

# GREEN MARINE MED



## D4.1 Green Shipping Finance Guide



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# D4.1 Green Shipping Finance Guide

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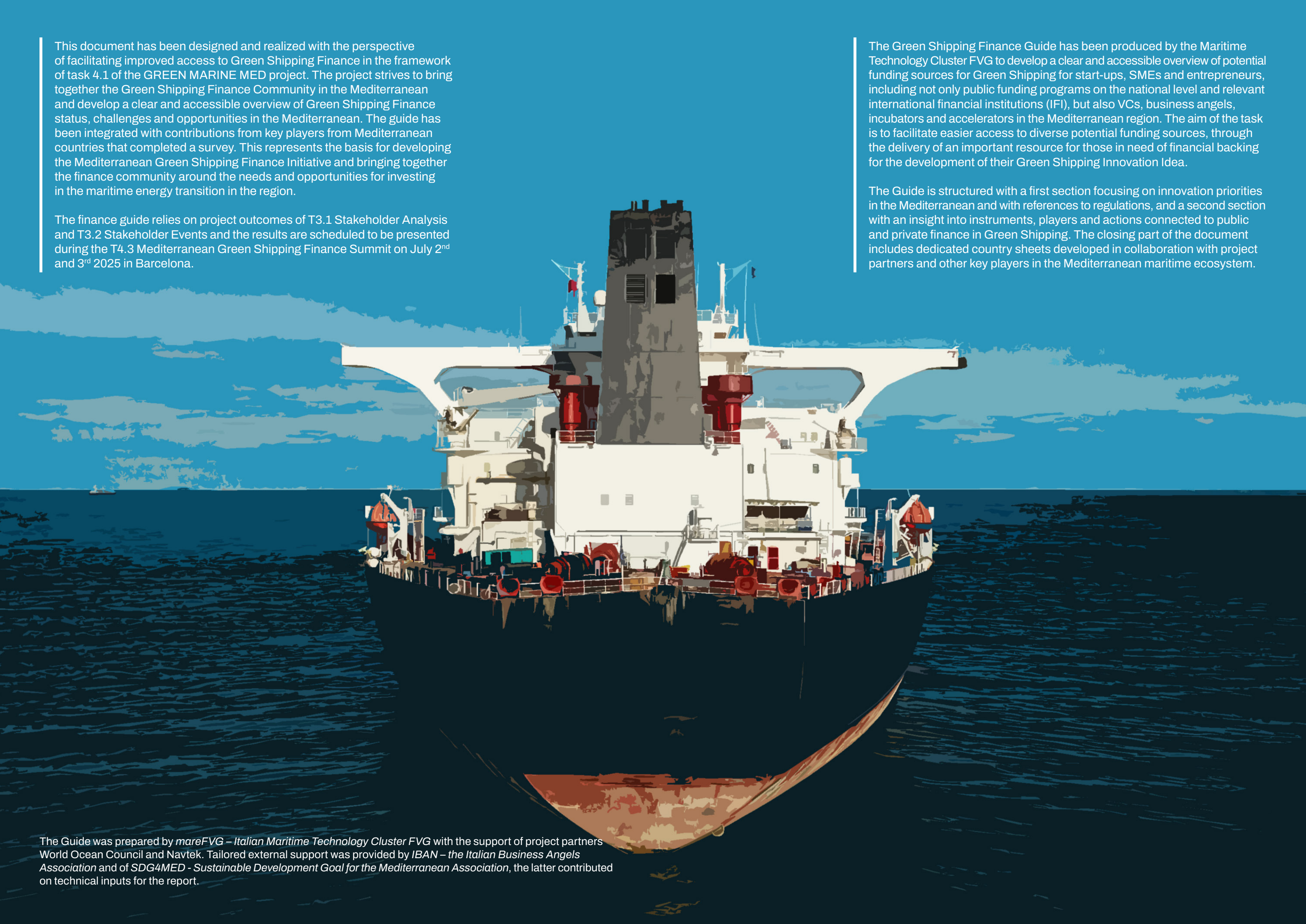
This document has been designed and realized with the perspective of facilitating improved access to Green Shipping Finance in the framework of task 4.1 of the GREEN MARINE MED project. The project strives to bring together the Green Shipping Finance Community in the Mediterranean and develop a clear and accessible overview of Green Shipping Finance status, challenges and opportunities in the Mediterranean. The guide has been integrated with contributions from key players from Mediterranean countries that completed a survey. This represents the basis for developing the Mediterranean Green Shipping Finance Initiative and bringing together the finance community around the needs and opportunities for investing in the maritime energy transition in the region.

The finance guide relies on project outcomes of T3.1 Stakeholder Analysis and T3.2 Stakeholder Events and the results are scheduled to be presented during the T4.3 Mediterranean Green Shipping Finance Summit on July 2<sup>nd</sup> and 3<sup>rd</sup> 2025 in Barcelona.

The Green Shipping Finance Guide has been produced by the Maritime Technology Cluster FVG to develop a clear and accessible overview of potential funding sources for Green Shipping for start-ups, SMEs and entrepreneurs, including not only public funding programs on the national level and relevant international financial institutions (IFI), but also VCs, business angels, incubators and accelerators in the Mediterranean region. The aim of the task is to facilitate easier access to diverse potential funding sources, through the delivery of an important resource for those in need of financial backing for the development of their Green Shipping Innovation Idea.

The Guide is structured with a first section focusing on innovation priorities in the Mediterranean and with references to regulations, and a second section with an insight into instruments, players and actions connected to public and private finance in Green Shipping. The closing part of the document includes dedicated country sheets developed in collaboration with project partners and other key players in the Mediterranean maritime ecosystem.

The Guide was prepared by *mareFVG – Italian Maritime Technology Cluster FVG* with the support of project partners World Ocean Council and Navtek. Tailored external support was provided by *IBAN – the Italian Business Angels Association* and of *SDG4MED - Sustainable Development Goal for the Mediterranean Association*, the latter contributed on technical inputs for the report.





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# Innovation priorities for maritime transport





# General context and structure of the section

The aim of this document is to provide a state-of-the-art report on technologies for decarbonisation of the maritime sector with special emphasis on both the regulatory context and the innovation priorities and challenges for the European and Mediterranean markets.

In doing so the report considers both marine vehicles, including leisure boats, and ports and provides also a picture of the current and forecasted status of these sectors including elements such as orderbook of shipyards and port activities. The report refers to several key documents, indicated as “supporting documents”, that are recommended to be consulted by readers interested in a deeper understanding of the reported information. Such supporting documents are either listed among the references (section 6 of the report) or provided as appendices.

In short, the most demanding medium- and long-term challenge is that related to net zero power generation and use that implies a mix of different technologies and solutions ranging from non-carbon fuels to power systems and ICT solutions that will quite significantly transform the maritime sector by 2050.

Maritime transport is facing the twin challenge of decarbonizing and the need to transition to cleaner energy sources. According to UNCTAD [R.1], shipping represents 3 per cent of all global greenhouse gas emissions, and the urgency to reduce them and overhaul the industry’s reliance on traditional fossil fuels has never been more critical. Swift action is needed, and this will require significant operational shifts, innovation, investments in a new and younger fleet, paperless and digitalized procedures and, crucially, a transition to cleaner technologies and ships equipped to run on alternative fuels. While the bill for this transformation will be considerable, shying away from the sector’s decarbonization and sustainability goals is not an option. It is important that this transition takes place with a whole-sector effort, guided by common International Maritime Organization standards.

Accordingly, the aim of this section 1 of this document is to provide a short- (2030) and medium-term (2050) outline of the likely scenario for maritime decarbonisation and of the related regulatory regime at international (IMO), Mediterranean (Barcelona Convention) and National (EU nations, therefore coinciding with EU directives) level.

The maritime sector, so critical component of global trade, is at a crossroads and the swift implementation of the IMO and EU regulatory frameworks will yield much-needed reductions in emissions and energy consumption, allowing crucial zero-carbon technologies to mature over time. The related innovation priorities are outlined and discussed in section 2 for both the medium (2040) and the long term (2050) time horizon.

## Decarbonisation of the maritime sector: international, mediterranean and national context and related short- and medium-term regulatory references

Building sustainable and resilient maritime transport is not just an option – it is a strategic necessity. Future-proofing global supply chains depends on strengthening maritime chokepoints, which are vital to the resilience of maritime trade. Achieving more robust, reliable and resilient maritime chokepoints requires maritime transport and logistics to embrace green technologies, digitalization and greater international cooperation. Yet this also demands significant investment, particularly on adaptation finance, as adaptation costs in developing countries are 10–18 times greater than current finance flows.

Maritime trade volumes reached 12,292 million tons in 2023, an increase of 2.4%, after contracting in 2022 and, in the period 2025–2029, UNCTAD [R.1] projects that total seaborne trade will grow on average by 2.4% and containerized trade by 2.7%. Global maritime trade in terms of ton-miles is estimated to have grown by 4.2% in 2023—faster than trade in tons—due to shifts in trade patterns from the ongoing impacts of the war in Ukraine, the disruptions in the Red Sea and reduced water levels in the Panama Canal, all of which extended ship journeys and distances. These downside risks persist and are expected to last in the next years.

Conversely, upside opportunities include the expansion of green energy and artificial intelligence-related product sectors, as well as potential interest rate cuts in major economies that could boost trade.

## The context

### 1.1 - Global

#### *Maritime transport energy demand*

According to DNV [R.2], the three main demand sectors — transport, buildings, and manufacturing — each use about 30% of the world’s energy, with feedstock claiming the remaining 10%. Transport energy demand is projected to reduce slightly from now to the mid-century, from 128 EJ/yr in 2023 to 115 EJ/yr in 2050. This 9% reduction occurs despite an increase in passenger and freight travel demand, higher car ownership, and more and more e-commerce/consumption. Although cargo-tonne-miles are projected to increase, the decarbonization of many demand sectors globally will curb and ultimately reverse the growth in seaborne transport of coal, oil and, later, natural gas.

