Accelerating Port and Maritime Decarbonization in Brazil

FRAMEWORK FOR ACTION

UN GLOBAL COMPACT
Rede Brasil

OCEAN BUSINESS
Working Group

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We would like to thank all members of the Ocean Business WG who actively participated in the various meetings that led to key reflections and content for the construction of this report.

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Brazilian Association of the Green Hydrogen Industry (Associação Brasileira da Indústria de Hidrogênio Verde – ABIHV), the National Agency for Petroleum, Natural Gas and Biofuels (Agência Nacional do Petróleo, Gás Natural e Biocombustíveis – ANP), the National Waterway Transportation Agency (Agência Nacional de Transportes Aquaviários – ANTAQ), the International Development Bank (IDB) Invest, BTG Pactual, Bunker One, Cubo Itaú, DNV Classificadora e Certificadora, Hidrovias do Brasil, International Association of Ports and Harbours (IAPH), J A Carmelo Consultoria, Lloyds Register Foundation (LRF), Logshare, Maersk, Ministry of Mines and Energy (MME), Ministry of Ports and Airports (MPor), Ocean Stewardship Coalition, Wilson Sons and the Ports of Antwerp-Bruges, Açu, Baku, Santos, Suape, and Trelleborg.

We thank our Executive Committee and other members of the WG who helped with the technical review of this work, e.g.: Acqua Mater, the National Waterway Transportation Agency (ANTAQ), the Ministry of Ports and Airports (MPor), OceanPact, Port of Açu, Port of Santos, Raízen, and Suzano.

Special thanks go to Port of Açu, which has led the Ocean Business WG so far.

Thank you very much!

This Guide was developed by the UN Global Compact – Network Brazil, as part of the “Action for Water and the Ocean” and “Action for the Climate” Platforms. Its main objective is to be a tool for providing information, guidance, and sharing good practices for companies and organizations interested in the main challenges and opportunities regarding decarbonization of the maritime and port sectors in Brazil.

Brought to you Global Compact Network Brazil

Execution acqua mater

The transition to a zero-emissions economy in the maritime and ports sector is not only an urgent environmental need, but also an opportunity to ensure a just and inclusive transformation. Although there are still many paths to be defined, with various fuel alternatives being studied globally, this framework brings together the best practices and innovations from around the world so that Brazil can take a leading position. We must be proactive, building solutions that are not only efficient, but also equitable, i.e. distributed fairly, with special attention to the needs of different groups. The future of maritime transport in Brazil will be shaped by the decisions we make today.

Carlo Linkevieius Pereira
CEO of the UN Global Compact – Network Brazil

The future has arrived. Both the future associated with technological change, which fascinated us so much when we watched fiction plays a few decades ago, and the future of climate change, which frightened us so much, but which has unfortunately been neglected by humanity, despite science extensively warning us. The fact is that there is no point in lamenting the past. We now need to keep looking to the future and projecting it based on solid actions taken in the present, so that we can adapt to the new climate realities and mitigate the impacts of environmental damage that may still be reversible to some extent. The maritime and port industry, responsible for 3% of global emissions, plays a major role in decarbonizing the planet. In this scenario, the National Waterway Transportation Agency (ANTAQ) acts in an effective and innovative way in seeking sustainable development. It pioneered the Environmental Performance Index for the waterway sector (IDA) in 2012. It is also promoting various other initiatives to contribute to the energy transition and decarbonization, such as a study of the impacts of climate change on Brazilian ports (2022) and a diagnosis of the energy transition in the waterway sector (2024). It is currently prioritizing the construction of a carbon emissions inventory for ports and water transport.
For all these reasons, Antaq is very proud to be part of Global Compact's Ocean Working Group and to contribute to new initiatives that can lead the sector towards achieving the decarbonization targets set out in the Paris Agreement and endorsed by the IMO (International Maritime Organization).

Eduardo Nery Machado Filho
General Director of ANTAQ

The port sector has an unprecedented opportunity to be a lever for improving the efficiency and sustainability of industries in response to the challenges posed by climate change. Rising sea levels and extreme weather events are consequences of an unbalanced relationship with the environment, threatening both port infrastructure and global logistics chains. These changes also create opportunities for innovation and adaptation. Investing in sustainable technologies and practices, in the resilience of operations and in the adoption of renewable energy solutions, will position ports as competitive means for the energy transition and climate adaptation. By establishing ourselves as energy hubs, we, as a port-industry, have a key role to play in the transition of the maritime sector and of industrial sectors in which reduction is difficult. By facilitating the storage and distribution of renewable energies, as well as supporting their transformation into sustainable consumer goods, we have established ourselves as a platform for the development of the necessary technological innovations. Brazil will be a major player in the energy transition and we, as a sector, will have a key role to play in strengthening this position, creating opportunities for the country's economic and social development.

Eugenio Figueiredo
CEO of Porto do Açu Operações S.A.

CONTENTS

EXECUTIVE SUMMARY

Maritime transport and ports are the backbone of global trade, responsible for moving between 80-90% of the world's goods in volume, and more than 70% in value.

Climate change requires urgent action and unprecedented collaboration along the value chains of ports and shipping, cargo, and passenger ship companies.

Currently, maritime transport contributes around 3% of global greenhouse gas (GHG) emissions, projected to increase up to 250% by 2050 due to the growth in operations[1]. These emissions affect the carbon footprint of the products transported, making it urgent to accelerate decarbonization in order to meet global targets, avoid losing the competitiveness of Brazilian products, and seize new opportunities for the country.

The International Maritime Organization's (IMO) revised 2023 strategy aims to achieve net zero emissions in maritime transport by 2050, with intermediate reduction targets of 30% by 2030 and 80% by 2040 compared to 2008. Achieving these goals will require a profound transformation of the entire chain.

Given this context, the Ocean Business Working Group (GTNO), an initiative led by the UN Global Compact – Network Brazil, was created with the aim of establishing a group dedicated to discussing and addressing the challenges and opportunities of the energy transition in the maritime and port sector, addressing the decarbonization agenda in the Brazilian context. Some of the results of the WG's first year have been compiled in this document, which brings together the main recommendations identified to speed up the agenda and leverage opportunities:

- **Ports as decarbonization ecosystems**
- **Energy and operational efficiency**
- **Electrification**
- **Alternative fuels**
- **Innovation, Research and Development**
- **Knowledge, Management and Leadership**
- **The role of charterers**
- **Just transition**
- **The role of government**

[1] The percentages indicated so far have been taken from the "Fourth Greenhouse Gas Study", published in 2020 by the International Maritime Organization (IMO).

GLOBAL DATA

- Maritime transport accounts for approximately 80-90% of global trade by volume (IMO and UNCTAD);
- The value of global trade driven by maritime transport is around 14 trillion dollars (UNCTAD and World Bank);
- The total value of goods transported by sea is around 20 trillion dollars (WTO and UNTAD);
- Around 3% of global greenhouse gas (GHG) emissions come from maritime transport (IMO);
- The International Maritime Organization (IMO) estimates that maritime transport must reduce its emissions, compared to 2008, by: 30% by 2030; 80% by 2040; 100% (net zero emissions) by 2050 (IMO);
- With the increase in activities, the associated emissions could rise by between 50% and 250% by 2050 if there are no mitigation measures (IMO).

BRAZIL DATA

- Brazil has around 7,367 km of coastline (IBGE);
- The maritime economy accounts for around 19% to 21% of the national GDP (FGV - 2018);
- Around 95% of Brazilian exports are made by maritime transport (BNDES).

INTRODUCTION

Brazil has around 7,367 km of coastline and the maritime economy accounts for almost 20% of the country's GDP. Approximately 96% of Brazilian exports pass through the sea, connecting key sectors of our economy to global markets, such as agriculture and industry.

The carbon footprint of any product refers to the sum total of GHG emissions associated with all activities throughout its life cycle. This includes everything from the extraction of raw materials, through production, to the distribution and end use of products. Therefore, if a company uses maritime transport to move its products or acquire its inputs, its carbon footprint is directly associated with emissions from the maritime sector.

The higher the emissions from maritime transport, the greater the indirect environmental impact of the companies that use this service. Thus, reducing emissions from maritime transport is an effective way of reducing the overall carbon footprint of various sectors.

The decarbonization of the maritime and port sector also offers substantial economic and environmental benefits. The transition to low-carbon fuels, improved energy efficiency and the adoption of innovative technologies, in addition to reducing emissions, can bring increased competitiveness and lower operating costs, while meeting growing environmental regulations and consumer expectations, strengthening the sector's reputation and opening up new market opportunities.

The maritime and port sectors are key to the blue economy and must be addressed strategically in the country's economy. Brazil has comparative advantages that place it in a leading position on the energy transition agenda: abundant and essential natural, energy and mineral resources; 88% renewable electricity matrix; 48% renewable energy matrix; interconnected national electricity system; varied menu of solutions aimed at decarbonization.

Faced with the urgent responses that this scenario requires in order to accelerate the energy transition of the maritime and port sector in Brazil at the beginning of 2023, the UN Global Compact – Network Brazil is building a project to engage Brazilian companies present: a cross-sector working group, made up of companies participating in the "Action for Water and the Ocean" and "Action for the Climate" Platforms, with a focus on decarbonizing ports and maritime fleets. This is how the Ocean Business WG was born.

The WG currently has 79 members, comprising 65 private sector companies and 14 non-business organizations, including government bodies.

As a governance structure, the WG's Executive Committee was set up, with the participation of the Ministry of Ports and Airports (MPor), National Waterway Transportation Agency (ANTAQ), and the companies Acqua Mater, OceanPact, Port of Açu, and Suzano. Several public ports are also part of the WG and have always been very active in the discussions, such as the Ports of Santos (SP), Suape (PE), and Itaqui (MA).

The meetings and gatherings of thematic sub-groups took place regularly between August and May 2024 and were attended by numerous national and international guests from various industries and governments, who shared with the group case studies, practices, and initiatives covering the most important topics on this agenda: Government policies and incentives, funding, energy and fuel efficiency, modernization of ports and maritime fleets, with "security" being a topic that cut across all others.

Representatives of the WG took part in workshops, face-to-face meetings and congresses, always with a view to exchanging knowledge, networking, and finding joint solutions to problems common to all, aware of the great "window of opportunity" that the country is experiencing to boost the national economy and because it has the potential to be a protagonist of this agenda in the world, due to all comparative advantages it offers.

The main goal of this publication, called "Framework for Action", is to guide ports, shipowners, charterers, and governments on actions that can be implemented to reduce greenhouse gas emissions.

Therefore, the following text should be understood as a brief introduction to our Recommendations Booklet, inviting the reader to learn about some of the main topics that were part of the WG's discussions, and which will be explored in greater depth at a later date.

> *I believe that great results are always achieved collectively. Doing things alone is very difficult. That is why this environment is sensational. When you manage to get people from different sectors on the same page, but who are interdependent, that is the first step. (...) This moment when we are building this report together, with surveys and information, showing 'where we stand' and what our potential is, is essential. We are that potential that the world sees in us, but we are not seeing.*
>
> **Luane Lemos**
> Port of Itaqui

1.

CLIMATE CHANGE AND JUST TRANSITION

The transition to a zero-emissions maritime transport must be aligned with the principles of a Just Transition, whose guidelines were launched by the International Labor Organization (ILO) in 2015. It refers to "a set of principles, processes, and practices aimed at ensuring that no person, worker, community, sector, country, or region is left behind in the changes towards a low-carbon economy".

The term "Just Transition" began to be used in the 1980s and 1990s, mainly in the context of the labor and environmental movements in the United States and Europe. The concept was initially promoted by trade unions and defenders of workers' rights.

The central idea was to ensure that the changes needed to tackle environmental crises, such as reducing greenhouse gas emissions, were implemented in a way that protected the workers and communities affected. This would include, for example, the creation of green jobs, retraining programs, and economic support policies for those who would lose their livelihoods due to the closure of polluting industries.

The term gained greater relevance in global discussions on climate and sustainability in the 2000s, especially with the increase in international negotiations and agreements on climate change.

In 2018, the Intergovernmental Panel on Climate Change (IPCC) began to address the concept in its reports, given the challenges linked to Global Warming and the goals of the Paris Agreement. Even when it does not use the term "Just Transition", it talks about social inclusion, equity, and the protection of workers and communities affected by climate change mitigation measures. It emphasizes that everyone must receive the necessary support to adapt to the economic and technological realities that arise during the transition to a sustainable and carbon-neutral future.

Advancing a just transition is also a priority for the UN Global Compact, which follows the ILO guidelines and reinforces the crucial role of the private sector in this direction. Companies must contribute to achieving environmental goals, economic growth, and social development through robust business practices, responsible conduct, respect for labor rights, but above all, human rights. The current energy supply system needs to be transformed to reconcile economy, human rights, and climate change mitigation.

