

High-Level Working Group on
Climate Change in the Caribbean

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The Future of the Blue Economy



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Ine Apapoe (Suriname) Lecturer,
Anton de Kom University

Verónica Arias (Ecuador)
Executive Director, CC35

Dr. Anthony T. Bryan (Trinidad
and Tobago) Non-resident Senior
Associate, CSIS

Dr. Samantha Chaitram
(Trinidad and Tobago) Lecturer,
Trinidad and Tobago Police
Training Academy

Amb. Anton Edmunds (St.
Lucia) Senior Advisor on
Caribbean Affairs, Inter-American
Development Bank; Former St.
Lucia Ambassador to the United
States

Dr. Georges Fauriol (United
States) Fellow, Global Americans;
Co-chair, Caribbean Policy
Consortium

Allison Fedirka (United States)
Director of Analysis, Geopolitical
Futures

Dr. Richard Feinberg (United
States) Member, Global
Americans International Advisory

Council; Professor Emeritus,
University of California, San
Diego

Shiloh Fetzek (United States)
Senior Fellow, Center for Climate
and Security

Amb. Carlos C. Fuller (Belize)
Belize Permanent Representative
to the United Nations

John Goedschalk (Suriname)
Executive Director, Conservation
International-Suriname

Dr. Ivelaw Griffith (Guyana)
Fellow, Global Americans; Former
Vice-Chancellor, University of
Guyana

Rasheed Griffith (Barbados)
Non-resident Senior Fellow, Inter-
American Dialogue

Dr. Legena Henry (Trinidad and
Tobago) Lecturer, University of
the West Indies, Cavehill

Amb. Riyad Insanally (Guyana)
Former Guyana Ambassador to the
United States and the OAS

Dr. Scott B. MacDonald (United States) Fellow, Global Americans; Chief Economist, Smith's Research & Gradings

Dame Billie Miller (Barbados) Member, Global Americans International Advisory Council; Former Deputy Prime Minister of Barbados

Luis Gilberto Murillo (Colombia) Member, Global Americans International Advisory Council; Former Minister of Environment and Sustainable Development, Colombia

Dr. Claire Nelson (Jamaica) Founder and Director, Institute of Caribbean Studies

Dr. Justin Ram (Barbados) Former Director of Economics, Caribbean Development Bank

Ivan Rebolledo (United States) Chair, Global Americans Board of Directors; Managing Partner, TerraNova Strategic Partners LLC

Alex Rosaria (Curaçao) Former Member, Parliament of Curaçao

Sir Ronald Sanders (Antigua and Barbuda) Antigua and Barbuda Ambassador to the United States and the OAS

Dr. Kalim Shah (Trinidad and Tobago) Assistant Professor, University of Delaware

Dr. Lorraine Sobers (Trinidad and Tobago) Lecturer, University of the West Indies, St. Augustine

Tulio Vera (Chile) Chair, Global Americans International Advisory Council; Former Managing Director, J.P. Morgan Latin America Private Bank

Lisa Viscidi (United States) Senior Manager, Deloitte Consulting

Bruce Zagaris (United States) Partner, Berliner Corcoran & Rowe LLP

INTRODUCTION

The “blue economy” has much to offer the Caribbean. To briefly define, the blue economy is “the concept of a sustainable ocean economy that provides social and economic benefits for current and future generations,” according to Trinidadian energy expert Dr. Anthony T. Bryan. Critically, the blue economy offers an eco-sustainable roadmap to an economic future, playing to the Caribbean’s strengths and minimizing its weaknesses. Policymakers in both the Caribbean and its major trade and investment partners need to recognize the value of marine ecosystem services and products as well as develop a deeper appreciation of the need to maintain the current health of fisheries, reefs, and other parts of local waters and islands. In this, there is a balance to be found between economic growth, social equity, employment, price stability, and a sustainable ecosystem.

There are significant reasons to move ahead with a more fulsome embrace of the blue economy in the Caribbean. The last few years have been highly challenging for the region. It has been buffeted by the COVID-19 pandemic, global regulatory measures have damaged offshore financial businesses, and geopolitical tensions have injected uncertainty into foreign investment and trade relations. As a result, the Caribbean’s longstanding economic structure, based on the pillars of tourism, extractive industries, and offshore finance—is under considerable pressure. Even agriculture and fishing are under stress, with much of the region dependent on food imports from external sources. Overfishing is a major problem, with knock-on effects hurting the region’s coral reefs, which function as essential oceanic ecosystems.

Hovering over these factors is climate change. This threat is made evident by extreme weather events like hurricanes, droughts, and rising sea levels that threaten freshwater supplies. Heavy use of fossil fuels, pollution from tourist activities and shipping, and illicit mining all contribute to climate change. While segments of North America’s population may argue that the impact of climate change is overstated, in the Caribbean, it is a very real, tangible point of concern. The fight against climate change is at a critical inflection point, and, as such, it necessitates novel economic approaches.

Caribbean governments looking toward the future know the regional economy needs to adopt a robust sustainability approach. New activities must be developed in ways that do not contribute to environmental degradation. It is also necessary to halt resource overexploitation by eliminating overfishing and other destructive fishing practices, especially in vulnerable reef-associated ecosystems.

The blue economy offers an exciting and creative path for Caribbean governments, private sectors, and non-profit organizations to play a major role in how the region interacts with its neighbors and what kind of future it will create for its population. It is also a process that is being pursued worldwide with the assistance of such international organizations as the World Bank, the Inter-American Development Bank, and the United Nations. These are important partners for the Caribbean to work in establishing and achieving blue economy objectives. Moreover, the blue economy offers an opportunity for low-carbon, clean, and energy-efficient diversification—developments that are increasingly important for everyone.



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1. Defining the Blue Economy

What exactly is the blue economy? According to the World Bank, “The ‘blue economy’ concept seeks to promote economic growth, social inclusion, and the preservation or improvement of livelihoods while at the same time ensuring the environmental sustainability of oceans and coastal areas. At its core, it refers to the decoupling of socioeconomic development through ocean-related sectors and activities from environmental and ecosystems degradation.”¹ To this definition, the World Bank adds that the blue economy “...concept draws from scientific findings that ocean resources are limited and that the health of the oceans has drastically declined due to anthropogenic activities.”² With this definition in mind, the objective of the blue economy is to provide island states and their populations the ability to restore, protect, and maintain biodiversity while considering the social and economic benefits for current and future generations. Part of this path is through clean technologies, alternative (renewable) energy, and better treatment of waste materials.