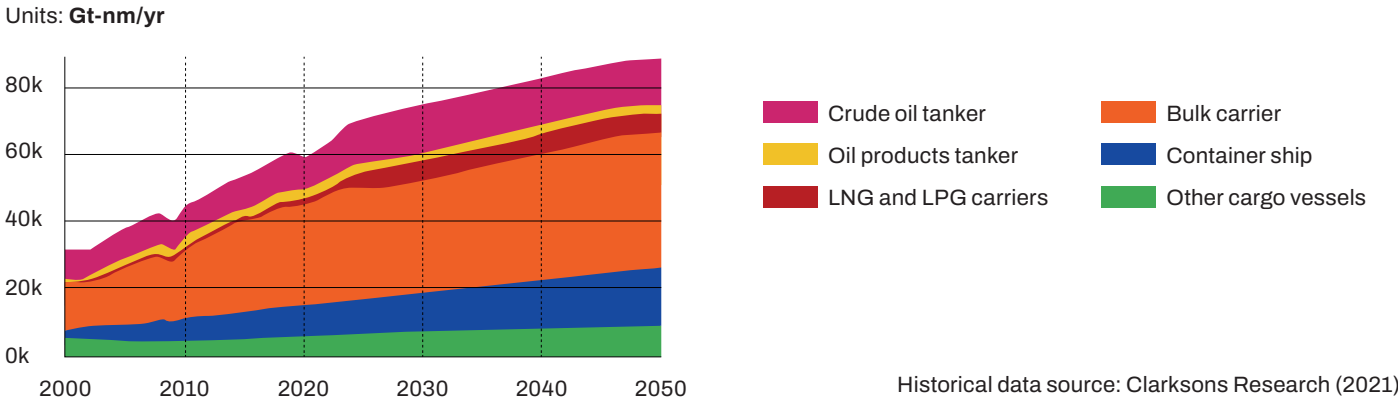
In a world where GDP doubles by 2050, the demand for cargo transportation will outweigh efficiency gains: cargo tonne-miles is estimated to rise across most ship categories (Figure 1), with a total growth of 40% from 2023 to 2050. Container transport is forecasted to see an 80% growth due to still growing containerization. Certain bulk segments, such as grain and minor bulk, are also growing, as is LNG transport. In other sectors, efficiency improvements and global trade pattern changes will lead to reductions. The drastic reduction in coal demand, thanks to dwindling coal demand in the power sector in countries such as China, will result in a halving of maritime coal transport. Similarly, deep electrification of the road transport has second-order impacts on both sea-borne crude oil and oil products transport, leading to a 20% reduction by 2050.

In addition to the economic drivers, several short- and long-term trends might and will influence forecasts of world seaborne trade:

- in the short term, certain seaborne trading routes coming under intense pressure from conflict activity (such as the attacks on commercial shipping in the Red Sea) and from climate change-related extreme events (such as the drought affecting the Panama Canal) could experience disruptions hence resulting in increased seaborne trade distances and increase the need for maritime transport;
- in the short to medium term, the world is likely to move from globalization to more regionalization whereby some regions will reduce dependence on raw materials and goods from regions outside their sphere of influence. This implies disruptions in well-established seaborne trading patterns and the establishment of new patterns. For example, when Russia invaded Ukraine, it disrupted piped natural gas to Europe from Russia. While this led to more LNG export from the US and Canada to Europe, it also resulted in more oil moving from Russia to China and India;
- in the longer term, protectionist policies enacted by some countries/regions to safeguard their industries will also lead to reduced trade.

These factors depend on how the geopolitical forces take shape and what the near-term trade equilibrium looks like. They therefore add to the uncertainties of maritime trade. In the coming years, transport on keel will become more expensive due to an increasing share of low-emission fuels in the maritime fuel mix. This might impact established transport routes in cases where domestic production has an advantage over higher priced transportation.

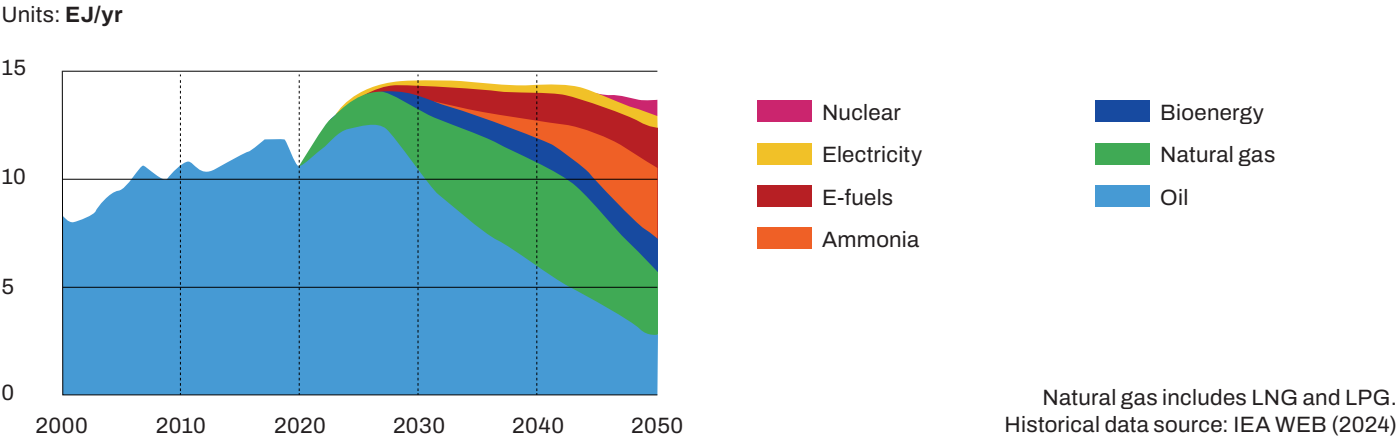
Fig. 1 - World seaborne trade (ton-miles) by ship type [R.2]



### Maritime fuel mix

The maritime sector is still regarded as a hard-to-abate sector. However, the regulatory push from the International Maritime Organization (IMO) and the EU, as well as demands from leading charterers for lower emission transport, are rapidly driving the sector’s focus, ability, and enforcement of decarbonization. As electrification options are limited to port-stays and short routes, decarbonization alternatives for maritime fuel will all come at a significant cost increase, estimated at about a 70% to 110% increase in total cost of transport [R.3]. Expensive fuel alternatives encourage further focus on energy efficiency and might, to a limited extent, influence freight volumes. Unlike many other demand sectors, there is significant uncertainty in which technology and fuel options will ultimately win the maritime decarbonization race. Shifting away from its predominately oil-based fuel mix today, a significantly decarbonized maritime 2050 fuel mix is dominated [3.2] by hydrogen-based fuels with 24% ammonia and 12% e-fuel (likely methanol) with an addition of 11% biofuel (Figure 2). Electrification will be low (4%) although it may dominate the smallest ships sailing short routes. Natural gas will continue its growth towards 2040, but towards 2050 will likely reduce again as its CO2 content is too high for deep decarbonization. For a comprehensive description of these estimates and an analysis of possible future scenarios reference is to be made to the 2024 edition of DNV\_Maritime\_Forecast\_2050 [R.3].

Fig. 2 - Maritime energy demand by carrier [R.2]



### Past and forecasted future maritime transport growth rate

Over the last 50 years, worldwide maritime transport has experienced steady growth, driven by globalization, trade expansion, and technological advancements. Below some key figures on the average growth rate of seaborne trade:

1. Long-Term Growth Rate
  - from 1970 to 2020, total seaborne trade (measured in billion tons) grew at an average 3% annual rate
  - in 1970, global seaborne trade was about 2.6 billion tons
  - by 2020, it had reached 11 billion tons, despite disruptions like the COVID-19 pandemic
2. Recent Growth Trends
  - in the 2000s, it accelerated due to China’s industrialization, averaging 4–5% per year
  - slowed slightly to 2.5-3% in the 2010s due to market maturity and environmental regulations
  - COVID-19 pandemic caused a temporary decline (-3.8%), but recovery followed in 2021–2022

As mentioned above, the estimated growth of worldwide maritime transport over the next 50 years (2024–2074) depends on various factors, including economic trends, technological advancements, environmental policies, and geopolitical shifts. However, based on current projections, the following is a likely scenario:

1. Projected Average Growth Rate
  - overall, it is expected to grow 2.0–2.5% per year, slightly lower than the past 50 years due to market maturity and sustainability regulations. Maritime trade will reach 20–25 billion tons per year in 2074
  - Container Shipping: 3–4% per year, driven by globalization, e-commerce, and trade digitalization
  - dry bulk: slower growth (~1.5–2%) as coal demand declines due to energy transition
  - oil tanker: expected to decrease or stagnate due to the shift toward renewable energy
2. Key Drivers of Future Growth
  - emerging markets: Africa and South Asia will drive demand for raw materials and manufactured goods
  - decarbonization efforts will reshape shipping (alternative fuels and energy-efficient ships)
  - automation & AI: smart ships, AI-driven logistics, and autonomous vessels will improve efficiency

### Current global merchant fleet composition by gross tonnage [R.4]

As of 2024, the global merchant fleet composition by gross tonnage is as follows:

- Bulk carriers: 43.2%
- Oil tankers: 27.8%
- Container ships: 14.0%
- Other ship types (including general cargo, liquefied gas carriers, offshore supply vessels, ferries, and passenger ships): 15.0%

The total carrying capacity of the world fleet is approximately 2.35 billion deadweight tons (dwt), with bulk carriers and oil tankers together accounting for 71% of the global shipping capacity. Container ships continue to grow, driven by global trade trends and increasing containerization.



### *Current (2024) global shipbuilding orderbook by main ship type [R.5]*

The total global shipbuilding orderbook has now reached 364.5 million dwt, accounting for 15% of the world fleet and a \$204 billion in value, marking the largest order intake in 17 years. Key ship types in the global orderbook include:

- Container ships: 4.4 million TEU ordered
- Gas carriers: 25.9 million cubic meters (includes LNG, LPG, ammonia, and ethane carriers)
- Tankers: 53.9 million deadweight tons (dwt), with 572 tankers ordered (including 106 crude tankers and 273 product tankers)
- Bulk carriers: Modest new orders compared to other segments
- Car carriers: 69 units ordered
- Large cruise ships: 10 new orders in European shipyards

### *Global port activities and development trends*

The latest available global port call statistics indicate the following estimated annual port calls by major ship types:

- Bulk Carriers: around 420,000 port calls
- Tankers: approximately 380,000 port calls
- Containerships: roughly 260,000 port calls
- Cruise Ships: estimated 150,000 port calls
- Ferries: over 500,000 port calls, considering their frequent short-haul trips
- Other Ship Types (including Ro-Ro, general cargo, and specialized vessels): about 300,000 port calls

These figures are based on data compiled from various maritime analytics sources [3.6] which track vessel movements worldwide. The numbers fluctuate due to market demand, trade shifts, and geopolitical factors.

In terms of broader port operations, the global port infrastructure investment in 2024 was estimated at \$73 billion, and it is expected to grow to \$132.6 billion by 2030. These investments focus on automation, sustainability, and infrastructure expansion to accommodate mega-vessels and meet stricter environmental regulations. Ports like Rotterdam and Los Angeles are leading the way in AI-driven automation, green hydrogen fuelling stations, and electrified port equipment.

