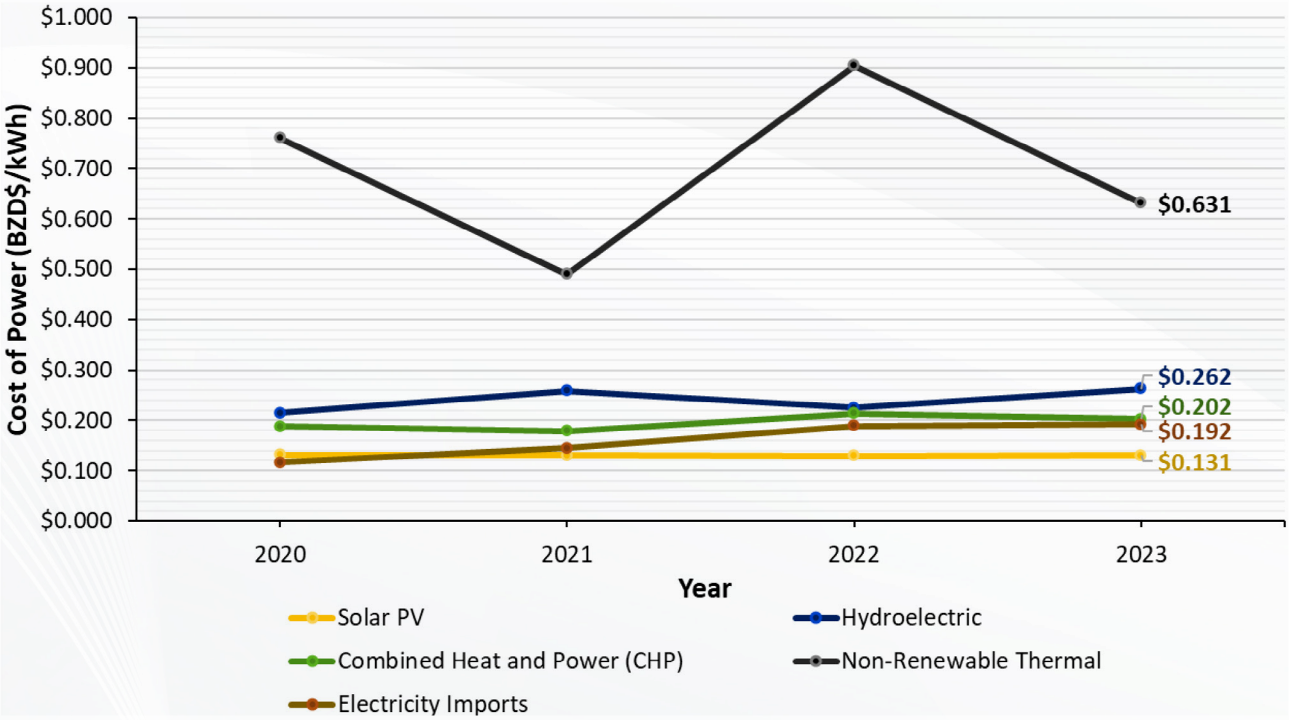


» Figure 36. Cost of Power for Belize Electricity Limited (BEL): 2020-2023

5.4.2 AVERAGE COST OF POWER BY TECHNOLOGY TYPES

When we disaggregate the average cost of power by type of electric generation and consider an average for each type, we get a chart like the one below in Figure 37. This allows us to compare the historical relative costs for the different technologies and sources that have contributed to the national grid mix, and therefore to the overall cost of power. It is immediately obvious that non-renewable thermals are simultaneously the most expensive and the most price-volatile contributors to the mix. However, a comparison with Figure 39 above shows that non-renewable in-country thermals represent the smallest share in terms of quantity and thus have little effect on the overall cost of power. Conversely the line that most closely resembles the average cost of power line is that for imports, which consistently represents the single largest quantitative share of the mix and therefore has the greatest influence on its trend.

Based solely on Figure 37, one might conclude that Belize's cost of power could be reduced by switching to larger shares of renewables (or imports, though imports come with their own set of challenges). However, a more comprehensive analysis of the economics of energy systems shows that while thermal plants have higher operational costs—primarily due to the continuous purchase of fuel—renewables are more expensive to build and install, due to the capital costs of the technology (Tobin, 2015). Therefore, each country's energy system needs careful consideration to balance sustainability, independence, up-front costs, and emissions.



» Figure 37. Cost of Power for Belize Electricity Limited (BEL): 2020-2023

5.5 ELECTRICITY END-USER TARIFF

Table #2 contains a summary of the customer tariffs and rates that were in effect in 2023. Each 'minimum charge' listed is charged monthly. The 'Social Tariff' is reserved for customers with very 'low or intermittent usage, while most households fall under the 'Residential Tariff.. 'Commercial Tariffs' 1 & 2 cater to most businesses, manufacturers, and agri-productive enterprises at different scales. The 'Industrial Tariff' is a special high-voltage connection created especially for customers with very high consumption, typically fewer than thirty in total. The 'Street Lights' tariff is charged to one —the Government of Belize—meaning this cost is covered by taxpayers.

The tariffs are established in the following procedure: first, BEL submits a proposed tariff scheme to the PUC, along with a cost analysis to justify it. The PUC then assesses the proposal and either approves it or requests changes. BEL may accept the decision or contest it, with the latter potentially lengthening the approval process. If both parties are unable to reach an agreement, the issue may escalate to a court case, based on an interpretation of the laws governing BEL and the PUC—namely, the Electricity Act and the PUC Act, both accessible on the PUC's website.

Once a tariff scheme is approved, it goes into effect provisionally for four years. However, BEL and the PUC conduct a review every six months, allowing for adjustments to the scheme in response to market conditions or cost changes. In the current tariff cycle (2020–2024), a new tariff scheme will be proposed in 2024, and once accepted, it will be in effect for the next four years. All of BEL's submissions and the PUC's responses are publicly available on the PUC's website, and the active tariffs can be viewed on BEL's website.

» Table 2. Belize Electricity Limited (BEL) Customer Tariff Groups and Rates, 2023

Tariff Rates		
Social Rate		
Block	**KWhrs**	**Rate ($BZD/kWh)**
1	0-60	$0.22
Minimum Charge		$5.00
Residential Rates		
Block	**KWhrs**	**Rate ($BZD/kWh)**
1	0-50	$0.33
2	51-200	$0.38
3	Above 200	$0.43
Minimum Charge		$10.00
Rates (Commercial customers with average consumption less than 2,500 kWh)		
Block	**KWhrs**	**Rate ($BZD/kWh)**
1	0-50	$0.33
2	51-200	$0.38
3	Above 200	$0.43
Minimum Charge		$10.00
Rates (Commercial customers who are not classified as Commercial 1 or Industrial)		
Block	**KWhrs**	**Rate ($BZD/kWh)**
1	0-10,000	$0.41
2	10,001-20,000	$0.39
3	Above 20,000	$0.38
Minimum Charge		$150.00
Industrial 1 Rates		
		Rate ($BZD/kWh)
Demand (KVA)		$ 35.82
Energy (per kWH)		$ 0.30
Service Charge		$ 250.00
Industrial 2 Rates		
		Rate ($BZD/kWh)
Demand (KVA)		$ 23.00
Energy (per kWH)		$ 0.26
Service Charge		$ 250.00
Streetlights		
KWhrs		**Rate ($BZD/kWh)**
1		$0.45

Information taken from: https://www.bel.com.bz/Rate_Schedule.aspx

6 ENVIRONMENT AND CLIMATE PROTECTION

6.1 ENERGY SUSTAINABILITY GOALS

As Belize continues to develop its energy sector, a critical focus is advancing energy sustainability and accelerating the decarbonization of the energy sector. The need for action has become increasingly urgent due to the significant risks and impacts of climate change, already being experienced worldwide, especially in vulnerable regions such as the Caribbean. Belize and other Caribbean nations are experiencing the severe consequences of climate change firsthand: more intense and frequent hurricanes, rising land and ocean temperatures, higher sea levels, and shifting weather patterns that are affecting energy production and threatening food security and economic stability (Intergovernmental Panel on Climate Change (IPCC), 2022).