How significant is the blue economy? The United Nations estimates that the global blue economy has a turnover of between USD \$3-\$6 trillion, which includes ecosystem services provided by the ocean.³ Part of these activities includes fisheries and aquaculture businesses, contributing \$100 billion per year and approximately 260 million jobs to the global economy.⁴ Therefore, the global

blue economy is massive and affects much of the world’s population.

As local economies work to recover from the deep recession caused by the COVID-19 pandemic, the blue economy strategy will grow in significance. Jamaica’s Minister of Tourism, Edmund Bartlett, recognized this shift in December 2021 when he stated, “The sector must find ways to answer how increasingly scarce natural resources can be prudently managed, how economic growth can be aligned with the social and economic needs of local populations and communities, as well as the preservation of the natural environment. Tourism development strategies and practices must be increasingly designed with the view of promoting more resource-efficient initiatives that are aligned with goals of sustainable consumption and production.”⁵

The Blue Economy and the Caribbean Economy

Three main sectors drive the Caribbean economy: tourism, financial services, and extractive industries. Of these sectors, tourism is the most widespread, being crucial for the larger islands like Cuba, the Dominican Republic, Jamaica, and Puerto Rico and the smaller jurisdictions like Aruba, Barbados, and most of the Eastern

¹ “The Potential of the Blue Economy: Increasing Long-Term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries,” The World Bank, June 2017, <https://www.tralac.org/images/docs/11715/the-potential-of-the-blue-economy-world-bank-un-desa-june-2017.pdf>

² Ibid.

³ <https://www.un.org/en/desa/exploring-potential-blue-economy>.

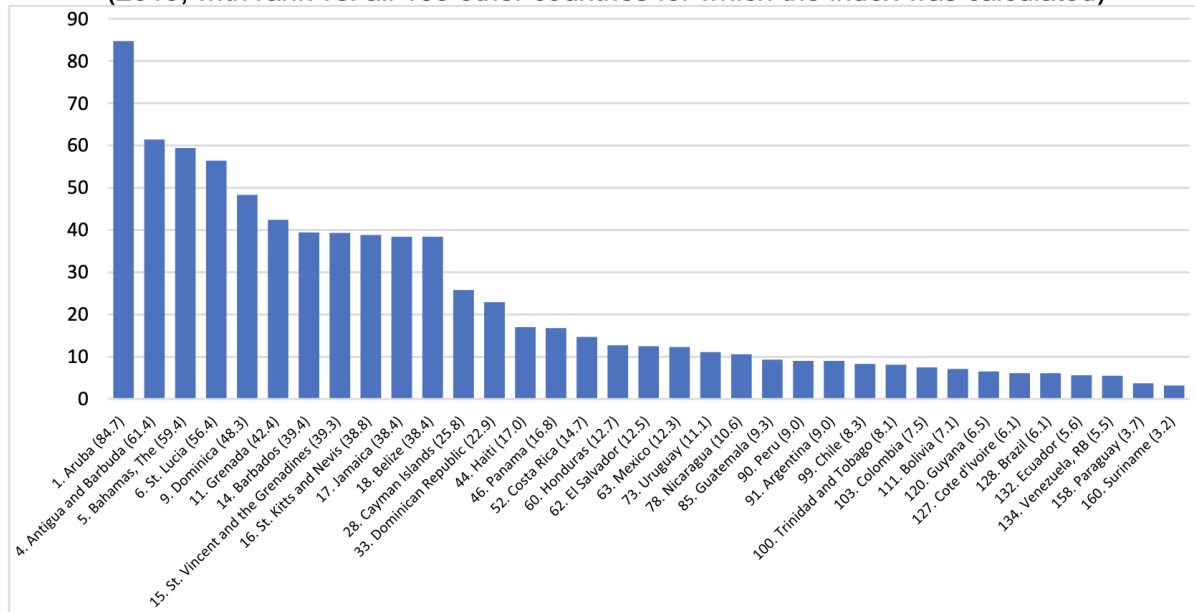
⁴ Ibid.

⁵ <https://www.mot.gov.jm/news-releases/post-covid-19-travellers-will-opt-sustainable-destinations>.

Caribbean.^{6,7} Extractive industries (energy and mining) are central to Guyana,

Suriname, Trinidad and Tobago, and, to a lesser extent, Jamaica and Cuba.

Figure 1. Tourism Dependency Index: Latin America and The Caribbean (35 countries)
(2018, with rank vs. all 166 other countries for which the index was calculated)



Notes: The Tourism Dependency Index (TDI) is calculated using 5-year averages (2014-2018) for the total contribution of tourism to export receipts, GDP, and employment for each country. The range is from zero to 100, with 100 representing total dependence on the sector. TDI for 35 countries in Latin America and the Caribbean for which data was available displayed. The digit preceding the country name represents its rank out of 166 countries around the world for which data was available.

Source: Authors' calculations based on data from World Bank Development Indicators and World Travel and Tourism Council databases.

Considering the importance of tourism, it is worth providing some idea of the size and scope of the sector. The Caribbean tourism industry contributes 2.8 million jobs to the regional economy and accounts for 14.1 percent of regional GDP, making the Caribbean one of the most tourism-intensive economies in the world.⁸ For many Caribbean countries, the impact of the industry extends well beyond airports, boats, and chic resorts; it encompasses other

sectors that are indirectly dependent on the flow of tourists, including wholesalers, retailers, real estate businesses, and insurance companies. Tourists bring revenues, with the cash going into workers' salaries, infrastructure maintenance, and government coffers. Considering tourism's economic weight, it is not only a source of income but a key factor in the overall stability of what are highly open economies. The pandemic demonstrated the region's

⁶ <https://www.statista.com/statistics/789517/caribbean-direct-contribution-travel-tourism-gdp-country/>

⁷ Figure 1: "Tourism Dependency Index: Latin America and The Caribbean," Inter-American Development Bank, July 2020, <https://www.iadb.org/en/news/idb-report->

[envisions-devastating-tourism-shocks-latin-america-and-caribbean.](https://www.iadb.org/en/news/idb-report-envisions-devastating-tourism-shocks-latin-america-and-caribbean)

⁸ <https://wtcc.org/Portals/0/Images/EIR2019-Infographic-Map-Regional.png?ver=2021-04-06-170730-000>

high degree of dependence on tourism, and climate change looms large over this sector in the shape of extreme weather and stressed land and sea resources.