### *Leisure boats*

This is a relevant segment of the maritime sector as it is relatively close to the cruise ship one, hence an high tech one and typically quite advanced as far as green technologies are concerned. From the regulatory point of view, if a yacht is registered to carry more than 12 passengers, it is a “passenger ship”, hence all the international (IMO) regulations apply exactly as for a cruise ship. In such case, therefore, all the requirements described in section 3.3 of this document apply if pertinent to passenger ships.

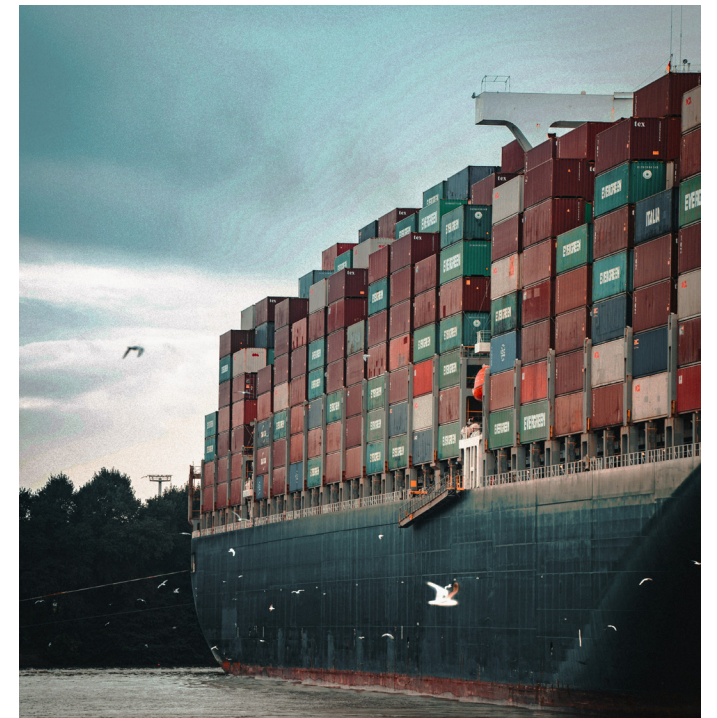
If it is registered to carry less than 12 passenger, then it is a leisure boat and is subject to the regulatory regime defined by the Country the flag of which the yacht is flying and no single international regulation applies. Among the national regulations, however, those from the UK Flag (so-called “red ensign”) are generally worldwide considered as a reference standard and could be referred to, in case of need, by consulting the most recent version, generally freely available for download; the current one is that issued in 2024 [R.9].

## 1.2 - Mediterranean

### *Past and forecasted future Mediterranean maritime transport growth rate*

Over the past 50 years, maritime transport in the Mediterranean has grown significantly, particularly due to the expansion of global trade, the increasing size of container ships, and the development of major hub ports. Additionally, trade between South Mediterranean countries and Asia has been growing rapidly, with an average import rate increase of about 8% for all South Mediterranean countries, driven by exports from Tunisia, Israel, and Jordan.

Looking ahead, maritime transport in the area is expected to continue expanding at an average rate of 4% per year. The region’s strategic role as a key trade corridor between Europe, Asia, and Africa will drive further investment in infrastructure, including larger container ships and expanded port capacities. However, challenges such as environmental impacts, congestion, and competition from alternative transport modes (such as rail and air freight) may influence the pace and nature of this growth.



### *Current Mediterranean merchant fleet composition by gross tonnage*

The composition of the merchant fleet by gross tonnage in the Mediterranean varies among key shipping nations.

Based on the most recent data:

- Bulk Carriers: around 420,000 port calls
- Tankers: approximately 380,000 port calls
- Containerships: roughly 260,000 port calls
- Cruise Ships: estimated 150,000 port calls
- Ferries: over 500,000 port calls, considering their frequent short-haul trips
- Other Ship Types (including Ro-Ro, general cargo, and specialized vessels): about 300,000 port calls

These figures indicate that, for instance, Malta and Cyprus have significant “flagged” merchant fleets, primarily due to their open registry policies while Greece has a large “owned” merchant fleet (mostly flying flags other than the Greek one).

### *Current (2024) Mediterranean shipbuilding orderbook by main ship type*

While European yards only hold 4% of global shipbuilding production by CGT (compensated gross tons), Mediterranean shipbuilding nations such as Italy, France, and Spain continue to focus on high-value sectors. In 2024:

- **Italy and France:** lead in cruise ship construction, securing orders for 10 large cruise vessels
- **Spain:** involved in LNG carrier and offshore wind vessel orders
- **Turkey and Greece:** specialized sectors with activity in ferries, smaller tankers, and dry bulk vessels

Unlike the dominant shipbuilding nations China, South Korea, and Japan, Mediterranean countries do not play a major role in the global newbuilding market. However, their focus on niche, high-value vessels such as LNG-powered cruise ships and offshore wind support vessels keeps them competitive and in the front edge of decarbonisation technologies.



Global and Mediterranean trends in alternative fuels

The maritime sector is undergoing a slow but steady shift toward alternative fuels to meet carbon reduction targets. The International Maritime Organization (IMO) aims to cut CO<sub>2</sub> emissions by 40% by 2030 and reach net-zero by 2050. However, as of 2024, only 7.4% of the global fleet can use alternative fuels, though nearly 50% of new vessels on order are dual-fuel capable, showing a commitment to future adoption. The Mediterranean market, particularly European shipping companies, is also leaning towards LNG and alternative fuels-based propulsion (as well as, although not yet clear if it will further develop, nuclear propulsion) as regulatory pressures increase under EU emission reduction policies. While alternative fuels are key to shipping’s sustainability, their widespread adoption will depend on regulatory support, investment in infrastructure (most ports are not yet ready to handle new fuels. Significant investments are required to make related supply chains viable) and technological advancements (shipbuilders are prioritizing dual-fuel vessels as a bridge toward full decarbonization, indicating that the transition will be incremental rather than immediate).

Global and Mediterranean trends in autonomous shipping

Autonomous shipping is making steady progress globally while AI-driven navigation, blockchain-enabled cargo tracking and IoT-based vessel monitoring are enhancing operational efficiency. Norway and Japan are leading the development of zero-emission, AI-operated vessels, while South Korea and China focus on autonomous LNG carriers. The Mediterranean region, particularly Italy, Spain, and Greece, is seeing increased investment in automated port operations and hybrid crew-autonomous vessel models.

Regulatory compendium

2.1 - International

Short term – Cybersecurity

Since 2021, when IMO added new provisions to the International Safety Management (ISM) code for merchant shipping, cybersecurity regulation in the maritime industry has proliferated. Today, there are new rules across the industry’s subsectors, with different jurisdictions imposing their own requirements. More recently, these have included the European Union’s NIS2 Directive which looks at overall critical infrastructure and the International Association of Classified Societies’ (IACS) unified requirements (IACS UR-E26 and UR-E27). E26 governs vessel design and operation for yards, designers and owners while E27 applies to essential onboard systems as well as original equipment manufacturers. Both are mandatory for new vessels contracted after 1 July 2024. Although not immediately connected with decarbonisation, cybersecurity is of relevance and is therefore included in this short compendium, since digitalisation is instrumental to decarbonisation and smart ships (connected and using AI) should be suitably protected from cyber attacks.

Short term - IMO GHG reduction strategy and alternative fuel regulatory framework

IMO’s short term (2030) strategy focuses on energy efficiency (EEDI, EEOI, EEXI and CII, shortly described in the following) and on use of alternative fuels as summarised in Table 1.

Table 1 - Regulatory framework on alternative fuels

REGULATORY FRAMEWORK ON ALTERNATIVE FUELS		
LNG	IGF Code was adopted at MSC 95 (June 2015)	Mandatory Provision
Methyl/Ethyl Alcohol	Interim Guidelines (MSC.1/Circ.1621) approved (Dec 2020)	Voluntary Provisions
Fuel cells	Interim Guidelines (MSC.1/Circ.1647) approved (June 2022)	Voluntary Provisions
LPG	Interim Guidelines (MSC.1/Circ.1666) approved (June 2023)	Voluntary Provisions

Fig. 3 - The EEXI framework

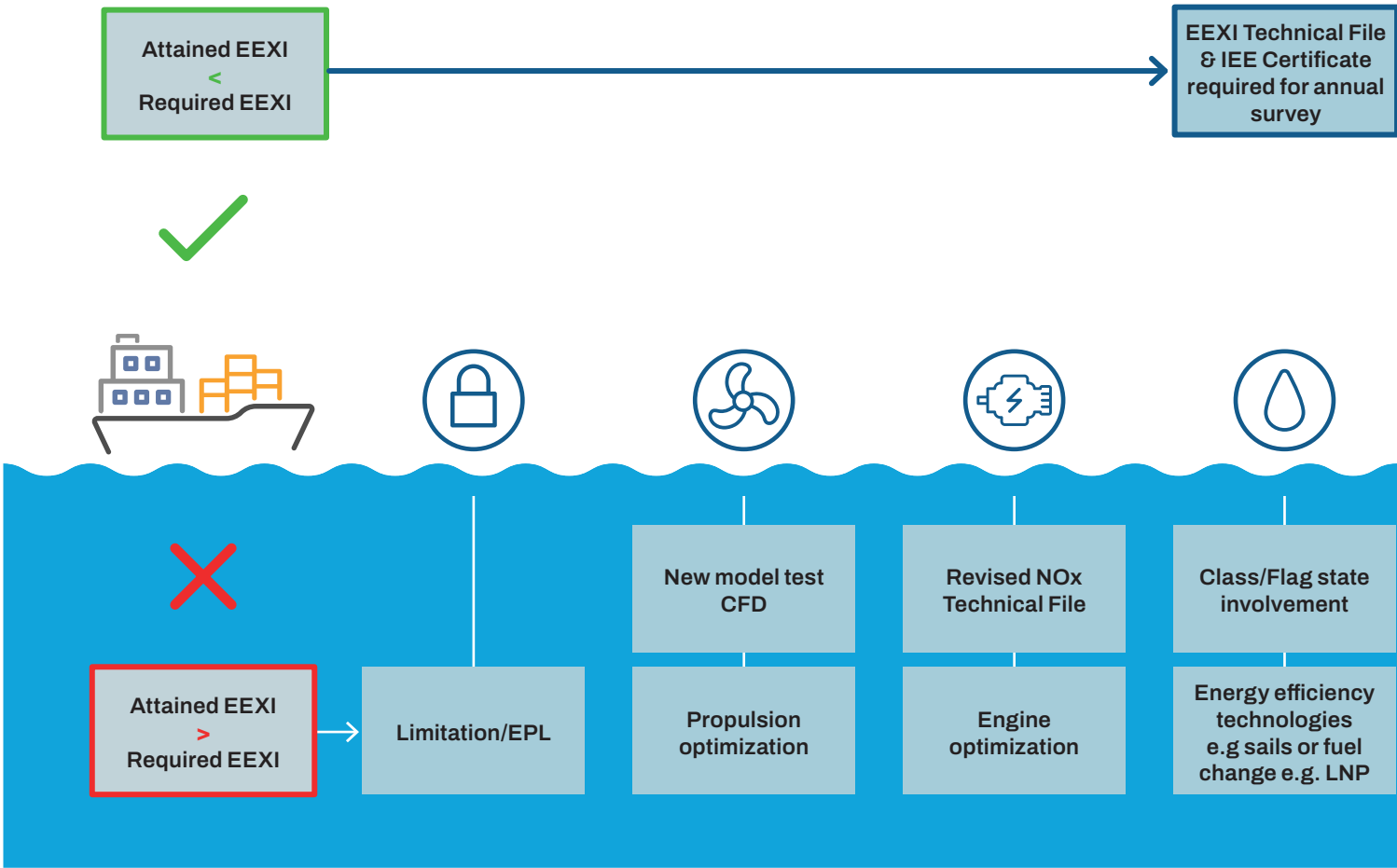
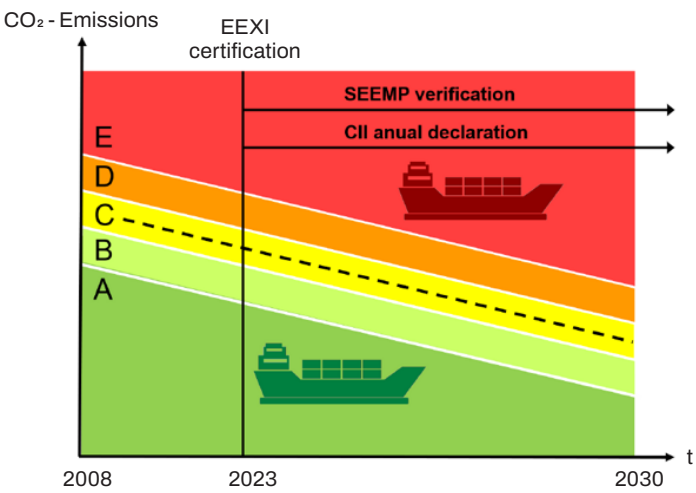


