BELIZE

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Maritime Sector Baseline Assessment Report

A Belizean Perspective

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MARITIME SECTOR
BASELINE ASSESSMENT STUDY

A Belizean Perspective

BPA
BELIZE PORT AUTHORITY
Maritime Service, Security & Efficiency

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Acronyms

BAU	Business as Usual
BEPSAP	Blue Economy Policy, Strategy and Action Plan
BCP	Belize City Port
BPA	Belize Port Authority
BTB	Belize Tourism Board
CBB	Central Bank of Belize
CNTMP	Comprehensive National Transport Master Plan
EE	Energy Efficiency
FSTV	Fort Street Tourism Village
GHG	Greenhouse Gas
HA	High Ambition
IMMARBE	International Merchant Marine Registry of Belize
LEDS	Low Emissions Development Strategy
MTC	Maritime Technical Committee
NDC	Nationally Determined Contributions
NCCPSAP	National Climate Change Policy, Strategy, and Action Plan
NEP	National Energy Policy
nm	Nautical Mile
PAX	Passenger
PBL	Port of Belize Ltd
SIB	Statistical Institute of Belize
SMTP	Sustainable Maritime Transport Policy
VHA	Very High Ambition
ZNZ	Zero/Near Zero Fuels

Key Notes

1. All monetary figures are in Belize dollars unless expressly stated otherwise. Where monetary figures are expressed in US dollars the fix peg of 1USD = 2BZD applies.
2. Totals may not add up due to rounding.
3. All Figures and Tables in the Report were compiled by the Author using information provided by the source listed.
4. For the purpose of this document
   4.1 *International fleet* means the ships registered under the Belizean flag
   4.2 *Transient fleet* means the foreign ships calling on Belizean ports
5. The data on the international fleet as well as transient fleet is provided for information purposes and are not meant to imply that emissions related to those categories of vessels are to be reflected as part of Belize's national emissions.

Executive Summary

This baseline study evaluates the greenhouse gas (GHG) emissions from Belize's national maritime transportation sector, focusing on emissions contributions, policy gaps, and governance issues. The report outlines the structure of Belize's maritime sector, comprising its international fleet, domestic fleet, seaports (two cruise and two cargo), and transient fleet, using 2023 as the baseline year for emissions data.

A key finding is that Belize's maritime transportation sector is poorly defined both in policy and in law, posing challenges to harmonizing decarbonization efforts. While a Maritime Technical Committee (MTC) exists, its role in overseeing maritime decarbonization is unclear and requires further refinement to improve governance. Despite these challenges, consultations with stakeholders confirmed that the sector is critical to Belize's trade and tourism, with seaborne imports valued at BZD $561 million, accounting for 63% of total imports in 2023, and exports at BZD $176.2 million, making up 87% of exports.

The total GHG emissions attributed to the maritime transportation sector for the base year were estimated at 47.9 $KtCO_2$, which represents 11.8% of total emissions in Belize's transportation sector. Data gaps were identified in several areas, particularly in relation to the transient fleet and within some aspects of the domestic fleet. Incomplete data on energy consumption by private and commercial cargo vessels resulted in assumptions for 35.4% of the domestic fleet. This lack of data likely underestimates the emissions attributed to domestic vessels. In addition, Belize's international fleet is only partially monitored for energy use, with 17% of the fleet covered by the IMO's Data Collection System (DCS), further limiting the accuracy of the baseline assessment.

The legal and policy review found that Belize lacks statutory emissions reduction targets for the maritime sector and has not fully domesticated the MARPOL 73/78 convention, particularly Annex VI, which regulates air pollution from ships. Belize's Low Emissions Development Strategy (LEDS) includes broad emissions reduction pathways, proposing a high ambition pathway of 45% emissions reduction and a very high ambition pathway of 86% reduction by 2050. However, these targets are not specific to maritime transport, and the absence of specific fuel standards, data collection frameworks, and enforcement mechanisms for maritime emissions poses significant challenges.

The report highlights that the existing policy landscape, including Belize's National Climate Change Policy and Action Plan (NCCPSAP), focuses primarily on terrestrial energy efficiency and renewable energy uptake. While these policies implicitly support decarbonization, they lack specific maritime provisions. The study underscores the need for the development of a comprehensive National Action Plan (NAP) for maritime decarbonization, aligned with Belize's broader climate goals and the IMO 2023 GHG Strategy.

Key recommendations include:

1. Establishing mandatory data collection frameworks for energy use in the maritime sector, particularly for the domestic fleet and private vessels.
2. Setting clear emission reduction targets specific to maritime transport, in line with the very high ambition pathway of 86% reduction by 2050.
3. Strengthening the legal framework, including the domestication of MARPOL Annex VI, to enforce emissions reductions and implement energy efficiency standards.
4. Conducting feasibility studies on the potential for shore-side power, biofuel production, and other low-emission technologies to support decarbonization.
5. Creating an incentive scheme for the maritime sector to encourage fleet renewal, energy efficiency, and the uptake of clean energy technologies.

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Introduction

The Baseline Assessment Report (BAR) provides an overview of Belize's maritime transport activities using 2023 as the baseline.[1] The BAR examines the legal and policy frameworks as well as energy use across key maritime economic dimensions. It is intended to help guide the development of Belize's first-ever National Action Plan for maritime decarbonization. Belize is reliant upon its maritime sector for trade (both domestic and international) and increasingly so for coastal travel. Whereas data is not readily available to demonstrate the contribution of Belize's maritime sector to GDP, data provided by the Central Bank of Belize (CBB) accounts for contributions from recognized maritime activities (in aggregate).

The Port Landscape

"The Belize Port Authority Act recognizes three types of ports: private ports, privatized ports, and leased ports. Of the three private ports, one is a cargo port[2] and two are cruise ports[3] whereas both the privatized and leased port are cargo ports"[4]. The draft National Ports Policy declares three port complexes: north, central, and south.

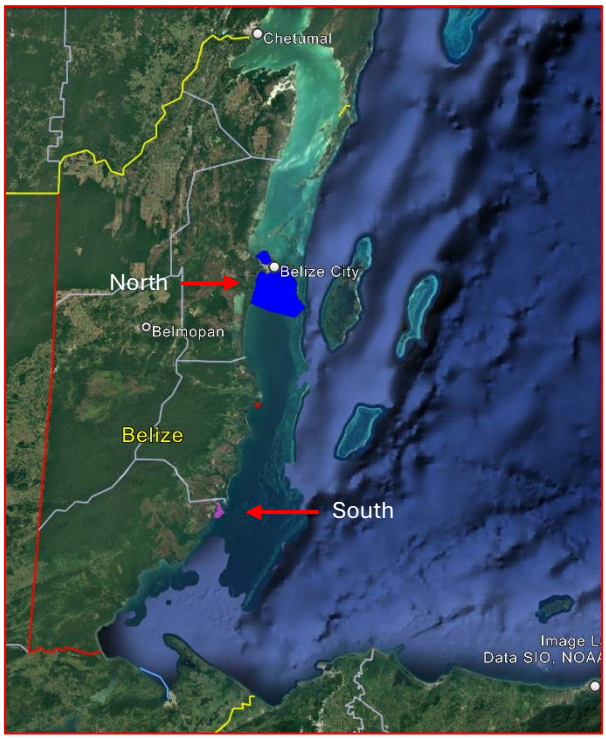

Figure 1: Port complexes (source: Google/Author)

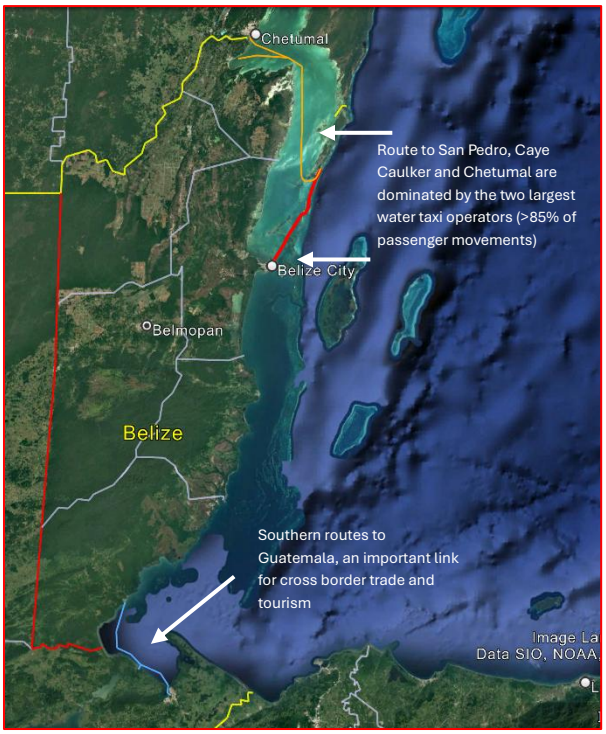

Figure 2: Main water taxi routes (source: Google/Author)

[1] Where it was not possible to get 2023 data, data from 2022 was used and so indicated.
[2] The Port of Big Creek.
[3] Harvest Caye and Port Coral (Stake Bank).
[4] Port of Belize Ltd and Commerce Bight Port respectively (draft national ports policy).

Port Operators

Under the existing legal framework, a license must be granted by the Minister with responsibility for Ports to construct and or operate a port in Belize. Currently, there are five regulated ports: four licensed ports and one leased port. Of the four license holders, three are private ports[5] and one a privatized port[6]. All four license holders are private limited liability companies that own and operate the port facilities governed by their license. Combined, the four licensed ports directly employ ~900 persons[7]; however, there is no publicly available study on the economic impact of the ports.

The Commerce Bight was leased in November 2020 and designated as a cargo port with clear obligations on the part of the lessee to operate the facility as "a cargo port facility primarily for the purpose of the importation of fuel". However, on May 28, 2021, Parliament voted not to approve the lease at which point the BPA resumed control of the Port. The Port was later leased to a private company using a PPP modality. The intent is for the Port to be developed as "pocket cruise" port facility; ground was broken on August 9, 2024.

Name of Port	*Type*	*Operator*	*Location*	*Authorization*	*Operational*
Port of Big Creek	*Cargo*	*Toledo Enterprises Ltd.*	*Stann Creek*	*License*	*Y*
Harvest Caye	*Cruise*	*Belize Island Holdings Ltd.*	*Stann Creek*	*License*	*Y*
Commerce Bight	*Cruise*	*Belize Port Authority*	*Stann Creek*	*GOB*	*N*
Port Coral	*Cruise*	*Stake Bank Enterprise Ltd.*	*Belize City*	*License*	*N*
Port of Belize	*Cargo*	*Port of Belize Ltd.*	*Belize City*	*License*	*Y*

Table 1: List of regulated ports (2021) (source: draft Port Policy)

Port Connectivity

The United Nations Conference on Trade and Development publishes an annual Liner Ship Connectivity Index in which it rates ports based on the indicators set out in the table below. Belize does not yet feature in this index, but the table below provides a good basis for independent comparison to UNCTAD's Liner Ship Connectivity Index.

[5] One cargo and two cruise ports

[6] Cargo

[7] Port of Belize: 262 (109 full time; 8 part time; 145 stevedores); Port Coral: 275 (temporary construction workers); Port of Big Creek: 200; Harvest Caye: 116.

Indicators	*Quantity*	*Remarks*
Number of shipping lines	*4*	*Hyde; Caribbean Feeder Service (CFS); Tropical Shipping; CMA-CGM*
Size of the largest vessel (TEUs)	*1,118*	*Hamburg Trader (CFS)*
Number of connecting services (node degree)	*3*	*Port Everglades, Kingston CT, Port of Palm Beach*
Number of transhipment (port betweenness)	*125*	*19 through Port Everglades and 106 through Kingston*
Number of deployed vessels	*9*	
Total lift capacity (TEUs)	*5,399*	

Table 2: Liner Ship Connectivity (source: draft Port Policy)

Key Maritime Trades/Economic Activities

The primary economic activities and key maritime trade occurring within Belize's blue spaces (and captured by CBB in its GDP data are Fishing and Aquaculture, Water Transport and Tourism. In terms of Fishing and Aquaculture and Water Transport (see Figure 2) these two industries have moved inversely to each other. GDP contributions from Fishing and Aquaculture declined over the period under review: it peaked circa 2004 when it accounted for $113.8 million (3.19% of GDP) but by 2022 its contribution to GDP was at 0.41%. The decline can be attributed to decreasing fisheries' stock and poor market prices. Contributions to GDP from Water Transport on the other hand have increased over the period under review due to sustained growth in the external tourism sector and an uptick in domestic tourism. In 2022 Water Transport made an equivalent contribution to GDP as Fishing and Aquaculture at ~0.41%.

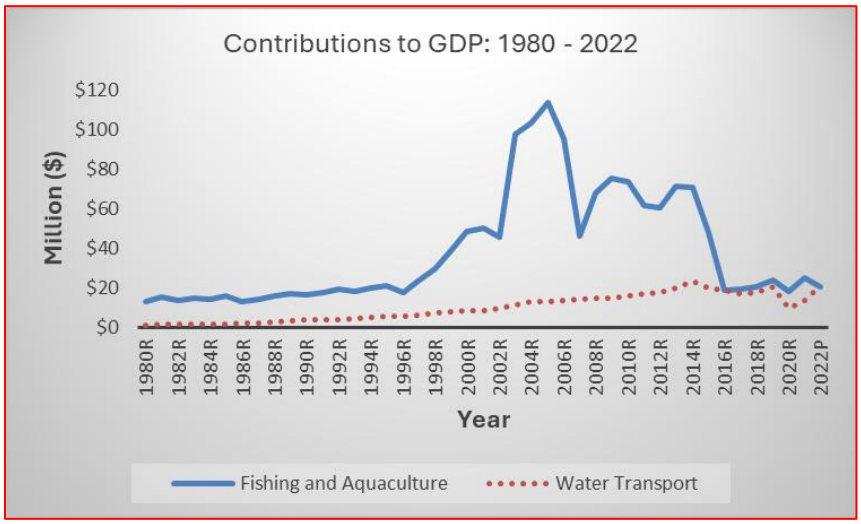

Figure 3: Contributions to GDP by water transport & fisheries (source: CBB)

Water Transport

Central Bank of Belize's data shows that GDP contributions from Water Transport have trended positively since 1980[8]. In 2003 the Water Transport sector broke the $10 million mark for the first time and in

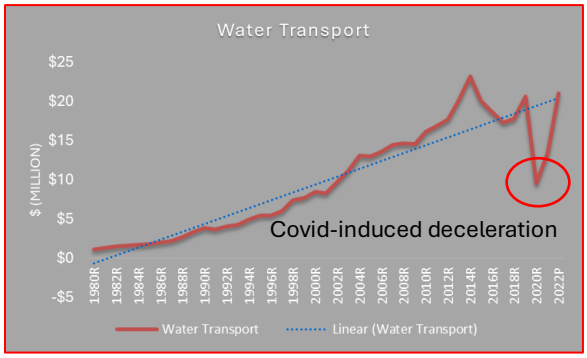

Figure 4: Contributions to GDP by water transport and fisheries (source: BPA)

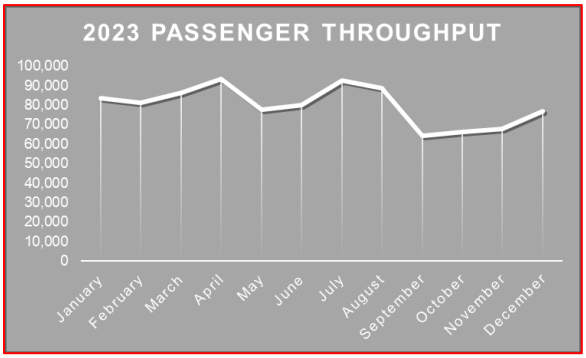

Figure 5: Water taxi passenger throughput (source: BPA)

2013 it broke the $20 million mark in terms of earnings. The sub-sector accounted for $21 million or 0.42% of GDP in 2022 (up from 0.29% in 2021). Water transport is driven primarily by passenger movements between Belize City and the islands of Ambergris Caye and Caye Caulker, both major overnight tourism hubs. In 2023 water taxi operators transported a total of 957,915 passengers.