Additionally, there is a strong interrelationship between the Caribbean and the United States. Both the Caribbean's proximity to the U.S. and its warm climate have been important factors in the growth of the U.S. cruise line industry. According to a 2018 study by the Florida-Caribbean Cruise Association, 76 percent of its surveyed Caribbean-bound passengers resided in the United States.⁹ Additionally, the U.S. cruise industry alone employs around 178,100 people (a large percentage of whom work Caribbean routes), and in 2020 contributed to a little over \$1 billion in revenue.^{10,11} This revenue was notably lower than in previous years due to the impact of COVID-19, and current estimates indicate that the industry will reach a pre-pandemic revenue total around \$12.5 billion by 2023.¹²

The State of Florida is closely linked to the Caribbean tourist trade, functioning as a hub for U.S. cruise line activity due to its proximity to Caribbean and Central American destinations. Floridian ports

launch around 60 percent of all U.S. departures.¹³ In Puerto Rico, tourism accounts for \$1.74 billion in total GDP contribution (with pre-pandemic numbers at \$5.17 billion).¹⁴ While in the U.S. Virgin Islands, tourism contributes slightly less to GDP, totaling \$934 million (with pre-pandemic numbers at \$2.32 billion).¹⁵ Hurricanes represent a major risk to this industry. As an example, 2017's Hurricane Irma was the most powerful Atlantic hurricane in recorded history and impacted 68.7 percent of cruise ports in the region.^{16,17} The storm went down as the costliest in history for Cuba and the Leeward Islands and resulted in an estimated \$77 billion dollars in combined U.S. and regional damage. Even the relatively weak effects of the Hurricane's outer bands on Miami-Dade County caused an estimated decrease of 334,544 tourist arrivals for a total loss value of \$547 million in visitor spending in the month of September 2017.¹⁸ It is clear from this case study that, as the Caribbean suffers economic loss from hurricanes and other climate-related disasters, the United States and its territories appear economically vulnerable to such events as well. Consequently, it is critical to get tourism right—making certain that it has a

⁹ <https://www.f-cca.com/downloads/Caribbean-Cruise-Analysis-2018-Vol-I.pdf>

¹⁰ <https://www.statista.com/statistics/201342/employment-in-the-cruise-line-industry-since-2007/>.

¹¹ <https://www.statista.com/forecasts/1250588/us-cruise-revenue>.

¹² Ibid.

¹³ <https://www.businessobserverfl.com/article/cruise-industry-surges-with-florida-at-the-helm>.

¹⁴ <https://wttc.org/Research/Economic-Impact/moduleId/704/itemId/187/controller/DownloadRequest/action/QuickDownload>.

¹⁵ <https://wttc.org/Research/Economic-Impact/moduleId/704/itemId/231/controller/DownloadRequest/action/QuickDownload>.

¹⁶

https://www.researchgate.net/publication/334560312_The_Development_of_A_Conceptual_Framework_on_the_Br_and_Personality_Self-

[Congruity and Tourist Loyalty The Moderator Role of Tourist Emotional Experience](https://www.researchgate.net/publication/334560312_The_Development_of_A_Conceptual_Framework_on_the_Br_and_Personality_Self-Congruity_and_Tourist_Loyalty_The_Moderator_Role_of_Tourist_Emotional_Experience)

¹⁷

<https://www.sciencedirect.com/science/article/pii/S2210539520300985>

¹⁸

https://www.researchgate.net/publication/334560312_The_Development_of_A_Conceptual_Framework_on_the_Br_and_Personality_Self-

[Congruity and Tourist Loyalty The Moderator Role of Tourist Emotional Experience](https://www.researchgate.net/publication/334560312_The_Development_of_A_Conceptual_Framework_on_the_Br_and_Personality_Self-Congruity_and_Tourist_Loyalty_The_Moderator_Role_of_Tourist_Emotional_Experience)

sustainability element that matches blue economy aspirations.

The pandemic shutdown of the tourism industry was brutal, as the region was hit hard by local outbreaks, lockdowns, and flight suspensions. These outcomes had a knock-on impact on other parts of local economies, from food supply and transport to fishing and retail businesses. In the tourism dependent-economies, real GDP contracted by 9.9 percent.¹⁹ In the Eastern Caribbean Currency Union (ECCU), real GDP contracted by 16.0 percent in 2020.^{20,21}

At the same time, public finances deteriorated as Eastern Caribbean governments sought to buffer the pandemic-induced economic downturn and purchase the medical instruments needed to contend with the pandemic. In the ECCU countries, the overall government fiscal balance, already in deficit, deepened to 6.6 percent of GDP in 2020, while public sector debt rose from 67.1 percent of GDP in 2019 to 83.9 percent of GDP in 2020.²² In one of the most hard-hit economies, the heavily-tourism

dependent Bahamas, the economy contracted by a little over 14.5 percent. Tourist receipts fell by 75 percent, one of the worst performances in the region.²³

Prospects for economic growth have improved in 2022, but considerable uncertainty hangs over the Caribbean. There are ongoing concerns of another wave of COVID-19, the impact of the Russo-Ukrainian War on international commodity prices (already demonstrated by higher oil and gas prices), and the potential for a recession in the U.S. and Europe. The Caribbean already sees and will feel all these developments in terms of the health of the tourist sector, cost of imported food and fuel, and inflation. This makes the issue of dealing with climate change all the more pressing by placing emphasis on what the blue economy can offer to the region, making it more competitive in certain niches and reducing concerns surrounding food security and energy dependence. As the region emerges from the pandemic, its leaders can introduce new practices with these challenges in mind and rebuild in a forward-thinking manner.