Fig. 4 - The CII rating



Regarding Hydrogen, Ammonia and Oil-fuels (Synthetic, Biofuel, etc.) it is worth to highlight that regulations are under still under development by IMO’s CCC Sub-committee and that, on 6 December 2024, the IMO approved the non-mandatory “Interim guidelines for the safety of ships using ammonia” that were developed using the IGF Code as a basis and aim to provide an international standard for the safety of ships using ammonia as fuel (other than gas carriers using their ammonia cargo as fuel). The Guidelines follow the goal-based standards approach and include goals and functional requirements. Concerning energy efficiency, having been adopted in 2011 a mandatory design (EEDI) and operational (EEOI) energy efficiency measures aimed at reducing GHG emissions from newly built ships, in 2023 existing ships where addressed (by the EEXI - Energy Efficiency Index for Existing Ships) as well as operational requirements to reduce carbon

intensity defined (based on the CII - Carbon Intensity Indicator). As of January 1, 2023, it is mandatory for all vessels to calculate their Existing Vessel Energy Efficiency Index (EEXI) and start collecting data for reporting their annual operational Carbon Intensity Indicator (CII) and CII rating:  
– all existing ships of 400 GT and above are required to calculate their attained EEXI (see Fig. 3);  
– CII, building upon fuel oil consumption, is mandatory for ships of 5,000 gross tonnages and above. The attained CII must be annually verified against the required, ship specific, CII. Based on that, Flag Administration rates the ship from A to E (see Fig. 4).

If any of the indexes is not attained, various technical solutions can be considered to ensure compliance as shown, in view of example, in Figure 5; worthless to say, developing innovative technical solutions to facilitate compliance is a (desired) fall out of these IMO's requirements.

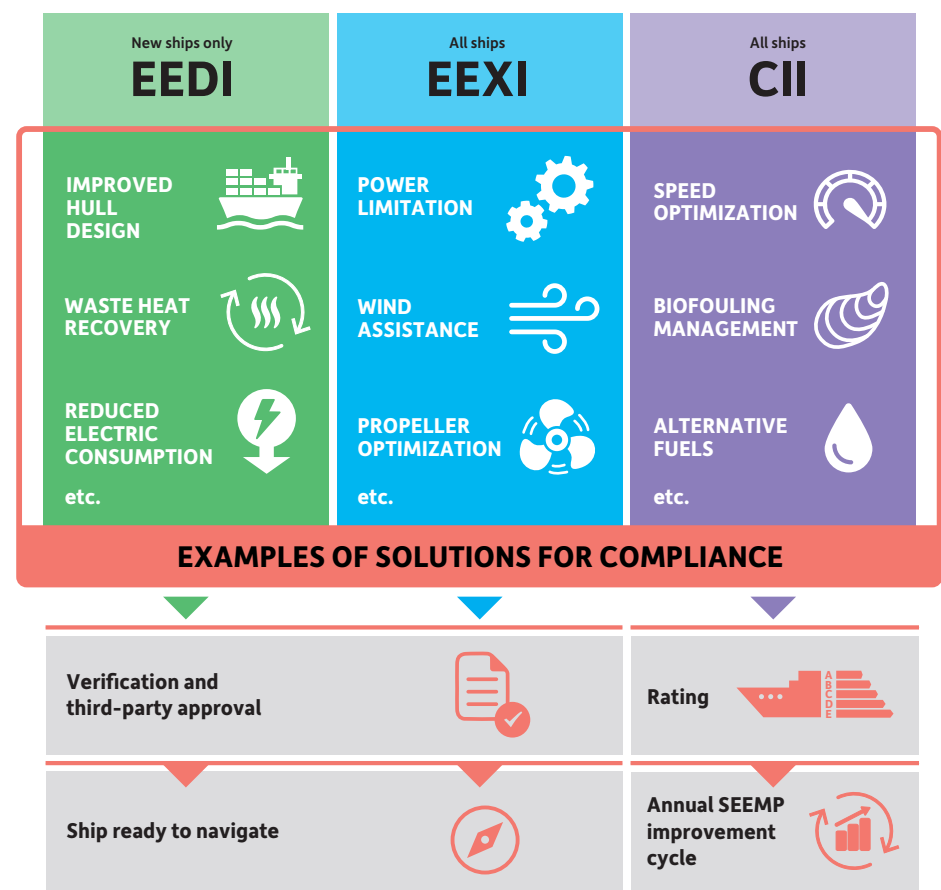


Fig. 5 - Compliance solutions for IMO's short term requirements

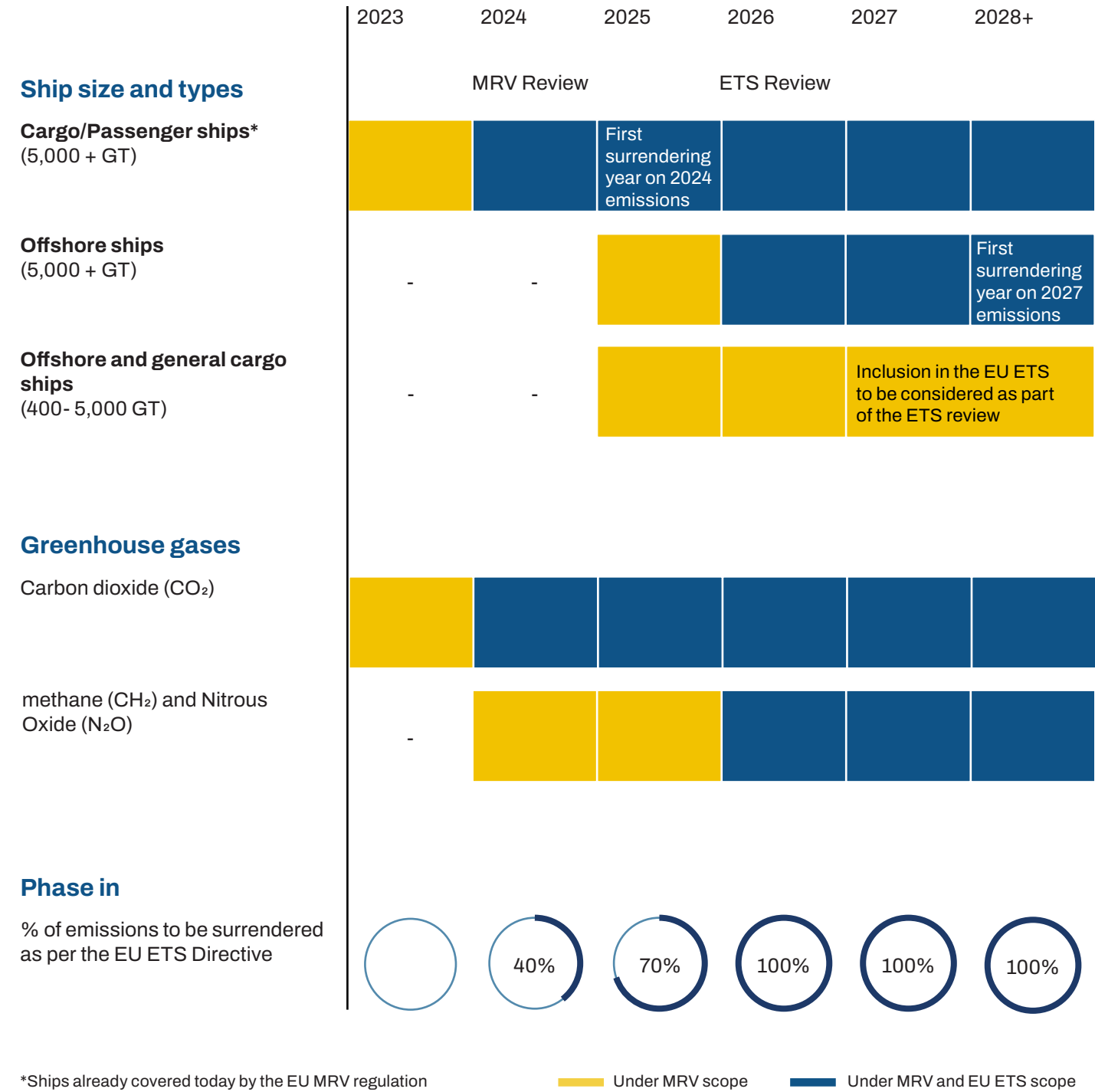
Short to Medium term – Atlantic SECA (Sulphur Emission Control Area)

Sulphur Emission Control Areas (SECAs), under IMO's MARPOL Convention, are international legislations that apply on a limited geographical area (hence are called "regional legislations") where all the coastal states in the area enforce more stringent regulations regarding the sulphur concentration in ship fuel. More specifically, ships navigating in a SECA shall use marine fuels containing no more than 0.1% Sulphur content. This represents a substantial reduction compared to the existing worldwide threshold of 0.5% enforced since 2020. The definition of Northeast Atlantic as a SECA is currently under discussion at the IMO and, if adopted, is expected to come into effect by 2027 therefore aligning this area with the existing SECAs in the North Sea, Baltic, Noth America and Mediterranean (entering into force on 1st May 2025) [R.7].