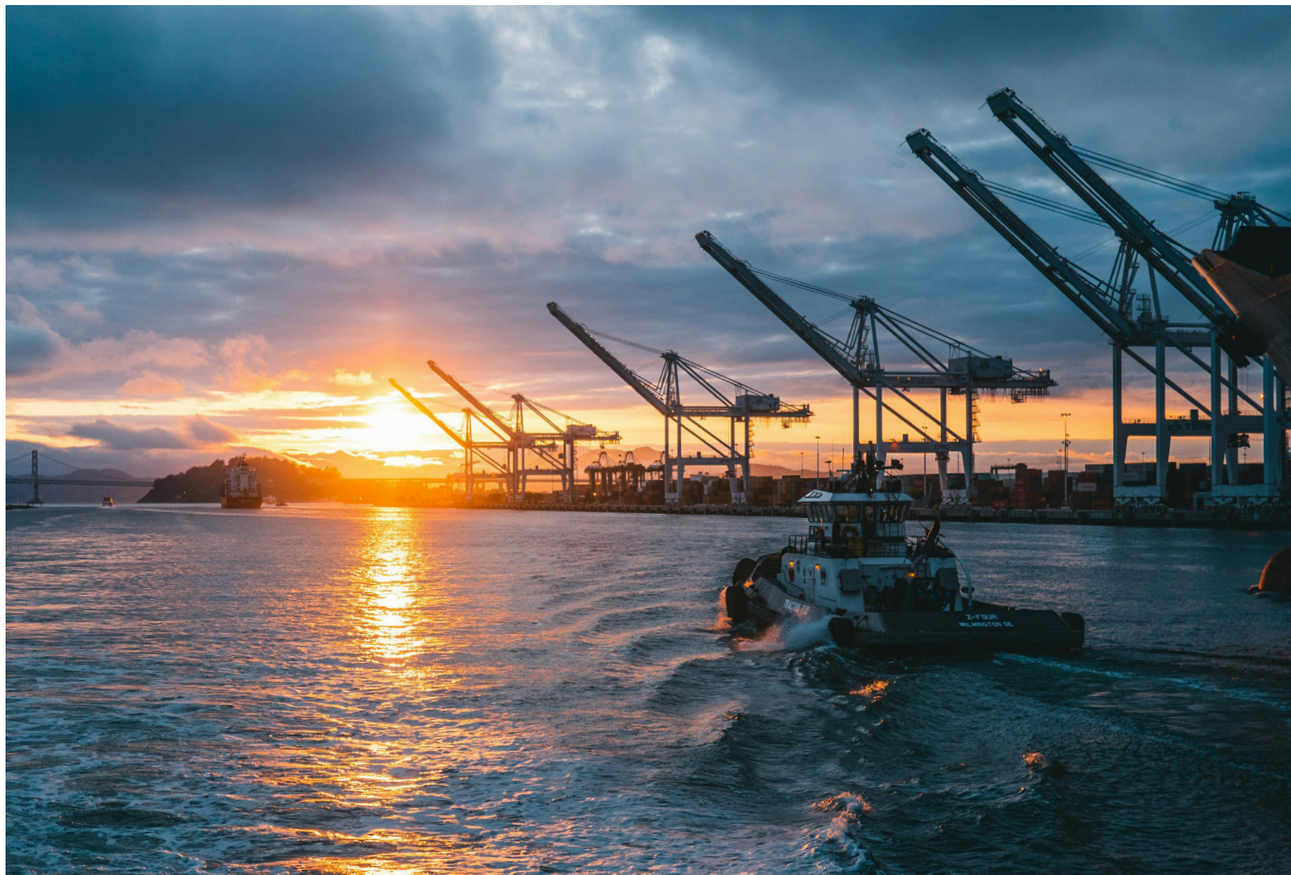
For this reason, the UN Global Compact has developed a series of guidelines for the private sector to plan its just transition and involve all its stakeholders in this objective, optimizing the social, economic, and employment impacts on this journey towards "Net Zero" and Social and Environmental Sustainability.

The just transition in the Brazilian maritime and port sectors is crucial to ensure that the transformation to more sustainable and decarbonized practices does not result in inequalities or negative impacts for the communities and workers involved.

This process involves adapting policies and strategies that ensure the inclusion of all stakeholders, offering support to workers who may be affected by the change to cleaner technologies, such as the modernization of ports and the adoption of alternative fuels.

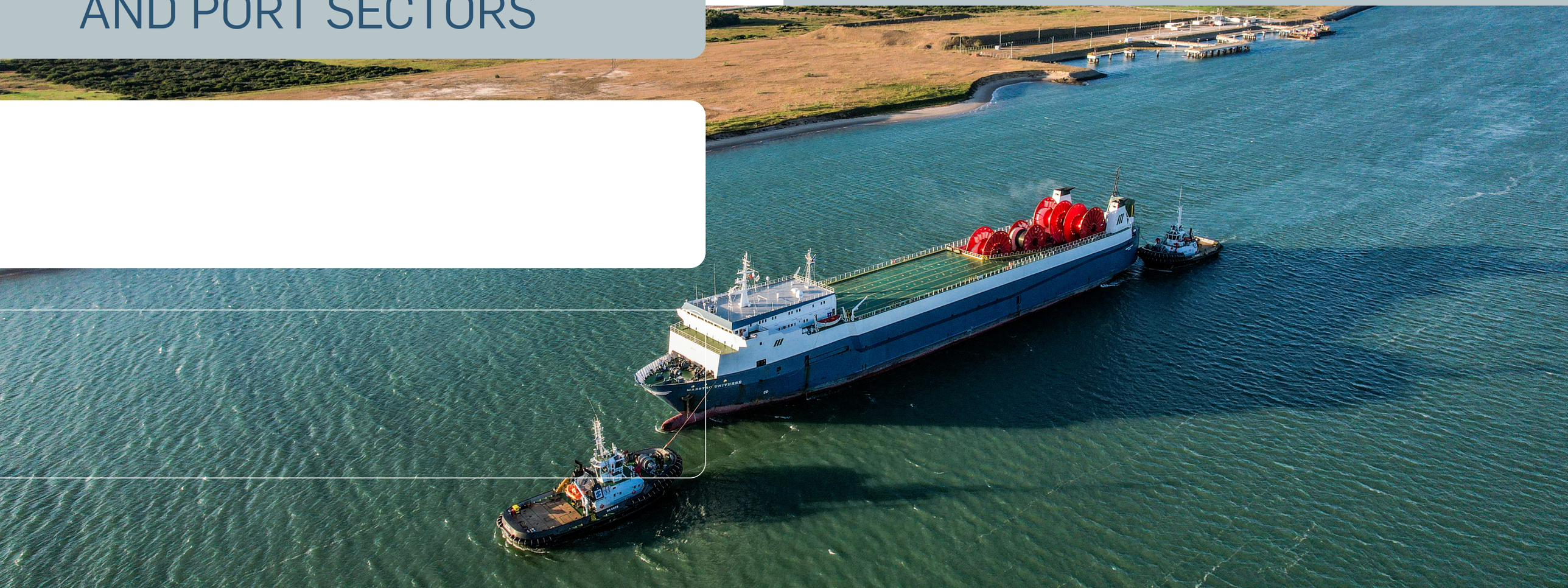
Measures such as specialized training, support for retraining and incentives for sustainable innovation are essential to promote a transition that is economically viable and socially equitable.

Moreover, it is important that government and industry collaborate to create a business environment that fosters innovation, while protecting and creating opportunities for local communities, ensuring that the move towards a more sustainable maritime and port sector does not widen existing inequalities, but rather contributes to more inclusive and sustainable development.



2.

CHALLENGES AND OPPORTUNITIES FOR THE MARITIME AND PORT SECTORS



The energy transition in Brazil's maritime and port sector faces significant challenges that require innovative solutions and a collaborative approach. Among the main challenges are the need for adequate infrastructure to support new fuels and technologies, the high initial cost of investing in more efficient equipment, and adapting ports to new environmental requirements. Additionally, the lack of clear regulations and specific government incentives can delay the implementation of sustainable practices. The diversity of stakeholders involved, which includes shipowners, port operators, and technology providers, can also make the coordination needed for an effective transition difficult.

On the other hand, the energy transition offers many opportunities for the Brazilian maritime and port sector. The adoption of clean technologies and sustainable practices can not only improve operational efficiency and reduce costs in the long term, but also position Brazil as a sustainability leader in global trade. Investments in innovation, such as the use of alternative fuels and advanced propulsion systems, could open up new market fronts and attract international investment. Additionally, the modernization of port infrastructure and the integration of digital solutions can increase the competitiveness of Brazilian ports, making it easier to adapt to environmental requirements and strengthening the country's position in the global sustainable trade scenario.

Main sources of GHG emissions in the port ecosystem

1. **Cargo handling equipment**
2. **Docked ship**
3. **Ship in motion**
4. **Tugboats**
5. **Dredging**
6. **Port Support**
7. **Inland Transportation**
8. **Electricity**

Other emission sources:
Waste disposal Employee transportation Corporate travel

On more modern vessels, built in the last 10 years or so, emissions are usually concentrated in the main and auxiliary engines. In the case of previously built vessels, emissions can also come from:

- Fuel Systems (storage tanks, pumps, pipes, filters, etc.)
- Exhaust Systems
- Boilers
- Incinerators
- Emergency Generators
- Lighting Systems
- Refrigeration units for machines and cargo
- HVAC (Heating, Ventilation, Air Conditioning) systems for the crew
- Ballast Water Treatment Systems
- Wastewater Management

2.1 Ports: Decarbonization ecosystems

Ports are not just routes for the entry or exit of goods or points of connection between land and sea. Many are becoming industrial and energy hubs, modernizing their infrastructure to support the production, storage, distribution, and conversion of renewable energies, building the necessary conditions for the production, availability, and marketing of various alternative fuels.

Thus, ports play a crucial role in maritime decarbonization, serving as strategic hubs for the sector's energy transformation. These energy hubs are becoming focal points for the implementation and distribution of low-carbon technologies, such as supply and lower carbon footprint solutions, renewable energy from land, and alternative fuels.

Around the world, port infrastructure is being adapted to support the supply of low-carbon solutions and energy, for the future supply of new fuels with renewable content, such as biofuel, ammonia, and methanol, as well as for installing electric chargers and Liquefied Natural Gas (LNG) filling stations. The integration of these resources within ports not only facilitates the transition to cleaner shipping, but also positions ports as key players in the global energy value chain.

In Brazil, ports are already investing in renewable energy generation, such as solar and wind, and are positioning themselves to support the development of *offshore* wind energy production. Adaptations to Brazil's port infrastructure will be necessary to support the energy transition. A recent study published by ANTAQ[2] shows that the Brazilian port sector has been investing in intelligent port logistics management systems, the supply of less polluting fuels, the planning and implementation of energy efficiency measures, and the generation of renewable energy for operational and administrative activities. Financial incentives such as the *Environmental Ship Index* (ESI)[3] are used as criteria for offering discounts on port fees, encouraging less polluting and more efficient ships. The replacement of port equipment with electric models and/or models powered by biofuels or hydrogen and derivatives are found in some Brazilian ports and are already playing a major role in the transition context.

Digitalization will play a crucial role in transforming ports into energy hubs. Tools such as big data, artificial intelligence, and *blockchain* will enable real-time monitoring, optimization of energy distribution and maximization of operational efficiency. With the use of intelligent energy management systems, ports will be able to efficiently integrate various renewable energy sources and ensure a balanced distribution of energy to their consumers, reducing waste and operating costs.

In addition to their role as energy hubs, ports are becoming low-carbon industrial clusters where innovation and sustainability converge. These clusters enable collaboration between technology companies, port operators, and renewable energy suppliers, creating an ecosystem that promotes efficiency and the reduction of emissions. The partnerships established in these clusters enable the development of new solutions and the integration of advanced technologies, such as carbon capture and storage and the use of renewable energies for port operations. This synergistic collaboration is key to accelerating the transition to a more stable maritime sector.

PORTS INFLUENCING PORT HARBORS, SHIPOWNERS AND CHARTERERS

- Applying tariff discounts or green seals for:
  - Harbors that inventory their emissions
  - Harbors that have good decarbonization practices, including setting and reporting their decarbonization and energy efficiency targets
  - More sustainable vessels
- Creating awareness campaigns and forums with the port community
- Implementing integrated compensation projects
- Establishing contractual clauses to encourage sustainable practices
- Establishing innovation systems
- Establishing partnerships for the development of more sustainable infrastructure

[2] Diagnosis of decarbonization, infrastructure, and hydrogen applications in ports. Brasília, December 2023.