¹⁹

<https://www.imf.org/en/Publications/REO/WH/Issues/2021/10/21/Regional-Economic-Outlook-October-2021-Western-Hemisphere>

²⁰ "Eastern Caribbean Currency Union: 2021 Discussion on Common Policies of Member Countries," International Monetary Fund, May 2021,

<https://www.imf.org/en/Publications/CR/Issues/2021/04/29/Eastern-Caribbean-Currency-Union-2021-Discussion-on-Common-Policies-of-Member-Countries-50181>

²¹ The Eastern Caribbean Currency Union Countries are Anguilla, Antigua and Barbuda, Dominica, Grenada,

Montserrat, St. Kitts and Nevis, Saint Lucia, and St. Vincent and the Grenadines.

²² "Eastern Caribbean Currency Union,"

<https://www.imf.org/en/Publications/CR/Issues/2021/04/29/Eastern-Caribbean-Currency-Union-2021-Discussion-on-Common-Policies-of-Member-Countries-50181>

²³ "Staff Concluding Statement of the 2022 Article IV Mission," International Monetary Fund, March 2022,

<https://www.imf.org/en/News/Articles/2022/03/21/the-bahamas-staff-concluding-statement-of-the-2022-article-iv-mission>

Table 1: Caribbean Real GDP Growth and Projections²⁴

	2019	2020	2021	2022
Tourism dependent (a)	-0.03%	-9.5%	2.3%	4.1%
Commodity exporters (b)	0.4%	4.0%	5.6%	21.2%

Notes: (a) Includes Antigua and Barbuda, Aruba, the Bahamas, Barbados, Belize, Dominica, Grenada, Haiti, Jamaica, St. Kitts-Nevis, St. Lucia, and St. Vincent and the Grenadines. (b) Includes Guyana, Suriname, and Trinidad and Tobago.

While tourism is a major source of government revenue and employment throughout the Caribbean, it also has its downsides. These include pollution, stress on ecosystems, and competition for fresh water use from other sectors, like agriculture. At the same time, cruise ships also contribute to seawater pollution. While wastewater is one factor, ballast water is another issue. Ballast water is fresh or salt water held in the ballast tanks and cargo holds of ships. Ships use ballast water to provide stability and maneuverability during a voyage when ships are not carrying cargo, not carrying enough heavy cargo, or when rough seas compromise stability. The problem is that ballast water is often filled in one region and discharged in another. This practice has resulted in the introduction of invasive species into the Caribbean (and other places around the world).

Waste treatment is a major problem for the Caribbean. This includes solid waste and wastewater, which is often untreated and can help facilitate the spread of infectious

diseases, like diarrhea, cholera, and typhoid. The World Bank estimates that in the Caribbean, 85 percent of wastewater enters the ocean untreated and poses a risk to water usage, fishing, and coral reef health.²⁵ The pollution issue also includes marine litter, of which, plastic is a major offender. In the northeastern Caribbean alone as many as 200,000 pieces of plastic have been found per square kilometer.²⁶ Much of the plastic originated from within the Caribbean or from northern waters. The combination of heavy tourist use of waters, along with their waste and plastics production, has also contributed to coral reef degradation. The Caribbean is home to around 10 percent of the world's coral reefs, which are home to 45 percent of the fish species and 25 percent of the coral species found nowhere else on the planet.²⁷

Another area posing tough questions for developing the ideal blue economy in the Caribbean is agriculture. As one of the most globally dependent regions on imported food, the Caribbean imports much of its food

²⁴ Table 1: "Caribbean Real GDP Growth and Projections," International Monetary Fund, October 2021, <https://www.imf.org/en/Publications/REO/WH/Issues/2021/10/21/Regional-Economic-Outlook-October-2021-Western-Hemisphere>.

²⁵ "Marine Pollution in the Caribbean: Not a Minute to Waste," World Bank Group, 2019, <https://documents1.worldbank.org/curated/en/482391554225185720/pdf/Marine-Pollution-in-the-Caribbean-Not-a-Minute-to-Waste.pdf>

²⁶ Ibid.

²⁷ <https://www.unep.org/news-and-stories/story/restoring-caribbean-paradise-it-used-be>

from the U.S. and other external sources. What food the region produces internally faces considerable challenges, including the increasing intensity of droughts, sea-level rise, ocean acidification, and storm surges. For example, rising sea levels are a serious problem for Guyana, where much of the coast is close to sea level and 80 percent of its population resides.²⁸ Guyana is particularly threatened by rising sea levels as most of its people, farmland, and industry are located on the coast and lie below sea level.²⁹ Guyana's capital, Georgetown, relies on seawalls for protection.³⁰ In addition, Guyana's water management is an issue that stretches beyond its borders, as it has the potential to be a future "bread-basket" for the region.³¹ Finally, while Caribbean food security faces nature-driven problems, food insecurity has been made worse due to the pandemic and subsequent supply chain issues.

Increased temperatures and infrequent rainfall could have devastating effects on the coffee industry in Puerto Rico and the Dominican Republic.^{32,33} As one USDA study concluded: "Building a sustainable and climate resilient coffee sector in Puerto Rico could provide a much-needed economic boost to the island. However, efforts to do so must be balanced with the island's pressing need to reduce its dependency on imported food and consider

the significant risks posed by climate change in the coming years. Large portions of the traditional coffee-growing region of Puerto Rico may be exposed to increases in annual mean temperature within the next few decades."

In the Caribbean, agriculture is reliant upon water coming from rainfall. The environmental changes could lead to arable land loss and trigger internal and external migration patterns in and from the islands. General impacts of drought include increased vulnerability to pests, harming the growth stages of crops.³⁴ Droughts can also amplify food scarcity and, thus, increase food prices. The lack of water could also lead to sanitation issues as food washing becomes more challenging and costly. A natural response of farmers during a drought may be to increase irrigation using local groundwater. However, the increased use of groundwater exacerbates the salinization of groundwater aquifers.³⁵ In addition to coffee crops, some susceptible crops in the region include bananas, plantains, and beans.³⁶

Developing sustainable agricultural practices in the Caribbean is critical, especially for the future development of the blue economy. The Caribbean has high levels of undernourishment relative to the rest of the world. Undernourishment in the region stands around 18.3 percent, just under

²⁸ <https://www.climatehotmap.org/global-warming-locations/guyana.html>

²⁹

<https://compass.onlinelibrary.wiley.com/doi/abs/10.1111/gec3.12199>.

³⁰ Ibid.

³¹ <https://blog.iica.int/index.php/en/blog/food-security-caribbean>.