Short to Medium term – EU ETS

From 1 January 2024, shipowners, operators and charterers will be subject to the world's first carbon price on shipping, with the inclusion of the maritime sector in the EU Emissions Trading System (ETS). In September 2025, the company mandated with the responsibility for EU ETS compliance will need to surrender sufficient EU Allowances, traded via the European Energy Exchange, to cover 40% of their fleets' 2024 tank-to-wake (TtW) carbon dioxide (CO2) emissions. By 2027 they will need to surrender allowances for all emissions – not only of CO2 but also methane (CH4) and nitrous oxides (N2O). Now that EU ETS is in force, failure to surrender sufficient allowances each September (see Fig. 6 reproduced from [R.8]) will result in a penalty being accrued, in addition to the owed EU allowance.

Fig. 6 - EU ETS maritime introduction timeframe [R.8]



Furthermore, according to the FuelEU Maritime, fleets will have to meet stepped improvements in the lifecycle greenhouse gas (GHG) emissions intensity of the energy they use, or face penalties. The first penalties, to be paid by June 2026, will be for those who fail to reduce GHG emissions intensity in 2025 by at least 2% compared to 2020. Further FuelEU requirements will begin in 2030 with container and passenger ships requested to use onshore power supply (OPS) or a zero-emission alternative fuel when berthed at major European ports. That requirement will be extended to a wider range of ports from 2035, by which time all shipping companies will be subject to penalties if their annual GHG intensity is not 14.5% lower than it was in 2020. FuelEU and the inclusion of shipping in the EU ETS reform are just two elements of Europe's 'Fit for 55' package, which aims to drive a 55% reduction in EU emissions by 2030. Other elements include:

- the Alternative Fuels Infrastructure Regulation (AFIR), setting targets for the deployment of supply networks to support the uptake of renewable fuels in the road, air and waterborne transport sectors;
- a revised Renewable Energy Directive (RED III), facilitating and setting both overall and industry specific targets for the proportion of Europe's energy demand to come from renewable sources;
- the Carbon Border Adjustment Mechanism (CBAM), which aims to prevent internal EU measures from increasing emissions outside EU borders by certifying emissions related to a range of imported goods and materials.

Basin strategies

Maritime Transport in sea basins surrounded by several coastal countries, such as the Mediterranean and the Black Sea, is generally regulated, besides by the IMO's Conventions, also by specific "IMO's regional" agreements that might defined additional, so-called "regional" regulations stricter than world-wide ones to be complied with by ships navigating the basin, irrespective from them calling a port in the basin or simply passing through it. Regional Agreements pertaining to the Mediterranean are defined in the context of the Convention for the Protection of the Mediterranean Sea Against Pollution that was adopted on 16 February 1976 in Barcelona, entered into force in 1978 and, amended in 1995, was renamed as the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, generally referred to as "Barcelona Convention". The Barcelona Convention and its seven Protocols<sup>1</sup> adopted in the framework of the Mediterranean Action Plan (MAP) constitute the principal regional legally binding Multilateral Environmental Agreement (MEA) in the Mediterranean.

Additionally, the EU has defined, mostly for innovation purposed, similar "basin" strategies that, although not being compulsory for transport operators (while the IMO's regional agreements, such as the Barcelona Convention, are), are important references for transport innovation purposes.

The most relevant such maritime strategies for the purposes of this document are:

- in the western Mediterranean, the last **WestMED Initiative**<sup>2</sup> Ministerial Declaration (2023) that identifies priority needs in the sustainable production and consumption through the support of the transition of maritime transport, green shipping, and ports towards carbon-neutrality and zero emission and ports as hubs for energy, as well as innovative and restorative aquaculture and fisheries;
- across the Mediterranean, the **Union for the Mediterranean** (UfM) Ministerial Declaration<sup>3</sup> (2021) and related Roadmap<sup>4</sup> (2023) that called for strengthening of expertise and boosting investments in infrastructure taking duly into account the specific needs and priorities of a green maritime transport sector including energy saving technologies as well as on the development of alternative fuels, and transitional fuels as appropriate;
- in the Black Sea the **Common Maritime Agenda**<sup>5</sup> (CMA) whose Goal 2 reflects on the need to support transformative solutions for a competitive, innovative and sustainable blue economy for the region, with its Priority 2 specifically mentioning the need for sustainable and safe shipping, protection of the marine environment through the development of modern navigation systems, environmentally friendly and carbon emissions efficient and safe ships; CMA Goal 3 also calls for support to SMEs to foster innovation and attract sustainable transformative investments, including in the areas of groundbreaking technological change such as green transport;
- at EU level, the **EU Mission Restore Our Ocean and Waters**<sup>6</sup> Goal 3 calls for a sustainable economy which is carbon-neutral and circular, with a key role for innovative green transport.

Short term – MED SECA (Sulphur Emission Control Area)

Sulphur Emission Control Area (SECA) is an outstanding example of a regulatory measure that nations might use. SECAs refer to specific maritime areas where nations enforce more stringent regulations regarding the sulphur concentration in ship fuel. Beginning from May 1st 2025, ships navigating in the Mediterranean Sea will be mandated to utilize marine fuels containing no more than 0.1% Sulphur content. This represents a substantial reduction compared to the existing worldwide threshold of 0.5% [R.7].

1. [https://wedocs.unep.org/bitstream/handle/20.500.11822/31970/bcp2019\\_web\\_eng.pdf](https://wedocs.unep.org/bitstream/handle/20.500.11822/31970/bcp2019_web_eng.pdf)  
2. <https://westmed-initiative.ec.europa.eu/westmed-initiative/>  
3. <https://ufmsecretariat.org/wp-content/uploads/2021/02/Declaration-UfM-Blue-Economy-EN-1.pdf>  
4. <https://westmed-initiative.ec.europa.eu/wp-content/uploads/2023/07/UfM-Advanced-Draft-Roadmap-Sustainable-Blue-Economy-April-2023.pdf>  
5. <https://black-sea-maritime-agenda.ec.europa.eu/about/our-mission>  
6. [https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters\\_en](https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/restore-our-ocean-and-waters_en)

# Medium (by 2040) and long-term (by 2050) zero-emission maritime transport innovation priorities: focus on ship types and ports and on the European and Mediterranean markets

Research and development of fuels like green hydrogen, sustainable biofuels and ammonia must be pursued aggressively, addressing infrastructure, production, and compatibility challenges. Electrification and advanced wind propulsion offer further pathways for specific use cases. Regional leadership in the Mediterranean is essential for demonstrating collaborative models, investing in sustainable ports, and driving localized solutions. The changeover will not be smooth. It demands a tailored approach, matching fishing vessels with upgrades and potentially biofuels, ferries with electrification and fuel cells, and leisure boats through solar and innovative designs. It is worth underlining that most of the information in this section are derived by the "European Maritime Transport Environmental Report (EMTER) 2024" [R.11] jointly published in 2025 by the European Environmental Agency and by the European Maritime Safety Agency and by the Strategic Research & Innovation Agenda (SRIA) of the EU Partnership Zero Emission Waterborne Transport (ZEWT) [R.12]. Both reference are recommended for further reading to those interested in more detailed analyses.

## EU and Mediterranean status in 2024

### 1.1 - Status quo

Most of the goods transported in and out of the EU are shipped using maritime transport and the EU accounts for 17.6% of the total commercial world fleet by gross tonnage (GT). Ports are integral to the maritime ecosystem and sit at the heart of the sustainable development of the maritime transport sector. They also enable economic and trade development through traditional activities such as cargo handling, logistics and servicing, while supporting a complex cross section of industries and facilitating the clustering of energy and industrial companies in their proximity. In 2022, more than 12 million port calls took place globally, with almost 3 million (approximately 23%) located in EU and European Economic Area ports. According to EMTER [R.11], the main environmental "pressures" in EU due to waterborne activities in 2022-2023 can be summarised as follows.



## Greenhouse gases

- CO<sub>2</sub> emissions generated by the maritime transport sector account for approximately 3-4% of all EU CO<sub>2</sub> emissions, and specifically in 2022, for 14.2% of CO<sub>2</sub> emissions of the whole EU transport sector.
- Between 2015-2023, CO<sub>2</sub> emissions increased by 46% in the Atlantic, 15% in the Mediterranean, 6% in the Baltic and 62% in the Arctic, while there was a decrease of 8% in the North Sea and 1% in the Black Sea.
- Fishing vessels in the EU have emitted about 3.7 million tonnes of CO<sub>2</sub> in 2023, accounting for 2% of total EU transport emissions.
- The contribution of the maritime transport to the EU overall transport emissions of methane (CH<sub>4</sub>) has increased over time, reaching approximately 26% in 2022.

## Air pollutants

- Sulphur oxides emissions (SO<sub>x</sub>) have decreased by about 70% since 2014, largely due to the introduction of Sulphur Emission Control Areas (SECAs).
- Between 2015 and 2023, Nitrogen oxides (NO<sub>x</sub>) emissions increased by 33% and 8% in the Atlantic and in the Mediterranean Sea, while they decreased by 17%, 7% and 6% in the North, Black and Baltic Seas, respectively. It is important to note that data and trends are also influenced by ongoing conflicts, other contingent situations, and the implementation of NO<sub>x</sub> Emission Control Areas (NECAs).
- The contribution of the maritime sector to the overall PM<sub>2.5</sub> in transport emissions has slightly increased over time, reaching approximately a 43% share in 2022. In 2022, domestic navigation constituted approximately 14% of the total maritime PM<sub>2.5</sub> emissions.

## Discharge waters and contaminants

- 98% of water discharge volumes consist of wash waters mostly from open-loop Exhaust Gas Cleaning Systems (EGCS) (74% of the scrubbers are open loop). The remaining 2% comprises primarily grey water (1.4%) and sewage (0.4%).
- Water discharges from grey waters from cruise ships increased by 41% from 2014 to 2023, while the highest discharge volumes on the freight side come from tankers with an increase of 25% since 2014.