The energy transition is closely linked to sustainable development; thus, the decarbonizing the energy sector should be viewed not only as an environmental necessity but also as a socio-economic one. According to the World Energy Transitions Outlook (2022), governments must address the challenging issues of affordability, energy security, and resilience. Nonetheless, transitioning to a low-carbon energy pathway is crucial for nations to address and mitigate the compounding economic issues that disproportionately impact ecosystems and vulnerable communities.

As a government who aims to be responsive, inclusive, and participatory in sustainability and environmental protection, Belize is committed to reducing its reliance on fossil fuels by incorporating more renewable energy into its energy mix. This goal aligns with the broader objectives of the Belize National Energy Policy 2023-2040, which envisions an energy future that stimulates social and economic development via the provision of modern energy services to its citizens. In addition to supporting domestic energy resilience, these national objectives also align with efforts to significantly impact energy consumption patterns and reduce greenhouse gas emissions (Ministry of Public Utilities, Energy, Logistics, and E-Governance (MPUELE), 2023).

Belize's pursuit of these sustainability goals is further reinforced by its engagement with international and regional initiatives, such as the Paris Agreement, which aims to reduce greenhouse gas emissions in the fight against climate change. This approach positions Belize as a proactive player in the quest for a low-carbon energy pathway, demonstrating its commitment to delivering a sustainable, secure, and affordable energy future for all Belizeans.

6.1.1 SUSTAINABLE DEVELOPMENT GOAL 7

As a small, developing nation, Belize faces typical challenges in its energy sector, such as its dependency on imported petroleum products to meet its energy needs and the need to provide equitable access to modern energy services for its people. These challenges are closely linked to international commitments, including Belize's dedication to achieving the Sustainable Development Goals (SDGs), particularly, SDG 7: Affordable and Clean Energy, of the United Nations 2030 Agenda for Sustainable Development.

SDG 7, which focuses on energy, aims to "ensure access to affordable, reliable, sustainable, and modern energy for all" (International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; & World Health Organization, 2024). Table 3 offers an overview of the primary targets under SDG 7.

By aligning national energy policies with global energy targets, Belize aims to ’enhance its energy landscape, contributing to improved outcomes in combating climate change, reducing poverty, and advancing sustainable development. Section 2.2, ‘Energy Indicators,’ summarizes national progress on energy targets to advance SDG 7.

» Table 3. Sustainable Development Goal 7: Targets

Target	Target Description
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.

6.1.2 NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

At the global level, Belize is a signatory to the Paris Agreement, which aims to limit global temperature rise to well below 2°C above pre-industrial levels. To contribute to this global effort, Belize has set ambitious targets in its Nationally Determined Contributions (NDCs), including a significant commitment to reducing emissions from the energy sector. This includes increasing the adoption of clean energy technologies, enhancing energy efficiency measures, and expanding the capacity of renewable energy sources.

Belize’s most recent and updated NDC was submitted in September 2021 to the United Nations Framework Convention on Climate Change (UNFCCC). Table 4 below outlines energy specific targets and their associated actions under Belize’s NDC (2021), reflecting its commitment to enhanced climate ambition. The next update of Belize’s NDC is scheduled for 2025, during which new and/or updated energy-specific targets and actions will be formulated.

» Table 4. Belize's NDC (2021) Energy Sector Commitments: Targets and Actions

Type	Commitment	SDG Linkages
Target	**Avoid emissions from the power sector equivalent to 19 KtCO2e per year through system and consumption efficiency measures amounting to at least 100 GWh/year by 2030**	**SDG 7, 13**
Action	Reduction in transmission and distribution losses from 12% to 10% by 2030 resulting in reduced electricity demand and better quality of supply	SDG 7, 13
Action	Improve energy efficiency and conservation by at least 10% by 2030 compared to a BAU baseline projection, including through an increase of appliance efficiency in buildings and implementation of building codes, appliance standards and labels and promotion of energy efficient technology in the tourism sector	SDG 7, 13
Target	**Avoid 44 KtCO2e in the national electricity supply by 2030 through the introduction of expanded capacity from renewable energy sources**	**SDG 7, 13**
Action	Achieve 75% gross generation of electricity from renewable energy sources by 2030 through the implementation of hydropower, solar, wind and biomass, including in the tourism sector.	SDG 7, 13
Action	Reduce emissions from high carbon electricity sources including taking 2MW diesel generation offline by 2022 and converting new LPG generation to CNG by 2026.	SDG 7, 13
Action	Install 40 MW utility-scale solar power by 2025.	SDG 7, 13
Action	Implement an interconnection policy and regulatory framework to facilitate distributed renewable power generation by 2022.	SDG 7
Action	Expand the use of biomass, including bagasse, for electricity generation.	SDG 2, 7, 13
Action	Explore the feasibility of onshore wind power generation and flexible storage technologies to complement high levels of variable renewable power sources	SDG 7, 13
Target	**Avoid 117 KtCO2e/year from the transport sector by 2030 through a 15% reduction in conventional transportation fuel use and achieve 15% efficiency per passenger- and tonne-kilometre through appropriate policies and investments**	**SDG 7, 13**

Action	Improve efficiency in the public transit system through the deployment of 77 hybrid and electric buses by 2030 (17 by 2025)	SDG 7, 11, 13
Action	Implement a policy framework to promote more efficient vehicles and alternative fuels/blends through incorporation of fuel economy labels; emissions testing; fuel economy standards, limitations and emissions-based taxes/feebates for imported vehicles by 2025	SDG 7, 11, 13
Action	Facilitate adoption of electric vehicles in the passenger fleet by conducting a feasibility study for EV penetration, including assessment of potential incentives, and investing in EV charging infrastructure	SDG 7, 11, 13

6.1.3 NATIONAL ENERGY POLICY 2023

At the national level, the National Energy Policy 2023-2040 serves as Belize's strategic blueprint for advancing its energy sector over the medium to long term. This policy outlines ambitious targets and goals[10], aimed at ensuring energy security, sustainability, and resilience. Key objectives focus on increasing the share of renewable energy in the national energy mix, enhancing energy efficiency across all sectors, and expanding access to modern energy services, all with the goal of reducing of energy-related greenhouse gas emissions. These key objectives are in alignment with national development priorities and international climate commitments, such as the Paris Agreement. Table 5 outlines the main targets and goals of the National Energy Policy 2023-2040.

[10] A key conditional variable on the development of these energy sector targets is based on the assumption that all stated policies in the National Energy Policy would have been successfully implemented by 2030.