³²

https://data.fs.usda.gov/research/pubs/iitf/ja_iitf_2017_Fa_in001.pdf

³³

<https://publications.iadb.org/publications/english/document/Vulnerability-to-Climate-Change-and-Economic-Impacts-in-the-Agriculture-Sector-in-Latin-America-and-the-Caribbean.pdf>.

³⁴ <https://www.usgs.gov/programs/climate-adaptation-science-centers/drought-impacts-crops-us-caribbean>.

³⁵ Ibid.

³⁶ Ibid.

double the world average of 9.9 percent.^{37,38} According to the UN Food and Agriculture Organization (FAO), 39 percent of the population lives with severe food insecurity.³⁹ Food insecurity has recently worsened due to COVID-19 and its resulting supply chain effects.⁴⁰

Exclusive Economic Zone (EEZ) management and fishery access represent a significant challenge related to food security. In 2019, the fishing sector provided stable employment to around 350,000 people in 17 Caribbean countries, generating production valued at over \$500 million.⁴¹ However, according to data from the Caribbean Regional Fisheries Mechanism (CRFM), fish production in the Caribbean region in 2019 had declined by 40 percent, a record low in ten years.^{42,43} Data reported from the FAO classified the Caribbean's fisheries as one of the most overexploited in the world.⁴⁴ The CRFM is keenly aware of the need to deal with overfishing but finds that its mission has been undercut as Member States still struggle with data collection and management activities at national levels due to limited human and financial resources.⁴⁵

The declining numbers of fish also increase the potential for tensions between countries. As fish become harder to find, increasingly desperate fishers may intentionally or unintentionally venture into the EEZs of other Caribbean states, causing tension between competing fisheries. Competition between Suriname, Guyana, Venezuela, and French Guiana in the Southern Caribbean has caused political friction regarding fishing rights and offshore oil reserves. Directly related to increasing ocean resource scarcity is the potential for greater illegal, unreported, and unregulated (IUU) fishing. IUU fishing can result in two consequences: 1) overfishing and an aggravation of the already scarce fishing resources, and 2) increased crime related to evading fishing regulations. Widespread illegal fishing has forced Caribbean countries to take tougher measures to contend with the problem. For example, a number of governments have signed the International Declaration on Transnational Organized Crime in the Global Fishing Industry, also known as the "Copenhagen Declaration." The main thrust of the non-binding declaration is to recognize the importance of ocean resources to humankind and the determination "to support a healthy and thriving fishing industry that is based on fair competition and

³⁷

<https://publications.iadb.org/publications/english/document/Vulnerability-to-Climate-Change-and-Economic-Impacts-in-the-Agriculture-Sector-in-Latin-America-and-the-Caribbean.pdf>.

³⁸ <https://www.fao.org/state-of-food-security-nutrition>.

³⁹

https://www.fao.org/3/cb4474en/online/cb4474en.html#chapter-2_1.

⁴⁰ <https://blog.iica.int/index.php/en/blog/food-security-caribbean/>.

⁴¹

<https://www.caf.com/en/knowledge/views/2021/11/opportunities-in-the-blue-economy-for-postcovid-reactivation-in-the-caribbean/>.

⁴²

https://www.crfm.int/images/documents/CRFM%20Statistics%20and%20Information%20Report%202020_Final_Published.pdf

⁴³ The CRFM is an inter-government organization of CARICOM.

⁴⁴

<https://www.caf.com/en/knowledge/views/2021/11/opportunities-in-the-blue-economy-for-postcovid-reactivation-in-the-caribbean/>

⁴⁵

https://www.crfm.int/images/documents/CRFM%20Statistics%20and%20Information%20Report%202020_Final_Published.pdf

the sustainable use of the ocean.”⁴⁶ Among the Caribbean countries that have signed the Copenhagen declaration include the Bahamas, Belize, Grenada, Guyana, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, and the Turks and Caicos Islands. To this end, in March 2022, the CFRM and the CARICOM

Implementation Agency for Crime and Security (CARICOM IMPACS) convened a technical meeting of senior fisheries and maritime law enforcement officers to identify priority actions to strengthen regional and international cooperation to combat and eradicate IUU fishing and transnational organized crime in the fisheries sector.⁴⁷

Table 2: Total Primary Energy Supply Fuel Source⁴⁸

Country	Oil	Gas	Coal & others	Renewables
Antigua & Barbuda	99%	-	-	1%
The Bahamas	99%	-	-	1%
Barbados	90%	5%	-	5%
Belize	57%	-	1%	42%
Cuba	75%	9%	-	16%
Dominican Rep.	72%	11%	9%	8%
Dominica	94%	-	-	6%
Grenada	91%	-	-	9%
Guyana	87%	-	-	13%
Haiti	25%	-	-	75%
Jamaica	87%	3%	2%	8%
St. Kitts & Nevis	99%	-	-	1%
St. Lucia	92%	-	-	8%
St. Vincent & the Grenadines	96%	-	-	4%
Suriname	87%	-	-	13%
Trinidad & Tobago	8%	91%	-	1%

⁴⁶ <https://bluejustice.org/copenhagen-declaration/#:~:text=The%20Declaration,-We%2C%20the%20Ministers&text=Recognize%20that%20our%20countries%20are,sustainable%20use%20of%20the%20ocean>

⁴⁷

https://www.crfm.net/index.php?option=com_k2&view=i

<temlist&task=user&id=81:crfmcommunications&Itemid=284&limitstart=0>

⁴⁸ Table 2: “Total Primary Energy Supply Fuel Source,” International Renewable Energy Agency, 2018, <https://www.irena.org/lac>.

Finally, the Caribbean economy heavily depends on fossil fuels to generate electricity. Considering the impact of fossil fuels on climate change (i.e., the carbon footprint), this is an area that demands attention. Therefore, Guyana and Suriname should see their massive finds as transitory vehicles for national and regional development with an eye to develop alternative energy more fully.

The Caribbean has considerable potential in geothermal, solar, and wind resources. Unfortunately, wind and solar development have been slow in many countries and territories. In 2001, one Jamaican energy expert wrote, “The Caribbean has the potential for a significant increase in wind-powered electricity production. A number of wind farm projects are being implemented, making wind potentially the fastest growing renewable energy technology in the region over the next two decades. Wind promises more than 10 percent of the electricity in many Caribbean countries by the year 2020.”⁴⁹ While the use of wind power has expanded, it has not lived up to expectations—so far. That could change with a more concerted and motivated push to go green.