## Underwater radiated noise (URN)

- The areas with highest URN sound pressure level (SPL) values are parts of the English Channel, the Strait of Gibraltar, parts of the Adriatic Sea, the Dardanelles Strait and some regions in the Baltic Sea. The lowest values are recorded in the north-west part of the North-East Atlantic and the southern part of the Mediterranean Sea.
- Tankers and cargo ships emerge as primary contributors to URN, particularly at lower frequencies.
- Foresight analysis indicates that the implementation of technical and operational URN and GHG mitigation measures may lead to a substantial reduction in URN for all ship types and in all regions by 2050. In specific cases, this reduction could be as much as 70% compared to the business-as-usual scenario.

## Waste reception at ports

- Oily waste (855,000m<sup>3</sup>) and garbage (488,000m<sup>3</sup>) are the largest amounts of waste delivered to port reception facilities in Europe, according to data reported in 2023, followed by sewage (250,000m<sup>3</sup>).
- Ports in Rotterdam, Antwerp and Copenhagen handle the highest volumes of waste, with respectively 475,000m<sup>3</sup>, 210,000m<sup>3</sup>, and 132,000m<sup>3</sup> in 2023.

## Physical disturbance of the seabed

- 27% of the seabed in near-shore marine waters (one nautical mile from the coastline) experiences physical disturbance, with 5% of the area being subject to high impact.
- Between 2000 and 2018, there has been a 12.5% increase in port areas. The expansion has been the most prominent in the North-East Atlantic Ocean in absolute terms (53 km<sup>2</sup>) and in the Black Sea in relative terms (17%).

## Low emission EU fleet

- In 2023, the EU maritime sector had 1083 battery-powered ships in operation, with 160 more on order for 2024. Methanol use is rising, with 33 ships in operation and 29 on order in 2024. The number of wind propulsion uses is increasing, with installations on over 30 ships and ongoing retrofits on 26 more. Hydrogen-powered ships include three in operation and five on order.
- The projected electrolyser capacity by 2030 could supply hydrogen fuels for 13-19% of the global fleet if sufficient renewable electricity and capacity increases are realised. Green ammonia production needs a 3-4-fold increase to support the foreseen demand.





# 1.2 - Leisure boats

This is a relevant segment of the maritime sector, particularly for the EU boating industry and for Mediterranean marinas. As already noted, large yachts registered to carry more than 12 passengers are from the regulatory point of view, “passenger ships”, and are basically very similar to small cruise ships as far as greening trends are considered; therefore, they need not to be addressed in this report. However, smaller boats are worth being addressed as they are significantly different from almost all other types of ships and from cars. The related worldwide fleet is over 30 million boats with a lifecycle of 30-50 years and a 2% turnover (i.e. 600.000 boats) per year, according to the U.S. National Marine Manufacturers Association, and account for 0.4% and 0.7% of carbon dioxide (CO2) emissions emitted by the transport sector in the EU and USA respectively [R.16]. As for the other segments of maritime transport and marine tourism, the target reduction for the sector is to reach net zero by 2050; related technological trends are summarised in sub-section 3.2 at page 35 of this report.

# 1.3 - Medium and Long-Terms decarbonisation targets

The regulatory decarbonisation targets respectively for the medium (2040) and long (2050) term re summarised in the following; accordingly, they are taken as the reference for the innovation priorities listed in the following two sub-sections.

## Medium Term (2040) targets

- EU Emission Trading System (ETS) for maritime transport foresees shipping companies to surrender allowances for 100% of their verified greenhouse gas emissions as of 2026
- The FuelEU Maritime Regulation enforces the use of onshore power supply by 2030
- The IMO EEDI, EEXI and CI regime are in force

## Long Term (2040) targets

- The FuelEU Maritime Regulation stipulates that the yearly average GHG intensity of the energy used on board ships will have to be reduced 80% from the 2020 baseline by 2050

# Medium term horizon – achieving intermediate targets

The focus in the medium term will be enabling the use of alternative (green, non-carbon based) fuels and in deploying large scale energy efficiency solutions. This will require separate approaches respectively for new buildings and existing ships as most of the latter will have to undergo “green retrofitting” during their operational life. In view of example, in the following figure MSC Cruise’s decarbonization strategy [R.12] until net zero emissions in 2050 is shown: waiting for innovation to be deployed and commercially available in 2035-2050, the main focus in the medium term will be on transition fuels, such as LNG that although fossil based is less emission intensive than traditional marine diesel oil, and on energy efficiency. This approach, with the obvious adaptations on a ship type basis, will be the same for the whole sector as outlined in the following sub-sections.

## ROADMAP TO ACHIEVE POWER WITHOUT EMISSIONS

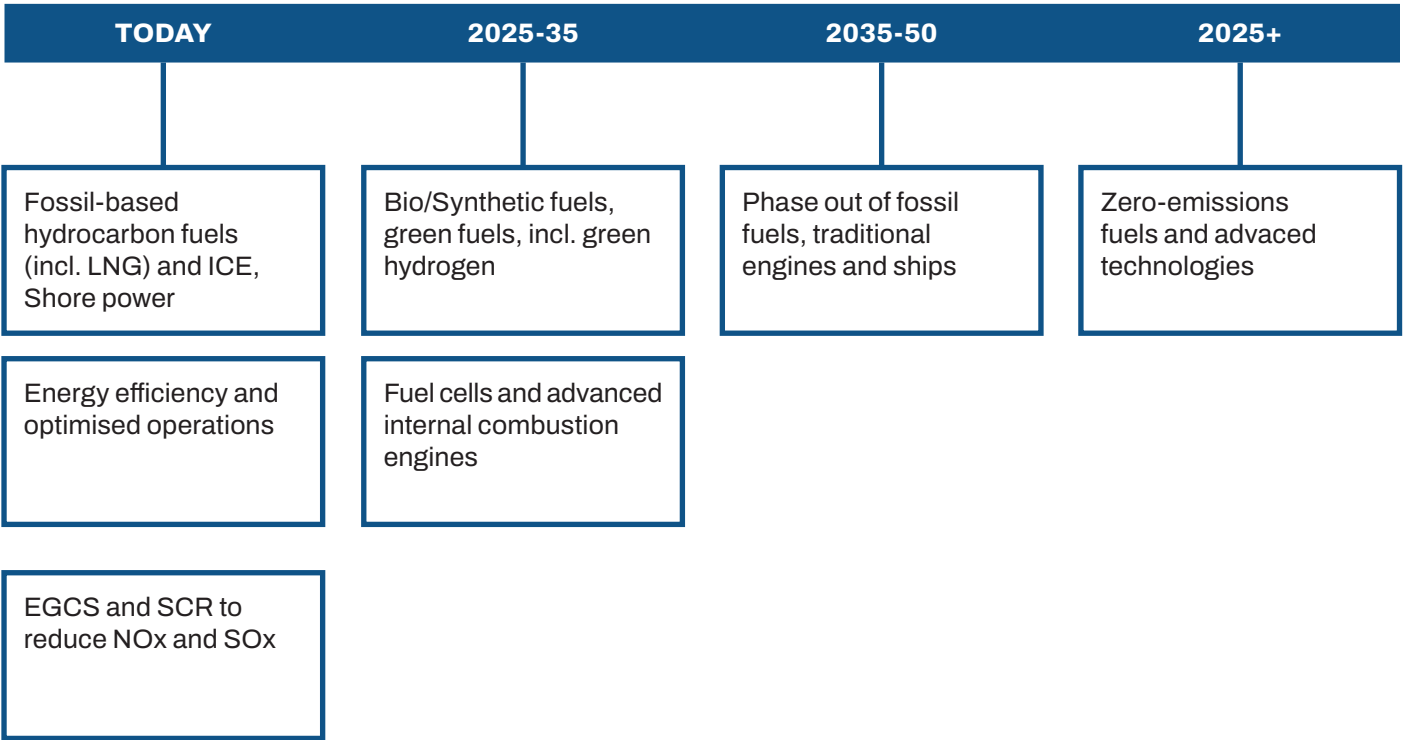


Fig. 7 - Reproduced from MSC’s M. Francioni speech at the Shipping Week in 2022

# 2.1 - Innovation priorities

## New ships

### Fuel-ready ships

Since few years, when ordering a new ship, most of the shipowners ask her to be “fuel-ready”; these are ships that are built to use traditional carbon fuel (either HFO or MDO) but are built in such a way that converting them for use a specific alternative fuel when it will be available at competitive price is possible and not too costly. This practice started in 2015 when the first LNG-ready ships were delivered; currently approximately 55% of new ships are “ready” for a certain type of fuel, sometimes for 2 different types of fuel. This is illustrated in figure 8 from Clarkson Research showing the past and future number of ready-ships ordered world-wide as of February 2025.

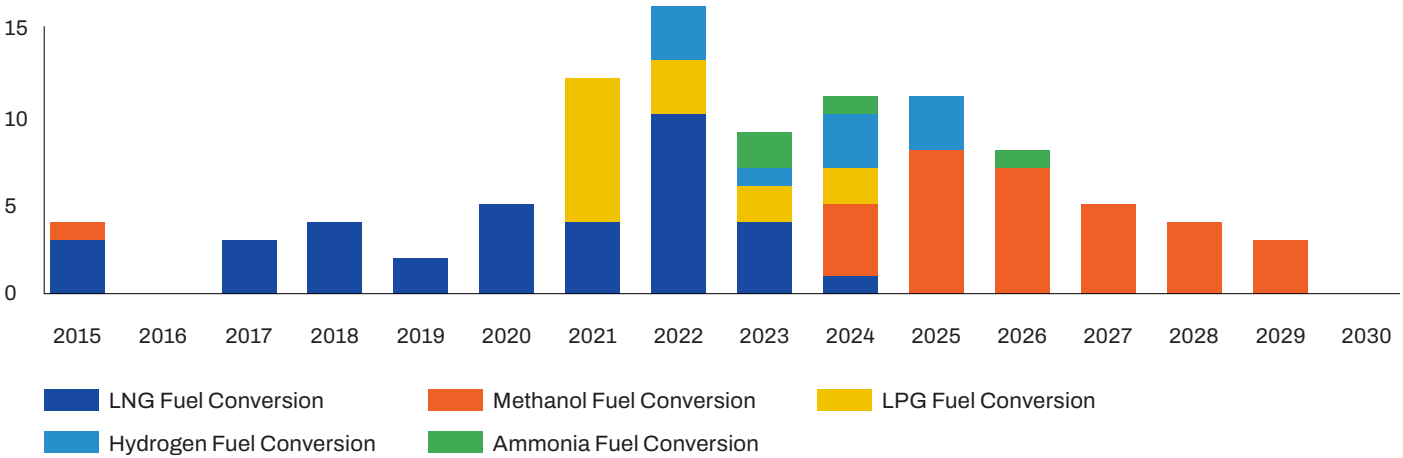


Fig.8 - Green retrofitting – alternative fuel conversions. Source: Clarkson’s Research (February 2025)

## Alternative fuels and electrification

A medium-term horizon (2040) is generally considered viable for almost all alternative fuels except for on-board nuclear power as discussed in the following sub-section on long term perspectives. In this respect, it is worth noting that the most time demanding part of the deployment relates to the development of the network of refuelling stations in ports. This fact brings the following worth-to-keep-in-mind implications:

1. basically, all alternative fuels, perhaps excepts fuel cells that are better suited for large cruise ships, are applicable to all ship types
2. from the engine/power generation point of view, technology will be market ready by 2030-2035
3. what matters is not really the ship type but the ship service; short sea shipping and regular liners, irrespective from being passengers, container or liquid/bulk cargo carriers, will be early adopters as they are generally engaged in shorter routes hence will need less fuel therefore relatively easily adaptable to a situation where not many ports can refuel those ships

This having said, in the following the innovation priorities are provided as foreseen by the EU Partnership ZEWT that forecasts that, by 2030, use of the fuels will be demonstrated in real operational environment.