» Table 5. Belize National Energy Policy 2023-2040 Targets and Goals

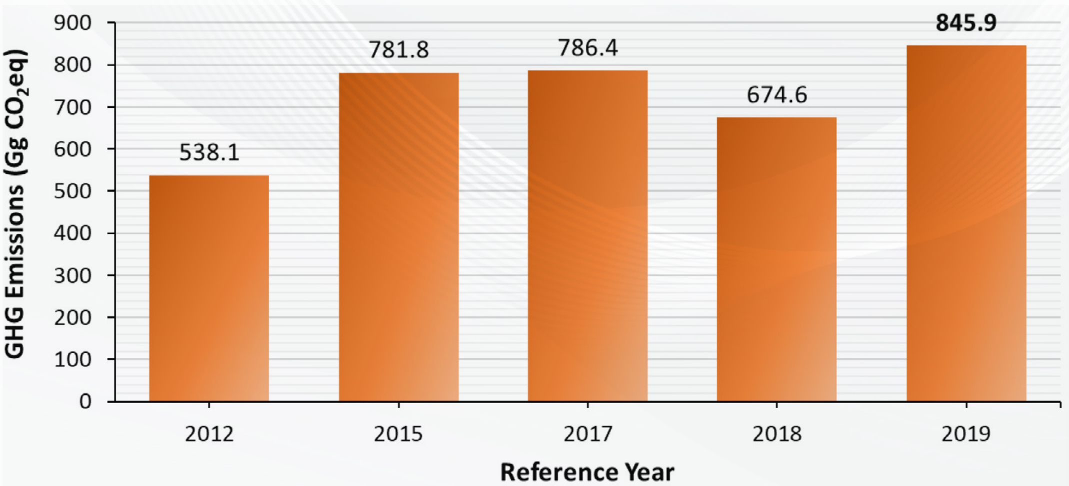
Goal	Description	Target
Enhance Energy Efficiency	Reducing energy intensity across all sectors through collaboration	Reduce energy consumption by 10%, with projection to reduce energy intensity to 0.141 toe/USD000s of GDP
Increase Renewable Energy Share	Raise the share of renewables in the energy supply mix, to include biofuels, as well as more solar, hydro, and biomass.	Renewable energy share in national energy supply mix above 60% by 2040.
Increase Renewable Energy Share	Increase renewable energy penetration in the electricity mix	Increase renewable energy electricity penetration to 75% by 2030.
Greenhouse Gas Emissions	Reduction of energy-related greenhouse gas emissions, in line with NDC commitments.	Achieve a 30% reduction in GHG emissions by 2030.
Expand Energy Access	Expand access to modern energy services, especially in rural areas.	Ensure 100% access to reliable and affordable electricity by 2030.
Energy related Expenditure	Decrease the energy expenditure in relation to GDP	Reduce energy expenditure to 15% of GDP by 2030, in comparison to 21% of GDP in 2021.

6.2 GHG EMISSIONS FROM THE ENERGY SECTOR

As the foundation of global climate action, governments are tasked with limiting the amount of greenhouse gas emissions within their national boundaries while fostering economic stability and growth simultaneously. Given the energy sector's role as a primary driver of greenhouse gas emissions, transitioning to renewable and efficient energy systems is crucial for reducing emissions and, by extension, mitigating the harmful effects of climate change that are already being felt globally. As Belize continues to develop its energy infrastructure and policies, understanding the emission profile of the energy sector is becoming increasingly critical. Fundamentally, this is a result of sustainable energy being vital for building resilience against climate impacts and for promoting sustainable economic development.

The most updated energy sector emission profile forms part of Belize's Fourth National Communication Report, submitted to the UNFCCC. According to this report (2022), sequestration from the Agriculture, Forestry, and Other Land Use (AFOLU) sector continues to help Belize maintain its status as a net emission sink, with the largest source of greenhouse gas emission coming from the energy sector.

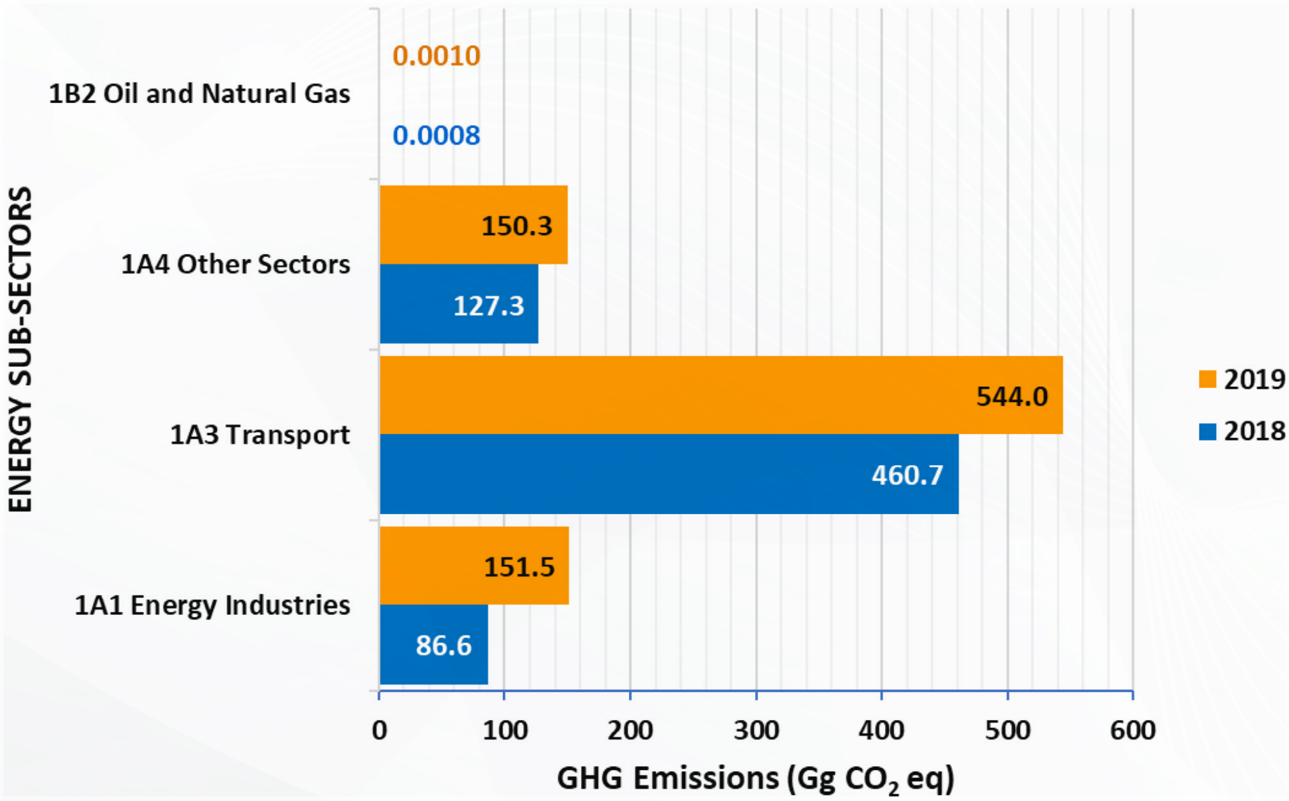
Figure 38 presents the latest emission figures for Belize, showing annual energy sector GHG emissions over five reference years: 2012, 2015, 2017, 2018, and 2019[11]. As illustrated, emissions from the energy sector depict a general upward trend between 2012 and 2019, despite the observed temporary reduction in 2018. Emissions spiked in 2019 to the highest value over the reporting period, reaching 845.9 Gg CO2eq, reflecting a substantial increase compared to previous years. This spike could be attributed to multiple factors, such as higher energy demand, economic growth, and/or changes in the energy mix, including more carbon-intensive sources because of climate change impacts on renewable energy production.