In terms of employment, the Water Transport sector directly employs over 1,000 persons[9] as crew and assuming an employment multiplier of 2[10], the total employment would be ~2,500 person, inclusive of indirect positions derived from the sector's suppliers (fuel, lube oil, life jackets, ship maintenance & repairs, etc.) and induced jobs derived from the economic activities stimulated when salaried employees spend their wages. This represents 0.7% of total employment across the Belizean economy.

Fishing and Aquaculture

According to the Central Bank of Belize, the Fishing and Aquaculture sector accounted for $20.6 million or 0.41% of GDP in 2022, down from 0.54% of GDP in 2021. The Fishing and Aquaculture sector enjoyed rapid growth over the two decades between 1996 and 2015 but declined sharply in

[8] y=0.9249x + 17.903.
[9] Deduced from the National Sustainable Maritime Transport Policy (draft) version 0.7 [page 9].
[10] 40% of the employment multiplier of the port sector. [see TYPSA Report page 35].

2016 due primarily to bio-security shocks[11] to the aquaculture sub-sector brought on by disease[12]. The Fishing and Aquaculture sectors have not recovered from those shocks and sector earnings are now levelized at about the $20 million mark.

In terms of employment, the Fishing and Aquaculture sector directly employs ~3,500 persons as crew (onboard vessels registered with the Belize Port Authority as fishing vessels) and assuming an employment multiplier of 2, the total employment would be over 7,000 persons, inclusive of indirect positions (fuel, lube oil, vessel maintenance & repairs, fishing cooperatives, etc.) and induced jobs derived from the economic activities stimulated when salaried employees spend their wages. This represents 1.9% of total employment across the Belizean economy.

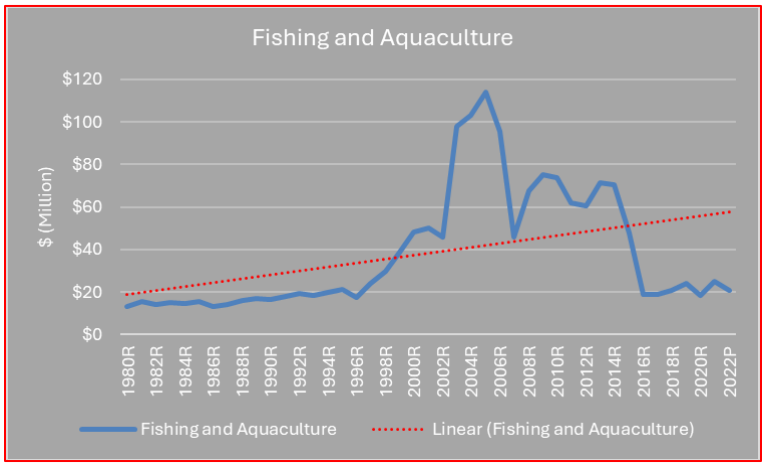

Figure 6: Contributions to GDP by fisheries (source: CBB)

Cruise Tourism

Whereas cruise ship arrivals over the ten-year period 2014-2023 have remained steady, Belize has seen a decline in passenger arrivals. Cruise passenger arrivals peaked in 2018 with 1.2 million passengers but declined by 3.1% in 2019.

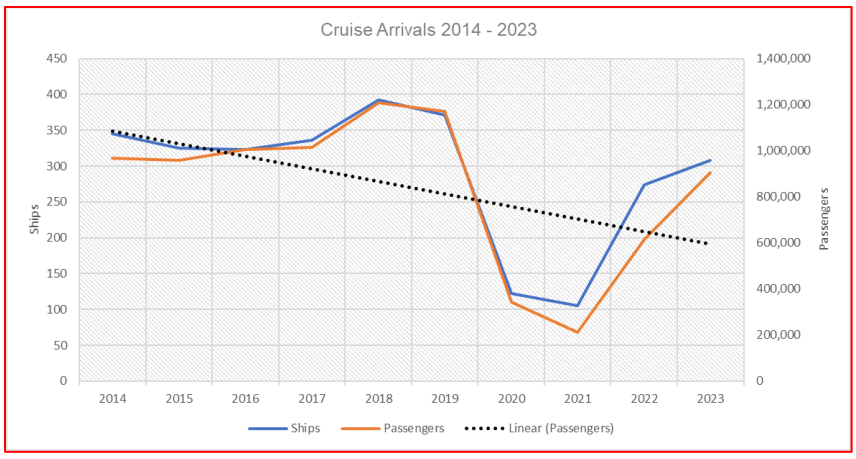

Figure 7: Ten-year cruise tourism performance (source: BTB)

[11] Early Mortality Syndrome (EMS), or Hepatopancreatic Acute Necrosis Syndrome, a relatively new disease that affects shrimp.

[12] In 2015, production fell by more than 95 per cent [found here].

Regrettably, Covid-induced shocks (first reflected by the low 2020 arrivals) have persisted: arrivals in 2023 were 25.2% below the 2018 high of 1.2 million passengers. The post-Covid rebound is widely believed to have been retarded due in part to the absence of a "berthing facility" in the Belize City Port. The Government of Belize is currently working on resolving this deficiency, which would present an opportunity to ensure that MARPOL, in general, but decarbonization in particular, is planned for in any new cruise port development.

Notwithstanding the challenges related to the lack of a berthing facility, analysis of the last five years (2019-2023) shows significant post-Covid year-on-year growth from 2021. The post-Covid rebound, though not complete, is expected to do so by 2030.

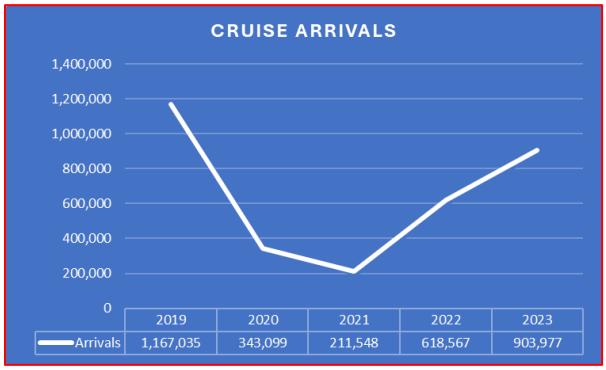

Figure 8: Cruise arrivals 2019 – 2023 (source: BTB)

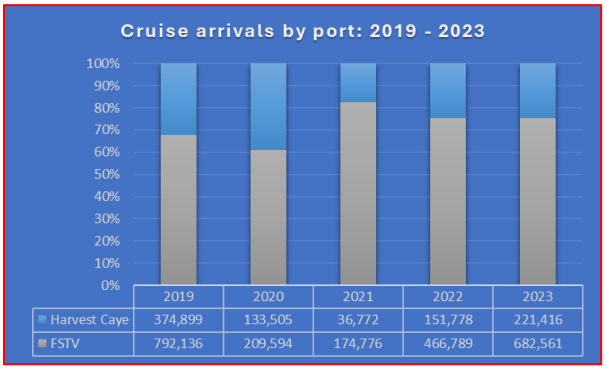

Figure 9: Cruise arrivals by port (source: BTB)

On the economic side of cruise tourism, Belize – known as a tour port – does enjoy considerable disembarkation rates: 80 percent for passengers and 15 percent for crew members[13]. Concomitantly, the *"tour purchasing rate for disembarked passengers is 60 percent, which compares favorably with the Caribbean average of 35 percent."*[14] According to Belize's Cruise Policy (Vol. 2, pg. 12) the *"2018 BREA[15] study estimated that Cruise tourism in Belize generates approximately 2,500 jobs or US$27.7 million in wage income. This employment is predominantly within the commercial services sector, including tour services areas, retail and hospitality sectors."* In 2018, cruise related employment therefore represented ~1.6% of total employment in Belize. However, by 2024 BREA reports that direct economic impact had contracted significantly with direct jobs shrinking to ~1,700 and the concomitant wage income declining to US $14.9 million. According to BREA cruise tourism expenditure injected US$86.1 million into the Belizean economy: 3.9 % of its 2018 GDP compared to US$88.6 million in 2023 (or 2.9% of GDP).

[13] Belize Tourism Board [https://www.belizetourismboard.org/licensing/cruise/].
[14] Ibid.
[15] Full studies may be found here (2018) and here (2023).

Seaborne Trade

Belize continues to suffer from a chronic trade deficit: in 2023, it exported only $384.2million in goods while importing $2,681.7 million. Its primary trade partners for exports are Europe, the United Kingdom and CARICOM (see Figure 9); for imports its primary trade partners are the United States of America, China, Central America, and Mexico (see Figure 10). Belize's trade profile suggests a heavy reliance on international shipping. In 2023 Belize imported $561 million by sea, accounting for 63% of total merchandise imports ($886.5 million), and 47% of its total imports of goods and services ($1,193 million)[16]. The Port of Belize dominated imports due to its proximity to the commercial capital of Belize City.

Exports by sea were valued at $176.2 million, making up 87% of total merchandise exports ($202.9 million) and 15% of total exports of goods and services ($974.1 million)[17]. The Port of Big Creek dominated exports due to its legacy role as the export point for bananas to Europe; and then it later expanded its throughput to include raw sugar (from Santander, 2017 and later Belize Sugar Industries, 2021).

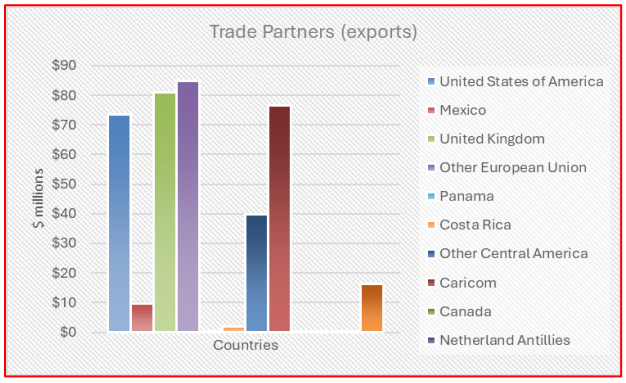

Figure 10: Trade partners (exports) (source: CBB)

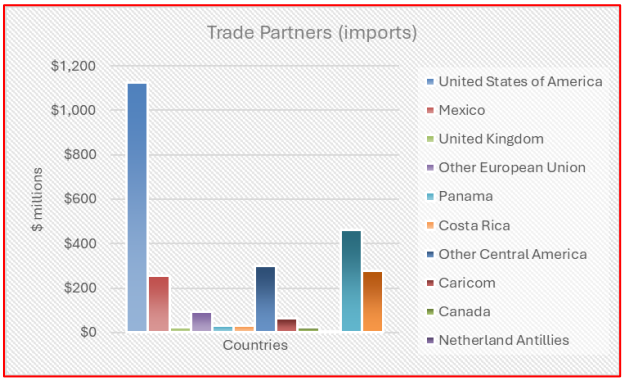

Figure 11: Trade partners (imports) (source: CBB)

In terms of trade value, the United States dominated both imports and exports enjoying a trade surplus of $1,050,000,000.

[16] Email data from the Directorate of Foreign Trade.
[17] Ibid.

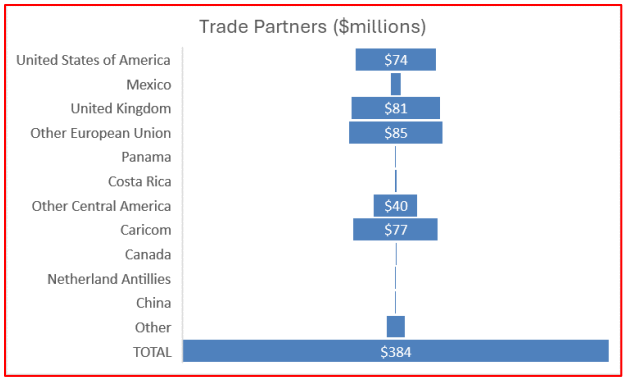

Figure 12: Exports (by value) (source: CBB)

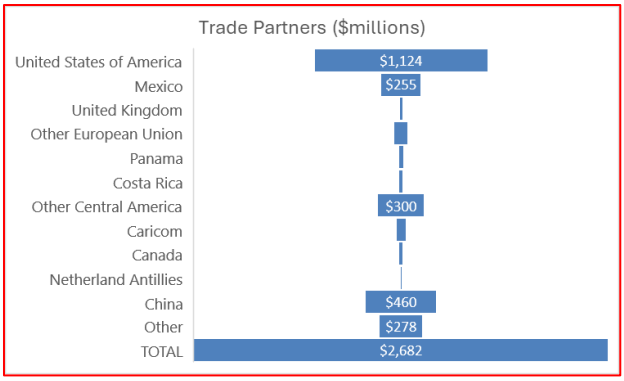

Figure 13: Imports (by value) (source: CBB)

In terms of key commodities, imports were dominated by Machinery & Transport Equipment, Mineral Fuels & Lubricants, and Manufactured goods (see Figure 13). Exports on the other hand were dominated by Food and Live Animals, Oils and Fats, and Manufactured Goods (see Figure 14).