[3] The *Environmental Ship Index* (ESI) is an environmental performance index that classifies ships in relation to the GHG emissions standards defined by the IMO, allowing us to identify those that meet or exceed current regulations. The initiative is led by the World Ports Sustainability Program (WPSP), an international sustainability program linked to the International Association of Ports (IAPH) (WPSP, 2024).

2.2 Energy and Operational Efficiency

GHG emissions from maritime transport and related operations are directly linked to fuel consumption. Investing in increasing operational efficiency can bring significant gains in the short term. Studies indicate that operational optimization can cut fuel costs by 20-25% and reduce annual emissions by more than 200 million tons of CO2. Adopting efficiency strategies not only reduces immediate costs and emissions, but can also offer future cost savings with alternative fuels.

Optimizing operations does not require huge investments or complex regulatory changes, but rather a change in mentality and a willingness to adopt existing solutions in a commercially viable way. Data transparency, contractual changes and collaboration in value chains and a culture of leadership are essential for this transition to be effective.

Ports will also have to become more efficient. Delays in docking, cargo handling, bunkering, and other port operations significantly increase the cost of ships, reducing their profitability, in addition to energy consumption and other expenses related to idle time, which also increase. To streamline their operations, they will have to invest in automating operations and digitizing processes.

Existing practices in the logistics chain, e.g. which promote faster shipping, cause congestion in ports and increase emissions due to divergent incentives in contracts between shipowners, charterers, and other players. Information management systems, real-time monitoring platforms and data analysis are key to boosting operational intelligence, and reducing waiting times for ships, improving cargo flow. Forecasting and scheduling systems can also optimize docking windows and reduce port congestion. Effective communication platforms between ports and fleets also speed up the process of loading and unloading goods.

To face this challenge, it is essential to work collaboratively along the value chain, adapting contracts and aligning incentives to promote systemic operational efficiency by addressing inefficiencies in the chain, e.g. through digitalization, arrival sequencing, and the use of virtual arrival and virtual warning of readiness, such as “just-in-time arrival” systems.

Further, planning maneuvers with an eye on the efficiency of port support operations can bring significant reductions in emissions and costs from tugboat operations, whose emissions are significant in the port ecosystem and, in Brazil, still 100% dependent on fossil fuels. In this context, tugboat modernization initiatives stand out, with more efficient models and designs, achieving reductions in fuel consumption per maneuver of up to 14%, as is the case with the results achieved with the new Wilson Sons tugboats operating in Brazil.

In addition to the efficiency actions that can be promoted at the port-ship interface, there are initiatives to reduce fuel consumption and increase efficiency during maritime transport:

1. Anti-fouling *Technologies*: Application of special coatings to the hulls of ships to prevent or reduce the adherence of marine organisms, which reduces the vessel’s resistance, with lower fuel consumption.

2. Efficient Propulsion Systems: Adoption of more efficient propulsion systems, such as variable pitch propellers and hybrid electric propulsion systems, which allow optimizing energy consumption, increasing operational efficiency.

3. Course and Stability Control Technologies: Implementation of devices such as stabilizers and advanced course control systems that reduce drag by optimizing the vessel’s movement, improving fuel efficiency.

4. Energy Recovery Systems: Use of technologies such as exhaust gas energy recovery systems, which capture waste heat to generate additional energy and reduce fuel consumption.

5. Intelligent Load and Route Management: Application of optimization software for route planning and cargo management, which helps determine the most efficient route and distribute the cargo in a way that minimizes fuel consumption.

6. Use of Alternative Propulsion Technologies: Development and integration of alternative technologies, such as the use of alternative fuels (biofuels, LNG) and propulsion systems based on renewable energy (such as wind energy with the use of rigid sails or solar panels).

Implementing these technologies not only helps to reduce emissions, but also offers economic advantages, such as lower operating costs and greater competitiveness in the market.

The planning of dredging operations, which today make a significant contribution to port emissions, up to 80% in some Brazilian ports, must incorporate increased efficiency and a reduced carbon footprint as criteria. Other measures to reduce energy consumption in ports can be found in infrastructure projects, such as the replacement of more efficient lighting and refrigeration systems.

2.3 Electrification

The electrification of port equipment, replacing traditional models that use fossil fuels as an energy source, is crucial for the decarbonization of ports and the logistics chain around the world. In Brazil, considering our predominantly clean electricity matrix and the availability of energy, Brazilian ports have a great opportunity to reduce the carbon footprint of their operations through electrification. Gradually, diesel-powered cranes and forklifts are being replaced by electric ones, as are trucks, tractors, and warehouse loaders. However, this transition will depend on the availability of equipment on the market, the level of technological readiness and the costs and resources involved. The sector needs incentives for technological development to encourage the purchase of this equipment.

Onshore power supply for ships is a key solution for decarbonizing ports and ships, offering a clean alternative to the fossil fuels used during a ship's stay in port. By supplying electricity directly to ships via the shore power grid, replacing the energy generated on board from the combustion of fossil fuels, GHG emissions, and air pollutants within the port environment are significantly reduced. The widespread adoption of shore power systems also contributes to: Improving air quality in ports and surrounding communities; complying with increasingly strict environmental regulations; promoting energy efficiency, with great potential for reducing ships' operating costs in the long term.

In Brazil, some tugboat fleets already benefit from onshore power systems. Wilson Sons, a Brazilian port operations and logistics company, has this system in 20 ports, which contributes to a reduction of up to 20% in total GHG emissions.

On the one hand, the supply of clean energy to vessels is an opportunity for Brazilian ports, which can add this service to their portfolio of port facilities. On the other hand, as in other parts of the world, the widespread implementation of onshore power systems faces significant challenges that require substantial investment and long-term planning. Among these challenges are: The need to modernize the port infrastructure; adapting the ports' electrical networks to support the additional demand; coordination between various stakeholders. Additionally, the implementation of these systems requires harmonization with environmental and technical regulations, as well as the formation of partnerships between ports, ship operators, and energy suppliers. The logistical complexity and associated costs, combined with the need to align diverse interests and overcome regulatory barriers, make the implementation of shore power systems a considerable but crucial challenge to promote the decarbonization and sustainability of Brazilian ports.

Overcoming these and other challenges requires an integrated approach that includes significant financial investments, supportive public policies, technical training, and collaboration between all stakeholders. Government incentives, such as subsidies and tax credits, can help make these investments viable. However, it is essential that a clear regulatory framework is developed to encourage the adoption of *shore power*, as has been seen in other parts of the world.

It should be mentioned that electrification, whether of port machinery or by powering vessels, not only reduces the carbon footprint of ports and ships, but also helps to reduce air pollution and negative impacts on public health and the environment, especially in ports located in metropolitan areas. In addition to improving energy efficiency, electrification can reduce operating costs in the long term and promote technological innovation within ports.

2.4 Alternative fuels

Achieving the maritime sector's medium and long-term emission targets depends on technological progress and the scale of alternative fuels with renewable content and a lower carbon footprint, replacing traditional fossil fuels. The IMO strategy also identifies a milestone of 5-10% adoption of low-emission fuels by 2030.

There are several types of fuel currently being studied, which vary according to their renewable content and can be low-carbon, carbon-neutral, or carbon-negative. Among the main fuels for maritime decarbonization are biofuels, LNG, synthetic fuels (e-fuels), methanol, ammonia, and low-carbon hydrogen. The most diverse economic segments, including the energy, transport, and industrial sectors, are diving increasingly deeper into this huge world of opportunities, with the aim of best putting together their strategies for decarbonizing the economy. Each solution has its own benefits and challenges, and the choice of fuel will depend on different contexts and scenarios, varying for each geographical region.

Additionally, the level of adaptation required for ships can vary significantly, from small operational adjustments for the use of *drop-in*[4] fuels, such as some biofuels, to large-scale changes for fuels that require other types of engines and storage and supply systems. Solutions such as dual-fuel or tri-fuel engines appear as important short-term solutions, as they bring operational flexibility and allow the use of alternative fuels already available in some regions, while ships are able to operate with conventional bunker in case of need.

The use of LNG has established itself as an important solution for reducing emissions in the maritime sector, offering a cleaner alternative to traditional fossil fuels. LNG reduces carbon dioxide (CO_2) emissions by up to 20% during combustion compared to heavy fuel oil, in addition to significantly reducing emissions of sulphur oxides (SOx) and nitrogen oxides (NOx). According to an article published on the website Petronotícias in April 2024, the adoption of LNG as a marine fuel has been growing globally, with more than 2,400 vessels already equipped to use it and another 1,000 ordered yet to be delivered.

Brazil has explored various technological routes in search of alternative fuels for maritime transport, such as biodiesel and HVO, ethanol, and methanol. The choice of the best alternative will depend on a wide range of factors, such as costs, energy density, available technologies, dangerousness, availability of supply infrastructure, application for different types of vessels and routes, among others.

Although much has been discussed and progress made regarding the use of low-carbon hydrogen as a decarbonization solution, especially its use in fuel cells, assisted combustion or adapted engines, it still faces significant challenges, such as the need for a robust production and distribution infrastructure and energy efficiency compared to alternatives such as biofuels and methanol. Biofuels, derived from biomass, methanol, and ammonia, which can be produced from renewable sources, already have more established technologies and therefore present a more viable transition as they can be integrated into existing infrastructures with fewer technological adaptations.

Biofuels and their blends are important short-term alternatives. Due to their characteristics, they can be presented as a *drop-in* solution, being used directly or in mixtures, without the need for major modifications to existing equipment and transfer and storage systems.

In this context, the most promising biofuels for ships are biodiesel, HVO (*Hydrotreated Vegetable Oil*), and FAME (Fatty Acid Methyl Ester). Some Brazilian companies, such as Petrobras and Suzano, have already begun testing fuel blends with a mixture of bunker and biodiesel. Large dredging companies operating in Brazil and port tugboat companies are also investing in the use of biofuels. This is the case with Van Oord, which has already carried out several successful tests in operations in the Netherlands and Germany, further investing in new LNG-powered dredgers. Wilson Sons, mentioned above, has already announced tests using HVO on tugboats.

Another biofuel that is seen as the most promising in Brazil for use in maritime transport is ethanol. Internationally, Brazil is recognized as a global leader in the production of sugarcane ethanol. It has been almost 50 years of investment, technological innovation, and supportive government policies.

It is currently widely used by road and the country already has robust integrated logistics to serve this market. Recent studies have begun testing ethanol as a marine fuel in dual-fuel engines, with the aim of proving its efficiency in engines designed to use methanol.

[4] Fuels that can directly replace fossil fuels in existing engines and infrastructure, without the need to adapt the vessels.

FUELS	SOURCE	ENERGY DENSITY	POTENTIAL FOR REDUCING GHG EMISSIONS
Biodiesel and FAME	Produced from vegetable oils or animal fats.	Comparable to diesel.	Potentially carbon neutral if produced sustainably (life cycle).
HVO	Produced by hydro-treating vegetable oils and animal fats.	Comparable to diesel.	Can be carbon neutral depending on the sources of the raw materials used, reducing CO2 and particulate emissions. Better performance than FAME in terms of reducing NOx emissions.
ETHANOL	Produced from the fermentation of sugars or starch of vegetable origin. Can be advanced or cellulosic when produced from waste such as sugarcane bagasse.	Lower energy density (around 70% of gasoline).	Has significantly lower GHG emissions than fossil fuels (up to 80% compared to gasoline) and can be carbon neutral if derived from renewable sources.
LNG - Liquefied Natural Gas	Fossil fuel composed mainly of methane, which offers significant benefits in terms of reducing emissions and improving air quality compared to fossil fuels.	Lower energy density (around 60% of diesel).	20% to 30% reduction in CO2 emissions compared to heavy fuel oil. Performs better in terms of air quality.
Biomethane	Produced from the anaerobic digestion of organic biomass, considered renewable, such as agricultural waste, food waste, solid waste, among others.	Comparable to natural gas.	Can be carbon neutral if produced from renewable sources.
Synthetic Fuels (e-fuels)	Produced from electricity, usually from renewable sources such as solar or wind power. Examples: e-methanol, e-ammonia, e-diesel, e-gas.	Similar to conventional fuels depending on the specific type of e-fuel.	Significantly reduces CO2 emissions if the electricity used comes from renewable sources or combined with carbon capture, and can also be carbon neutral.
Methanol	Conventional route: Produced from fossil sources. Low-carbon methanol: When produced from a renewable source.	Lower energy density (around 40% of diesel and 80% of ethanol)	Conventional production routes can reduce GHG emissions if combined with carbon capture. Can be emissions neutral if renewable source is used (energy and biomass).
Ammonia	Conventional route: Produced from natural gas. Low-carbon ammonia: Produced from low-carbon hydrogen.	Lower energy density (around 35% of diesel).	Conventional production routes can reduce GHG emissions if combined with carbon capture. Can be emissions neutral if renewable energy is used.