» Figure 38. Total Annual Energy Sector GHG Emissions

[11] Emissions are measured in gigagrams of CO2 equivalent (Gg CO2eq).

Figure 39 presents further information on GHG emissions generated by various energy sub-sector[12] activities in Belize for reference years 2018 and 2019. Overall, there is a clear upward trend in GHG emissions across most energy sub-sectors from 2018 to 2019. The transport sub-sector being the most significant contributor to this increase in both years, rising from 460.7 Gg CO2 eq in 2018 to 544.0 Gg CO2 eq in 2019. This highlights the growing impact of transportation activities on overall GHG emissions in Belize. Furthermore, the energy industries sub-sector also saw a notable increase in GHG emissions, with changes in the energy supply mix and demand effects. These trends underscore the need for continuous efforts to transition the energy sector to more efficient and greener technologies and strategies to meet climate and sustainable development targets.



» Figure 39. Annual Energy Sub-Sector GHG Emissions, 2018-2019

[12] The sub-sectors analyzed include Energy Industries (1A1), Transport (1A3), Other Sectors (1A4), and Oil and Natural Gas (1B2).

6.3 GRID EMISSION FACTOR FOR BELIZE

The grid emission factor (GEF) for Belize represents the amount of GHG emissions (tCO_2) produced per unit of electricity generated (megawatt hour, MWh) and delivered through the national grid[13]. In collaboration with the Belize National Climate Change Office and the UNFCCC, a standardized baseline grid emission factor for Belize's national power grid was produced and entered into force on August 24, 2021 (Table 6). The grid emission factor for Belize was derived using the Clean Development Mechanism (CDM) method/tool[14], ensuring that it adheres to international standards for measuring and reporting emissions.

» Table 6. Grid Emission Factor for Belize

Parameter	SI Unit	Description	Value
$EF_{grid,OM,y}$	tCO_2/MWh	Operating margin CO_2 emission factor for the BEL	0.49
$EF_{grid,BM,y}$	tCO_2/MWh	Build margin CO_2 emission factor for the BEL	0.21
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the BEL applicable to the project activities of wind and solar power generation	0.42
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the BEL applicable to all project activities other than wind and solar power generation project activities for the first crediting period	0.35
$EF_{grid,CM,y}$	tCO_2/MWh	Combined margin CO_2 emission factor for the BEL applicable to all project activities other than wind and solar power generation project activities for the second and third crediting period	0.28

The grid emission factor for Belize is an important measure for understanding the environmental impact of electricity consumption, especially in relation to energy access projects and Belize's climate change targets. Monitoring and reducing the GEF is paramount to decarbonizing the energy sector as stipulated in multiple climate commitments for Belize, both at the national and international levels.

[13] Grid under the ownership and management of Belize Electricity Limited.
[14] CDM TOOL07: Tool to determine the emission factor of an electricity system

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

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 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 service reduction, energy efficiency provides energy reductions without sacrificing service.

Energy Indicators: These are key statistic markers that offer 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: 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) in one year, measured at the output terminals of the generators. (International Recommendations on Energy Statistics, 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 that 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 continually 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: These 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: 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 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 the 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.

APPENDIX B: DATA TABLES

TABLE 7 - DETAILED ENERGY BALANCE

Energy Flows \ Energy Products	Crude oil	Natural gas	Oil products							Hydro	Solar[2]	Wind	Biofuels		Electricity[4]	Heat	Total
			Motor Gasoline[1]	Diesel Oil	Kerosene	Fuel Oil[1]	Aviation Fuel[1]	LPG	Non-Energy Oil Products				Bagasse	Firewood[3]			
Indigenous Production	917.3	34.2	-	-	-	-	-	-	-	636.1	23.4	-	3,997.8	611.8	-	-	6,220.6
Imports	-	-	3,687.5	3,320.1	993.8	378.3	1,233.2	1,388.3	NR		-	-	-	-	1,550.4	-	12,551.7
Exports	-57.9	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-57.9
International marine bunkers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
International aviation bunkers	-	-	-	-	-	-	-1,027.1	-	-	-	-	-	-	-	-	-	-1,027.1
Stock changes (+/-)	45.2	-	-	-	-	-	-	-	-	-	-	-	37.5	-	-	-	82.7
Total Energy Supply (TES)	**904.7**	**34.2**	**3,687.5**	**3,320.1**	**993.8**	**378.3**	**206.1**	**1,388.3**	**0.0**	**636.1**	**23.4**	**0.0**	**4,035.3**	**611.8**	**1,550.4**	**0.0**	**17,770.0**
Statistical Difference	**11.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**37.5**	**0.0**	**3.2**	**0.0**	**52.2**
Transfers	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Transformation Processes	**-176.4**	**0.0**	**0.0**	**-529.4**	**0.0**	**-378.3**	**0.0**	**0.0**	**0.0**	**-636.1**	**-23.4**	**0.0**	**-3,997.8**	**0.0**	**1,515.3**	**0.0**	**-4,226.2**
Electricity plants	-	-	-	-529.4	-	-378.3	-	-	-	-636.1	-23.4	-	-	-	944.7	-	-622.5
CHP plants	-176.4	-	-	-	-	-	-	-	-	-	-	-	-3,997.8	-	570.6	NR	-3,603.6
Heat plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Gas works (and other conversion to gases)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Natural Gas Blending Plants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Charcoal Plants	-	-	-	-	-	-	-	-	-	-	-	-	-	NR	-	-	0.0
Other Transformation processes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Energy Industry Own Use	**-21.8**	**0.0**	**0.0**	**-2.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-269.6**	**0.0**	**-293.5**
Losses	**0.0**	**-34.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-337.7**	**0.0**	**-371.9**
Total Final Energy Consumption	**695.1**	**0.0**	**3,687.5**	**2,788.6**	**993.8**	**0.0**	**206.1**	**1,388.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**611.8**	**2,455.1**	**0.0**	**12,826.3**
Manufacturing, Construction, Non-fuel Mining Industries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	119.8	-	119.8
Non-metallic minerals	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Machinery	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Mining and quarrying	15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.6
Food, beverages, and tobacco	120.0	-	-	NR	-	-	-	NR	-	-	-	-	-	-	-	-	120.0
Paper, pulp and print	NR	-	-	NR	-	-	-	NR	-	-	-	-	-	-	-	-	0.0
Wood and wood products	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5
Construction	83.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83.2
Not elsewhere specified	301.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	301.6
TRANSPORT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Road	-	-	3,687.5	2,788.6	NR	-	-	NR	-	-	-	-	-	-	NR	-	6,476.1
Domestic Aviation	-	-	-	-	-	-	206.1	-	-	-	-	-	-	-	-	-	206.1
Domestic Marine Navigation	-	-	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Not elsewhere specified	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
OTHER	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Residential	-	-	NR	-	993.8	-	-	1,388.3	-	-	-	-	-	611.8	938.5	-	3,932.5
Commercial and public services	125.9	-	-	-	-	-	-	NR	-	-	-	-	-	-	1,396.7	-	1,522.6
Agriculture/Forestry	42.2	-	-	NR	-	-	-	-	-	-	-	-	-	-	-	-	42.2
Fishing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
Not elsewhere specified	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
NON-ENERGY USE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
in Industry/Transformation/energy	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
of which: feedstocks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0
in transport	-	-	-	-	-	-	-	-	NR	-	-	-	-	-	-	-	0.0
in other	-	-	-	-	-	-	-	-	NR	-	-	-	-	-	-	-	0.0
Electricity and Heat Output																	
Total Electricity Generated[5] - MWh	**17,843.8**	**0.0**	**0.0**	**43,378.4**	**0.0**	**36,032.5**	**0.0**	**0.0**	**0.0**	**176,680.7**	**6,498.9**	**0.0**	**140,651.8**	**0.0**	**0.0**	**0.0**	**421,086.0**
Electric Utility	-	-	-	43,200.8	-	-	-	-	-	-	-	-	-	-	-	-	43,200.8
Electricity plants (IPPs)	-	-	-	-	-	36,032.5	-	-	-	176,680.7	6,498.9	-	-	-	-	-	219,212.0
CHP plants (IPPs)	16,864.4	-	-	-	-	-	-	-	-	-	-	-	140,651.8	-	-	-	157,516.2
Electricity Autoproducers	979.4	-	-	177.6	-	-	-	-	-	-	-	-	-	-	-	-	1,157.0