## OPERATIONAL OBJECTIVES

- ✓ **Eliminating GHG emissions**  
To develop and demonstrate solutions for the use of climate-natural, sustainable alternative fuels applicable to ships with high energy demand (e.g. long distance shipping) before 2030  
  
To develop solutions for clean and climate-neutral, climate-resilient inland waterway vessels before 2030
- ✓ **Eliminating air pollution**  
To develop and demonstrate solutions to cut coastal and inland pollution to air from inland waterway transport and maritime shipping by at least 50% by 2030, compared to current levels
- ✓ **Eliminating water pollution**  
To develop and demonstrate solutions to eliminate pollution to water (including harmful underwater noise) from ships, by 2030

Fig.9 - Medium term innovation objectives - alternative fuels' priorities, reproduced from [R.12]

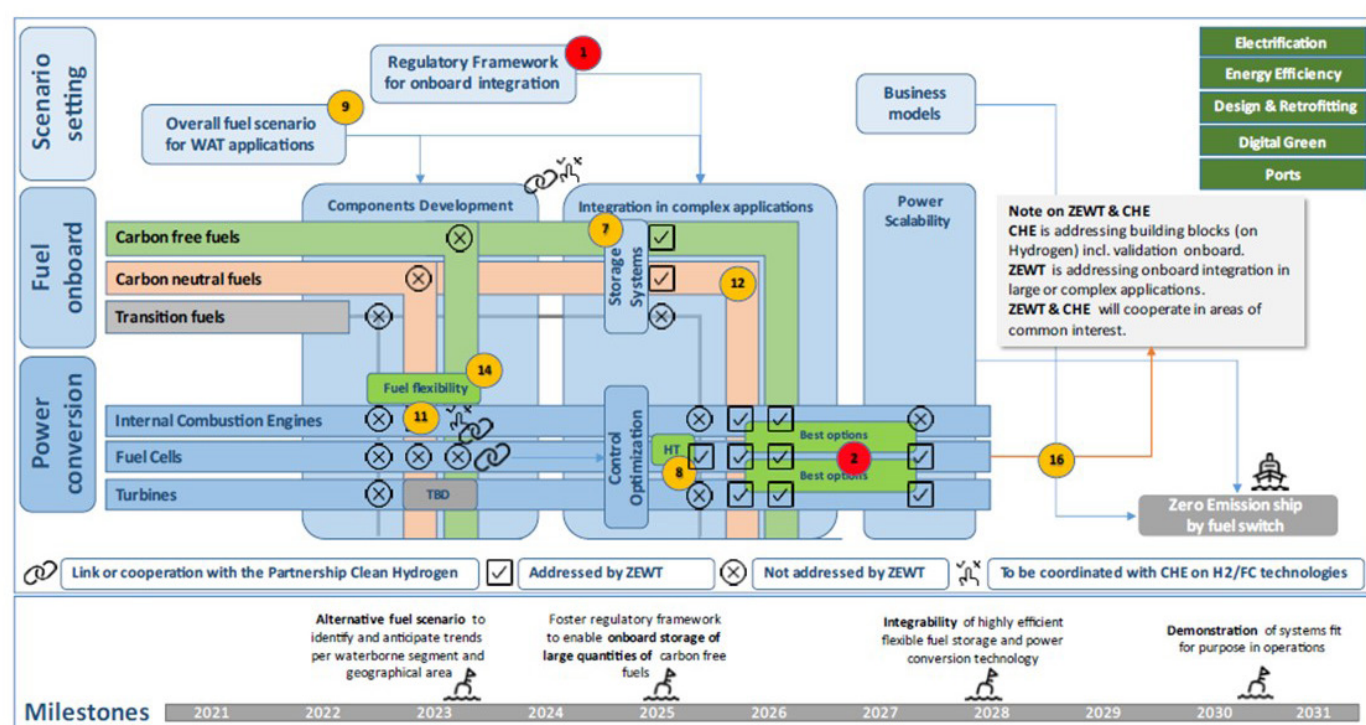


Fig.10 - Medium term innovation priorities - alternative fuels' priorities, reproduced from [R.12]

## OPERATIONAL OBJECTIVES

- ✓ **Eliminating GHG emissions**  
To develop and demonstrate before 2030 solutions for the integration of high-capacity batteries solutions as single energy source for short distance shipping (up to 150 to 200 nautical miles)  
  
To develop and demonstrate solutions for port based supply infrastructure (i.e. infrastructure for bunkering of alternative fuels and electricity) needed to enable zero-emission waterborn transport, to be implemented by 2030 at the latest  
  
To develop and demonstrate solutions for clean and climate-neutral, climate-resilient inland waterway vessels before 2030
- ✓ **Eliminating air pollution**  
To develop and demonstrate solutions to cut coastal and inland pollution to air from inland waterway transport and maritime shipping by at least 50% by 2030, compared to current levels
- ✓ **Eliminating water pollution**  
To develop and demonstrate solutions to eliminate pollution to water (including harmful underwater noise) from ships, by 2030

Fig.11 - Medium term innovation objectives - electrification's priorities, reproduced from [R.12]

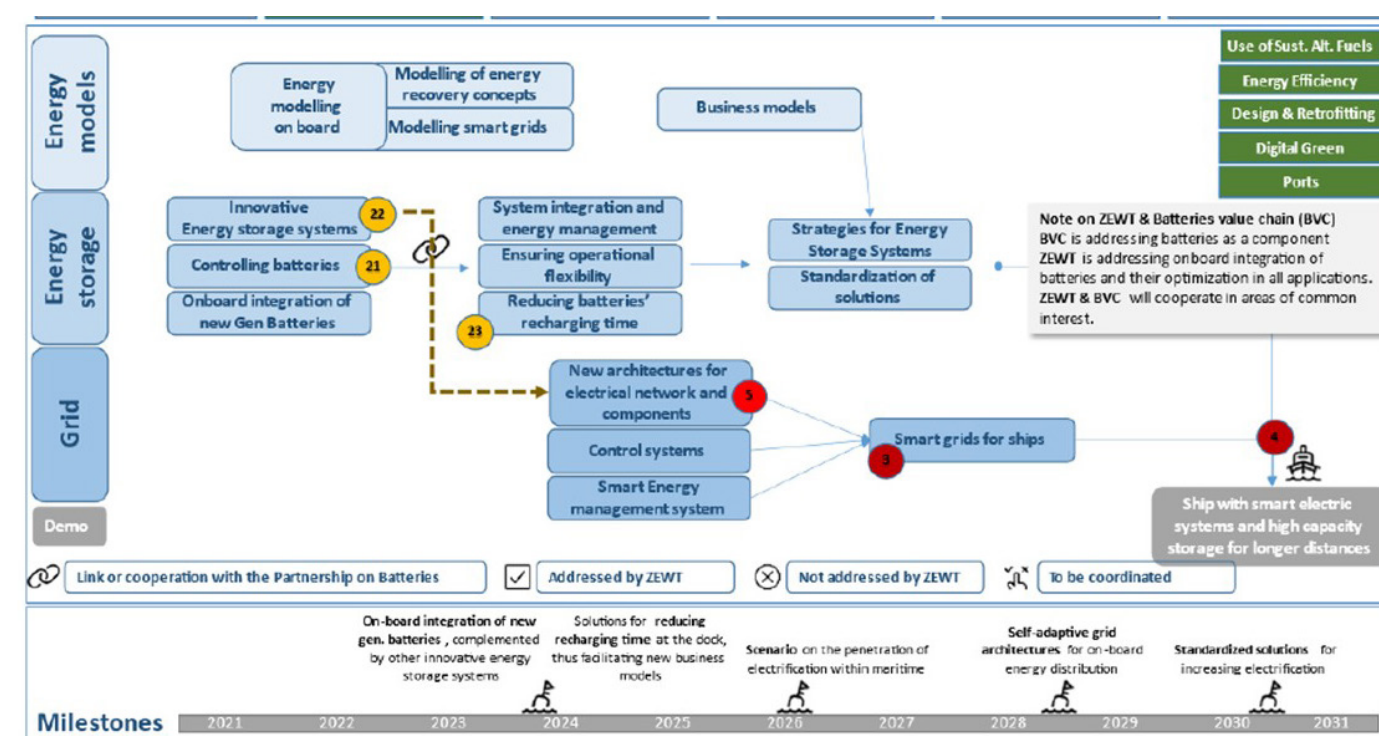


Fig.12 - Medium term innovation priorities - electrification's priorities, reproduced from [R.12]



## Energy efficiency

As far as energy efficiency interventions is concerned, in the following the innovation priorities are provided as foreseen by the EU Partnership ZEWI that forecasts that, by 2030, also in this set of innovative solutions will be demonstrated in real operational environment.