SITC	$ (million)
Food and Live Animals	$301.8
Beverages and Tobacco	$51.6
Crude Materials	$48.9
Mineral Fuels & Lubricants	$395.8
Oils and Fats	$32.5
Chemical Products	$266.5
Manufactured goods	$372.1
Machinery & Transport Equipment	$590.2
Other Manufactures	$210.4
Commercial Free Zone (CFZ)	$369.6
Designated Processing Areas	$39.0
Personal Goods	$3.4
TOTAL	$2,681.7

Figure 14: Imports by commodity (source: CBB)

SITC	$ (million)
Food and Live Animals	$351.5
Beverages and Tobacco	$6.4
Crude Materials	$6.2
Mineral Fuels & Lubricants	$1.5
Oils and Fats	$7.4
Chemical Products	$3.1
Manufactured goods	$7.1
Machinery & Transport Equipment	$0.2
Other Manufactures	$1.0
Commercial Free Zone (CFZ)	$0.0
Designated Processing Areas	$0.0
Personal Goods	$0.0
TOTAL	$384.2

Figure 15: Exports by commodity (source: CBB)

The Legal and Regulatory Framework

The Baseline Assessment Report (BAR) examines seven Acts of Parliament, two sets of regulations related thereto, and seven national policies to provide a broad understanding of the statutory footing and official outlook in terms of maritime decarbonization. Although Belize is a signatory to MARPOL 73/78 and all its annexes[18], the review of Belize's legal framework indicates that there is no expressly written statute that directly addresses maritime decarbonization. There are various

[18] MARPOL 73/78 (Annex I/II), MARPOL 73/78 (Annex III), MARPOL 73/78 (Annex IV), MARPOL 73/78 (Annex V), MARPOL Protocol 97 (Annex VI)

actors with overlapping responsibilities for maritime transport but so far none has promulgated laws to stimulate decarbonization across Belize's blue spaces.

MARPOL

Belize ratified MARPOL (1973, as modified by the Protocol of 1978 relating thereto) and all its related Annexes. MARPOL was domesticated by the International Maritime Organization Conventions Act, 2020 (as amended 2021), which essentially declared that MARPOL shall have the force of law in Belize but there has been no accompanying legislation to properly domesticate MARPOL. However, at common law, Belize's treaty obligations trump Acts of Parliament, so where there are conflicts between a treaty and an Act of Parliament the treaty obligations will prevail. Nonetheless there is a need for operational legislation to guide implementation and enforcement.

MARPOL Convention Act - DRAFT

Belize has developed a draft MARPOL Convention Act through the Belize Port Authority (BPA) which has been endorsed by the Maritime Technical Committee (MTC). The draft Act provides for the implementation and enforcement of MARPOL and provides, among other things, for the promulgation of Regulations. Section 3 of the draft MARPOL Act states that:

> "*this Act applies to all ships entitled to fly the flag of Belize* ***and to all ships though not entitled to fly the flag of Belize but which operate under the authority of Belize in accordance with the Merchant Ships (Registration) Act, and to foreign ships under the jurisdiction of Belize for the time being;*** *[emphasis added] but does not apply to any warship, naval auxiliary or other ship owned or operated by Belize or of any other country while under the jurisdiction of Belize and used, for the time being, only on government non-commercial service.*"

Pursuant to Section 69 of the draft Act, Belize has also prepared five draft Regulations to give effect to Annex II – VI of MARPOL:

- Annex II – MARPOL Convention (Pollution by Noxious Liquid Substances in Bulk) Regulations
- Annex III – MARPOL Convention (Pollution by Packaged Harmful Substances) Regulations
- Annex IV – MARPOL Convention (Sewage Pollution) Regulations
- Annex V – MARPOL Convention (Garbage Pollution) Regulations
- Annex VI – MARPOL Convention (Air Pollution) Regulations

The draft Regulations most applicable to the work of Belize's NAP development is the MARPOL Convention (Air Pollution) Regulations. Regulation 5 of the said Regulations states that:

"these regulations apply to all ships as defined in section 3 of the MARPOL Convention Act, except where expressly provided otherwise in regulations 7, 21, 52-60, 69-76, 92-106 and 107-108."

The exemptions set out above relate to ship size (Reg 7), ship's certificates (Reg. 2), restrictions on levels of emissions of NO_2 (Reg 52-60), restrictions on levels of emissions of VOCs (Reg 69-76), fuel standards (Reg 92-106), drilling rigs and platforms (107-108).

To avoid immunization of the domestic fleet, which is well below convention size, Regulation 8 provides that *"In the case of ships of less than 400 gross tonnage, the Department*[19] *may establish appropriate measures in accordance with the relevant regulations to the MARPOL Convention Act, in order to ensure that the applicable provisions of these regulations are complied with".*

Belize Port Authority Act

The Belize Port Authority (BPA) Act empowers the BPA to control certain activities within the ports and approaches thereto. The Act does not expressly oblige the BPA to address air pollution from maritime transport activities nor does it empower the BPA to impose restrictions on fuel use onboard or to record and report fuel consumption.

However, for the purpose of conducting the baseline study Section 66 of the Act does oblige *"the master of any ship arriving in a port shall produce to an authorised officer-*

(a) the ship's register and the ship's papers;
(b) a list of the passengers, if any, showing particulars of their sex and occupation;
(c) a list showing the details, if any, of any incident which has occurred during the voyage;
(d) a list showing the stowaways, if any, on the ship,

and shall also supply such other information in relation to the ship, passengers, and cargo thereof, as such officers may reasonably require." **[emphasis added]**

The BPA is therefore able to gather information on shipboard fuel consumption within Belize's territorial waters during the conduct of port state control inspections or at such other times as the Ports Commissioner may require.

The Belize Port Authority Regulations[20] on the other hand, at Section 10(2) does impose a statutory duty on *"all ships and all persons using port facilities [to] take every precaution to avoid pollution of the air."* The said Regulations do not define what is meant by "pollution" nor do they provide the

[19] Department of the Environment
[20] Subsidiary legislation made pursuant to Section 74 of the BPA Act.

statutory powers to control fuel use onboard or the emissions related to port activities. The Regulations also do not prescribe any penalties for breaches/offences therefore upon conviction the Courts would revert to Section 34(b) of the Interpretation Act which provides that:

> *"(b) if the amount of the fine is unspecified, that such offence shall, without prejudice to any law against excessive or unreasonable fines or assessments, be punishable by a fine of any amount within the jurisdiction of the court."*

Harbours and Merchant Shipping Act

The Harbours and Merchant Shipping Act (HMS) assigns to the Minister responsible for ports the *"general superintendence, management and control of the harbours of Belize and … the territorial waters"* and it empowers him to do a number of things such as regulate, define scales of dues, and define public wharves. None of these tasks relates to decarbonization or the control of air pollution from the domestic fleet.

Although there is no expressed authority or imposed duty to control air pollution from vessels the Act provides for the registration and "licensing" of the domestic fleet and it can therefore be amended to support Belize's decarbonization efforts. Particularly as it relates to the means of propulsion, the collection and reporting of fuel consumption data, improved energy-efficiency on a per tonne of cargo and or a per passenger basis.

Merchant Ships (Registration) Act

Belize operates an open registry and the primary legal instrument governing its international fleet is the Merchant Ships (Registration) Act. The Act creates the International Merchant Marine Registry of Belize (IMMARBE) and defines a "Belizean ship".

Section 108 of the Act provides for the applicability and legal superiority of international conventions and instruments to which Belize is a party: -

> *108.-(1) When an International Convention or other international instrument has been ratified, acceded or adhered to by the Government of Belize, the Registrar or the Senior Deputy Registrar of IMMARBE is hereby empowered to issue Merchant Marine Notices in order to give full effect to the implementation of its provisions on board IMMARBE registered ships.*
>
> *(2) In the event that any Merchant Marine Notice conflicts in any manner with a provision of that Convention or instrument, the provisions of the Convention or instrument shall prevail.*

:-The Act then goes on to create the Maritime Technical Committee[21] (MTC) at Section 8 Sub-Section (3.:

> *(3) Any legal instrument issued by the International Maritime Organization (IMO) or the International Labour Organization (ILO) comprising International Conventions, Protocols or Codes pertaining to merchant shipping, shall, as far as practicable, be submitted for consideration to a technical committee consisting of the Belize Port Authority, the Belize National Coast Guard Service (BNCG) and IMMARBE, who shall advise and make recommendations to the Government of Belize prior to accession, adhesion or ratification by Belize of such legal instrument."*

Even though the above section does seem to suggest that the MTC's advisory powers are confined to new instruments, in practice the MTC also makes recommendations to the Government of Belize regarding the adoption of amendments to instruments to which Belize is already a party.

Upon the strength of the Act, IMMARBE has been uploading fuel consumption data to the IMO's Data Collection System.

Environmental Protection Act

The Environmental Protection Act (EPA) establishes the Department of the Environment (DOE) and, inter alia, empowers the DOE to prevent and control pollution by coordinating all activities relating to the discharge of waste into the environment. It further empowers the DOE to control the volume, types, constituents and effects of wastes, discharges, **emissions**, deposits or other sources of **emission** and substances that are of danger or a potential danger to the quality of the environment.

The EPA also empowers the Minister to make regulations to specify the permitted level for the **emission**, discharge or deposit of pollutants … into any area, segment or element of the environment; and for *"the establishment of measures for the use of economic instruments and market-based approaches for emission, trading, effluent and waste disposal fees"*.

The Pollution Regulations emanating from the EPA defines "emission" as *"any act of passing into the atmosphere an air contaminant or a gas stream, visible or invisible"* and it expressly prohibits any person from allowing or permitting *"contaminants to be emitted or discharged either directly or indirectly, into the ambient air from any source"* [Regulation 6]. The First Schedule of the Pollution Regulations related to Regulation 6 sets out the limits of Concentration of Air Contaminants in micrograms per meter cube:

[21] The MTC has since been expanded by the Cabinet to include the Ministry of the Blue Economy, the Department of the Environment, and the Coastal Zone Management Authority and Institute.

	SPM	SO2	CO	NOx
A. Industrial and mixed use	500	120	5,000	120
B. Residential & Rural	200	80	2,000	80
C. Sensitive	100	30	1,000	30

Although Part IX of the Pollution Regulations contains a section called "Marine Crafts" it does not address air pollution, only the dumping of refuse and the discharging of sewage from marine toilets.

Belize Electricity Act

The Belize Electricity Act, established the Public Utilities Commission (PUC) as the regulator of the electricity sector among other things, and it provides for the licensing of the supply of electricity The Act obliges the PUC to exercise its functions in a manner which it considers is best calculated to, among other things, *"secure that all reasonable demands for electricity are satisfied"* and to ensure *"the efficient use of electricity supplied to consumers"*.

The Act does not currently provide for e-mobility (terrestrial or maritime), nor does it provide for special tariffs related to e-mobility, time of use charges or other measures that would support e—mobility in maritime spaces.

Section 7 of the Act allows the PUC, with the approval of the Minister, to make by-laws for *"the prevention of the misuse or waste of energy supplied"* which implicitly covers energy efficiency, although no demand-side by-laws have yet been promulgated that would drive energy efficiency in the electricity sector. Ports that fall under the category of industrial customers are subject to a declining block tariff (the more electricity they consume the cheaper each kWh gets), which in and of itself does not inspire the efficient use of electricity.

The Policy Framework

Belize's energy landscape is governed primarily by polices as opposed to statutes. The challenge with this ***de facto*** approach to energy access and use is the inability to comply with policy objectives legally. The primary maritime transportation/energy use policies are as set out below:

Belize's Updated Nationally Determined Contributions (2021)

Although one of the targets of Belize's 2021 NDC[22] is to *"avoid 117 KtCO2e/year[23] from the transport sector by 2030 through a 15% reduction in conventional transportation fuel use by 2030*

[22] Aligns with SDG 7 and 13.
[23] As modelled in the TES scenario of IRENA's ReMAP analysis for Belize.

and achieve 15% efficiency[24] *... through appropriate policies and investments",* **there is no reference in the NDC to maritime transportation**.

The NDC does, however, project an estimated 117 KtCO2e of avoided emissions (compared to a baseline business as usual) from the planned mitigative actions in the transportation sector by 2030.[25] The associated pathways in passenger transportation are expected to yield 100 KtCO2e of avoided emissions while cargo transport efficiency is to contribute the remaining 17 KtCO2e. The aforementioned targets are presented in the NDC *"with partial conditionality considerations including: 1) financing through the NAMA facility for the purchase and deployment of efficient buses and 2) provision of technical assistance to develop an efficient light duty vehicle policy regime."* The foregoing conditionalities make clear that Belize hopes to achieve this target through mitigative actions in land transportation at a total cost to meet this target is US$71,000,000[26]. There are no expressed targets or planned actions for maritime transport-related activities.

> *"The transport sub-sector is the largest GHG emitter in the energy sector, representing a significant opportunity to reduce emissions through interventions targeting this sector."*
> **-Belize's Updated NDC, 2021**

National Climate Change Policy, Strategy and Action Plan

One of the strategic aims/goals of the National Climate Change Policy, Strategy and Action Plan (National Climate Change Policy) is to *"Plan, promote and effectively manage the production, delivery, and use of energy, through Energy Efficiency, Renewable Energy, and Clean Production interventions for the sustainable development of Belize."*[27] The rationale advanced for this strategic aim/goal is *"The inefficient ways in which Belize produces and uses energy, and the continued over-dependence on imported fossil fuels and electricity, particularly transport fuels, have been identified as major hurdles for achieving sustainable economic growth."*

Belize's stated strategy to address this challenge is through the *"development of appropriate policy tools and instruments to drive energy efficiency, accelerate the uptake of renewable energy, and shift to clean production..."*. The time for implementation of the associated actions (which were quoted from the Sustainable Energy Strategy was five years (by 2020)) but so far little has been done to realize these ambitions.

[24] Per passenger-kilometre and tonne-kilometre (passenger and freight respectively).
[25] Table 4, page 44.
[26] Page 22 of Belize's Updated NDC, 2021.
[27] See Table 7.9 of the National Climate Change Policy.

A second strategic aim/goal of the National Climate Change Policy[28] *"to take necessary measures to reduce the vulnerability of critical transportation and communications infrastructure to Climate Change impacts and increase the resilience of the transportation/communication sectors."* The rationale related to this strategic aim/goal is *"the fact that transport (the largest source of GHG emissions) is a major energy consumer, consuming almost half (½) of final energy used in Belize."*

Although the related strategic actions are not directly related to maritime decarbonization the most relevant of these is Strategic Action 4 which proposes to *"promote energy efficiency in the transport sector through appropriate policies and investments"*, more particularly, to stimulate the uptake of biofuels.

Low Emissions Development Strategy

Belize's Low Emissions Development Strategy (LEDS) has as its central goal the elimination of *"the majority of its gross carbon emissions by 2050 across all sectors of its economy."* The LEDS elaborates on three possible emission scenarios for Belize: Business as Usual (BAU); High Ambition (HA) and Very High Ambition (VHA). Under the BAU scenario *"Belize's gross emissions is projected to grow more than 40% over the period 2020-2050* to 7.2 MtCO2e*"*, however, if the mitigative actions proposed in the LEDS are implemented emissions could be reduced by almost 90% by 2050. However, gross emissions could fall by 45% under the HA scenario and by 86% under VHA by mid-century.

Mitigation pathways and targets are set out on page 58, and whereas they are not specific to maritime transport, many of the actions and targets could easily be applied to the sector, those are set out below:

Action 1: Reduction of fuel emissions in the public transit system

- 1.2. Increasing fuel efficiency and fleet renewal
- 1.3. Replacement of conventional (ICE)

Action 3: Improvement of fuel standards

- 3.1. Blend of biodiesel in regular diesel
- 3.2. Blend of ethanol in regular gasoline
- 3.3. Introduction of fuel standards in diesel and gasoline

Action 4. Reduction of emissions in freight transportation

- 4.1. Implementing regulations/ standards and fleet renewal for road freight vehicles

[28] See Table 7.10 of the NCCPSAP.