» Table 8. Petroleum Products Importation Figures - 2023

2023 Importation Figures		
Petroleum Product	**Unit**	**Volume**
Premium Gasoline	US Gallon	1,625,887.6
Regular Gasoline	US Gallon	26,360,670.4
Diesel	US Gallon	22,659,997.1
Kerosene	US Gallon	6,988,986.9
Heavy Fuel Oil	US Gallon	2,323,440.0
Light Fuel Oil	US Gallon	36,227.1
Aviation Gasoline	US Gallon	108,000.0
Jet Fuel Kerosene	US Gallon	8,572,000.0
Liquified Petroleum Gas	Kilogram	31,339,000.0

» Table 9. Installed Electricity Generation Capacity

Installed Capacity		2020	2021	2022	2023
ON-GRID					
Producer	**Type**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**
Hydro		54.5	54.65	54.65	54.65
Fortis Belize - Mollejon	Hydro	25.2	25.2	25.2	25.2
Fortis Belize - Challilo	Hydro	7	7	7	7
Fortis Belize - Vaca	Hydro	19	19	19	19
Hydro Maya*	Hydro	3.3	3.45	3.45	3.45
Biomass		21.5	21.5	21.5	21.5
BELCOGEN	Biomass	13.5	13.5	13.5	13.5
Santander	Biomass	8	8	8	8
Solar PV		0.48	1.36	1.33	1.33
JICA (University of Belize)	Solar	0.48	0.48	0.45	0.45
Paradise Shrimp Farms	Solar	0	0.88	0.88	0.88
Non-RE Thermal		43.6	42.5	42.5	41.5
Blair Athol Power Company Limited*	Fossil Fuel	23.6	22.5	22.5	22.5
Gas Turbine (BEL owned)	Fossil Fuel	20	20	20	19
OFF-GRID					
Producer	**Type**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**
Non-RE Thermal		11.7	11.8	11.9	11.8
Caye Caulker Plant (BEL owned)	Fossil Fuel	4	4	4.1	4
Farmers Light Plant Corporation (FLPC)*	Fossil Fuel	7.7	7.8	7.8	7.8
Solar PV		0	3.04	3.04	3.91
Farmers Light Plant Corporation (FLPC)	Solar	0	3.04	3.04	3.91
ENERGY IMPORTS					
Producer	**Type**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**	**Capacity (MW)**
Imported Electricity from Mexico		55	55	55	55
CFE		55	55	55	55
TOTAL		***131.78***	***134.85***	***134.92***	***134.69***

» **Table 10. Refined Transportation Fuels Prices: Regional Comparison**

Central America & the Dominican Republic: National Prices for Refined Fuels				
(BZD$/US Gallon)				
Product by Country	**Year**			
Diesel	**2020**	**2021**	**2022**	**2023**
Costa Rica	$5.96	$6.96	$9.70	
El Salvador	$4.52	$6.14	$8.08	
Guatemala	$6.50	$5.78	$8.66	
Honduras	$5.32	$6.70	$9.08	
Nicaragua	$5.52	$6.92	$8.92	
Panamá	$4.14	$5.62	$7.64	
República Dominicana	$5.26	$7.14	$8.70	
Belize	$8.51	$10.22	$12.95	$10.11
Premium Gasoline	**2020**	**2021**	**2022**	**2023**
Costa Rica	$7.62	$8.52	$10.42	
El Salvador	$5.40	$7.30	$8.42	
Guatemala	$5.46	$7.16	$9.30	
Honduras	$6.64	$8.26	$9.76	
Nicaragua	$6.52	$8.32	$10.06	
Panamá	$4.88	$6.62	$7.94	
República Dominicana	$7.22	$8.82	$10.60	
Belize	$10.02	$11.33	$15.25	$13.97
Regular Gasoline	**2020**	**2021**	**2022**	**2023**
Costa Rica	$7.32	$8.30	$10.18	
El Salvador	$5.02	$6.94	$8.14	
Guatemala	$5.22	$6.94	$8.96	
Honduras	$6.02	$7.66	$8.82	
Nicaragua	$6.32	$8.10	$9.84	
Panamá	$4.72	$6.42	$7.70	
República Dominicana	$6.76	$8.30	$9.92	
Belize	$9.01	$10.86	$13.06	$12.44

Central America refined fuels figures are from 'Centroamérica y la República Dominicana: estadísticas de hidrocarburos, 2022' (pg. 18) by CEPAL. Available at: https://www.cepal.org/es/publicaciones/69189-centroamerica-la-republica-dominicana-estadisticas-hidrocarburos-2022

» **Table 11. LPG Prices: Regional Comparison**

Central America and the Dominican Republic: National Prices for LPG				
(In BZD/lbs)				
	2020	**2021**	**2022**	**2023**
Costa Rica	$0.93	$1.18	$1.19	
El Salvador	$0.77	$1.03	$0.89	
Guatemala	$1.05	$1.25	$1.30	
Honduras	$0.77	$0.79	$0.80	
Nicaragua	$0.59	$0.86	$0.98	
Panamá	$0.35	$0.35	$0.35	
República Dominicana	$0.91	$1.13	$1.29	
Belize		$1.23	$1.42	$1.21

Central American LPG figures from ‘Centroamérica y la República Dominicana: estadísticas de hidrocarburos, 2022’ (pg. 21) by CEPAL. Available at: https://www.cepal.org/es/publicaciones/69189-centroamerica-la-republica-dominicana-estadisticas-hidrocarburos-2022

» **Table 12. Mean Electricity Rates: Regional Comparison**

Mean Electricity Rate Across Central America and the Dominican Republic										
(BZD$/kWh)										
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Costa Rica	$0.340	$0.322	$0.322	$0.294	$0.306	$0.316	$0.310	$0.262	$0.262	
El Salvador	$0.458	$0.382	$0.306	$0.348	$0.380	$0.408	$0.344	$0.362		
Guatemala	$0.460	$0.392	$0.372	$0.376	$0.378	$0.386	$0.396	$0.410	$0.448	
Honduras	$0.358	$0.258	$0.260	$0.290	$0.306	$0.380	$0.356	$0.366	$0.470	
Nicaragua	$0.432	$0.408	$0.382	$0.376	$0.376	$0.386	$0.436	$0.390	$0.392	
Panamá	$0.376	$0.410	$0.324	$0.346	$0.354	$0.362	$0.358	$0.326	$0.362	
República Dominicana	$0.350	$0.350	$0.360	$0.340	$0.332	$0.312	$0.284	$0.300	$0.352	
Belize	$0.448	$0.386	$0.364	$0.375	$0.388	$0.421	$0.422	$0.408	$0.401	$0.402

Central American data from: Estadísticas del subsector eléctrico de los países del Sistema de la Integración Centroamericana (SICA), 2022 (pg. 30). Available at: https://www.cepal.org/es/publicaciones/68763-estadisticas-subsector-electrico-paises-sistema-la-integracion-centroamericana


KLEIN JEANS

APPENDIX C: METHODOLOGICAL NOTES

The following section clarifies issues related to data quality, coverage, management, methodological treatments, and other relevant areas to ensure transparency and visibility for data users. The methodological notes are described below:

Section 2.1 Energy Balance:

Belize's 2023 energy balance table is presented in both detailed and a simplified version as recommended by IRES. The degree of detail provided depended on data and resource availability, as well as the classifications used in context with Belize's energy landscape. For a detailed definition of energy products and flows in Belize's 2023 Energy Balance Table, please refer to the IRES document (Chapter 3, D. Definition of Energy Products & Chapter 8, C. Structure of Energy Balance). Note that some prerequisite energy data on final consumption by sectors in Belize is currently underreported or not available in some cases.