In general, Brazil can boost its production of biofuels and other low-carbon fuels to serve not only the Brazilian market, but also the international market. An extremely important approach in this context is considering a careful and rigorous *Life Cycle Assessment* (LCA) of the fuel, thus bringing confidence to Brazilian biofuel in terms of its carbon content. A complete approach that brings transparency, traceability, and is auditable is essential.

The production and marketing of alternative fuels depends on a number of factors:

- **Market demand and scalability;**
- **Investments and production costs;**
- **Port infrastructure for production (in some cases), storage logistics, transport, and supply;**
- **Regulations, policies, incentives, subsidies;**
- **Compliance with national (domestic transport) and international (long-haul) standards;**
- **Sustainability of the production cycle;**
- **Social and environmental impacts;**
- **Hazard and safety factors;**
- **Response to emergencies and incidents.**

Adapting port infrastructure to alternative fuels is essential for the future multi-fuel scenario. This involves upgrading facilities to accommodate new types of fuel, as well as installing specific equipment for the safe storage and handling of these materials. In this adaptation, operational and infrastructure flexibility to allow the handling and supply of different types of fuel is also crucial. Modernization also includes the integration of supply systems and the adaptation of energy networks to support the additional demand. Investing in these changes is key to ensure that ports can efficiently and safely support maritime operations.

Ports will need to adapt their infrastructure to cater for the various fleets that will already be equipped to receive them: Building tanks, structures to store and offer various alternative fuel options, etc. Companies will have to plan with the entire logistics and supply chain structure in mind to be able to say: "This vessel will travel with this type of fuel.

Miguel Sieh
Suzano

CRITICAL FACTORS FOR SUCCESS

- Collaboration between value chains: Implementation requires that stakeholders are committed to decarbonization and willing to explore new forms of collaboration between value chains to enable routes with zero greenhouse gas emissions on both the demand and supply sides;
- A viable fuel pathway: Supply and availability of low-carbon or carbon-neutral biofuels, together with the necessary logistics infrastructure (*supply-chain*) for supplying ships, thus helping to reduce current emissions profiles;
- Demand creation: It is necessary to create the conditions to mobilize demand for low-carbon or carbon-neutral biofuels for maritime transport, whether from the public and/or private sectors, always focusing on the concept of decarbonizing the maritime segment;
- Policy and regulation: Adapting bills and regulations to the Brazilian reality versus international scenarios.
- Creation of Green Corridors and ECAs (*Emission Control Areas*) in Brazil. Limits on GHG emissions in Cabotage. Regulated Carbon Market. Approval of the Fuel of the Future Bill.

DEVELOPING THE BRAZILIAN MARINE FUELS SCENE

The country needs to establish a diversified fuel matrix and bring competitiveness to domestic fuel. Some initiatives have been identified aimed at this development:

1. Governmental, legal, regulatory, tax, and fiscal milestones in order to provide a clear vision of the path to be followed and the legal certainty needed to carry out the expected investments;

2. Regulated carbon market, limits on GHG emissions, including in cabotage;

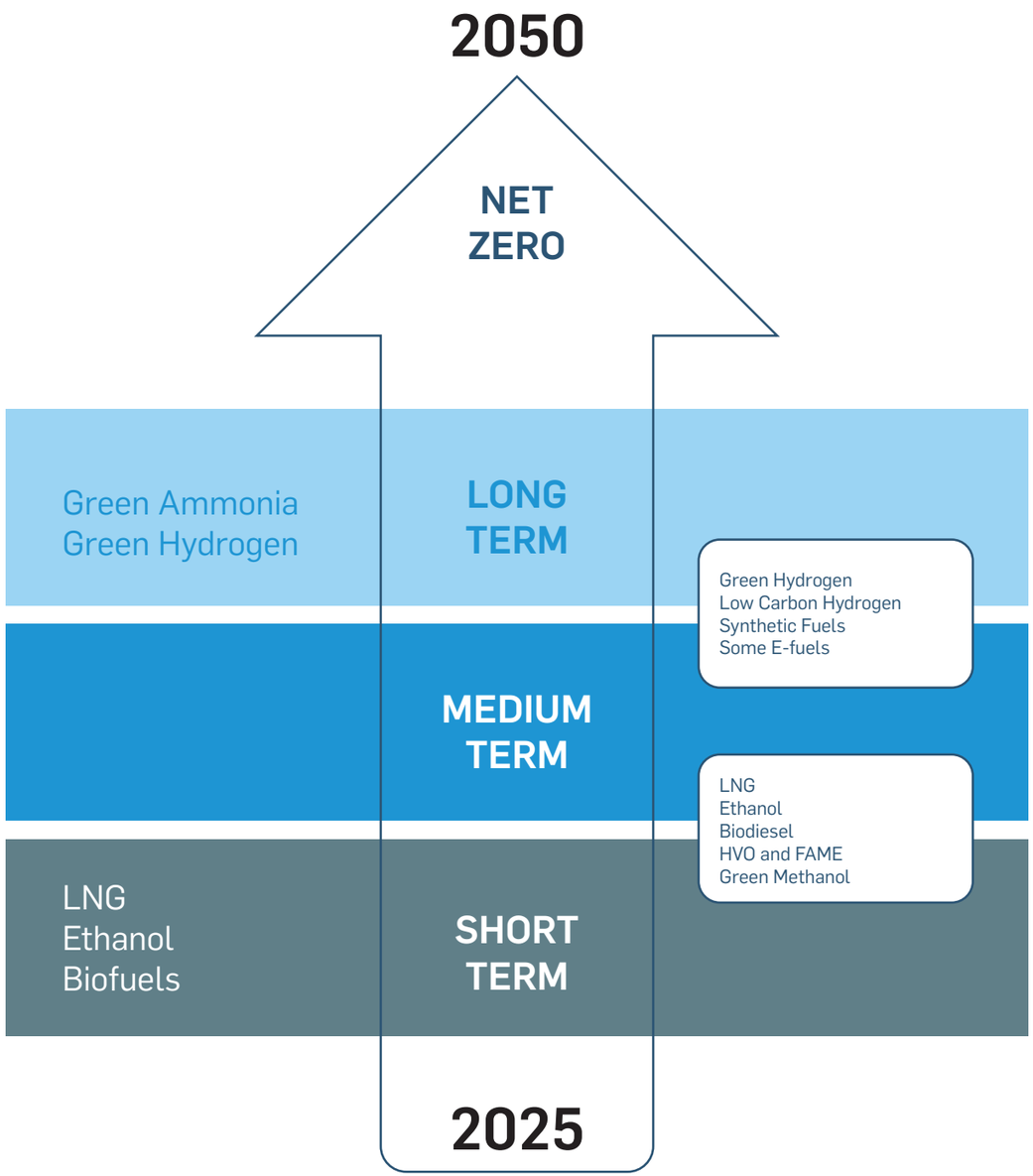
3. Creation of green corridors involving Brazilian long-haul shipping;

4. Inclusion of marine fuels in the Fuel of the Future Plan;

5. Creation of a more diversified fuel matrix in the medium and long term:

i. Biofuels - focus on the short and medium term;
ii. Ethanol and LNG also emerging in the medium term;
iii. Methanol growing faster than expected;
iv. Ongoing developments for ammonia and hydrogen;
v. On-board carbon capture and nuclear propulsion appear as alternatives.

Future fuel scenarios will be multiple and will depend on technological development, regulations, and appropriate incentives. Considering the current Brazilian scenario, some fuels are already looking more viable in the short term.



GREEN CORRIDORS

The creation of green corridors, specific trade routes that facilitate the viability of emission-free maritime transport through public and private actions, is a crucial strategy for accelerating the maritime sector's transition towards Net Zero, i.e. zero net emissions.

The development of green corridors makes it possible to concentrate efforts and investments on specific trade routes, facilitating the creation of an efficient ecosystem with adequate infrastructure, targeted regulatory measures, and financial incentives. This not only speeds up the implementation of clean technologies, but also provides predictability and security for investors and operators in the sector.

Certain routes offer advantages because they are close to sustainable fuel supply centers, have simple operational profiles or favorable economic conditions. Identifying and taking advantage of these advantageous routes is key to quick and effective action.

Regulators and *policymakers* can use these corridors to establish an advantageous ecosystem with appropriate regulatory measures, financial incentives, and safety regulations. Simultaneously, the maritime industry can create specific commercial arrangements that reduce investment risks.

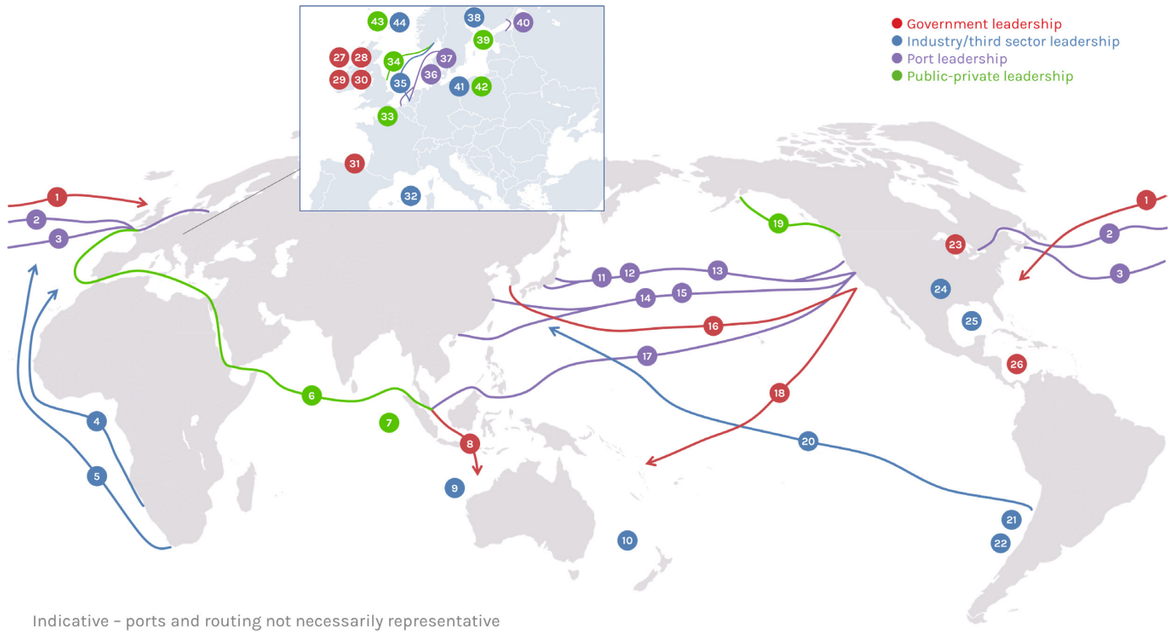
Green corridors are focused enough to make decarbonization manageable and wide enough to have a significant impact. They allow the participation of all essential players, including fuel producers, shipowners, operators, cargo owners, and regulatory authorities.

[5] Annual Progress Report on Green Shipping Corridors 2023. Getting-To-Zero Coallition, Global Maritime Forum.

In addition to ensuring security of supply for fuel suppliers, they foster investment in the technologies and infrastructure needed to achieve decarbonization targets, promoting the maturing of technologies, standards, and business models.

According to the annual report published by the Global Maritime Forum[5], a total of 44 initiatives are already underway around the world, at different stages, integrating a total of 171 different players, with the aim of developing green corridors in different regions of the world.

This map can be found on page 10 of the Report cited in Note 8, referring to the Global Maritime Forum. It refers to a map indicating the green corridors between international ports identified up until its publication. For more details, click on the QR Code.



Indicative – ports and routing not necessarily representative

2.5 Research, Development and Innovation

Research, development, and innovation are key processes for leveraging decarbonization. They enable the development of new solutions and technologies that reduce emissions and bring about new, more efficient and sustainable operating models. There are countless examples of how innovation can transform the sector, including advances in digitalization and automation, the optimization of routes to improve operational efficiency, the introduction of alternative fuels, and the development of alternative propulsion systems. Moreover, progress in emerging technologies, such as carbon capture, can speed up the transition to a more sustainable future in line with global emissions reduction targets.

In this context, ports are emerging as essential innovation ecosystems, acting as centers for the development and integration of new technologies and sustainable practices. Modern ports are becoming not only entry and exit points for goods, but also dynamic hubs where innovative solutions are tested and implemented. Collaboration between port authorities, logistics operators, startups, and research institutions fosters an environment conducive to experimenting with advanced technologies such as renewable energy systems, process automation, and intelligent resource management. The integration of digital technologies and the promotion of strategic partnerships also allow ports to become centers of excellence for decarbonization, offering reference models for sustainable and efficient practices. This multi-faceted role of ports as innovation ecosystems is key to their continuous adaptation to new environmental and operational demands, promoting a more sustainable and resilient maritime sector.