The LEDS indicates that transport accounted for 580,000 tCO_{2e} in 2020 or 10.86% of overall emissions (5,340,000 tCO_{2e}). However, ***"due to the lack of appropriate data, it was not possible to split out the fuel consumption into the different transport segments."*** **[emphasis added].** The transport action plan contained in the LED[29] calls for the "*reduction of fuel emissions across private and commercial light vehicles"*. To do this, the intent is to, among other things, replace combustion boat engines with electric hybrid engines. Noting that a significant barrier to this transition is the prohibitive cost of electric/hybrid boat engines compared to ICE engines, the LEDS foresee high-level interventions in the form of import incentives: the establishment of *"an incentivization scheme to subsidize the tax paid on the purchasing and importing of electric boats"*. This initiative will be led by the Energy Unit in the Ministry of Energy with a 3-year timeline for completion.

National Energy Policy

The National Energy Policy (NEP) does not speak directly to maritime decarbonization, but the following policy objectives have implications for sustainable maritime transportation. A National Energy Action Plan is supposed to follow the NEP, and this could provide an opportunity to include actions that can help to stimulate and support Belize's decarbonization of its maritime transport sector:

"Policy Objective 1 - reduce cost of energy services

Government recognizes that the energy sector plays a crucial role in stimulating social and economic development across all sectors,

[The Government] is committed to reducing the cost of energy services by reducing energy intensity through collaboration amongst key ministries

Policy Objective 2 - increase indigenous energy sources in the energy mix

Government recognizes that transitioning to indigenous energy resources, is the most critical step to reducing demand for foreign currency, developing new industries, and creating employment

1. Government is committed to the establishment of a mechanism for MPUELE to conduct research to determine project feasibility for all indigenous energy source in collaboration with recognized and respected research institutions.

[29] See Figure 89 on page 116 of the LEDS.

2. Government is committed to the establishment of regulations for a fair and transparent procurement process for all new investments in the development of indigenous energy sources.

3. Government is committed to attracting investments primarily through public-private investments to increase local production of energy from indigenous source and to reduce unit cost of these energy sources."

Comprehensive National Transport Master Plan

The Comprehensive National Transport Master Plan (Transport Master Plan) does examine water transportation (water taxis) under the chapter on Public Transport; it predicts that under a business-as-usual scenario water taxi passenger throughput should increase by 33.1% and 78.9% in 2025 and 2035 respectively, using 2017 as the baseline year.[30]

The Transport Master Plan noted that the Belize Port Authority (BPA) (the regulator of water transport) was not collecting passenger count data, and it recommended the "*implementation of regulation of water taxis to promote service development"*. In 2019, the BPA acted on this recommendation and adopted the Harbours and Merchant Shipping (Water taxi) Regulations, which among other things, provided for the issuance of permits to conduct water taxi operations, mandatory insurance coverage, development of routes and schedules, and the submission of passenger and crew manifests.

Although the Transport Master Plan speaks to energy efficiency and regulations for reducing GHG emissions, in relation to water transport it only speaks about the *"implementation of environmental regulations for water taxis must be a key component of this program, since this type of transport service can have severe impacts on the marine environment"*. The Transport Master Plan does call for investments in *"more efficient and additional supply of water transport to existing and future tourist destinations, by boat, ferry or water taxi"*[31] but it does not define efficiency, nor does it speak to related emissions.

[30] See table 3-79, page 3-126.
[31] See pg. 2-31 of the CNTMP.

Blue Economy Policy, Strategy and Action Plan

The Blue Economy Policy, Strategy and Action Plan (BEPSAP) like most national policies does not expressly provide for maritime decarbonization, certainly not in any explicit way. However, *"Policy Priority Area 2: Incentives for Blue Economy Development"* does speak broadly about incentivizing *"sustainable investments in the blue space"*.

The rationale supporting its *"Policy Statement 3: Incentive Packages are necessary to enhance the sustainability of established economic sectors in Belize's blue space and to encourage the sustainable development of emerging sectors"* refers to "fit-for-purpose incentive packages" that may help to reduce greenhouse gas (GHG) emissions and balance GHG mitigative actions against economic and environmental concerns. The BEPSAP speaks peripherally about global studies which show that for *"every USD $1 invested in decarbonising international shipping and reducing emissions to net zero is estimated to generate a return of USD $2 – USD $5."*

However, the rationale for *"Policy Statement 5: Targeted and innovative marine research is the basis for informed and viable blue economy development"* expressly declares that *"Technical data to be produced from marine research will inform the feasibility of investments in mangrove conservation, offshore renewable energy,* ***reducing carbon emissions to net zero for ships and other maritime transport operating in Belizean waters****, [emphasis added] and will be indispensable to develop investible projects for resource mobilization and a comprehensive Resource Mobilization Strategy (RMS)."*

National Sustainable Maritime Transport Policy (draft)

The National Sustainable Maritime Transport Policy (SMTP), although in draft and subject to adoption by the Honorable Cabinet, is the most comprehensive policy framework related to maritime transport. It sets out six priority areas:

- *"Priority 1: Regulatory Framework*
- *Priority 2: Institutional Framework*
- *Priority 3: Market Framework*
- *Priority 4: Monitoring & Evaluation Framework*
- *Priority 5: Financing & Economic Framework*
- *Priority 6: Coordination Framework"*

In the Action Plan[32], the policy speaks to the need for the BPA (with the support of other key stakeholders) to develop within the short term (1-2 years) the necessary framework to be able to routinely conduct "*cruise ship environmental impact assessment (& cost-benefit analysis for*

[32] See page 26 - 33.

determining the carrying capacity across territorial waters (fuel usage, food and water usage, solid/liquid waste generation, air pollution, GHG emissions, etc., relative to domestic consumption rates".

The most relevant sections of the Policy as it relates to the development of Belize's NAP may be found in the following maritime priority areas of the Action Plan:

Environmental Protection and Decarbonization

ii. Design fuel monitoring templates appropriate for each class of vessel operator through stakeholder participatory consultative process and public awareness campaign.

iv. Determine the position at IMO regarding GHG levy design and elaborate national priorities on level of ambition around decarbonization of maritime transport globally.

Innovation/ Technology

i. Convene working group between the maritime transport sector and agroforestry sector to explore local supply chain efficiency in sustainable forestry for shipbuilding industry.

ii. Initiate research & innovation council dialogue amongst domestic stakeholders to engage with multilateral maritime transport sector bodies (International Windship Association, Global Maritime Forum, SLOCAT, etc.)

iii. Design public-private partnership with academic researchers to develop and deploy next-generation maritime transport solutions fit-to-purpose for the sustainable blue economy of Belize.

iv. Integrated planning of aviation and maritime sector - investigate available technologies and establishment costs of an aerostat coverage plan for monitoring & evaluation of the maritime territory of Belize

v. Determine appropriate phase-out/replacement strategy for two-stroke fossil

Policy Analysis

The above listed policies provide a high-level view of Belize's decarbonization ambitions. They provide critical insights into Belize's emissions reduction targets and its emissions reduction strategies; they also signal in general terms how Belize intends to create the enabling environment to drive the desired policy outcomes. The decarbonization linkages related to each policy are reflected below in Table 3, a common thread across all policies is the stated desire to create an enabling environment to drive the desired policy outcomes:

Linkages	NDC	NCCPSAP	LEDS	NEP	CNTMP	BEPSAP	SMTP
Reduction Targets	X		X				
Reduction Strategies		X					
Energy Efficiency			X		X		
Uptake of Clean Energy		X		X			
Production of Clean Energy				X			
Fuel Usage/Air Pollution Actions					X		X
Enabling Environment	X	X	X	X	X	X	X
Incentives		X	X	X	X	X	
Capacity building	X	X	X		X	X	
Pilot projects							
Regulatory adjustments		X	X	X	X	X	X

Table 3: Linkages to existing national policies (source: author)

Reduction Targets

The Low Emissions Development Strategy (LEDS) establishes emissions reduction targets (across all sectors of the economy) to be achieved by 2050. It further proposes two pathways: a high ambition pathway (-45%) as well as a very high ambition pathway (-86%). Although the LEDS does not provide indicative checkpoints, the 2021 Nationally Determined Contributions (NDC) commits to *"15% reduction in conventional transportation fuel use by 2030 and achieve 15% efficiency"* , in relation to land transportation only.

The very high ambition pathway (VHA) set out in the LEDS aligns best with the IMO's 2023 GHG Strategy and therefore the NAP should consider using the VHA pathway as its guide and develop indicative checkpoints in pursuit thereof. The annual reduction factors needed to achieve the reduction targets should be determined during the NAP development process, mindful of the 2030 indicative check point for energy efficiency (-15%) set out in the LEDS, as well as current and future national capabilities (availability of low emission fuels, technology, and technical capacities, etc.).

Reduction Strategies

The subsisting policy landscape (in particular the National Climate Change Policy, Strategy and Action Plan (National Climate Change Policy)) suggests that Belize's decarbonization pathway is to be built upon the three pillars listed below. To ensure policy coherence, to the extent possible, the NAP should also be predicated upon these pillars:

Energy Efficiency (EE)

Belize's EE agenda is to be driven by the development of appropriate policy tools and instruments to improve energy efficiency. Action Point 1 of the LEDS espouses a reduction of fuel emissions in

the public transit system by increasing fuel efficiency and fleet renewal, as well as by replacing conventional (ICE) vehicles. To stimulate such outcomes the LEDs provides for *"an incentivization scheme to subsidize the tax paid on the purchasing and importing of electric boats"*. The NAP should build upon this commitment and further refine the incentivization scheme by drawing out from key stakeholders, sector-appropriate incentives that would help improved EE across the sector and stimulate fleet renewal.

Although the National Comprehensive Transport Master Plan does expressly provide for improved EE in the maritime space by calling for *"more efficient and additional supply of water transport to existing and future tourist destinations, by boat, ferry or water taxi"*, it does not establish EE targets nor does it address supply-side issues related to the fleet. The NAP should therefore consider these issues, within the context of existing policy (and where necessary recommend new policy options). The NAP should also prescribe suitable actions to improve EE in the maritime transportation sector as well as how to expand transportation supply, along with a credible pathway for doing so. To build upon pipeline pilot projects, the NAP should nest with the propulsion systems replacement project for fishing vessels soon to be undertaken by the Ministry of the Blue Economy with funding from the Central American Bank for Economic Integration.

Uptake of Renewable Energy

The National Climate Change Policy, Strategy and Action Plan (National Climate Change Policy) proposes to accelerate the uptake of renewable energy and its Strategic Action 4 suggests that the intent is to do so by promoting *"energy efficiency in the transport sector through appropriate policies and investments"*. More particularly, it commits to stimulating the uptake of biofuels. The National Climate Change Policy does not identify which biofuels will be incentivized nor does it speak to the supply chain dynamics related to such biofuels. Currently, biofuels are not available in Belize but the National Energy Policy does speak to domestic production of ethanol and domestic biodiesel and indicated that an investment portfolio of USD$17.36 million and USD$16.95 million would be needed, respectively. The National Energy Policy postulates that the introduction of E10 and even up to E30 gasoline (ethanol blended in gasoline) has been reported as viable without the need for retrofits of existing gasoline vehicles or the fuel distribution network.

The NAP should therefore explore options for the conduct of feasibility studies related to (1) the production of low emission fuels considering the current and prospective means of propulsion across the fleet, (2) existing barriers to such a transition, and (3) the incentives needed to aid the transition. The feasibility studies would allow the appropriate market signals to be transmitted to what would be a nascent industry for Belize. This approach would accord with the recommended actions set out in the National Energy Policy as it relates to the *"access to clean and affordable energy sources"* as well as position Belize to be able to access any funding that may become

available by way of the IMO Fund/Facility linked to the mid-term measures being contemplated by the Marine Environment Protection Committee of the IMO.

Production of Clean Energy

The interpretation of clean energy gleaned from existing policies seems to focus on the production of electricity from renewable sources: hydro, solar and to a lesser extent wind. The implication for the maritime transport sector outside of the "traditional" use of electricity (lighting and cooling), is the possibility of providing shore power to reduce GHG emissions from ships whilst in port. However, Belize is currently experiencing a supply-demand imbalance that has led to short-term load shedding. There is no additional capacity planned in the near term that would be able to satisfy domestic demand while being able to provide shore power, given the significant loads imposed by seagoing ships: especially cruise ships.

Currently Belize does not provide bunkering services but it might be able to offer such services prospectively if, in partnership with the private sector, it is able to stimulate fresh investments in the production of low-carbon fuels, if not zero/near zero fuels (ZNZ). Although such efforts would accord with the goals and objectives of the NEP, no feasibility studies have been done by the government to understand Belize's clean energy production potential, nor to determine how to stimulate this particular GHG reduction pillar. It might therefore be helpful for the NAP to provide support in the form of feasibility studies in this area, and in future iterations of the NAP, on the production of ZNZs itself.

Suggestions for Creating the Enabling Environment

All seven of the policies discussed above speak in one way or the other about the central role government must play in creating the enabling environment. The current policy space implicitly defines the "enabling environment" as being circumscribed by (1) the provision of incentives (tax breaks), (2) the development of technical capacity, and (3) the adoption of the appropriate legal framework.

The Provision of Incentives

None of the policies are clear about the specific incentives to be provided nor do they provide a roadmap for the development of a clearly defined incentive scheme linked to measurable outcomes, specific time horizons, qualifying factors, and disbursement modalities, etc. In essence this provides the NAP development process with carte blanche to develop an incentive scheme that could not only support maritime decarbonization but also drive Belize's wider climate change ambitions, particularly its GHG reduction targets.

Capacity Building

The Blue Economy Policy Strategy and Action Plan (Blue Economy Policy) speaks to the development of technical skills through the introduction of related courses of study at tertiary institutions both at the technician and degree levels. It also speaks about the conduct of appropriate research that would underpin evidence-based decision-making and envisions such research to, among other things, focus on renewable energy, maritime development, and port development. Although the NEP does speak to capacity building for EE management, the focus seems to be on the Energy Unit within the Ministry of Energy. The Transport Master Plan, on the other hand, sets out a narrow capacity-building framework for the BPA which is confined to only water taxi and port management.

The most comprehensive discussion about capacity-building is featured in the SMTP under Priority Area 2 "Institutional". It provides a comprehensive list of sectoral capacity needs for technical assistance and capacity building. However, none of the policies specifically call for capacity-building activities that are linked to maritime decarbonization.