2. Recommendations to Create a Blue Economy

While many of the necessary elements of a blue economy exist throughout the Caribbean, major challenges exist. These include developing a deeper state comprehension of local ecosystems,

investing in the human capital needed to match a change in economic direction, and linking up with international and regional organizations oriented to tackling such issues as full implementation of the 1982 United Nations Convention on the Law of the Sea (UNCLOS).

Suggestions for creating a blue economy in the Caribbean include the following:

Improving the use of maritime living resources

This category includes seafood harvesting and related activities such as food processing, boat construction and maintenance, and marketing and distribution. The fisheries of greatest importance are pelagic fish, reef fish, lobster, conch, shrimp, continental shelf demersal fish, deep slope fish, and bank fish. There are also less important fisheries for marine mammals, sea turtles, sea urchins, and seaweeds. Governments can do much more to develop more competitive fisheries in the Caribbean. In the United States, Caribbean efforts are underway to develop further island-based fishery management plans in designing policies specific to different locations' biodiversity, culture, and other characteristics.

A critical component in helping improve the sustainability of Caribbean fisheries is to help countries to better collect, manage, and use scientific data information. While efforts have been made to address this need, the fiscally-challenged nature of a number of

⁴⁹ Raymond M. Wright, “Wind Energy Development in the Caribbean,” *Science Direct, Renewable Energy*, November 2001, Col. 24, Issues 3-4: 439-444, <https://www.sciencedirect.com/science/article/abs/pii/S096014810100026X>.

Caribbean governments has limited further advances. This remains an important area of development as it helps define the size and scope of the problems of overfishing and IUU fishing.

Within territorial waters governments need to adopt improved regulatory frameworks and legislation regarding ocean governance, especially for vulnerable ecosystems like coral reefs. Belize and the Dominican Republic have taken an active role in identifying and protecting their valuable marine ecosystems, with Belize closing 11 percent and the Dominican Republic closing 18 percent of their respective territorial waters to non-living and living resource extraction.⁵⁰

In Belize, the health of the tourism and fishing industries are directly tied to the management of marine protected areas (MPAs). Paradoxically, case studies of the country's MPAs suggest that closing territorial waters has had significant commercial benefits. According to a 2017 World Wildlife Fund report, "at least 46,000 people in Belize directly depend on the health of reef and mangrove ecosystems for their livelihoods and approximately 190,000 people in total if to include the support for their families."⁵¹ Though the promise of oil wealth looms large for countries like Guyana and Suriname, Belizean MPAs demonstrate how protecting at least 10 percent of territorial waters drives tourism, promotes

food security, and sustains thousands of livelihoods.⁵²

Another economic outlet for maritime living resources is the use of marine living resources for the commercial development of pharmaceuticals, enzymes, cosmetics, and many other products. Nature has been the traditional source of new pharmaceuticals. According to the National Center for Biotechnology Information, over 50 percent of the marketed drugs are either extracted from natural resources or produced by synthesis using natural products as templates or starting materials.⁵³ Marine-derived pharmaceuticals include the anticancer drug, Ara-C and the antiviral drug, Ara-A; both derived from nucleosides from a shallow-water marine sponge collected off the coast of Florida. With the Caribbean's extensive biodiversity, this is a sector that could responsibly coexist alongside MPAs and expand considerably.

Extraction and use of non-living maritime resources

This broad category encompasses seabed mining, offshore oil and gas extraction, and desalination. While there is a debate over oil and gas exploration and exploitation, desalination is increasingly important in Caribbean development. Seabed mining is also controversial, but battery metal exploration of cobalt, nickel, and copper

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https://data.worldbank.org/indicator/ER.MRN.PTMR.ZS?locations=GY-SR-BZ-DO-BS-AG-BB-TT-JM&name_desc=true

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https://files.worldwildlife.org/wwfmsprod/files/Publication/file/91r0y99nrk_Belize_Natural_Heritage_Natural_Wealth.pdf?ga=2.257208843.1456044559.1652901790-633886616.1652901788

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https://www.researchgate.net/publication/284030354_Benefits_of_No-take_Zones_for_Belize_and_the_Wider_Caribbean_Region

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<https://www.ncbi.nlm.nih.gov/books/NBK230700/#:~:text=Today%2C%20over%2050%25%20of%20the,as%20templates%20or%20starting%20materials>

have attracted attention from the public and private sectors.

Considering that meeting demand for fresh water is likely to become more challenging with climate change, desalination is decidedly a growth area. According to the World Bank, 150 countries use desalination, including a number of Caribbean countries.⁵⁴ Curacao was the first island to produce fresh water from seawater through evaporators. This practice has been taking place since 1928. As pressure on water resources grows due to climate change, desalination is likely to see more plants spread in the region. Considering the importance of fresh water in the Caribbean, extensive care will be necessary for developing this sector due to the costs entailed and energy use. The World Bank notes that desalination technologies “capable of producing significant quantities of water generally have high upfront capital and operational costs and produce environmental impacts that are not well understood but that include potential impacts on maritime organisms and their larvae during the intake of seawater.”⁵⁵

Water sharing represents a distinct policy avenue to meet the region’s needs with fewer negative environmental impacts, less upfront financing, and lower operational costs than desalination. Many Caribbean nations qualify as “fresh water stressed,”

according to the FAO.^{56,57,58} For example, Barbados’ 279 m³ of renewable internal fresh water per capita per year makes it the most water-scarce nation in the region and the 20th most water-scarce nation in the world. However, Guyana’s 310,880 m³ and Suriname’s 173,531 m³ of renewable internal freshwater resources per capita rank second and third best in the world, respectively.⁵⁹ In a fixed water sharing agreement (FWSA), water-abundant countries would voluntarily commit to releasing a fixed amount of water to water-stressed countries in exchange for an agreed compensation.⁶⁰ The prospect of an FWSA would still require ample financing to cover infrastructure and shipping costs, and service providers must generate sufficient income to cover these costs.⁶¹

Transitioning to a blue economy energy regime

The Caribbean needs to continue to make further headway in developing alternative sources of energy. Efforts thus far have resulted in the installation of a solar power plant in Antigua and Barbuda, with similar programs being put in place in St. Kitts and Nevis, as well as Aruba. Wind farms have also been established in Aruba, Jamaica, and

⁵⁴ "The Potential of the Blue Economy," World Bank Group, 2017, <https://openknowledge.worldbank.org/bitstream/handle/10986/26843/115545.pdf?sequence=1&isAllowed=y>

⁵⁵ Ibid.