Among the main innovation hubs in ports around the world, we can highlight: Singapore's maritime-port hub PIER71; Halifax Port Authority's PIER; Port of Hamburg's HOMEport; and the Port of Valencia's Opentop. The latter three have joined forces in the *Port Innovator Network* – PIN initiative. In Brazil, the first innovation hub focused on the sector was created in 2022: Hub Cubo *Maritime &Port*[6], an initiative of Cubo Itaú in collaboration with Wilson Sons, Port of Açu, and Hidrovias do Brasil, which will join PIN in 2024. We can also mention Cais Açu Lab, Port of Açu's innovation ecosystem, and the Port of Itaqui's Port of the Future Program.

The recent work published by Cubo Maritime & Port[7], which brings together information consolidated through consultation with various stakeholders in the sector, highlights the following as the main challenges to advancing innovation in the maritime and port sector: The lack of coordination between organizations involved in innovative projects, the lack of incentive for intelligent risk-taking, the lack of long-term planning, and the lack of incentives for innovation.

[6] https://cubo.network/hub/maritime-port
[7] Manifesto pela inovação do setor marítimo e portuário, março 2024.

The publication contains recommendations for overcoming the historical barriers that limit the sector's development and competitiveness. Among the recommendations are the defining a national baseline scenario based on a diagnosis; identifying sectoral metrics and targets; incentives for innovation in the sector; and building long-term public policies, with a focus on the modernization of ports.Alguns

Some important aspects to consider in innovation for decarbonization include:

- **funding and subsidies;**
- **public-private partnerships, to facilitate collaborations between governments, the private sector, and universities;**
- **institutes to develop and implement sustainable technologies and practices;**
- **tax incentives;**
- **capacity-building with investments in training and education programs.**

In Brazil, the promotion of research, development, and innovation in the blue economy and decarbonization is a strategic and growing area, essential for promoting sustainable growth and tackling climate change.

Some programs to foster innovation in the blue economy have been implemented to promote sustainable development and innovation in the maritime and ocean sector. The main ones include:

BRAZILIAN INITIATIVES TO ACCELERATE RESEARCH, DEVELOPMENT & INNOVATION

- **Blue Program:** An initiative of the Ministry of Science, Technology and Innovation (MCTI), which seeks to foster research and technological development aimed at the blue economy, promoting innovation in areas such as marine biotechnology, conservation technologies, and the management of ocean resources.
- **Blue Fund:** Managed by Financier of Studies and Projects (Financiadora de Estudos e Projetos – FINEP), aims to support technological innovation and sustainability projects in the maritime and fishing sectors.
- **Company of the Future:** Also managed by FINEP, the program covers a wide range of sectors and technologies, including industry 4.0, automation, artificial intelligence, internet of things (IoT), biotechnology, and renewable energies.
- **RFPs by CNPq:** The National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq) offers specific calls for research and innovation projects focused on the blue economy. These RFPs fund studies on marine biodiversity, technologies for sustainable exploitation, and environmental monitoring of the oceans.
- **BNDES Blue:** An initiative of the Brazilian Development Bank (Banco Nacional de Desenvolvimento Econômico e Social – BNDES) aimed at promoting innovation and sustainable development in the blue economy, supporting projects aimed at preserving marine resources, protecting the ocean and encouraging sustainable practices in the maritime and fishing sectors.

These programs and initiatives are essential for boosting innovation in the blue economy, contributing to decarbonization, preserving marine ecosystems, developing sustainable technologies, and strengthening the Brazilian maritime and port sector's competitiveness.

One example is the recently published call for business plans for investments in the production and technological development of low-carbon aviation and navigation fuels. This joint action between the BNDES and FINEP, with an estimated R$6 billion in resources, aims to foster the development of projects that boost Brazil's leading role in the energy transition and decarbonization

We now need to discuss the future of the sector and where we want to be in the coming years. Data shows that Brazil's port logistics are still inefficient compared to other regions. This inefficiency results in unnecessary emissions, avoidable costs, and loss of competitiveness. We have enormous potential for transformation through innovation. Ports need to advance in integration, digitalization, and efficiency, reducing the carbon footprint of operations and increasing Brazil's competitiveness.

Fernanda Sossai
Port of Açu

2.6 Knowledge, Management and Leadership

Of great importance for advancing the decarbonization agenda in Brazil's port sector is investment in training and in port management teams. Proper management of the climate agenda requires specialized teams to deal with highly complex issues. The need to invest in the capacity-building of the team is highlighted in ANTAQ's[8] work on port decarbonization, especially with regard to managing emission inventories, setting targets and monitoring decarbonization projects, and publishing results It is essential that port leaders recognize the importance of decarbonization and integrate sustainability into their long-term strategies. Ports that fail to remain competitive and "greener" in this new scenario will find it harder to meet the expectations of investors and business partners, putting the port's own reputation at risk.

GHG Emissions Management

The management of the Greenhouse Gas (GHG) Emissions Inventory is essential for the decarbonization of ports and shipping. Understanding the sources of emissions and the factors that influence the carbon intensity of operations is crucial to formulating and effectively implementing emission reduction strategies. According to a recent ANTAQ study, there is a significant gap in the management of these emissions: Only 19% of public ports and 65% of harbors have an inventory. The main difficulties pointed out are factors such as lack of training, insufficient teams, and limited financial resources. Developing an emissions inventory offers a valuable opportunity to identify and assess GHG mitigation projects, as well as setting clear targets for decarbonization.

The preparation of GHG inventories must follow internationally recognized standards and methodologies for greater reliability and comparability of results between organizations. Additionally, it is important that they are made available on public platforms for greater transparency. In Brazil, there is still no regulation or definition of methods for publishing inventories for the maritime and port sectors.

Currently, the *GHG Protocol* is the main reference for accounting for GHG emissions, setting standards for various sectors. In Brazil, the Brazilian *GHG Protocol Program*, developed in 2008 by the Center for Sustainability Studies of the Getúlio Vargas Foundation (Centro de Estudos em Sustentabilidade da Fundação Getúlio Vargas – FGVces), in collaboration with the *World Resources Institute* (WRI) and the Ministry of the Environment (MMA), adapts the methods of the *GHG Protocol* to the national context.

The program produces specialized publications and tools, as well as training courses. It also maintains the Public Emissions Registry, a platform that publishes Accelerating Port and Maritime Decarbonization in Brazil FRAMEWORK FOR ACTION the GHG emissions inventories of private and public companies, as well as third sector entities.

This register is a crucial tool for promoting transparency and the efficient management of emissions in the country. The "Transport, Storage and Mail" category lists the organizations that have joined the initiative. Among them are some players in the port sector, e.g.: BTP - Brasil Terminal Portuário, Hidrovias do Brasil, Porto do Açu, Porto Itapoá, Porto Sudeste do Brasil, Portos RS, VLI, OceanPact, and Wilson Sons.

Another important point that differentiates GHG emissions inventories is the level of transparency and reliability of the data. Finally, the importance of inventory management is highlighted, as it provides the necessary basis for formulating emission reduction targets which, in turn, guide the prioritization and detailing of the initiatives to be taken. In Brazil, according to the same ANTAQ study, only 26% of harbors said they had targets for reducing GHG emissions, showing the urgency of progress in the sector.

In May 2023, SBTi[9] launched the Maritime *Transport Tool* to guide companies in the maritime sector to set science-based targets for reducing and accounting for GHG emissions. Along with this tool, it released a Guide that supplements it, providing guidance on how to use it.

[8] "Diagnóstico de Descarbonização, Infraestrutura e aplicações de Hidrogênio nos Portos - Relatório Final",, carried out by ANTAQ in partnership with GIZ, the Ministry of Ports and Airports (MPor) and the Federal Government, published in December 2023.

Operational and Cyber Security

The energy transition needs to be just. Therefore, in addition to being technically and economically viable, it must ensure safety in all its aspects, protecting human health and the environment.

The new fuels bring additional challenges to safety, which need to be properly addressed and remain at the top of the transition agenda. Safety in the operation and handling of alternative fuels in ports and on vessels is essential to ensure the integrity of operations and prevent accidents that could have serious environmental and economic consequences. With the growing adoption of fuels such as LNG (liquefied natural gas), hydrogen, and biofuels, ports face specific challenges related to the storage, transport, and transfer of these energy sources.

Considering the risks mentioned above, it is essential to implement strict safety protocols and carry out specialized training for the staff involved. The main actions include:

• modernization of port infrastructures to meet the requirements of new fuels;

• adoption of international standards and regulations governing the safe handling of various fuels;

• regular inspections and preventive maintenance of equipment;

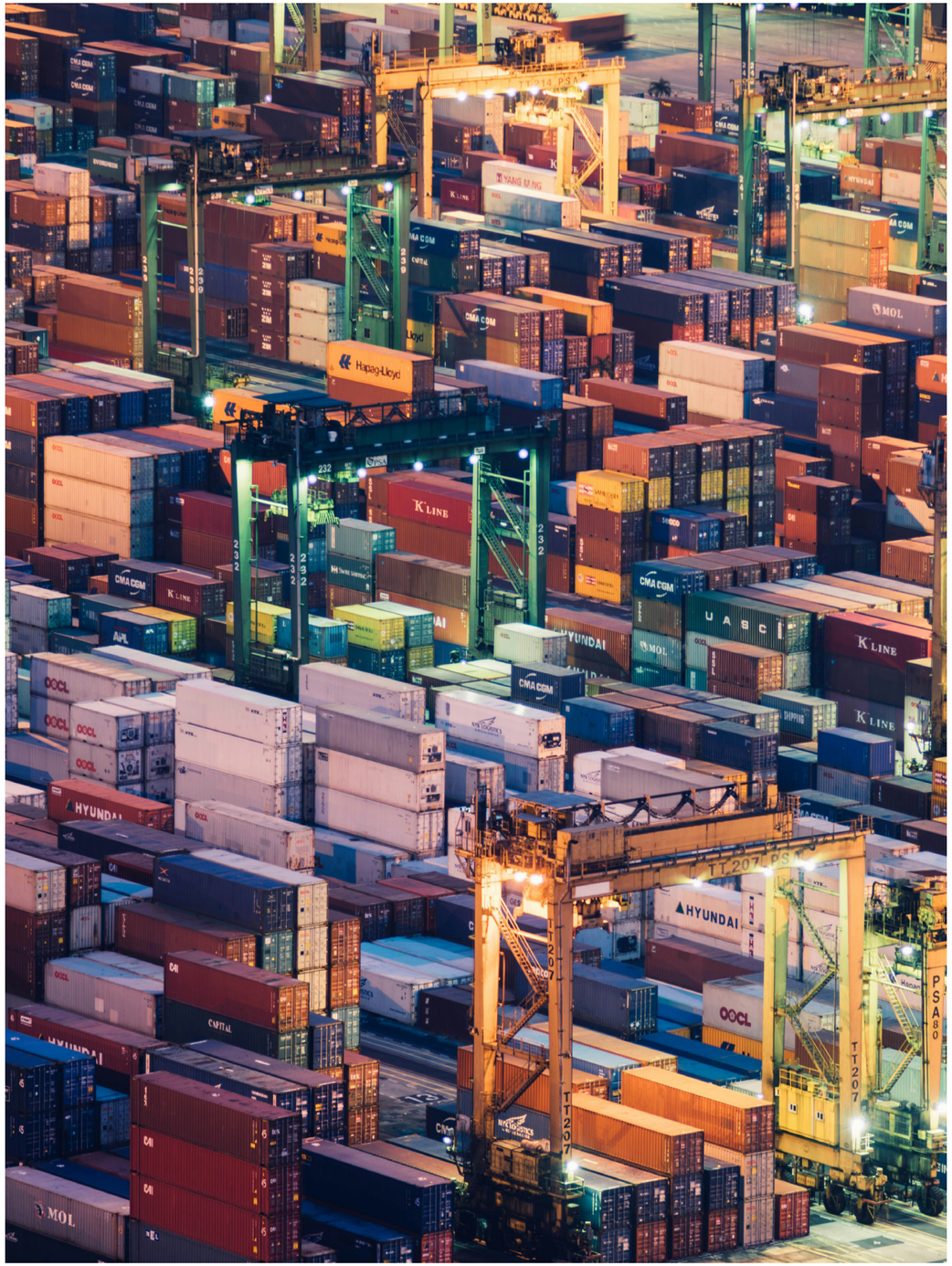
• development of emergency and incident response plans, ensuring that all safety procedures are strictly followed to minimize risks and protect workers and the environment.

In addition to Brazil's regulations for the safety and safeguard of human life at sea, the Brazilian industrial sector has extensive experience in the operation of various fuels. All this could serve as the basis for new safety protocols to be developed.

The maritime-port sector must be able to influence Brazilian legislation to formulate a robust regulatory framework that considers all risks involved in the production, handling, transport, storage, and supply of each of these new fuels.