For biofuels (bagasse), the FORECAST.ETS Excel function was employed for the calculation of steam production data for Belcogen in 2023, using data from the previous five years (2018 – 2022). The excel function returns a statistical value based on time series forecasting for steam production.

For biofuels (firewood), 2021 and 2022 firewood estimates were recalculated due to revised population estimates published by the Statistical Institute of Belize (SIB) following the results of the 2022 Census. Firewood estimates for 2023 was calculated using "Households by Major Administrative Area and Main Type of Cooking Fuel" data, taken from the September Labour Force Survey administered by SIB.

For international bunkers (aviation fuels), its volume is assumed to equate to Total Imports – (minus) domestic aviation fuel consumption (done separately for aviation gasoline and jet fuel kerosene).

Section 2.2 Energy Indicators:

For energy intensity, the unit of measure remains as tons of oil equivalent per $1,000 USD of GDP, as stipulated by the International Energy Agency and the International Atomic Energy Agency (2005). Annual GDP statistics for 2023 from SIB were unavailable during the production of this report. Hence, once updated GDP data for 2023 becomes available, the updated energy intensity parameter for Belize will be calculated and published.

For renewable energy generating capacity (watts per capita), results were recalculated because of revisions to the generating RE capacity and new population estimates, resulting in changes to the overall renewable energy generating capacity over the timeline presented.

Section 3.3 Primary Energy:

The energy supply represented by Belize's consumption of fuelwood or firewood for 2023 as well as in earlier annual energy reports, is not quantified by direct measurement or monitoring. Instead, it is derived from yearly estimates based on population and labour force survey data published by the Statistical Institute of Belize, with the baseline being the 2010 national census.

Section 3.5.3 Gross Electricity Consumption by Sectors:

The breakdown of gross electricity consumption by economic sectors is defined by the customer tariff groupings as stipulated by 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 and electricity sourced from distributed generation.

It should also be noted that while BEL utilizes five tariff groupings - residential, social, commercial, industrial, and street lighting. For the purposes of this report, the social and residential groupings have been aggregated into one category, resulting in four main groups.

Section 4.2 Installed Electricity Generation Capacity:

Installed electricity Generation Capacity included changes reported from year to year. The variation reported for UB – JICA Solar and Caye Caulker Plant (CCK) were due to an error in the data reported by the electric utility.

Section 4.6 Electricity Production by Plant Type:

The data related to electricity production required the classification of independent power producers to showcase the disaggregation of power plant types in Belize and their contributions to electricity production. Plants were then classified as: Hydroelectric, Combined Power and Heat (CHP), Solar PV and Non-Renewable Thermal plants. This classification may be subject to change upon further review.

Section: 5.2.1 Average Pump Price for Refined Petroleum Fuels:

In contrast to previous Annual Energy Report (AER) editions, the average pump prices for refined petroleum fuels were calculated using a weighted average method. This involved multiplying the prices by the number of days for which those prices were effective, then distributing among the 365 days in a year.

Previous AER editions used a simple arithmetic mean. The 2023 report also included recalculated average values for previous years to facilitate year-to-year comparisons.

The historical price trends from Central American countries, were obtained from the Comisión Económica para América Latina (CEPAL) publication Centroamérica y la República Dominicana: Estadísticas de Hidrocarburos, 2022 (page 18), which provided figures up to 2022. This publication reported prices in USD per gallon, but it did not specify whether these were US gallons or Imperial gallons. There was no specification on whether this meant US Gallons or Imperial Gallons. The 2023 AER analysis treated these figures as US gallons, aligning with Belize's practice, under the supposition that like Belize, American technologies are readily distributed across the continental mainland. The 2023 AER assumes that "Premium Gasoline" in Belize is comparable to "Gasolina prémium sin plomo" in the CEPAL publication. The same assumption was made for 'Regular Gasoline' and 'Gasolina regular sin plomo'. The CEPAL report notes that the stated prices are drawn from urban or capital city prices, except for Costa Rica, which has a national average cited. In Belize, all prices reflect national averages.

Section 5.2.2 Annual Average Price for Liquified Petroleum Gas (LPG):

Unlike previous AER editions, national averages for LPG were calculated by a weighted average method: multiplying the prices by the number of days for which those prices were effective, then distributing among 365 days in a year. Effective price dates are collated from the Supplies Control Unit Press Releases found via social media. Previous AER editions used a simple arithmetic mean, applied quarterly. Comparison between years within the 2023 report was also conducted using recalculated average values for previous years.

The historical price trends from Central American countries were accessed from the Comisión Económica para América Latina (CEPAL) publication Centroamérica y la República Dominicana: Estadísticas de Hidrocarburos, 2022 (page 21), with figures available up to 2022. This publication provided prices in USD$ per 25 lbs-tank. For this analysis, a 2:1 conversion factor for BZD to USD was applied, and the converted price was divided by a factor of 25 to create figures comparable to Belize's pricing in BZD per pound. The CEPAL report notes that prices are drawn from urban or capital city prices, except for Costa Rica, which reports a national average. In Belize, all prices reflect national averages.

Section 5.3 Mean Electricity Rate:

The historical timelines for Mean Electricity Rates (MER) in Central America were taken from the CEPAL publication Estadísticas del Subsector Eléctrico de los Países del Sistema de la Integración Centroamericana (SICA), 2022 (page 30), with figures available up to 2022. The dataset includes no 2022 value for El Salvador. The source figures were stated in $USD per kWh. The 2023 AER assumed a 2:1 conversion factor for $BZD to $USD.

APPENDIX D: MEASUREMENT/CONVERSION UNITS

This section provides a summary of the units used throughout the 2023 Annual Energy Report, along with their definitions and derivations (Table 12 and 13). Included are some conversions to the metric system. While Belize has historically used both Imperial and American units, recent movements towards an internationally recognized standard has prompted the incorporation of metric-derived systems.

Economics

All dollars and cents that are referenced in this report are in Belize dollars (BZD), unless stated otherwise. Each Belize dollar is exchanged at a rate of approximately 0.5 to 1 US dollar. GDP is measured in Belize dollars, while GDP per capita is measured in Belize dollars per person (BZD/person).

Area

Spatial area, which is used to quantify land and land uses, is measured in km^2.