Adjustments to the Legal Framework

In terms of the legal framework, the Blue Economy Policy, Strategy and Action Plan (Blue Economy Policy) advances that *"there is no legislative and institutional framework in place in Belize that is designed and structured to deliver BE development and implementation as an integrated and multi-sector process."* The (Blue Economy Policy) argues for a Blue Economy Act and for a legal framework that would support the consolidation of the Belize Port Authority and IMMARBE under a unified Maritime Administration. The latter legal expectation has implications for the NAP as both entities are co-leaders in the implementation of MARPOL Annex VI and co-leaders of the Maritime Technical Committee. A properly crafted NAP will therefore nest well within the existing policy framework and should help to inform the legal adjustments will become necessary pursuant to the Blue Economy Policy.

The National Climate Change Policy, under its mitigation and adaptation measures related to energy, speaks to the need to *"strengthen the ongoing development of an appropriate legal and regulatory framework, and other policy mechanisms to support the mainstreaming of the clean energy and clean production technologies."* This would have implications for the development of low-carbon fuels (and electricity) which could help stimulate the energy transition in Belize's maritime transportation sector because the legal framework could create opportunities as well as barriers (if not done right).

The Transport Master Plan noted the lack of climate change-specific legislation in Belize and went on to recommend that new legislation be developed to mitigate and adapt to the effects of climate

change and that such legislation can include, among other things, GHG reduction targets, the formalization of a GHG inventory, a GHG emission registry, and a market-based mechanism.

Maritime Governance

Driving policy implementation is a complex array of ministries, statutory bodies, and government departments (see Figure 19); by way of example, Belizean registered ships (flag state responsibilities) are under the remit of the International Merchant Marine Registry of Belize (IMMARBE) whereas port state obligations, including the registration of the domestic fleet, are assigned to the Belize Port Authority (BPA). These entities sometimes take different positions related to Belize's convention obligations and therefore, as a means to improve cross-institutional coordination a national Maritime Technical Committee (MTC) was created which included IMMARBE, the BPA and the Coast Guard. The MTC was later expanded to now include the other agencies reflected below. It is expected that the expanded MTC will play a critical role in driving Belize's decarbonization agenda.

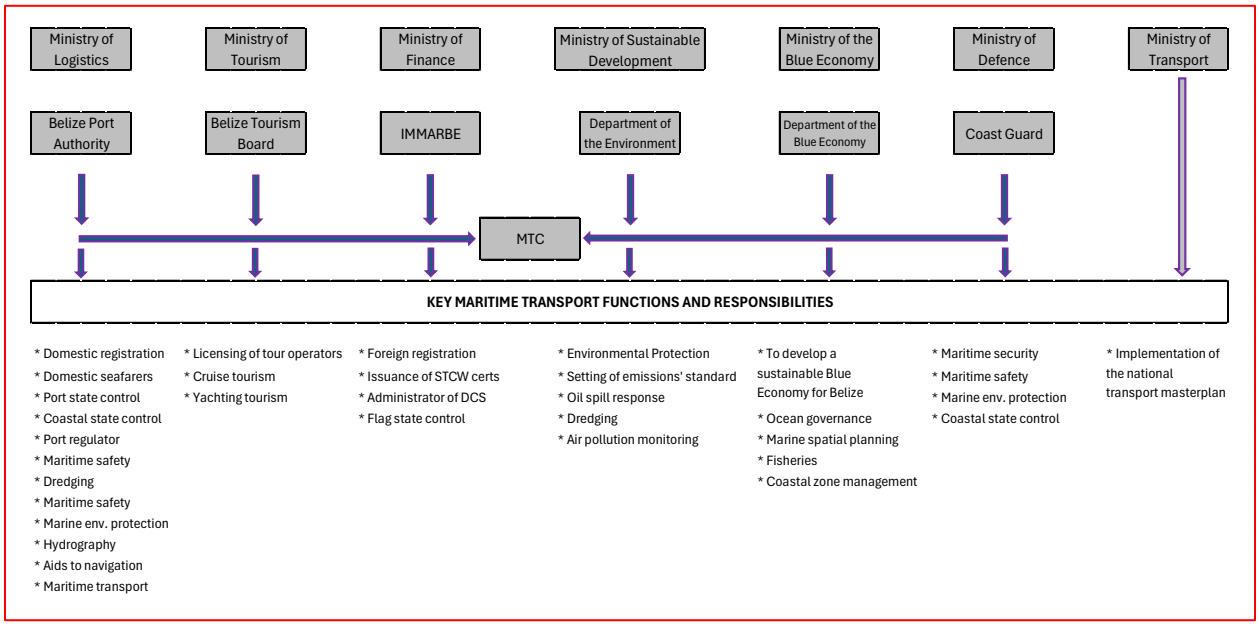

Figure 16: Maritime transport governance framework

Belize's Fuel Imports: 2012-2023

Belize is not a producer of primary or secondary energy from fossil fuels save for the negligible production of crude oil,[33] all of its liquid energy must therefore be imported. Over the period 2012 –

[33] Production has declined from peak production of 4,252 barrels/day (found here) [accessed June 3, 2024], to just 456.6 barrels/day in 2022 (Belize Energy Report 2023).

2023 Belize imported an average of 6,760,190 gallons of premium gasoline, 16,774,895 gallons of regular gasoline and 21,584,986 gallons diesel per year.

Used mainly in the agriculture and transportation sectors, diesel remains the largest imported fuel type, averaging 48% of all imports over the period under review. Diesel's end use means that government taxes are lower than gasoline; its polluting potential is ignored in favor of its utility in agricultural production.

Two primary types of gasoline are imported: regular and premium: the year-on-year importation rate of premium gasoline showed less volatility than regular gasoline and diesel over the period under review. Based on the available data, the average annual growth rate (AAGR) of premium gasoline was -7.76%, whilst regular gasoline had an AAGR of 12.66% and diesel, 0.89%.

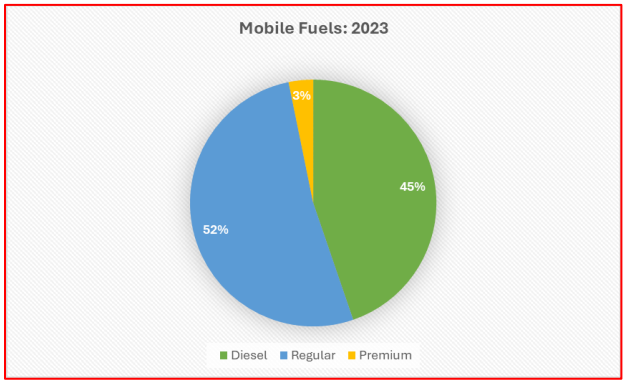

Figure 17: Mobile fuel imports by category (source: Ministry of Energy)

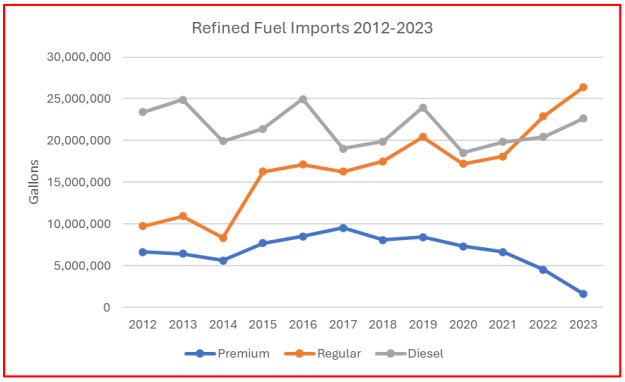

Figure 18: Total fuel imports by type (source: Ministry of Energy)

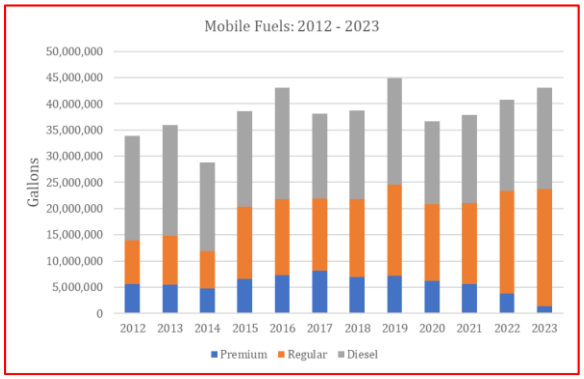

Figure 19: Total mobile fuel imports by type (source: Ministry of Energy)

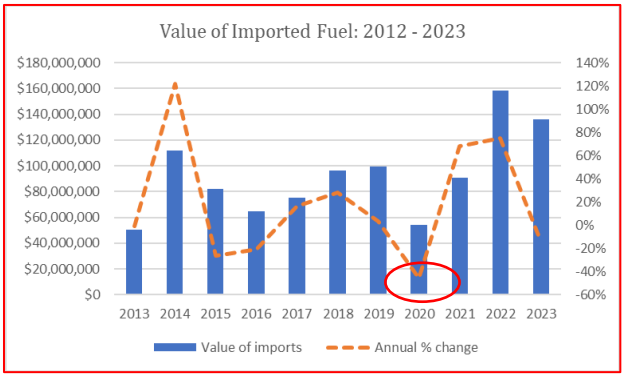

Figure 20: Value of fuel imports (source: Ministry of Energy)

On average, over the twelve-year period under review, Belize spent $89,143,507/annum on imported fossil fuels. In 2022[34] it spent $158,590,357 or a significant 3.2% of its GDP. The 2020 fuel-import bill reflects the covid-induced economic contraction but it also highlights how intensely Belize's economy is fossil fuel dependent.

Baseline Assessment

Methodology

Using 2023 as the baseline year, historical data related to fuel consumption, electricity consumption, passenger throughput, and cargo throughput were collected across four main segments of Belize's maritime transportation landscape: (1) Belize's international fleet, (2) domestic fleet, (3) transient fleet, and (4) seaports.[35]

Efforts were made to secure firsthand fuel/energy consumption data directly from key stakeholders which was then multiplied by the appropriate CO_2 coefficient set out below under assumptions. Where firsthand consumption data was not provided (as in the case of tenders) the best-fit available data (from water taxis) was analyzed and extrapolated to form best estimates. Where extrapolation was done it is so noted.

Assumptions

The following assumptions informed the analysis contained in the Report and readers are asked to be mindful of them as they read the Report:

- Emission calculations in this Report use the CO_{2e} coefficients developed by the US Energy Information Administration which assigns the following weight (kg) of CO_{2e}/gallon for the below listed fuels:
    - Diesel: 10.19
    - Gasoline: 8.78
    - Butane: 6.47[36]
    - Lube Oil: 10.70

[34] The latest year that Central Bank has publicly available data.
[35] Belize's international fleet is composed of those vessels registered with the International Merchant Marine Registry of Belize (IMMARBE). Belize has a registry for its international fleet and one for its domestic fleet each under a separate legal entity. The domestic fleet are those vessels that operate exclusively in Belize, and which are required to license with the Belize Port Authority under the Harbours and Merchant Shipping Act. The transient fleet is considered to be those international vessels (not registered with IMMARBE) which call at Belizean ports.
[36] Source found here.

- No distinction was made between premium and regular gasoline due to the fuel quantity verification challenges reportedly being faced by Belize.
- The CO_2 calculations are on a TtW basis.
- Electricity generated in 2023 contained the same levels of renewables as 2022 (52.9%)[37] and has an emissions factor of 0.3 $KgCO_2$ /kWh (as published by united4efficiency.org in its country assessment for Belize).

Emissions from Transport Fuels

Belize's total liquid fuel imports contributed 5,119 $KtCO_2$ of GHGs over the twelve-year period under review. Fuel-specific emissions over the said period were as follows (see Figure 20):

- Premium gasoline: 712 $KtCO_2$
- Regular gasoline: 1,767 $KtCO_2$
- Diesel: 2,639 $KtCO_2$

Imported fuels consumed across the transportation sector[38] contributed 4,349 $KtCO_2$ over the twelve-year period under review (see Figure 21) made up as follows:

- Premium gasoline: 605.4 $KtCO_2$
- Regular gasoline: 1,502.3 $KtCO_2$
- Diesel: 2,241.3 $KtCO_2$

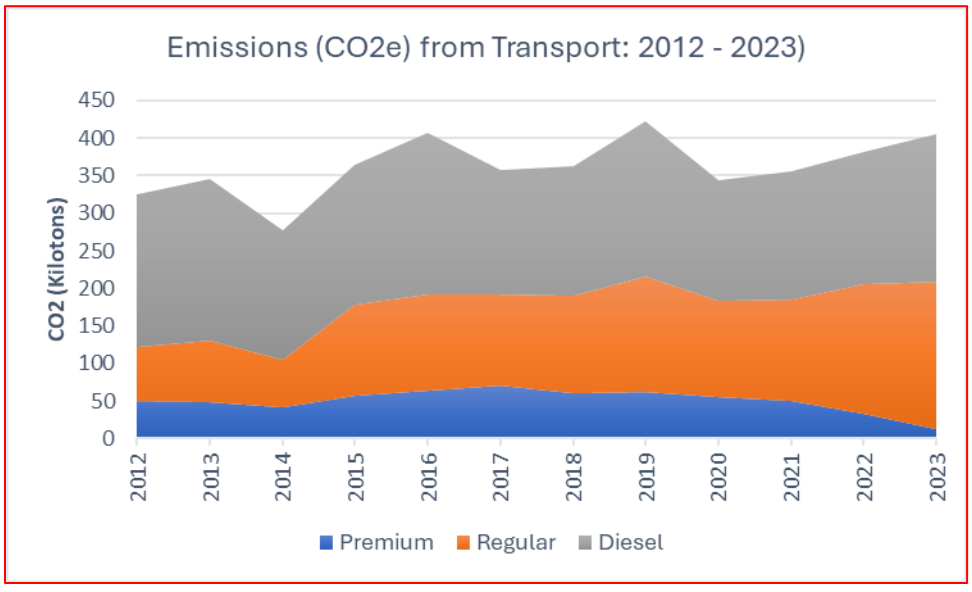

Figure 21: Transportation emissions (source: analysis author /raw data from Min. of Energy)

[37] Renewable energy sources contributed a substantial 52.9% of total electricity generation (see page 10 of the Belize Energy Report 2022).
[38] 85% of total imported fossil fuels according to the National Sustainable Energy Strategy.