Increased digitalization and connectivity in maritime systems opens up gaps for digital piracy and cyber attacks that can cause significant damage, such as operational interruptions, theft or loss of sensitive data, compromising the physical safety of crews or port operators, as well as financial losses. It is necessary to implement preventive measures to guarantee cyber security, such as implementing cyber security protocols, regular training, updating *software* and security patches, among others.

[9] Science based targets initiative: https://sciencebasedtargets.org/



2.7 The Role of Charterers

Shipowners and charterers, pressured by the competitiveness of the market and by increasingly demanding investors and clients, need to adopt ESG practices, which in our context means hiring less polluting vessels. Therefore, by directly influencing operational practices linked to the maritime and port sector, they play a crucial role in global maritime decarbonization. By opting for more efficient vessels and negotiating contracts that encourage the adoption of green technologies to reduce their emissions, such as alternative and low-carbon fuels, they can drive the transition to more sustainable shipping.

There are different tools that can help charterers report their emissions and set targets, including the *Science Based Targets initiative* (SBTi) and the GHG Protocol. To be able to report all their emissions, one of the challenges faced by companies in the process is measuring and monitoring Scope 3 emissions, which are indirect and linked to the entire value chain, and therefore to transport. The methodologies clearly disclose what can be considered in the calculations, but the task becomes very challenging when charterers hire their vessels through third parties.

The main obstacles to choosing green vessels are the investment needed to make the initiatives viable, the availability of alternative fuels and their high cost, and the lack of partners willing to invest in operations that reduce GHG emissions at a time when there is no international or governmental requirement to do so. The lack of incentives or benefits, whether fiscal or financial, from the government and international bodies, coupled with the lack of regulation, implies a substantial increase in costs for shippers/freight forwarders, with implications for the entire chain.

To remain competitive and in line with the growing demands of investors and clients, shipping charterers must prioritize hiring more sustainable vessels. This choice will help reduce global GHG emissions and strengthen the companies' position in the market. In a world where sustainability is increasingly valued, adopting green practices in maritime transport is not just an option, but a strategic necessity for long-term success.

Implementing, managing, and monitoring these practices requires a commitment from the entire organization, from top management to day-to-day operations. This allows for a careful analysis of the actual impact of the solutions adopted, in addition to making it possible to disclose the results in ESG reports and in the commitments made by the company. To ensure accurate data on maritime transport emissions, emissions management systems rely on voyage information provided by the ship operator.

Collaboration with suppliers, investment in innovative technologies, and adherence to strict standards are essential steps to ensure that maritime transport operations are truly sustainable. Partnerships with clients and other players in the chain, such as shipowners and producers of new fuels, equipment and technologies, are also essential at this stage.

Participating in and promoting forums in their sector, through associations and federations to debate the issue and take the discussion forward with the government and international entities, also helps in the process, highlighting the relevance of the issue and engaging all those involved in the chain.

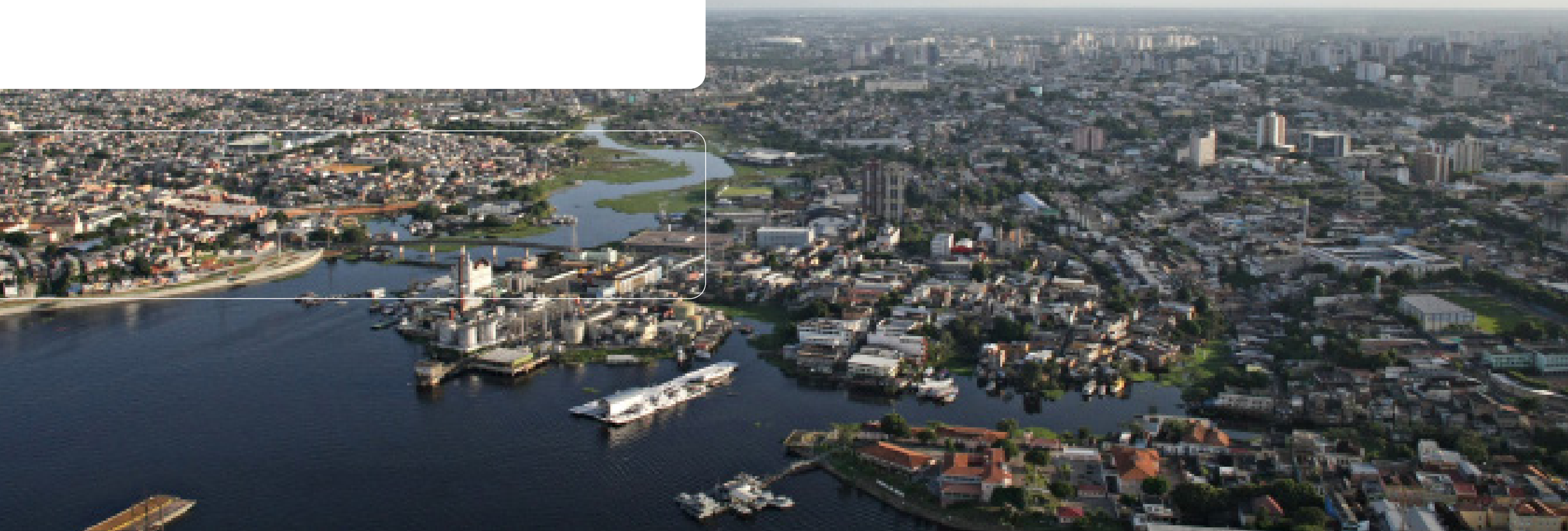
In the long term, these actions will provide significant competitive advantages, ensuring resilience and continued success in the global market.

OPPORTUNITIES FOR CHARTERERS

- Charterers can prioritize hiring low-carbon ships or energy-efficient technologies;
- Contracts can include clauses that oblige shipowners to comply with environmental standards and certifications, encouraging reduced emissions;
- Charterers can offer long-term contracts to shipowners who invest in sustainable practices;
- Charterers can provide regular feedback to shipowners on the environmental performance of their ships and work together to identify areas for continuous improvement;
- Charterers and shipowners can develop pilot projects to test new propulsion technologies or alternative fuels, promoting innovation.

3.

DECARBONIZATION ON THE GOVERNMENT'S AGENDA



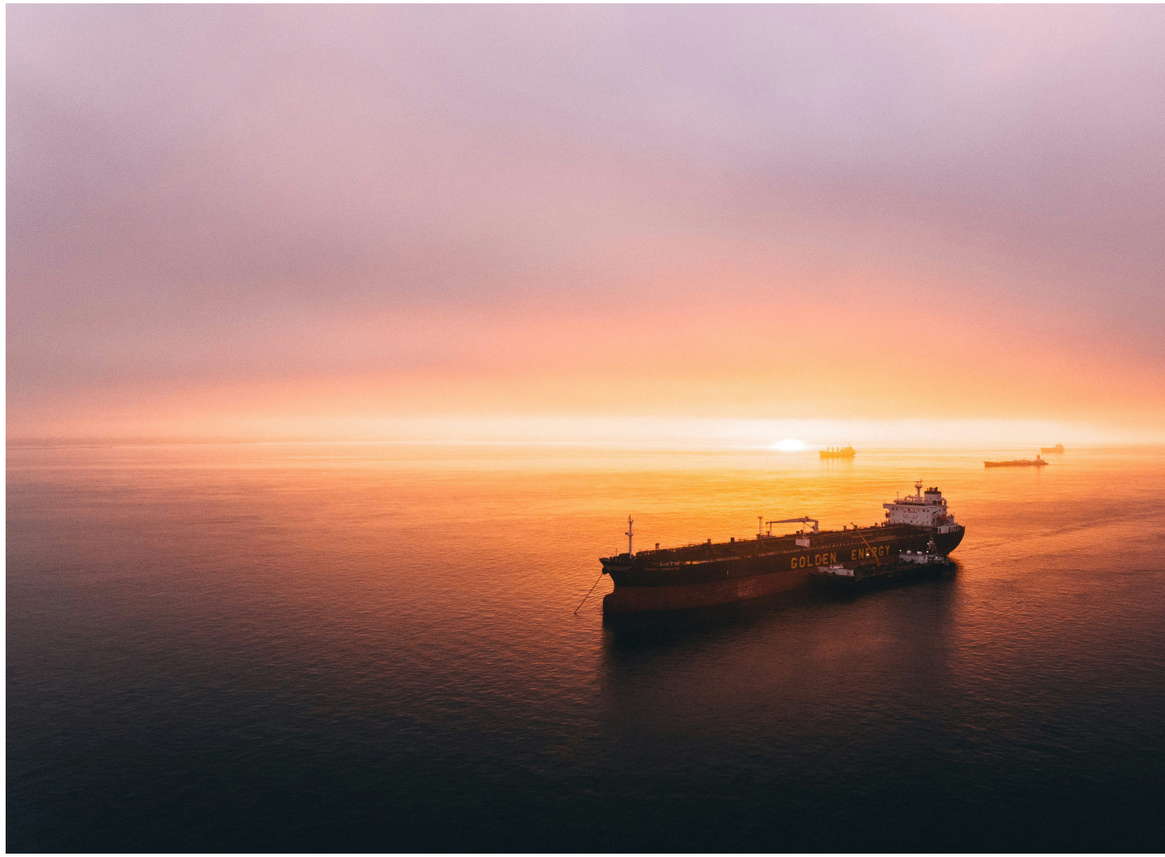
The Brazilian government plays a key role in promoting the decarbonization of the country's maritime and port sectors, which is essential to increasing its competitiveness on the global stage. To catalyze the energy transition, the government must implement robust public policies that encourage the adoption of low-carbon technologies. This includes creating clear regulations and standards for reducing emissions, as well as offering tax and financial incentives for companies that invest in technological innovation and green infrastructure. Subsidy and funding programs aimed at modernizing ports and integrating alternative fuels can speed up the transformation needed to bring the sector into line with international climate targets.

In addition to promoting regulations and incentives, the government must invest in research, development, and innovation for sustainable technologies applied to maritime transport and ports. Partnerships with research institutions, universities, and the private sector are crucial to developing innovative solutions that can be adopted on a large scale. Encouraging the creation of innovation hubs and centers of excellence in decarbonization technologies will help position Brazil as a leader in sustainability in the maritime sector. Additionally, the government must support the training and capacity-building of specialized professionals, ensuring that the workforce is prepared to deal with new demands and emerging technologies.

Considering the continental dimensions of Brazil and the diversity of ecosystems in its various states, it is necessary to assess the "regionalization" factor for the production and consumption of the various alternative fuels in the different regions of the country. There are studies that address this issue, but a lot of uncertainty still remains about their projections. It is hoped that more in-depth diagnostic studies will emerge that will provide greater guidance to the port and maritime industries.

Several secretariats from different Brazilian ministries are working on the decarbonization agenda, which is cross-cutting. It is necessary to adopt a systemic and integrated approach to the challenges and opportunities associated with the transition to a low-carbon policy, which involves different industries in the country. Inter-ministerial cooperation, in turn, allows for developing more comprehensive public policies, which can be interesting at a time we are still looking for solutions to speed up the reduction of emissions.

Today, the Brazilian ministries that are most directly involved with the decarbonization agenda that can benefit the country's port and maritime sector are: Ministry of Ports and Airports (MPor), Ministry of Mines and Energy (MME), Ministry of Environment and Climate Change (MMA), Ministry of Development, Industry, Trade and Services (MDIC). Although not all of its decarbonization policies include the port and maritime sector, we have made progress.



Considering the decarbonization of ports and maritime transport, we need to create a 'maritime mentality' within the government, as it is also a legislative agenda. We have little representation of these sectors in the national congress. So we have enormous difficulty explaining in Congress what maritime transport is, what BR do Mar is, what the Merchant Marine Fund is. Few deputies and senators understand the maritime sector. This will be necessary to strengthen this agenda in the country

Bruna Roncel
Ministry of Ports and Airports (MPor)

The first transport decarbonization plans focused on land and air transport, and now we need to focus on maritime transport. That is why a coordinated effort is urgently needed in the sector right now.

ANTAQ, the National Waterway Transportation Agency, also has an extremely important role to play in developing studies, plans, and regulations that leverage this transition with reduced risk.

International cooperation is essential to maximize the benefits of decarbonization and increase the competitiveness of the Brazilian maritime sector. The government must promote agreements and collaborations with other countries and organizations to share best practices, access advanced technologies, and participate in global initiatives to reduce emissions. Actively participating in international forums and committing to global climate goals will allow Brazil to improve its image abroad, as well as access new markets and business opportunities.

The international market, for its part, is establishing restrictions and regulations. On the one hand, the sector is waiting for government guidelines that will help speed up this process in the country. On the other hand, it needs to be proactive and take some risks so as not to lose competitiveness. The transition is at the center for all: Ports, shipowners, charterers, fuel and renewable energy producers. Thus, the government can ensure that the Brazilian maritime and port sector becomes a model of sustainability and innovation, strengthening its position in the global market.