Volume

Instead of the corresponding SI units of cubic metres (m^3) or kilolitres (kL) for volume, barrels (bbl) and US gallons (US Gal) are used for the volumetric measurement of liquid fuels such as gasoline and diesel. One barrel is equivalent to 159 litres, and one US gallon equals 3.8 litres. For gaseous fuels, such as natural gas, the measurement unit used is thousand cubic feet (Mcf).

Mass

For most solid fuel masses, the standard SI unit is kilotons (kt) or thousand tonnes (10^3 t). In Belize, the import and retail of gaseous fuels such as Liquefied Petroleum Gas (LPG), are measured in pounds (lbs), where 1 pound is equivalent to 0.5 kilograms (kg) in SI unit.

Quantities of fuels, regardless of their physical state, may often be expressed in energy units, as shown 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 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, with each boe corresponding to 0.00581 TJ. Similarly, tons-of-oil-equivalent (toe), equivalent to 0.04184 TJ, are used.

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

» **Table 13. Multiples of Energy Units**

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

» **Table 14. Conversion Table for Units Used in this Publication**

Common Unit	Standard/SI Unit
Currency	
1 Belize Dollar	0.5 US Dollars
Volume	
1 Barrel	159 Litres [15]
1 US Gallon	3.8 Litres [15]
Million Cubic Meters	10^9 Litres [15]
Thousand Cubic Feet	28,317 Litres [15]
Mass	
1 Pound	0.5 Kilograms [15]
1 Metric Kiloton/thousand tonnes	1,000,000 kilograms
Energy	
1 Kilowatt-hour	3.6×10^{-6} Terajoules [15]
1 Barrels-of-Oil-Equivalent	0.00581 Terajoules [16]
1 Tons-of-Oil-Equivalent	0.04184 Terajoules [15]

[15] (International Energy Agency (IEA), 2023)
[16] (Organización Latinoamericana de Energía (OLADE), 2016)

APPENDIX E: REFERENCE

Asghar, Z. (2008). Energy-GDP Relationship: A Casual Analysis for the Five Countries of South Asia. Applied Econometrics and International Development, 8(1). Retrieved from https://www.usc.gal/economet/reviews/aeid8114.pdf

Beare, M. (2018, November). The Importance of Energy Security. Retrieved from Oxford Policy Management Limited: https://www.opml.co.uk/blog/importance-energy-security

Belize Electricity Limited. (2020). 2019 Annual Report. Belize City: Belize Electricity Limited. Retrieved from https://www.bel.com.bz/annual_reports/Annual%20Report%202019.pdf

Belize Electricity Limited. (2022). 2021 Annual Report. Belize City: Belize Electricity Limited. Retrieved from https://www.bel.com.bz/annual_reports/Annual%20Report%202021.pdf

Belize Electricity Limited. (2023). BEL 2022 Annual Report . Belize City: Belize Electricity Limited.

Bunker, K., Torbert, R., & al., e. (2018). Belize Consolidated Project Plan. Rocky Mountain Institute.

Comisión Federal de Electricidad. (2023). Investor Presesntation: Financial Results, 2022 4th quarter. Retrieved from CFE: Financial & Economic Information: https://www.cfe.mx/finanzas/financial-economic-information/pages/investor-presentation.aspx

Commonwealth Secretariat. (2021). National Climate Finance Strategy of Belize 2021 - 2026. Belize: Commonwealth Secretariat.

Eastern Caribbean Central Bank. (2024, July). Fuel Price Tracker. Retrieved from Eastern Caribbean Central Bank: Dashboard: https://www.eccb-centralbank.org/eccu-fuel-price-tracker

Encyclopaedia Britannica Inc. (2023). Britannica - Energy, physics. Retrieved from Encyclopedia Britannaica: https://www.britannica.com/science/velocity

Energy Unit. (2021). 2020 Belize Energy Balance. Belmopan: Ministry of Public Utilities, Energy and Logistics.

European Environment Agency. (2022, March 4). Indicators: Share of energy consumption from renewable sources in Europe. Retrieved from European Environment Agency: https://www.eea.europa.eu/ims/share-of-energy-consumption-from

Forbes Advisor. (2024, August 20). Convert United States Dollar To East Caribbean Dollar. Retrieved from Forbes Advisor Currency Converter: https://www.forbes.com/advisor/money-transfer/currency-converter/usd-xcd/

Geology and Petroleum Department. (2020). Petroleum Companies Operating in Belize. Retrieved from Ministry of Economic Development: https://med.gov.bz/petroleum-companies-operating-in-belize/

Geology and Petroleum Department. (2021, March 23). Belize Petroleum Industry. Retrieved from Ministry of Economic Development and Petroleum: https://med.gov.bz/belize-petroleum-industry/

Geology and Petroleum Department Belize. (2022). Belize's Petroleum Industry. Retrieved from Geology and Petroleum Department Belize: https://gpd.gov.bz/index.php/belize-petroleum-industry/

Government of Belize. (2016). Belize Nationally Determined Contributions. Belmopan: Government of Belize. Retrieved from https://unfccc.int/files/focus/ndc_registry/application/pdf/belize_ndc.pdf

Government of Belize. (2021). Updated Nationally Determined Contributions. Belmopan: Government of Belize.

Greening the Grid. (n.d.). Distributed Generation. Retrieved from Greening the Grid: https://greeningthegrid.org/integration-in-depth/distributed-generation

Harvey, S. (2020, September). Smart, Stable, Reliable-Smart grids and nuclear power in low carbon energy systems. Retrieved from International Atomic Energy Agency - Bulletins: https://www.iaea.org/bulletin/smart-stable-reliable

Intergovernmental Panel on Climate Change (IPCC). (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the IPCC Sixth Assessment Report. Cambridge, UK and New York, USA.: Cambridge University Press. doi:10.1017/9781009325844

Intergovernmental Panel on Climate Change. (2022). Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the IPCC. Cambridge, UK, and New York, USA: Cambridge University Press.

International Energy Agency . (2021). Climate Change. Retrieved from International Energy Agency: https://www.iea.org/topics/climate-change

International Energy Agency (IEA). (2020). Global Energy Review 2020. Retrieved from International Energy Agency - Reports: https://www.iea.org/reports/global-energy-review-2020

International Energy Agency (IEA). (2021). Honduras: Sources of Electricity Generation. Retrieved from IEA: Coutries and Regions: https://www.iea.org/countries/honduras/electricity

International Energy Agency (IEA). (2022). Costa Rica: Sources of Electricity Generation. Retrieved from IEA: Countries and Regions: https://www.iea.org/countries/costa-rica/electricity

International Energy Agency (IEA). (2023, December). Oil Market Report - December 2023. Retrieved from IEA Reports: https://www.iea.org/reports/oil-market-report-december-2023

International Energy Agency (IEA). (2023, December 31). Unit Converter. Retrieved from IEA Data and Statistic: Data Tools: https://www.iea.org/data-and-statistics/data-tools/unit-converter

International Energy Agency. (2022). Climate Change. Retrieved from International Energy Agency: https://www.iea.org/topics/climate-change

International Energy Agency. (2022, March). Global Energy Review: CO2 Emissions in 2021. Paris: International Energy Agency. Retrieved from https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2

International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, World Bank, & World Health Organization. (2022). Tracking SDG 7: The Energy Progress Report. Washington, DC.: World Bank. Retrieved from https://trackingsdg7.esmap.org/data/files/download-documents/sdg7-report2022-full_report.pdf