The National Sustainable Energy Strategy 2012 – 2033 postulates that "*the transport sector is a major user of petroleum products, accounting for … 85 percent of the fossil fuel use.*" **Therefore, for the base year (2023) imported fossil fuels used in the transportation sector contributed 406.1 $KtCO_2$** made up as follows:

- Premium: 12.1 KtCO2
- Regular Gasoline: 196.7 $KtCO_2$
- Diesel: 196.3 $KtCO_2$

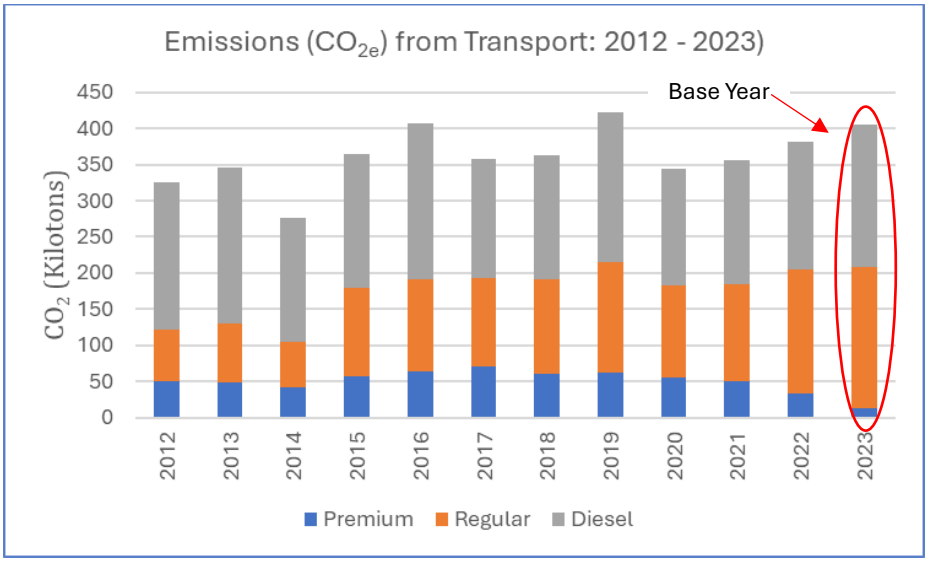

Figure 22: Total emissions (imported transport fuels) (source: author/data from Min. of Energy)

Energy Use and Related Emissions (Maritime Transport)

The details of emissions related to the various maritime transport subsectors may be found under each of the following headings but overall, in 2023 (base year) Belize's maritime transportation sector emitted an estimated 47.9$KtCO_2$ while transporting 957,915 passengers[39] and handling 605,862.86 tonnes of cargo. In context, emissions that were attributed to Belize's overall transportation sector from the use of fossil fuels in 2023 (406.1 $KtCO_2$).

The Transient Fleet

In 2023 Belize received 301 ship calls from cargo ships and 314 cruise calls[40] across the northern and southern port complexes:

[39] 907,903 cruise passengers (average 10 nm/round trip) and 957,915 water taxi passengers (average 60 nm/round trip).

[40] The available data showed arrivals for individual cargo ships (195) and cruise ships (244) at the Belize City Port but there were no such granular details for ship calls at the southern port complex (Big Creek and Harvest Caye), the data for these ports showed only the number of calls but not the number of individual ships.

The Northern Port Complex

In the northern port complex[41] cargo ships must berth at the Port of Belize and cruise ships must go to anchorage since there is no available berthing facility and there is no shore power infrastructure at the Port of Belize.

In the base year, Port of Belize reportedly received 195 calls from twenty-two individual cargo ships which transported 250,165 short tons of cargo[42]. Cargo ships calling at Port of Belize had an average dwell time[43] in port of 13.90 hours, and a median dwell time of 9.20 hours. During the same period the Belize City Port saw 242 cruise calls from fifty-one individual ships which delivered 682,561 manifested passengers. Cruise ships calling the Belize City Port had an average dwell time in port of 12.5 hours and a median dwell time of 10.3 hours.

The Southern Port Complex

The Southern Port Complex is comprised of the Port of Big Creek (cargo) and Harvest Caye (cruise) both of which have alongside berthing but like ports in the northern port complex there is no shore power infrastructure. In 2023 , the Port of Big Creek received 106 calls from cargo ships which transported 355,698 tonnes of cargo, while Harvest Caye received 72 cruise calls delivering 221,416 passengers.

Related Emissions for the Transient Fleet

The emissions related to the transient fleet (foreign ships calling Belizean ports) were not calculated due to gaps in the data provided. Fuel consumption data for the transient fleet is uploaded to the IMO's DCS, but more granular details of fuel consumption while in port are needed to calculate "transient emissions".

The calculation of transient emissions by ships in port are important as such emissions have implications for air quality in port areas and therefore to the possible impacts on public health; in particularly upper respiratory health. The quantum of related emissions can also be helpful to the political, social, and business case for the installation of shore power systems.

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[41] Legally defined as the Belize City Port (BCP).

[42] Throughput is tracked using short tons because the Belize Port Authority (Tariff) Regulations sets all tariffs against short tons. In addition, 20 tanker calls were added to reflect fuel imports through the adjoining fuel depot which were not captured in the reported 195 calls.

[43] Total time in port (from pilot station inbound to pilot station outbound), Data was not readily available on time at anchorage, waiting time for berth vs. time alongside berth.

Ship Type	No. of Calls
Bulk carrier	3
Bulk carrier	7
Container	150
Container	53
General cargo	30
Liquefied gas tanker	16
Oil tanker	20
Other liquids tankers	5
Cruise	314
Ro-Ro	37

Table 4: Emissions by ship type (source: author)

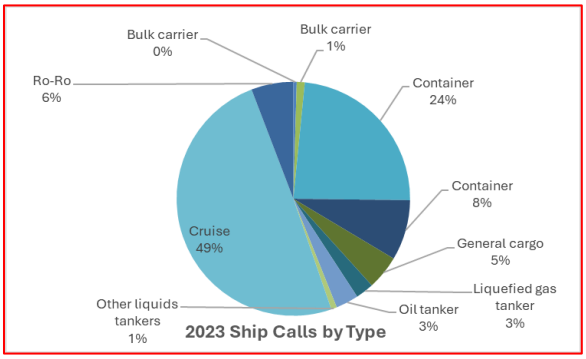

Figure 23: Percentage share of emissions by ship type (source: author)

The International Fleet

Ships flying the Belizean flag are registered with IMMARBE (the International Merchant Ship Registry of Belize); in 2023 IMMARBE reported that it had 821 ships on its flag registry. The combined total deadweight of the fleet was reported as 2,846,095 tons and the average age of the ships in the fleet was 22 years (oldest 80 years); (see Figure 24).

Of the 821 ships 140 were above 5,000 GT and as such their fuel consumption data was captured in the DCS[44]. In 2023 Belize's recorded emissions of 1,223.89 megatons CO_2e in the IMO's DCS while travelling a combined distance of~4 billion nautical miles (n-m) and consuming 395,865,264 tons of fuel. The resultant average consumption rate was therefore 10.18 tons of fuel/n-m, while the average carbon emissions factor (CF) of the fuels consumed in 2023 was 3.1359. Data reflecting actual transport work was not provided by IMMARBE. Fuel consumption data is not currently being collected for vessels below 5,000 GT and IMMARBE expressed concerns about how such data would be collected and the administrative burden that would be imposed if collection becomes mandatory.

[44] IMO's Ship Fuel Oil Consumption System commonly known as DCS.

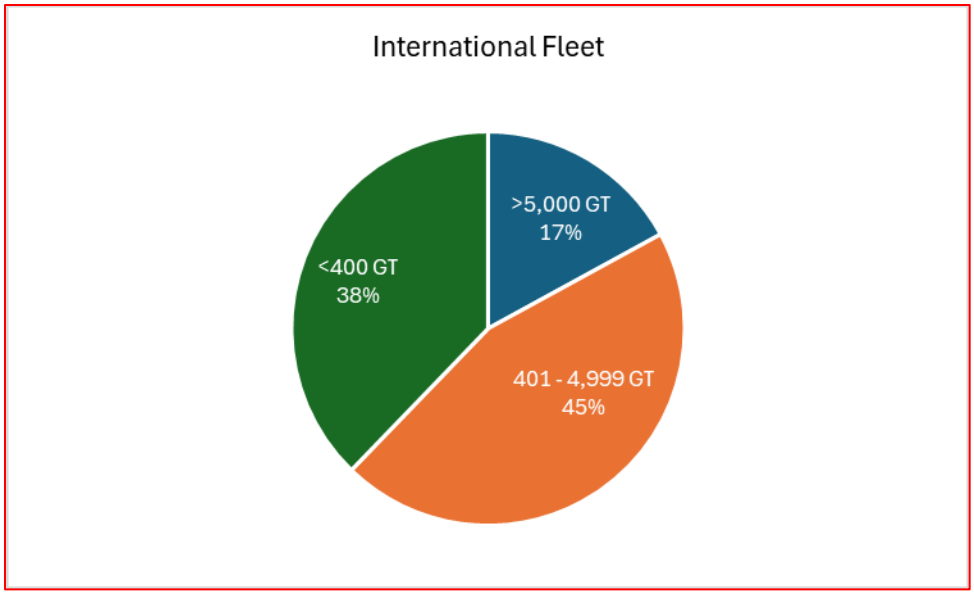

Figure 24: Breakdown of the international fleet (source: IMMARBE)

It is important to note that emissions from Belizean registered ships are not accounted for under Belize's domestic carbon stocktake and that the information provided herein is just for informational purpose to give readers an idea of what the total emissions are for vessels flying the Belizean flag.

The Domestic Fleet

The domestic fleet is comprised of 2,317 vessels broken down into the following five "classes" based on length and hull type[45] as set out below. Class refers only to the size (LOA) of the vessel whereas "purpose"[46] refers to the activity that the vessel is authorized to conduct by the Belize Port Authority:

Class	Size	Purpose				No. Registered
		Private	Passenger	Cargo	Fishing	
A	≤ 35'	674	674	25	638	2,011
B	35' – 44'	33	83	16	2	134
C	45' – 64'	7	52	18	0	77
D	≥ 65	0	6	39	0	45
E	Catamaran (irrespective of size)	7	43	0	0	50

Table 5: Classification of the domestic fleet (source: BPA)

[45] In the case of catamarans.

[46] Private: used in any way that owner desires so long as no revenues are generated; Passenger: used to transport passengers for profit; Cargo: used to transport cargo for profit; Fishing: vessel used domestically for fishing but they must first present a fishing license from the Fisheries Department to be so registered.

In terms of Class (vessel size), the domestic fleet is dominated by small vessels (A Class) spread evenly across license purpose, save for "cargo" vessels which accounted for a mere 1.2% of all A Class vessels (see Table 4). In terms of license purpose "passenger" vessels were the largest category of vessels with a total of 858 being registered. Passenger vessels were followed closely by "private" vessels with 721 registered.

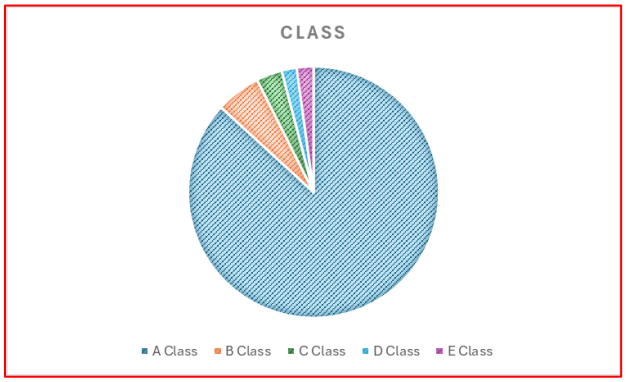

Figure 25: Fleet composition (by class) (source: BPA)

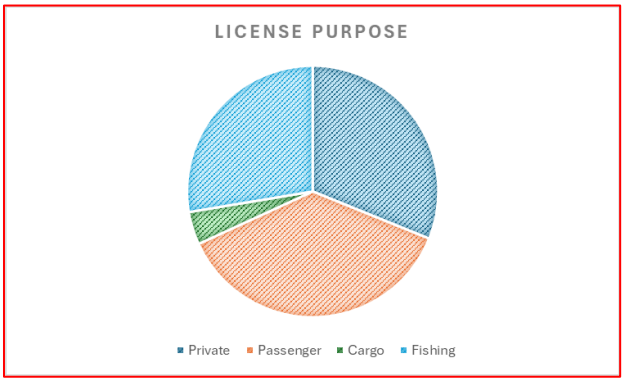

Figure 26: Fleet composition (by license purpose) (source: BPA)

Commercial (Passenger) (Water Taxis)

Water taxis are registered as Commercial (Passenger) vessels but for the baseline study they were segmented to be able to determine CO_2 emissions per transport work ($KgCO_2$/pax). One anonymized water taxi operator provided data[47] which was used to determine the CO_2 emissions per passenger (pax), and it was assumed that all other water taxi operators conducted their operations with similar efficiencies thus their emissions/pax were the same. Based on the data received, in 2023 water taxis transported a total of 957,915 passengers and emitted 12.22 $KtCO_2$ or 12.8 $KgCO_2$/pax. Considering that the round trip of the longest water taxi route for Sea Transport Belize (anonymized operator) is sixty nautical miles (nm), and assuming all other operators transported their passengers that said distance then the emissions per passenger-mile was 0.213 $KgCO_2$/pax-nm.

Photo courtesy of San Pedro Belize Express

[47] Referred to in the Report as "Sea Transport Belize"

The resultant fuel efficiencies of water taxis (in aggregate) extrapolated from the data received from Sea Transport Belize (anonymized operator), are estimated as follows:

Fuel	**Amount** (gals)	**Efficiency** (gals/pax)	**Related emissions** ($kgCO_2$)
Gasoline	712,062.2	0.74	6,251,906.2
Diesel	554,833.1	0.58	5,653,749.5
Lube Oil	29,176.6	0.03	312,189.3

Table 6: Fuel Efficiency and Related Emissions (water taxis) (source: author)

Passenger movements on water taxis are cyclical; March and April are considered "Easter" season during which many Belizeans flock to the cayes; this period is also considered to be the height of the tourism season as well which also influences water taxi passenger movements. June – August is "summer break" which also stimulates travel to and from the cayes.

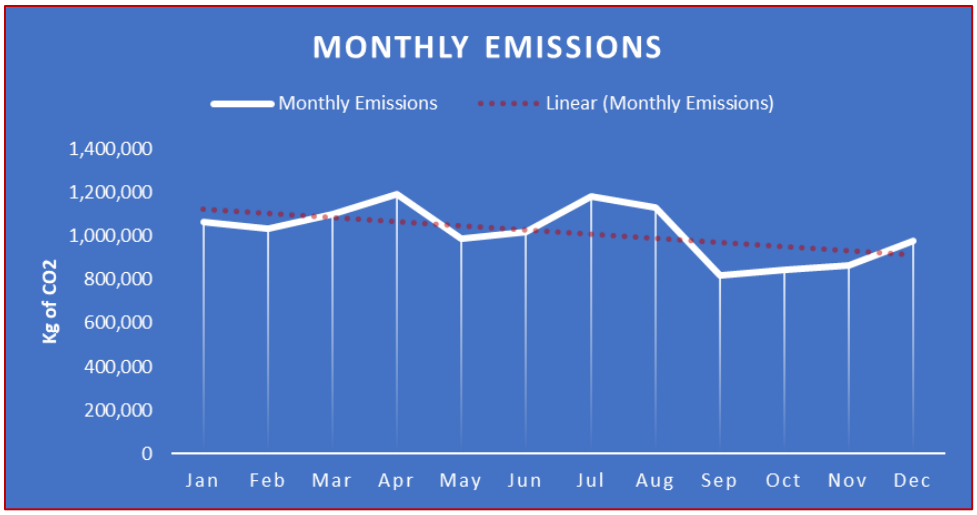

Figure 27: Monthly emissions from water taxi (source: analysis author/raw data Port Authority)

Commercial (Passenger) (Tenders)

Commercial passenger vessels, outside of water taxis, are used primarily for marine tours and tender services for cruise passengers. Marine tours, on average, tend to be less than 25 nautical miles (round trip) from the major tourist destinations and tendering less than 10 nautical miles from ship-to-shore (round trip).