⁵⁶ The FAO defines populations living with freshwater stress as those receiving less than 1000 m³ per year per capita.

⁵⁷ <https://www.fao.org/land-water/water/water-scarcity/en/>

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<http://www.fao.org/nr/water/aquastat/data/glossary/search.html?termId=4188&submitBtn=s&cls=yes>

⁵⁹ Ibid.

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<https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.678.9487&rep=rep1&type=pdf>

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<https://publications.iadb.org/publications/english/document/Water-Security-and-Services-in-The-Caribbean.pdf>

Nevis.⁶² Commercial and residential application of solar power is in place in Barbados, St. Lucia, and Grenada, and geothermal is being explored on other islands. The Eastern Caribbean has pledged to double the use of renewable energy from 10 percent in 2020 to 20 percent in 2025.⁶³ Alternative energy projects are also being established in the Dominican Republic and Cuba. In Cuba, the goal is to have 24 percent of its energy generation come from renewables by 2030.⁶⁴ The Dominican Republic is seeking to increase its contribution of renewable energy sources in electricity generation to 25 percent by 2025.⁶⁵

Despite these efforts, the Caribbean remains heavily dependent on oil and natural gas for its energy needs. Renewable energy remains well behind oil and gas in meeting the Caribbean's energy needs, despite the region's optimal conditions for leveraging abundant renewable energy sources like the sun and wind. Considering that the Caribbean gets around 217 days of sunshine a year, it has an excellent solar resource. The technology for solar power has improved considerably over the past decade and the cost of solar panels has become more affordable, making the installation of small units for rooftops a possibility.

The development of a green energy system is complicated by a number of factors. These include the existence of what are effectively monopolies on oil supply that have little incentive to transition to clean energy, inadequate legal and regulatory frameworks, and financial constraints.⁶⁶ The pandemic also slowed the transition to alternative energy. In the Eastern Caribbean, the pandemic disrupted supply chains, delayed the arrival of solar panels and batteries, and prevented technical advisors from visiting the islands.

The green energy transition is not going to occur overnight. Despite the hope for a more rapid transition, the energy transformation process is likely to proceed at a slower pace and take place in the next two to three decades. As Trinidadian energy expert Dr. Anthony T. Bryan states in his book, *The Caribbean Blue Economy*, the oil and gas sectors, "...at the present time they play a critical role in financing our transitions to green and blue economies and in maintaining economic resilience for countries that are fortunate in having these resources." Money earned from fossil fuels has to be used to build a sustainable alternative energy future.

Another element in the energy transition is that Caribbean governments have a key role in managing the process through proper laws

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<https://www.powerengineeringint.com/renewables/construction-of-solar-storage-microgrid-on-st-kitts-commenced/>

⁶³ <https://www.reuters.com/article/caribbean-energy-coronavirus/pandemic-derails-caribbean-islands-bid-for-greener-cheaper-energy-idUSL8N2MY64F>

⁶⁴ "The Cuban Electric Grid: Lessons and Recommendations for Cuba's Electric Sector," Environmental Defense Fund, 2017, <https://www.edf.org/sites/default/files/cuban-electric-grid.pdf>

⁶⁵ "Dominican Republic – Country Commercial Guide,"

International Trade Administration, 2021,

[https://www.trade.gov/country-commercial-](https://www.trade.gov/country-commercial-guides/dominican-republic-renewable-energy#:~:text=The%20Dominican%20Republic%20passed%20legislation,to%2025%20percent%20by%202025)

[guides/dominican-republic-renewable-energy#:~:text=The%20Dominican%20Republic%20passed%20legislation,to%2025%20percent%20by%202025](https://www.trade.gov/country-commercial-guides/dominican-republic-renewable-energy#:~:text=The%20Dominican%20Republic%20passed%20legislation,to%2025%20percent%20by%202025)

⁶⁶ Anastasia Moloney, "Pandemic Derails Caribbean Islands' Bid for Greener, Cheaper Energy," Reuters, 2021, <https://www.reuters.com/article/caribbean-energy-coronavirus/pandemic-derails-caribbean-islands-bid-for-greener-cheaper-energy-idUSL8N2MY64F>

and regulations. These considerations extend to the role of the U.S. and other large international oil companies in oil and gas exploration and production, all of which fit into the mix of the Caribbean's blue economy. Equally important, Caribbean countries need to position themselves for growing demands for the materials needed for green energy, which include copper, nickel, aluminum (bauxite), graphite, and lithium. Although these minerals are not abundant throughout the Caribbean, Jamaica and Guyana rank in the top 15 countries in terms of bauxite reserves. Additionally, CARICOM countries could position themselves by collectively bargaining for these resources, as their combined economies are worth an estimated \$82 billion.⁶⁷ Underwater mining could also potentially open some opportunities and help further develop energy diversification, although there are serious environmental risks involved with the process that must be properly considered.⁶⁸

Caribbean governments are generally committed to reducing their carbon signature and developing alternative energy. In this, there is support from international organizations such as the Inter-American Development Bank and the World Bank. The European Union, European countries, and the United States have also been supportive of this effort.

During the Obama administration, then-Vice President Joe Biden hosted the first Caribbean Energy Security Summit in

Washington, D.C., in 2015. All countries in the Caribbean, except for Cuba, participated in the summit, as did CARICOM, the Caribbean Development Bank, the European Union, the Inter-American Development Bank, the International Renewable Energy Agency, the Organization of American States, and the World Bank. The meeting marked the launch of the Caribbean Energy Security Initiative (CESI), whose mission is “to boost energy security and sustainable economic growth through a focus on improved governance, increased access to finance, and strengthened coordination among energy donors, governments and stakeholders.”⁶⁹ According to the U.S. State Department, the U.S. Overseas Private Investment Corporation (OPIC) has financed over \$120 million in energy deals in the Caribbean since CESI's launch.⁷⁰ While CESI's mission statement is admirable, OPIC needs to make much more funding available to achieve the Initiative's stated goals. With the inauguration of Joe Biden as President in 2020, the U.S. had an administration that was probably the most green-oriented to enter the White House. Moreover, considering the President's background, the U.S. should be more actively engaged in pushing an agenda of energy innovation aided by bilateral, regional, and multilateral development banks to drive cost reductions.