International Energy Agency; International Renewable Energy Agency; United Nations Statistics Division; World Bank; & World Health Organization. (2024). Tracking SDG 7: The Energy Progress Report. Washington, DC.: World Bank. Retrieved from https://iea.blob.core.windows.net/assets/cdd62b11-664f-4a85-9eb6-7f577d317311/SDG7-Report2024-0611-V9-highresforweb.pdf

International Renewable Energy Agency. (2022). World Energy Transitions Outlook 2022: 1.5°C Pathway Executive Summary. Abu Dhabi: International Renewable Energy Agency. Retrieved from https://www.irena.org/-/media/files/irena/agency/publication/2022/mar/irena_weto_summary_2022.pdf?la=en&hash=1da99d3c3334c84668f5caae029bd9a076c10079

Kirk, K. (2022, October 24). Energy loss is single-biggest component of today's electricity system. Retrieved from Yale Climate Connections - Energy: https://yaleclimateconnections.org/2022/10/energy-loss-is-single-biggest-component-of-todays-electricity-system/

Manzano M., O., & Vernon, D. (2018). Oil in Belize: New sector in a young country. Retrieved from Science Direct: The Extractive Industries and Society: https://doi.org/10.1016/j.exis.2017.06.003

Marchán, E., Espinasa, R., & Yépez-García, A. (2017, November). he Other Side of the Boom: Energy Prices and Subsidies in Latin America and the Caribbean during the Super-Cycle. Retrieved from IDB Publications: https://publications.iadb.org/en/other-side-boom-energy-prices-and-subsidies-latin-america-and-caribbean-during-super-cycle

Masson, M., Ehrhardt, D., & Lizzio, V. (2020). Sustainable Energy Paths for the Caribbean. Washington: Inter-American Development Bank. doi:10.18235/0002236

Merriam-Webster, Incorporated. (2023). Merriam-Webster: Energy definition. Retrieved from Merriam-Webster: https://www.merriam-webster.com/dictionary/energy

Ministry of Public Utilities, Energy, Logistics, and E-Governance (MPUELE). (2023). National Energy Policy (2023 - 2040). Belmopan: Government of Belize. Retrieved from https://www.mpuele.gov.bz/wp-content/uploads/2023/11/Belize-National-Energy-Policy-2023.pdf

Ministry of Sustainable Development, Climate Change, and Disaster Risk Management. (2021). Belize's National Climate Change Policy, Strategy and Master Plan Belize. Belmopan: Government of Belize.

Ministry of Sustainable Development, Climate Change, and Disaster Risk Management. (2022). Belize Updated Nationally Determined Contribution. Retrieved from UNFCCC Documents: https://unfccc.int/documents/497339

National Climate Change Office. (2021). Belize's Fourth National Greenhouse Gas Inventory Report. Belmopan, Belize.: Government of Belize. Retrieved from https://unfccc.int/sites/default/files/resource/Fourth%20National%20GHG%20Inventory%20rev%20Aug42020.pdf

National Climate Change Office. (2022). Belize Fourth National Communication. Belmopan City: Ministry of Sustainable Development, Climate Change, and Disaster Risk Management, Government of Belize. Retrieved from https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/24836071_Belize-NC4-1-Belize%20National%20Communication.pdf

Organización Latinoamericana de Energía (OLADE). (2016, November). Sistema de Información Económica Energética - Energía en Cifras 2016. Retrieved from OLADE: Library Catalog: https://biblioteca.olade.org/opac-tmpl/Documentos/hm000658.pdf

Oxford University Press. (2023). Oxford Languages. Retrieved from https://languages.oup.com/

PUMA Energy Bahamas S.A . (2021). Where we operate: Belize. Retrieved from Puma Energy: https://pumaenergy.com/en/whoweare/whereweoperate/detailspage?countryName=Belize&region=2

REN21. (2022). Renewables 2022 Global Status Report. Paris: REN21 Secretariat. Retrieved from https://www.ren21.net/wp-content/uploads/2019/05/GSR2022_Full_Report.pdf

Secretariat, C. (2021). National Climate Finance Strategy of Belize 2021 - 2026. Belize. : Commonwealth Secretariat.

Shenzhen CLOU Electronics Co. (2022, September 21). What is the difference between technical loss and non-technical loss? Retrieved from Smart Energy International: https://www.smart-energy.com/industry-sectors/smart-grid/what-is-the-difference-between-technical-loss-and-non-technical-loss/

South Trinidad Chamber of Industry and Commerce. (2009). Assessment of the Energy Service Sector in the Caribbean . San Fernando: South Trinidad Chamber of Industry and Commerce.

Statistical Institute of Belize. (2019). Belize National Housing Characteristics (Statistics Poster). Belmopan, Belize. Retrieved from http://sib.org.bz/wp-content/uploads/HouseholdCharacteristics_2019-04.pdf

Statistical Institute of Belize. (2024, January 31). External Trade Summary Bulletin - 2023. Retrieved from SIB Economic Statistics - Merchandise Trade: https://sib.org.bz/wp-content/uploads/ExternalTrade_2023-12.pdf

Stein, Z. (2024, August 8). Distributed Generation (DG). Retrieved from Carbon Collective: https://www.carboncollective.co/sustainable-investing/distributed-generation-dg

Tobin, M. (2015, February 13). Comparing the Costs of Renewable and Conventional Energy Sources. Retrieved from Energy Central: Posts: https://energycentral.com/c/ec/comparing-costs-renewable-and-conventional-energy-sources

U.S. Energy Information Administration (EIA). (2011, April 6). Demand for electricity changes through the day. Retrieved from Today in Energy: https://www.eia.gov/todayinenergy/detail.php?id=830

United Nations. (2017). International Recommendations for Energy Statistics (IRES). Department of Economic and Social Affairs, Statistics Division. New York: United Nations.

United Nations. (2017). The Sustainable Development Goals Report. New York: United Nations.

United Nations Development Programme. (2000). World Energy Assessment: Energy and the Challenge of Sustainability. New York: United Nations Development Programme. Retrieved from https://www.undp.org/sites/g/files/zskgke326/files/publications/World%20Energy%20Assessment-2000.pdf

United Nations Framework Convention on Climate Change. (2021). The Paris Agreement. Retrieved from United Nations Framework Convenment on Climate Change: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

United Nations Statistics Division. (2021, February). SDG Indicators: Metadata Repository. Retrieved from Sustainable Development Goal Indicators: https://unstats.un.org/sdgs/metadata/?Text=&Goal=7&Target=

US Department of Energy. (2024). Renewable Energy: Distributed Generation Policies and Programs. Retrieved from www.energy.gov: https://www.energy.gov/scep/slsc/renewable-energy-distributed-generation-policies-and-programs

Vivid Economics. (2021). Low Emissions Development Strategy and Action Plan: Belize. Belmopan: National Climate Change Office (Government of Belize).

Wirtz, N. (2024, March 4). Latin America: Subsidies Are Here To Stay. Retrieved from Global Finance: Economics, Policy & Regulation: https://gfmag.com/economics-policy-regulation/latin-america-subisides-persist-despite-debt/

World Meteorological Organization. (2021, October 31). State of Climate in 2021: Extreme events and major impacts. Retrieved from World Meteorological Organization: https://public.wmo.int/en/media/press-release/state-of-climate-2021-extreme-events-and-major-impacts

World Meteorological Organization. (2024, May 08). El Niño and climate change impacts slam Latin America and Caribbean in 2023. Retrieved from WMO Media Releases: https://wmo.int/news/media-centre/el-nino-and-climate-change-impacts-slam-latin-america-and-caribbean-2023

THE BELIZE ENERGY REPORT 2023

www.mpuele.gov.bz