OPPORTUNITIES TO ACCELERATE THE COUNTRY'S DECARBONIZATION AGENDA

- Promoting diagnostic studies on: The potential for regional production of alternative maritime fuels; shipping routes and supplies for the various segments of vessels in national, inland, and coastal ports;
- Including Brazil in a green corridor initiative to leverage investment by identifying demand, coordinating players, and reducing risks;
- Creating standards and incentives for emissions inventories and setting targets for ports and maritime fleets;
- Encouraging the creation of government policies, regulations, subsidies, and incentives that favor: Research into the development of new technologies to be adopted by ports and fleets with a view to reducing emissions;
- Prioritizing low-emission products and services in public bidding processes, giving priority to the use/consumption of biofuels and national products;
- Focusing credit projects, tax incentives and funding on the national production chain;
- Fostering greater dialogue between managers of Brazilian ports and harbors and the country's shipowners, to find joint solutions to internal challenges;
- Encouraging national shipowners operating in inland and cabotage shipping to take part in the major international discussions linked to fleet decarbonization;
- Reducing bureaucracy in some administrative processes of ports and harbors that are under public management, when time delays decision-making;
- Making it easier to publicize tariff discounts that ports and harbors offer to fleets demonstrating decarbonization initiatives: Seeking greater energy efficiency and publicizing their emissions inventory.

4.
CONCLUSIONS

The decarbonization of ports and shipping in Brazil presents a significant challenge, but also a strategic opportunity to position the country as a global leader in sustainable practices in the maritime sector. Tackling the obstacles to decarbonizing the economy requires a multi-faceted approach that incorporates technological innovations, effective public policies, and cross-sector collaboration.

Brazil, with its pioneering role in the development and use of biofuels, is well placed to lead this transformation in the South Atlantic and provide solutions for other parts of the world. The use of biofuels offers a practical and scalable solution for reducing emissions in the maritime sector in the short, medium, and long term.

In addition to its pioneering role in biofuels, Brazil stands out for its predominantly renewable energy matrix, which gives it a unique competitive advantage. The extensive use of hydroelectric, wind, and solar energy allows the country to implement decarbonization solutions with a significantly lower carbon footprint compared to other economies.

Brazil has the opportunity to offer innovative solutions to global challenges related to decarbonization. The development of technologies and practices adapted to the Brazilian context can serve as a model for other countries facing similar problems. Intersectoral cooperation is essential to maximize the impact of this innovation, bringing together the efforts of government, industry, academia, and civil society to create a robust ecosystem that supports decarbonization.

Decarbonization strategies that integrate land and maritime operations are key to a successful transition. The modernization of ports, the engagement of value chains, and the implementation of sustainable solutions throughout port logistics are crucial steps to ensure that decarbonization targets are met.

Continued collaboration between all the players involved – from port operators to regulators and local communities – will allow Brazil not only to overcome the challenges of decarbonization, but also to seize the opportunities to strengthen its position in the global market, contributing significantly to a greener and more sustainable future.

5.

NATIONAL AND INTERNATIONAL CASES

Sharing case studies of ports, shipping companies, maritime logistics companies, charterers, and government agencies that are promoting the decarbonization of the maritime and port sector are essential elements within what the Global Compact advocates, especially in encouraging collective and scaled solutions.

These are practical examples that demonstrate how innovation, the use of new technologies, and the adoption of alternative fuels are speeding up the transition towards decarbonization of the economy. With this, we want to encourage the exchange of knowledge and collaboration between the various players involved in this agenda, strengthening the competitiveness and sustainability of the sector as a whole.

NATIONAL CASES

PORT OF AÇU

Maritime clean energy hub

Located in northern Rio de Janeiro and with operations commecing in 2014, the Port of Açu is a private port-industry, with integrated infrastructure and strategically positioned. With an area available for industrial and port development, availability of essential resources, potential for local renewable energy generation, and modern port infrastructure, Açu is positioned as a reference platform for the development of low-carbon industry and maritime decarbonization in Brazil.

Its strategy is to transform itself into an ecosystem of low-carbon industrial projects, attracting the local development of industrial chains, including production of steel, chemicals, fertilizers, and alternative fuels such as methanol and biofuels, increasing the local availability of energy and fuels from renewable sources by means of an efficient and safe infrastructure.

In this context, Açu developed the Low Carbon Hydrogen and Derivatives Hub project, the first in Brazil. A 1 million square meter industrial cluster connecting the production of low-carbon hydrogen with the production of ammonia and methanol, integrated with the port infrastructure and industrial areas of the complex. The first environmental license was issued in 2024 and will allow industrial projects to begin development on a large scale, laying a solid foundation for innovative projects in the coming decades and generating development and opportunities for the region and the Brazilian industrial sector.

PORT OF SANTOS

Reduced tariffs encourage green ships, cruises, and cabotage

The initiative was created in October 2023 after studies were carried out that allowed the discounts to be granted. The aim is to boost tourism, create jobs, and promote social justice, in line with the federal government's strategy of increasing economic activity and environmental preservation. The tariff reduction for green ships will depend on their score in the *Environmental Ship Index* (ESI).

The discounts are: 15% for scores between 71 and 100 points, 10% between 51 and 10 points and 5% between 31 and 50 points. The assessment considers the use of technologies for systems or fuels that enable the reduction of nitrogen oxide (NOX) and sulphur oxide (SOX) emissions beyond the regulatory limits. Below are indications of the discounts offered to cabotage and cruise ships..

• Cabotage ships: The discount table values ships that sail frequently along the Brazilian coast, offering reductions of up to 65% for those with the highest number of calls – the percentage increases the more the ships use the country's port services;

• Cruise ships: Will have progressive discounts based on the number of passengers, reaching 60% for ocean liners with more than 650,000 passengers.

PORT OF SUAPE

"Ocean Friendly Harbor" (Terminal Amigo do Oceano) Seal

In October 2023, during the UN Decade of the Ocean, the Industrial Port Complex of SUAPE, or "Port of Suape", located in Pernambuco, launched the "Ocean Friendly Terminal" environmental certification. Created by the Environment and Sustainability Board, the certification aims to raise awareness among lessee harbors about their environmental responsibility and recognize those that adopt responsible practices in line with the goals of the Decade of the Oceans and the 2030 Agenda for Sustainable Development. This seal helped Suape become one of the three public ports in Brazil with the best Environmental Performance Index (IDA), monitored by the National Waterway Transportation Agency (ANTAQ), in November 2023.

The seal is awarded in recognition of compliance with environmental legislation and the adoption of good practices that promote the control of environmental aspects, the reduction of impacts, and the preservation of the quality of the marine-coastal environment. 22 criteria related to port environmental management are assessed, including:

• environmental licensing,
• emergency prevention and response plans,
• voluntary certifications,
• human resources and training,
• water and energy consumption,
• solid waste management,
• combating litter at sea,
• environmental education,
• monitoring the quality of water, effluents, sediments and biota.
• monitoring and controlling noise and air pollution.

OCEANPACT

Integrated approach to overcome challenges

OceanPact offers solutions for the environment, subsea operations, logistics support, and engineering, ensuring the protection and sustainable use of the sea. The decarbonization of its fleet of maritime support vessels has specific operational demands due to the need for high autonomy and energy density in intensive operations in the open sea. The diversity of the fleet makes it difficult to standardize decarbonization solutions, as emissions vary according to the operational profile.

To overcome these challenges, OceanPact adopts an integrated approach, combining technological and operational innovations. The Decarbonization Working Group conducts detailed technical, operational, and financial assessments, developing the Marginal Abatement Cost Curve (MACC) to ensure that solutions are environmentally effective, economically viable, and aligned with the company's business needs.

The technology assessment process begins with a technical analysis to verify the viability of the projects, followed by an operational and financial assessment. Projects that require no initial investment and reduce operating costs are being implemented, such as the use of onshore energy. Technologies that require CAPEX, but which may be viable in the long term, such as anti-fouling, are tested as pilots. Economically unfavorable solutions, such as advanced fuels, can be reconsidered in new contracts and partnerships.

OceanPact's decarbonization strategy combines energy efficiency improvements in the short term with the adoption of alternative fuels and innovative propulsion technologies in the medium and long term, promoting reduced GHG emissions and strengthening the sustainability of the maritime sector.

WILSON SONS

Investing in technology and innovation to reduce emissions

Wilson Sons is a Brazilian maritime and port logistics company that has a fleet of more than 80 tugboats and has been investing in technology and innovation to mitigate its carbon emissions. Among the initiatives that stand out are:

• Through its Operations Center: Assesses movements, speed, and maneuvering flow in real time, optimizing the use of vessels; plans and schedules the movement of vessels with lower speeds and/or more constant rotations;
• Proper sizing of the number of tugboats required for each maneuver, with a view to efficiency;

• Construction of vessels with innovative hull technology, with double keels that save up to 14% of fuel and reduce emissions;

• More than 70% of the total tugboat fleet uses shore power in 20 different ports in the country equipped for this supply, bringing a potential reduction in total GHG emissions of up to 20%.

SUZANO

Studies into the production of renewable hydrogen and synthetic fuels

In July 2024, Suzano announced that it had begun developing a study to produce renewable hydrogen and sustainable synthetic fuels from its production process. The project involves the development of sustainable solutions based on the use of biogenic CO_2 generated at Suzano's Production Unit. The agreement on the use of renewable raw materials provides for the development of joint studies with a partner for the production of renewable hydrogen and synthetic fuels, aimed, for example, at replacing fossil fuels in various logistics modes.

The production of synthetic fuels from biogenic CO_2 and renewable hydrogen is a route that presents potential demand and scalability. The biogenic CO_2 generated from burning biomass and black liquor from the pulp production process at Suzano's mills can be captured and mixed with renewable hydrogen, generated from the electrolysis of water, to produce clean synthetic fuel, especially e-methanol. This study is a great example for the Brazilian industry, given the potential for scalability and the size of the biomass industry in the country.

In green energy generation, the company stands out for being one of the largest producers of energy from biomass in Brazil, with an installed power generation capacity of 1.3GW, soon to rise to 1.7GW.

RAÍZEN

Etanol como combustível marítimo da transição

Raízen, an integrated energy company with a vast portfolio of renewable products, has signed an agreement with Wartsila, a global leader in technologies for the maritime and energy markets, to explore the use of ethanol as a maritime fuel. The aim is to reduce greenhouse gas (GHG) emissions in the maritime sector and develop the first ethanol-powered vessel. The new initiative aims to offer sustainable fuel alternatives to clients, making a significant contribution to the global discussion on the energy transition in the sector.

Paulo Neves, Vice President of Trading at Raízen, highlighted ethanol's potential as a promising and available marine fuel, mentioning that the collaboration with Wartsila aims to support the sector's global decarbonization efforts. Wartsila, for its part, has already reached important milestones in its fleet decarbonization program, including developing sustainable solutions and carrying out tests with ethanol as the main fuel.

Stefan Nysjo, Vice President of Energy Supply at Wartsila Marine Power, said that the agreement reflects the company's commitment to moving towards a decarbonized future. Preliminary studies by Raízen suggest that the use of ethanol can reduce CO_2 emissions by up to 80% on specific routes. This partnership represents a significant step in Raízen's commitment to providing low-carbon solutions, in line with the goals of the International Maritime Organization (IMO).

MINISTRY OF PORTS AND AIRPORTS (MPOR)

Initiatives of the National Waterways and Shipping Secretariat (SNHN) under construction:

1. Definition of sustainable vessels: To encourage chartering under the BR do Mar decree and the construction of sustainable vessels for cabotage, socio-environmental criteria will be defined for qualifying vessels as sustainable. Issues such as energy efficiency, new technologies, new fuels, and respect for decent work, adequate worker training and capacity-building, gender equity, among others, are on the agenda;

2. Creation of criteria for prioritizing projects: That highlight their social and directive composition, and gender equity policies, among other issues, to obtain priority funding with resources from the Merchant Marine Fund (FMM), see Ordinance 424, of September 2nd, 2024;

3. Actions to Decarbonize Inland Shipping (BR dos Rios): With a view to reducing emissions and mitigating the environmental impacts of the waterway sector, measures are being put in place to increase the energy efficiency of operations and promote the use of low-carbon fuels. The retrofitting and adaptation to new fuels are among the main actions. This requires investment in technology and innovation, as well as public policies that encourage and facilitate investment. In addition to the environmental benefits, these actions can also result in long-term operating cost savings, strengthening the sector's attractiveness and competitiveness.