Tenders are propelled by marine diesel engines unlike water taxis which operate both diesel and gasoline engines. On this basis, it was assumed that the Tenders operated with similar fuel efficiencies as water taxis for diesel consumption (0.74 gals/pax for every 60 nm) given the typical marine diesel engine sizes 300 hp – 550 hp used in both water taxis/tenders. Plus the larger water

taxi operators sometimes use their larger vessels as tenders when there are 4 or more cruise ships in port at the same time.

Given that the round trip for tenders is only ~10 nm a correction factor of 0.166 was applied to the fuel efficiency (diesel) for water taxis. Consequently, the total diesel and lube oil consumption related to the tendering of cruise passengers in the Belize City Port (2023) would be 84,224.9 gallons and 3,451.1 gallons respectively. Aggregated emissions for this class of vessels were estimated to be 0.895 $KtCO_2$[48] or 131.2 gCO_2/pax-nm: less than the 213 gCO_2/pax-nm for water taxis (due in large measure to the economies of scale achieved by the size of tenders when compared to water taxis).[49]

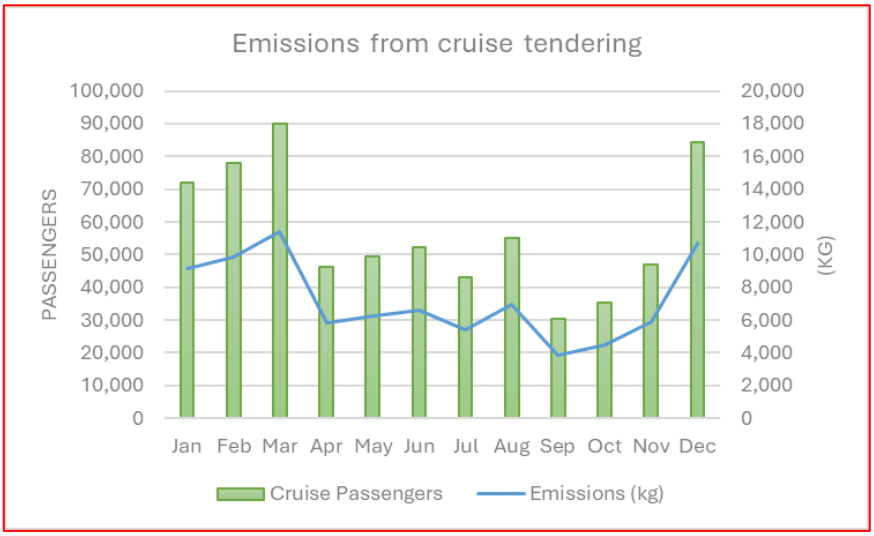

Figure 28: Emissions from cruise tendering (source: author)

Commercial (Passenger) (rest of)

The BPA's registry records 956 commercial vessels: (98 cargo and 858 passengers). The analysis above considers forty-four passenger vessels, thirty-two of which are water taxis and eleven of which are tenders, the remaining 815 Commercial (passenger) vessels are addressed in this section.

Assuming that the other E Class vessels[50] enjoy the same levels of fuel efficiency as Tenders: meaning an average annual fuel consumption of 7,656.8 gallons and 313.7 gallons of lube oil per vessel; and assuming further the below listed efficiency ratios for the fleet[51]; the total emissions for vessels classified as Commercial (Passenger) (rest of), are estimated to be 31.403 $KtCO_2$ based on the efficiency ratios below:

- 1 .0 -Class E (same as for other catamarans)
- 0.9 -Class D (marine diesel engines; large but decreasing carrying capacity)
- 0.7 -Class C (predominantly outboard gasoline engines, and smaller carrying capacity)

[48] 682,561 pax * 131.2 gCO2/pax-nm * 10 nm.
[49] The average carrying capacity of Tenders is ~175 pax compared to 65 pax for Water Taxis.
[50] Those not deployed as water taxis or tenders.
[51] Compared to the reference vessels and their consumption patterns.

- 0.6 -Class B (all outboard gasoline engines, decreasing carrying capacity)
- 0.5 -Class A (all outboard gasoline engines, less than 25 passengers)

The application of the above ratios to the benchmark consumption data for tenders are captured in the table below:

Class	Efficiency ratio	Reference consumption	Consumption (gals)	Emissions (Kg)	Number of vessels	Sub-Total
A	0.5	7,657	3,828.4	33,613.4	664	22,319,293.3
		314	156.9	1,678.5		1,114,515.2
B	0.6	7,657	4,594.1	40,336.1	75	3,025,205.4
		314	188.2	2,014.2		151,063.8
C	0.7	7,657	5,359.8	47,058.8	42	1,976,467.5
		314	219.6	2,349.9		98,695.0
D	0.9	7,657	6,891.1	70,220.6	6	421,323.6
		314	282.4	3,021.3		18,127.7
E	1	7,657	7,656.8	78,022.9	28	2,184,640.9
		314	313.7	3,357.0		93,995.3
					Total Emissions	**31,403,327.6**

Lube Oil
Gasoline
Diesel

Table 7: Fuel Efficiency and Related Emissions Commercial (Pax) (Rest of) (source: author)

Commercial (cargo)

The BPA's registry accounts for ninety-eight cargo vessels (4.23% of the fleet). Unfortunately, it was not possible to gather credible data on fuel consumption or transportation demand for this category of vessels. Corrective actions should be identified during the NAP development process so that subsequent stocktaking is more accurately conducted.

Private vessels

The BPA's registry accounts for 721 private vessels (31.12% of the fleet), unfortunately it was not possible to gather credible data on fuel consumption for this category of vessels. Corrective actions should be identified during the NAP development process so that subsequent stocktaking is more accurately conducted given the substantial segment of the fleet that falls within this category.

Seaports

Belize's seaports consumed 4,313,611.1 kWh of electricity in 2023 (primarily for cooling and lighting in buildings/passenger facilities); at a mean electricity rate of $0.4006 expenditure on electricity was $1,728,032 or < 0.03% of GDP. In terms of cargo ports the average consumption of electricity was 2.39 kWh/tonne of cargo, whereas for cruise ports it was 5.15 kWh/manifested passengers. Total GHG emissions related to electricity use in ports were 1.294 $KtCO_2$.

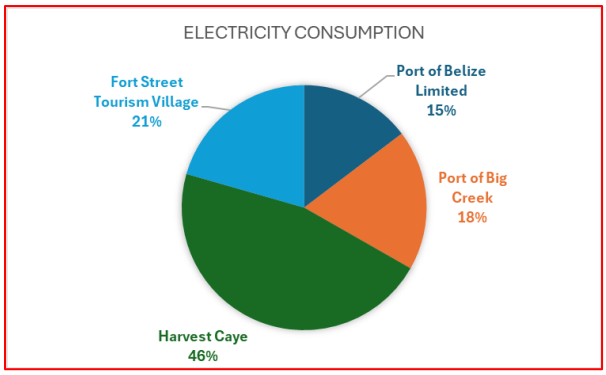

Figure 29: Port share of electricity consumption (source: author)

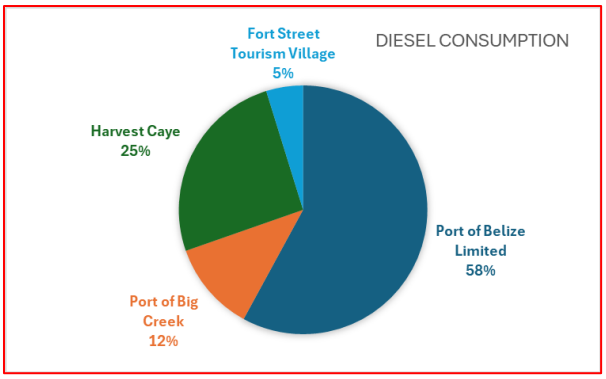

Figure 30: Port share of diesel consumption (source: author)

In terms of diesel, Belize's seaports consumed 129,441 gallons of diesel in 2023 accounting for average consumption of 0.065 gallons/tonne of cargo and 0.044 gallons/manifested passengers. Total GHG emissions related to diesel use in port were 1.319 $KtCO_2$.

Harvest Caye

In 2023 Harvest Caye (located in the southern port complex) consumed the following fuels which contributed emissions amounting to 1.540 $KtCO_2$:

Fuel	**Amount**	**Efficiency**	**Related emissions** ($kgCO_2$)
Electricity	1,992,213 kWh	9.0 (kWh/pax)[52]	597,663.9
Gasoline[53]	49,658.0 gals	0.22 gals/pax	435,997.2
Diesel	33,067.0 gals	0.15 gals /pax	336,952.7

Table 8: Fuel Efficiency and Related Emissions (Harvest Caye) (source: author)

[52] Belize Island Holdings Ltd (the license holder) operates the cruise port at Harvest Caye and a landing point (Malacate) on the mainland, the reported consumption and related analysis are for both locations.
[53] Diesel and gasoline are used mainly for vessel operations (mostly tendering) and jet ski rentals.

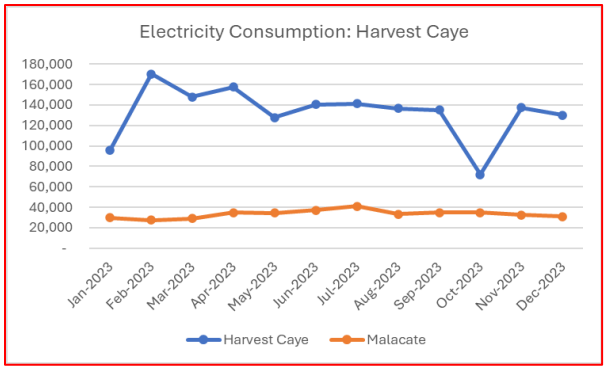

Figure 31: Electricity consumption - Harvest Caye (source: Belize Island Holdings Ltd)

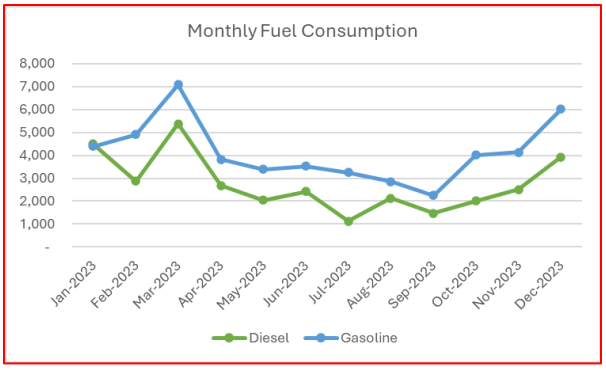

Figure 32: Monthly fossil fuel consumption - Harvest Caye (source: BIHL)

Port of Big Creek

During the baseline year the Port of Big Creek (POBC) handled 355,698 tonnes of cargo while consuming 800,767 kWh of electricity and 15,157 gallons of diesel. The foregoing presents the following energy efficiency profile:

- Electricity: 2.25 kWh/tonne of cargo
- Diesel: 0.04 gals /tonne of cargo

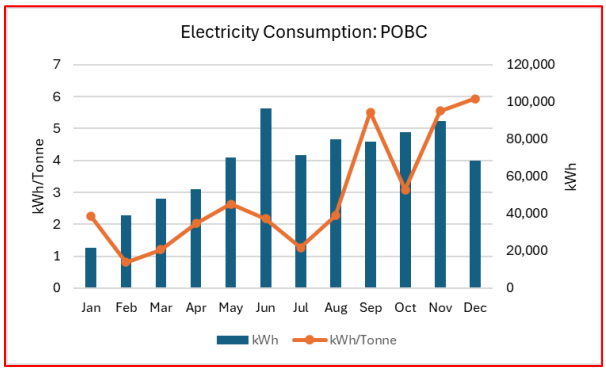

Figure 33: POBC's electricity consumption (source: POBC)

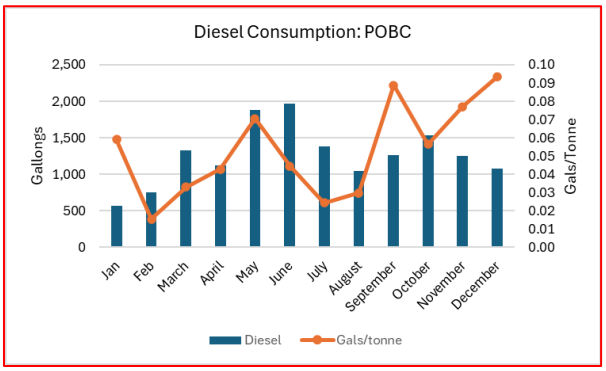

Figure 34: POBC's diesel consumption (source: POBC)

POBC's total energy consumption contributed to 0.395 $KtCO_2$ of emissions in the baseline year or combined emissions of about 2.29 $kgCO_2$ /tonne of cargo:

Fuel	**Amount**	**Efficiency**	**Related emissions** ($kgCO_2$)
Electricity	800,767.0 kWh	2.25 kWh/tonne	240,230.1
Diesel	15,157.4 gallons	0.04 gals /tonne	154,453.7

Table 9: Fuel Efficiency and Related Emissions (Port of Belize Ltd) (source: author)

The Belize City Port

The Belize City Port (BCP) is comprised on two separate facilities: one to received cruise passengers (Fort Street Tourism Village) (FSTV) and one for cargo operations (the Port of Belize Ltd) (PBL).

The Port of Belize Ltd.

In 2023 PBL handled 250,164.86 tonnes of cargo while consuming 633,326 kWh of electricity, 75,000 gallons of diesel and 16,500 gallons of gasoline. The foregoing presents the following energy efficiency profile:

- Electricity: 2.53 kWh/tonne of cargo
- Diesel: 0.30 gals /tonne of cargo
- Gasoline: 0.07 gals /tonne of cargo

In relation to the consumption of gasoline, the data provided by PBL did not allow for monthly analysis unlike the other energy sources (see Figures 36 & 37).