Trade in and around the oceans

The Caribbean enjoys a strategic location at the crossroads of a number of major global

⁶⁷ <https://today.caricom.org/2021/12/15/caricom-gdp-as-an-indicator-of-the-status-of-national-economies-a-false-impression/>

⁶⁸ “Science & Tech Spotlight: Deep-Sea Mining,” U.S. Government Accountability Office, 2021, <https://www.gao.gov/products/gao-22-105507>

⁶⁹ “Caribbean Energy Security Initiative (CESI),” U.S. Department of State, <https://www.state.gov/caribbean-energy-security-initiative-cesi/>

⁷⁰ <https://www.state.gov/caribbean-energy-security-initiative-cesi/>

trade routes linking Asia, the Americas, Africa, and Europe. While Caribbean countries are not what can be considered major trading nations, they sit aside these critical oceanic trade routes, a position reinforced by the Panama Canal through which roughly \$270 billion worth of cargo transits each year.⁷¹ A number of ports, such as Kingston (Jamaica), Freeport (The Bahamas), and Caucedo (Dominican Republic) rank among the busiest in the Americas. The trade in and around the Caribbean is likely to expand, making Caribbean engagement all the more compelling. Reflecting this, the main transport mode for global trade is ocean shipping, with around 90 percent of traded goods carried over the waves.⁷² The Organization for Economic Cooperation and Development forecasts that maritime trade volumes are set to triple by 2050.⁷³ Significantly for the Caribbean, maritime transport forms part of a cluster of economic activities that can generate greater economic value added.

Maritime transport can be an industry multiplier. Shipping is part of a larger maritime cluster in its position as buyer and customer; shipping companies purchase ships, helping the shipbuilding industry. The industry also uses ports, terminals, and logistics services, with an indirect effect of local companies providing food, supplies, and land transport.⁷⁴ One example of Caribbean engagement is the Jamaica-based Caribbean Maritime Institute, which offers professional training in their “Seafarers Programmes.” The Maritime

Authority of Jamaica also offers training through a certificate program. The Maritime Authority is focused on maritime safety, marine pollution prevention, and the welfare of Jamaican seamen.⁷⁵

Digital technologies can make a greater contribution to maritime trade and sustainability, especially in data collection and analysis on the impact of climate change and human activity on marine ecosystems. This assumes greater importance considering that the shipping industry over the past three years has been marked by increasing customer demands, unprecedented cargo logjams, workforce shortages, carrier capacity constraints, and the lingering effects of the pandemic.

Another area of importance for Caribbean governments to address is the need for better communication on national planning. Considering the massive impact of the ocean on economic life throughout the Caribbean, there could be greater regional planning, though this remains a challenge considering political and economic issues between some countries.

Other blue economy activities

Carbon sequestration, the process of capturing and storing atmospheric carbon dioxide, could be a major area of expansion in the Caribbean. Guyana has already been active in this area. In 2010 it signed an agreement with Norway to maintain its forests, pursue more renewable energy projects, and fund low carbon development

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https://www.ifc.org/wps/wcm/connect/news_ext_content/ifc_external_corporate_site/news+and+events/news/panama+canal+expansion+key+to+global+trade

⁷² <https://www.oecd.org/ocean/topics/ocean-shipping/>

⁷³ Ibid.

⁷⁴ Ibid.

⁷⁵ <https://maritimejamaica.com/About-Us/Our-Responsibility>

and sustainable livelihoods. The Norway program earned Guyana an estimated \$200 million. Considering the abundance of forests in Belize, the Dominican Republic, and Suriname, this type of program could be expanded.

Climate change financing is essential

Considering that the shift to a blue economy incorporates a wide range of items, including infrastructure and better training of human resources, there are considerable costs attached to what is fundamentally a major transformation in the Caribbean's economic life. Multilateral lending institutions, development aid agencies of various governments, and the private sector have provided some of the lending. But much more is needed, especially in the post-COVID-19 era where Caribbean debt levels are high and fiscal conditions are strained. Extra-regional actors need to do more to guarantee blue and green bonds, climate insurance, and debt-for-nature debt swaps. Green bonds provide investors with a means to construct a sustainable bond portfolio by directing investment towards projects that have a positive impact on the environment and are aligned with global climate goals. Green bonds have been in use for some time, but blue bonds that are linked to ocean-related climate issues are a relatively new field.⁷⁶

The need to deal more forcibly with the transformation of the Caribbean economy away from its current heavy dependence on fossil fuels and to a blue economy based on a broader foundation coincides with a push in developed capital markets of ESG (environment, sustainability, and governance) investor guidelines. Green bonds, which have already hit an issuance of over \$1 trillion, clearly indicate that there is an investor base that does care about the environment and are willing to consider projects that can help the Caribbean become a blue economy.

The blue economy holds considerable potential for the Caribbean. Given the need to move away from old development models based on fossil fuels and the impact of climate change on the region, new thinking about economic development is essential. The blue economy provides a thoughtful and comprehensive approach to a different future, with core concern given to future sustainability, inclusiveness, and resilience—as well as diversification away from dependence on tourism, imported food, and imported energy. The blue economy has its own set of challenges, one of the most glaring being a gap in financing sources, but it offers a path through a changing and more uncertain world.

⁷⁶ One definition of blue bonds is provided by the Asian Development Bank: “A blue bond is a relatively new form of a sustainability bond, which is a debt instrument issued to support investments in healthy oceans and blue economies. Like in the case of conventional bonds, investors lend money to a bond issuer, who agrees to repay the interest every year for the bond's term plus the capital on a certain day. However, in a blue bond,

earnings are generated from the investments in sustainable blue economy projects. Furthermore, the issuance of a blue bond enables investors to fulfill their corporate social responsibilities and generate benefit for the ocean and humankind.”

<https://www.adb.org/sites/default/files/publication/756966/adb-sovereign-blue-bonds-start-guide.pdf>.