NATIONAL WATERWAY TRANSPORTATION AGENCY (ANTAQ)

Portos brasileiros na liderança da transição energética

In 2024, with the aim of positioning Brazilian ports at the forefront of the energy transition and anticipating government regulations and market pressures for more sustainable practices, ANTAQ launched a study entitled "Decarbonization, Infrastructure and Hydrogen Applications in Ports" (Descarbonização, Infraestrutura e Aplicações do Hidrogênio nos Portos). Carried out in partnership with the Ministry of Ports and Airports and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the study addresses the need for Brazilian ports to adapt to the transition to a low-carbon economy, further including a guide to good practices for decarbonizing ports.

The study focuses on key aspects such as: Reception of vessels powered by green or low-emission fuels, an analysis of the decarbonization initiatives of ports and port services, wind energy production, the potential of low-carbon hydrogen and its derivatives for decarbonization, electrification of port equipment, and implementation of OPS (*Onshore Power Supply*) systems to supply electricity to docked vessels.

Among the main results of the diagnosis, it can be seen that 35% of Harbors (TUPs, TAs, and ETCs) and 81% of Public Ports still lack a GHG emissions inventory, and 98% of the fleet is still fueled by fossil fuels, with only 21% of the ships being produced adopting alternative fuels, such as LNG and methanol.

INTERNATIONAL CASES

PORT OF ANTWERP-BRUGES

A green energy hub of the future

The Port of Antwerp-Bruges stands out as an example of innovation and sustainability in the port sector, with the aim of becoming a green energy hub of the future. Among its initiatives, the port is implementing a comprehensive strategy for the supply of clean fuels, offering a wide range of alternatives to its clients.

By 2025, the port intends to offer various alternative fuels, including LNG/methane, methanol, ammonia, hydrogen, and electric batteries for different modes of transport, such as inland vessels, containers, and deep-sea vessels. It is also planning to implement a complete onshore power supply infrastructure, with the goal of making dock power available at all high-potential harbors by 2030.

The port has developed a framework for safe bunkering operations and is promoting discounts on port fees for sustainable vessels. It is also working on the creation of green corridors, such as the one from Antwerp-Bruges to Montreal, one of the first in the world, to facilitate the use of low-carbon fuels and integrate the entire necessary value chain.

PORT OF BAKU - AZERBAIJAN

The region's first eco-port

Its aim is to maximize Azerbaijan's transit capacity, transforming the port into Eurasia's main trade and logistics hub, serving a population of approximately 140 million people living within a 1,000 km radius around it. By connecting Asia to Europe via different corridors, it acts as a hub along the ancient Silk Road. In addition to improving the country's operational efficiency, it intends to share best port practices in the Caspian region and expand collaboration with Black Sea ports and other route participants.

The Port of Baku aims to achieve carbon neutrality by 2035, and its strategy for achieving carbon neutrality can be pursued through the following strategic objectives:

- avoid actions that lead to GHG emissions;
- continuously reduce port-related energy consumption;
- develop energy efficiency measures;
- engage with stakeholders to reduce Scope 3 emissions (mainly from ships, railway locomotives, and heavy vehicles);
- promote and develop the production of renewable energy and clean fuels; • develop carbon reduction activities to offset the remaining part of GHG emissions that could not be physically mitigated by 2025;
- set an example and promote green activities in the ecosystem (Alat settlement and Azerbaijan in general);
- improve the Port's green reputation.

MAERSK

Integrated logistics solutions in the strategy towards net zero

Maersk is one of the world's largest shipping companies, specializing in maritime transport, logistics services, and harbor operations. It has distinguished itself by integrating logistics solutions as a crucial means of achieving decarbonization, optimizing operations, and reducing carbon emissions throughout the supply chain. By 2030, it aims to have zero emissions from its fleet and, by 2040, from all its operations. By 2025, it will have 25 carbon-neutral container ships.

One of the main pillars of Maersk's decarbonization strategy is investment in alternative fuels. By adopting dual-fuel engines, the company has pioneered the use of green methanol, positioning it as a viable alternative to conventional marine fuels.

It is also exploring other low-carbon fuel options, such as ammonia and biofuels, and actively investing in renewable energy projects to support these initiatives. The company is also improving its energy efficiency through the use of advanced propulsion systems and intelligent energy management technologies.

The company is working on decarbonizing its entire supply chain, including harbors and logistics operations, and collaborating with industry partners to establish green shipping corridors. These initiatives underline Maersk's role as a catalyst for change, boosting the maritime industry towards a more sustainable future.

CMA CGM

Reduzindo emissões, capturando e armazenando carbono

In 2018, CMA CGM launched its first LNG-powered container ship, self-produced to supply its fleet and other vessels, marking a significant step in the transition to cleaner fuels. With this initiative, it becomes the first major shipping company to order a series of LNG-powered ships, aiming to have 30 of them by 2025.

Aiming to achieve Net Zero by 2050, it collaborates with strategic partners and invests in new fuels, such as hydrogen, advanced biofuels, and synthetic fuels, which have the potential to achieve carbon neutrality. The company has been active in developing green corridors, especially on routes between Europe and Asia, collaborating with ports that are investing in bunkering infrastructure for alternative fuels.

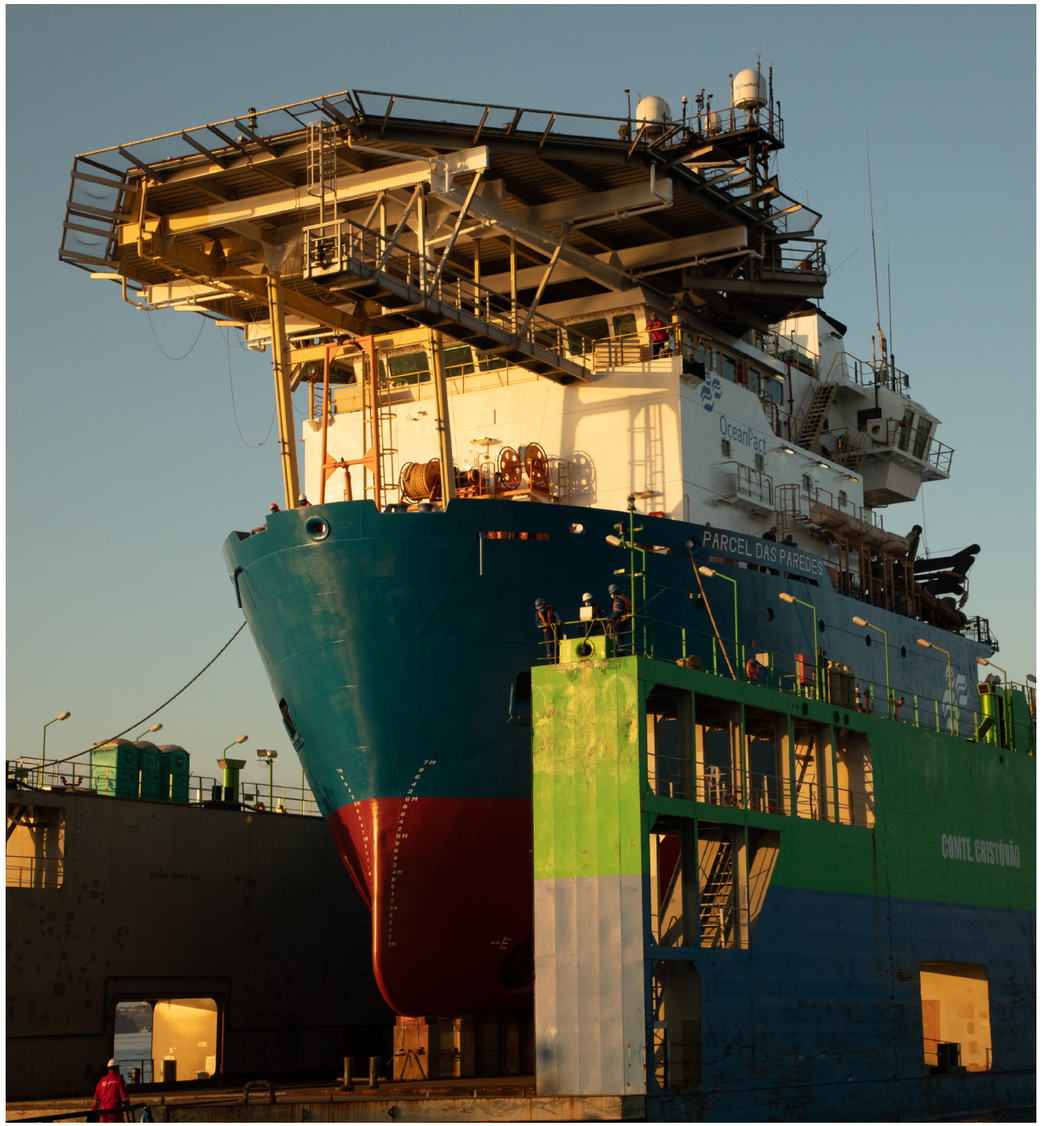
Additionally, CMA CGM is investing significantly in Carbon Capture and Storage (CCS) technologies to reduce its CO_2 emissions. These technologies capture CO_2 from emission sources, such as industrial and power plants, and store it safely in underground geological formations or use it in industrial processes. The company engages in partnerships and research projects to develop and implement these innovative solutions. With these investments, CMA CGM aims not only to reduce its direct emissions, but also to contribute to the global objectives of mitigating climate change and decarbonizing the sector.

6.

RECOMMENDATIONS BOOKLET

This Recommendations Booklet is a strategic tool designed to guide the implementation of sustainable and effective practices with the aim of reducing GHG emissions in the maritime and port sector.

Our recommendations have been drawn up on the basis of extensive research and international best practice. We believe that its implementation will contribute to environmental preservation and to promoting competitiveness and innovation in the global market.



GENERAL RECOMMENDATIONS FOR PORTS AND SHIPOWNERS

1. Reduce GHG emissions (Scopes 1, 2, and 3 of the GHG Protocol) by setting clear targets and accounting for them in reports

2. Use alternative fuels, low or zero carbon

3. Produce and/or integrate renewable energy into operations

4. Improve energy efficiency, taking advantage of available resources, avoiding waste, and optimizing energy use and management

5. Continuously monitor emissions and fuel consumption, carrying out audits to ensure the accuracy of reports

6. Automate, digitize, and optimize operations

7. Invest in technological innovation and establish partnerships with research and technology institutions

8. Reduce environmental and social impacts, ensuring transparency and traceability in processes

9. Develop integrated plans that consider all areas of the supply chain, including logistics and operations, to maximize the effectiveness of decarbonization initiatives

10. Promote a culture of decarbonization and offer ongoing training on sustainable practices and new technologies

11. Implement new security practices (operational and cyber)

12. Seek joint solutions between various *stakeholders* towards decarbonization

RECOMMENDATIONS FOR PORTS

We provide practical and strategic guidelines for the decarbonization of port facilities and operations, helping ports and harbors adapt to emerging environmental requirements while meeting global emissions reduction targets. The recommendations range from the retrofitting of port infrastructure and the adoption of cleaner technologies to the implementation of environmental management systems and energy efficiency practices, one complementing the other.

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RECOMMENDATIONS FOR SHIPOWNERS

We guide the transition to more sustainable operations in line with international guidelines, such as those of the International Maritime Organization (IMO) and the European “Fit for 55” initiative. To this end, we have prepared interdependent recommendations, organized by topic, covering everything from technological innovation to environmental risk management. By implementing these measures, shipowners will be able to comply with environmental regulations, reap economic and operational benefits, and position themselves as leaders in sustainability and innovation in the market.

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RECOMMENDATIONS FOR CHARTERERS

We encourage charterers to promote the decarbonization of ports, port harbors, and vessels. On the one hand, they can request or demand that shipowners adapt their fleets and renew them, already taking into account the standards of more efficient and greener vessels. On the other hand, although the choice of ports is made on the basis of a more comprehensive analysis that considers end-to-end logistics – from the point of origin to the final destination of cargo, which may include integration with road or rail modes of transport – it may not be based solely on the costs involved. This means that, as part of their analysis of the integrated and economically viable logistics for their operations, charterers can take into account some of the benefits that the entire port infrastructure can offer, in addition to the value of the tariffs. Our guidelines also apply to the use of cabotage and inland shipping.

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RECOMMENDATIONS FOR THE GOVERNMENT

They aim to promote the creation of policies, programs, incentives, and regulations that speed up the country’s economic development based on the energy transition in the maritime and port sector, taking advantage of the “window of opportunity” that is opening up. On a global level, the sector is undergoing rapid transformation, driven by the competitiveness of the market. The support of the Brazilian government, at various levels, is crucial for the country to position itself as a world leader in this agenda, considering its competitive and comparative advantages. Our recommendations for the government are divided into 5 blocks:

- Port and Maritime Sector
- Energy Efficiency: On Shore Power (OPS)
- Alternative Marine Fuels
- Ports and Port Harbors
- Maritime Fleets

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Working Group