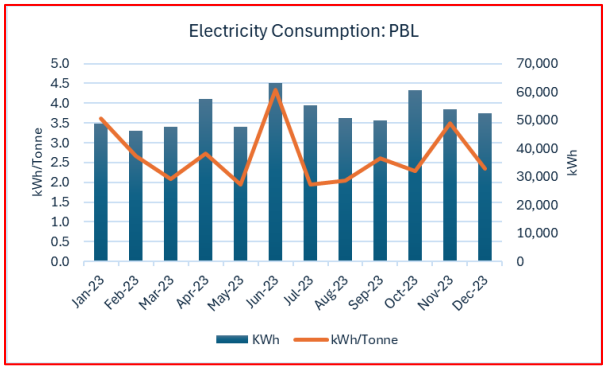

Figure 35: PBL's electricity consumption (source: PBL)

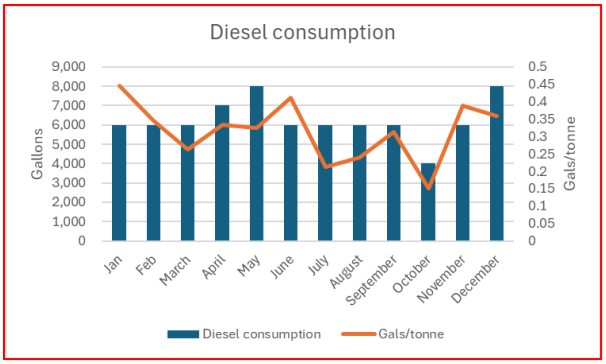

Figure 36: PBL's diesel consumption (source: PBL)

PBL's total energy consumption contributed to 1,099,117.8 $kgCO_{2e}$ of emissions in the baseline year or combined emissions of about 4.39 $kgCO_{2e}$ /tonne of cargo:

Fuel	**Amount**	**Efficiency**	**Related emissions** ($kgCO_2$)
Electricity	633,326 kWh	2.53 kWh/tonne	189,997.8
Diesel	75,000 gallons	0.30 gals /tonne	764,250.0
Gasoline	16,500 gallons	0.07 gals/tonne	144,870.0

Table 10: Fuel Efficiency and Related Emissions (Port of Belize Ltd) (source: author)

Fort Street Tourism Village

The Fort Street Tourism Village (FSTV) is the landing point for cruise passengers tendered to shore from cruise ships that have to anchor in the northern port complex. In 2023 FSTV received 682,561

passengers while consuming 887,305 kWh of electricity and 9,564 gallons of fuel (both diesel and gasoline). The foregoing presents the following energy efficiency profile[54] which contributed 0.359 $KtCO_2$ of emissions or ~ 0.53 $kgCO_2$ /passenger (pax):

Fuel	**Amount**	**Efficiency**	**Related emissions** ($kgCO_2$)
Electricity	887,305 kWh	1.30 kWh/pax	266,191.50
Diesel	6,216.6 gallons	0.009 gals /pax	63,347.20
Gasoline	3,347.4 gallons	0.005 gals/pax	29,390.20

Table 11: Fuel Efficiency and Related Emissions (FSTV) (source: author)

In relation to the consumption of liquid fossil fuels the data provided by FSTV did not allow for monthly analysis nor did it provide data on consumption of specific fuels. However, given the author's understanding of the operations of FSTV, a consumption rate of 65%/35% was assumed for diesel and gasoline, respectively.

Challenges

Any reduction in the consumption of fossil fuels would mean a reduction in taxes collected by the government. In the approved Estimates of Revenue and Expenditure for fiscal year 2023-2024 taxes on fuel included 12.5% general sales tax plus $2.94/gallon (premium gasoline), $2.82/gallon (regular gasoline), and $1.88/gallon for diesel. In 2023, taxes on fuel were ~5.2% of GDP[55], while total fuel taxes collected in 2021 represented a significant 22.2% of governments' total recurrent revenues.

It would therefore be prudent for Belize to undertake a study to understand how the energy transition would impact on government revenues; and to develop "revenue replacement" strategies to avoid political reluctance and indifference towards the energy transition.

Opportunities

The following opportunities present themselves as Belize begins to shape its maritime decarbonization pathways:

[54] Please note that consumption by the tenants of FSTV were not provided and are thus not reflected herein.
[55] Using the average fuel taxes for January and September 2021.

The Provision of Shore Power

In 2023 Belize received a substantial number of cruise-ship-calls (314), with associated emissions of 102.3 $KtCO_2$. This presents an opportunity to provide shore power to the cruise sector and to rebrand Belizean cruise ports as "green" ports. The Government of Belize recently reacquired the Port of Belize Limited and it is in the process of drafting "modernization plans". An opportunity therefore exists to factor in the provision of shore power in those development plans so that the designs are mindful of the infrastructure necessary to support shore power even if such services are to be provided at a later phase of the development.

According to CLIA[56] *"120 ships (46% of the fleet and 52% of global capacity) have the ability to plug in in ports where the infrastructure is available."* This represents an important opportunity for Belize to decarbonize while contributing to a reduction in air pollution with positive benefits to the respiratory health of populations in port areas.

Bunkering Infrastructure

The 2023 IMO GHG Strategy will stimulate the production of increased stocks of zero/near-zero fuels and as such it would stimulate the need for new bunkering infrastructure to support the distribution of such fuels. Belize has an opportunity to enter the bunkering space which would not only help the Caribbean region prepare for the uptake of such fuels but it would also make Belizean ports more attractive. Currently only Jamaica offers bunkering facilities for LNG (a so called "transition" fuel), the market is therefore wide open for the building of strategic partnerships in preparation for these new kinds of port services necessary to support the energy transition.

It might be an opportune time for Belize to consider demand studies as well as pre-feasibility studies related to new bunkering services/opportunities.

Building a Maritime Transport Data Ecosystem

Whereas the baseline study highlighted areas where data was either lacking or incomplete, it also presents an opportunity for Belize to build an appropriate maritime transport data ecosystem. Belize's sustainable maritime transportation agenda is ambitious but it must be data driven. The Belize Port Authority and other key stakeholders must continue to shape data collection efforts, data analyses and they must build a country-appropriate dissemination framework in order to create greater visibility and understanding of emissions

[56] Cruise Lines Industry Association

related to its maritime transportation sector. Such an ecosystem would give Belize's development partners greater insights into how they may target their support for Belize's maritime decarbonization efforts.

Production of Clean Fuels

Among CARICOM members, Belize is second only to Guyana in terms of arable lands. Belize has a robust agro-productive sector with significant production of grains. The NAP development process provides Belize an opportunity to examine ways in which its agro-productive sector can support the energy transition, particularly its domestic fleet, in terms of the provision of biofuels (~50 million gallons per annum). This would be in harmony with the National Energy Policy which calls for the introduction of biodiesel blends and blends of ethanol in regular gasoline.

Belize also has significant renewable energy potential, particularly related to solar. It may be able to produce clean electricity which can then be used to generate e-fuels, in addition to the provision of shore power to the cruise sector. Belize could possibly use the NAP to help determine a pathway for the production of clean fuels.

Gaps & Related Recommendations

The following gaps were identified and recommendations made related thereto; these gaps are to be presented to key stakeholders for validation, adjustment and elaboration as necessary, after which they should inform the NAP:

Data Collection and Analysis.

1. The Belize Port Authority is empowered by law and by license to request data from ships and ports but it has not been doing so on a consistent basis. Belize also does not collect energy use data related to domestic maritime transportation; national monitoring and reporting efforts related to energy use do not extend to domestic maritime transportation even though a substantial percentage of fuel imports[57] are consumed by the domestic maritime transportation sector.

   In those instances where data is provided upon the request of the Belize Port Authority there is no systemic analysis and follow up actions to help steer the maritime transportation sector in terms of the efficient use of energy. In any event, there is no standardized reporting format for

[57] 5.32% of diesel and 16.37% of gasoline. Consumption is likely to be much more given the gaps in the data related to private vessels and commercial cargo vessels.

the collection of fuel consumption data that allows for ease of comparison and analysis, even among stakeholders within the same sub-sector.

Related Recommendations

1.1 Belize should take measures, including the adoption of maritime statistics regulations, to mandate by law, the systematic collection and analysis of maritime transport data, and to protect sensitive data provided by stakeholders from improper disclosure.

1.2 Belize should also require, either by way of policy or law ,the periodic publication of the results of maritime energy use analyses conducted by public bodies: the BPA, the Statistical Institute of Belize (SIB), the University of Belize, etc.

1.3 The BPA should consider forging a partnership with SIB to assist with data analysis, and with regular reporting to raise awareness of Belize emissions profile and its overall maritime decarbonization efforts moving forward.

1.4 Data analysis (in aggregate form) should be made public to encourage academic inquiries and research.

1.5 The data to be collected in relation to international shipping should, among other things, include cargo volumes, cargo values, fuel consumption, energy use along the maritime supply chain, ship calls (by ship type, dwell time, parcel size distribution, etc.).

1.6 The data to be collected in relation to the domestic fleet should include among other things annual fuel and lube oil consumption, engine hours, distance travel, cargo/passenger throughput, etc.

1.7 The BPA should collaborate with the Ministry of Energy (Energy Unit) to improve fuel use monitoring and reporting to provide a clearer picture of the flow and use of fossil fuels along the maritime supply chain.

1.8 The BPA should consider reporting requirements for marinas/fuel depots on liquid fuel consumption.

1.9 The BPA should consider a vessel re-registration exercise that would allow for the appropriate data related to the domestic fleet to be recorded (including the age of domestic vessels). This would also help to clean up the registry given the number of inactive vessels remaining thereon. The profile of the re-registered fleet should then be used to inform incentive schemes in aide of the energy transition.

2. The BPA does not collect, validate, and analyze ship traffic at the southern port complex reportedly due to the lack of radio coverage in that area. This presents a major gap in overall maritime domain awareness and hinders efficient maritime data collection and analysis.

Related Recommendations

2.1 The BPA must enforce the duty on the part of the license holders to submit statistical information periodically.

2.2 The BPA should consider expanding its communications network to include the southern port complex as well as the use of AIS data to analyze ship traffic at all its ports.

3. The international registry does not track energy use for vessels <5,000 GT (82.9% of the fleet), vessels >5,000 GT are monitored only because of the compulsory nature of the DCS. Belize does not have the means to expand the energy use data collection, verification and analysis related to vessels not captured by the DCS at this time since it would require significant resources to do so.

Related Recommendations

3.1 Conduct appropriate feasibility studies to determine the best possible system design for the submission, collection, analysis, and use of energy use data.

3.2 Design an incentive scheme that allows for a pilot period, followed by a voluntary period and then a mandatory requirement. The approach to be adopted must help to prevent flight from the registry because of any undue administrative burdens imposed by meeting compliance with the new data collection system (particularly if it is not a universal obligation).

Emissions Reduction Targets

4. There are no clearly defined emissions reduction targets for maritime transportation either in policy or in law. Emissions reduction targets expressed in this baseline study were therefore deduced from existing policy.

Related Recommendations

4.1 The NAP should align with the very high ambition target (-86%) set out in the LEDS, to the extent possible, given the current as well as prospective endowment factors and national limitations.

4.2 Although the policies speak primarily to land-based emissions, the NAP development process should also consider the emissions reduction strategy already committed to in policy. Such an approach would help to harmonize GHG reduction efforts and build upon complementary strategic actions.

Legal Framework

5. The current legal frameworks do not support the collection and analysis of maritime energy use data. The inability of the BPA to demand, upon the pain of penalties, such information will make any meaningful decarbonization strategy extremely difficult to achieve.

Related Recommendations

5.1 Efforts should be made to domesticate MARPOL in general but Annex VI in particular. Such efforts should produce a legal instrument that provides for effect enforcement of MARPOL , maritime decarbonization, and an appropriate incentive scheme.

5.2 Belize should consider the adoption of regulations that would require actors across the maritime transport sector to collect energy use data that would help the BPA along with other governance bodies to set emissions reduction targets leading to net zero by 2050.

Basket of Incentives

6. Although several policies speak to incentivization, there is no expressly defined incentive scheme linked to any particular emission reduction target; those are yet to be developed.

Related Recommendations

6.1 The NAP development process should consider designing a performance-based incentive scheme in support of the agreed emissions reduction targets.

6.2 Key stakeholders should be consulted to ensure a fit-for-purpose incentive scheme but also to ensure buy-in that would catalyze the right investments in the sector.

Zero/Near Zero Fuels

7. Belize does not yet produce biofuels or zero/near-zero fuels nor does it provide bunkering services at its ports. Whereas international ships are able to bunker elsewhere and therefore able to participate in the energy transition, the domestic fleet would be subjected to technology lock-in or at best be limited to a transition to electric propulsion unless this reality changes.

Related Recommendations

7.1 Belize should consider the conduct of feasibility studies to determine the best solutions for the development and deployment of biofuels and zero/near-zero fuels in support of the energy transition not just locally but also internationally. More particularly in relation to:

a) Biofuels
b) E-fuels
c) Bunkering infrastructure

d) The provision of shore power
e) The addition of new renewable capacity to support electrification of the sector

7.2 Feasibility studies should also be conducted to examine the prospective demand for shore power and the necessary additional capacity that would be needed to meet such demand. Such studies are crucial given the current electricity supply-demand realities of Belize.

7.3 A study should be undertaken to understand the propulsion systems currently deployed at sea with a view to determining the best transition pathways considering the investments needed, the technical capacities that would be needed to install, operate, and maintain new propulsion systems, and the ability of new propulsion systems to deliver on the emissions reduction targets.

Maritime Governance

8. Maritime governance is still not optimal but it can be enhanced if the role of MTC is further refined. An improved MTC would help to avoid duplication of efforts and to harmonize decarbonization actions.

Related Recommendations

8.1 Develop a clear TOR and rules of procedure for the MTC.

8.2 Create standing committees of the MTC which are to be tasked with specific responsibilities to ensure that Belize fulfills its international obligations.

Conclusion

Belize's maritime transportation sector has a comparatively small carbon footprint, which is dominated by imported emissions of the transient fleet. Global actions to decarbonize shipping are likely to drive down those emissions, which would leave the other outflows of GHG emissions: the domestic fleet and seaports. To determine the best possible decarbonization pathway Belize will need to improve its data collection and analysis mechanisms, enshrine them in law and incentive the agreed emissions reduction strategies.

The findings of this baseline assessment should provide relevant context and a good starting that could promote policy coherence moving forward.

References

1. CARIBBEAN COMMUNITY CLIMATE CHANGE CENTRE (2014). *A National Climate Change Policy, Strategy and Action Plan to Address Climate Change in Belize*. Belmopan.

2. INTERNATIONAL MARITIME ORGANIZATION (2022). GREENVOYAGE2050 PROJECT COORDINATION UNIT. *National Action Plan to address GHG emissions from ships From decision to implementation*. London

3. GOVERNMENT OF BELIZE. OFFICE OF THE PRIME MINISTER (2017). *Comprehensive National Transportation Master Plan*. Belmopan.

4. GOVERNMENT OF BELIZE (2021a). *Updated Nationally Determined Contribution*. Belmopan.

5. GOVERNMENT OF BELIZE (2021b). NATIONAL CLIMATE CHANGE OFFICE. *Low Emissions Development Strategy and Action Plan*. Belmopan.

6. GOVERNMENT OF BELIZE. MINISTRY OF THE BLUE ECONOMY (2022). *Blue Economy Development Policy, Strategy & Plan*. Belmopan.

7. GOVERNMENT OF BELIZE. MINISTRY OF ENERGY (2023). National Energy Policy. Belmopan

8. GOVERNMENT OF BELIZE (2024). BELIZE PORT AUTHORITY. *National Maritime Transport Policy (draft)*. Belize City.

9. GREENVOYAGE2050, *Fleet and CO_2 Calculator*, found here [accessed 05/10/2024].