### OPERATIONAL OBJECTIVES



#### Eliminating GHG emissions

To develop and demonstrate solutions for the use of climate-natural, sustainable alternative fuels applicable to ships with high energy demand (e.g. long distance shipping) before 2030

To develop and demonstrate before 2030 solutions for the integration of high-capacity batteries solutions as single energy source for short distance shipping (up to 150 to 200 nautical miles)

To develop and demonstrate solutions to be able to reduce the fuel consumption of waterborne transport, including by the use of non-fuel based propulsion (such as wind), by at least 55% before 2030, compared to 2008

To develop and demonstrate solutions for clean and climate-neutral, climate-resilient inland waterway vessels before 2030



#### Eliminating air pollution

To develop and demonstrate solutions to cut coastal and inland pollution to air from inland waterway transport and maritime shipping by at least 50% by 2030, compared to current levels



#### Eliminating water pollution

To develop and demonstrate solutions to eliminate pollution to water (including harmful underwater noise) from ships, by 2030

Fig.13 - Medium term innovation objectives – energy efficiency's priorities, reproduced from [R.12]

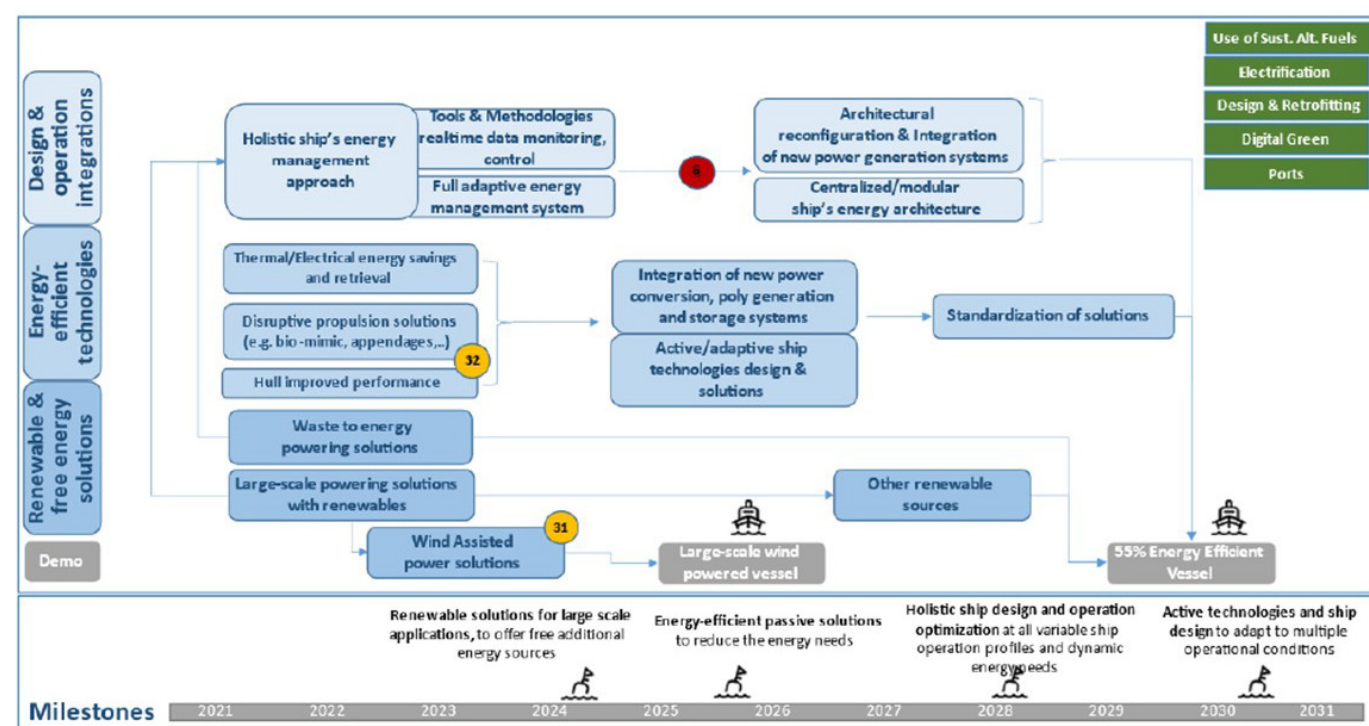


Fig.14 - Medium term innovation priorities – energy efficiency's priorities, reproduced from [R.12]

## Digital green

By digital green, ICT solutions are referred to. These are expected to have an increasingly significant impact depending on the availability of relatively cheap connectivity (5G or above) all over the world; it is noted that as of 2025 still large portions of deep seas are not covered but, quite costly, satellite communication. Also in this case the following information is reproduced from ZETP [R.12].

### OPERATIONAL OBJECTIVES



#### Eliminating GHG emissions

To develop and demonstrate solutions to be able to reduce the fuel consumption of waterborne transport, including by the use of non-fuel based propulsion (such as wind), by at least 55% before 2030, compared to 2008

To develop and demonstrate solutions for port based supply infrastructure (i.e. infrastructure for bunkering of alternative fuels and electricity) needed to enable zero-emission waterborn transport, to be implemented by 2030 at the latest

Fig.15 - Medium term innovation objectives – energy efficiency's priorities, reproduced from [R.12]

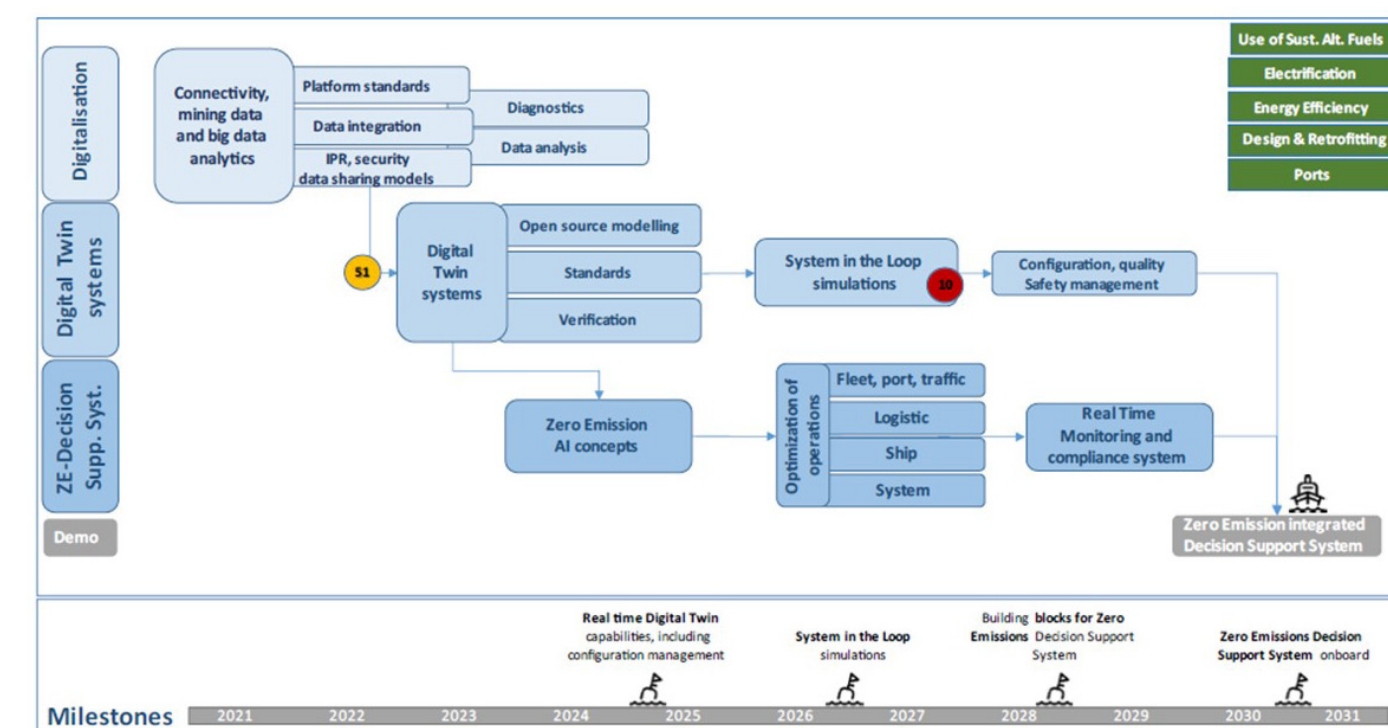


Fig.16 - Medium term innovation priorities – digital green's priorities, reproduced from [R.12]

Green retrofitting of existing ships

Fuel-enabled and energy efficient retrofitting

Since few years, when ordering a new ship, most of the shipowners ask her to be “fuel-ready”; these are ships that are built to use traditional carbon fuel (either HFO or MDO) but are built in such a way that converting them for use a specific alternative fuel when it will be available at competitive price is possible and not too costly. This practice started in 2015 when the first LNG-ready ships were delivered; currently approximately 55% of new ships are “ready” for a certain type of fuel, sometimes for 2 different types of fuel. This is illustrated in figure 8 from Clarckson Research showing the past and future number of ready-ships ordered world-wide as of February 2025.

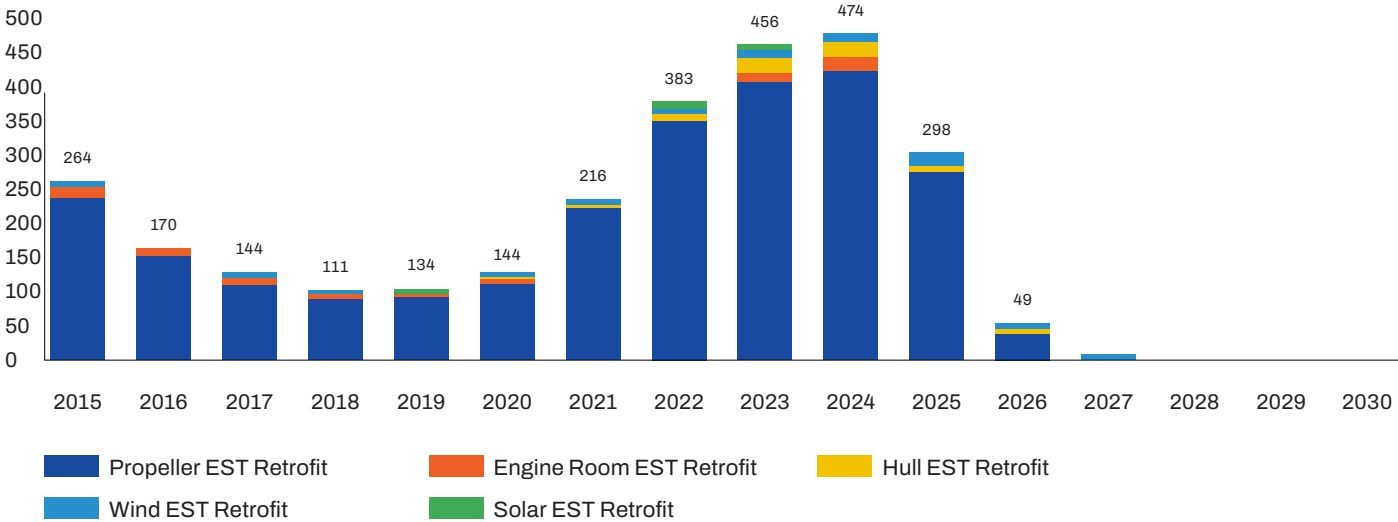


Fig.17 - Green retrofitting – energy saving interventions. Source: Clarkson’s Research (February 2025)

OPERATIONAL OBJECTIVES

✓

**Eliminating GHG emissions**

To develop and demonstrate solutions for the use of climate-natural, sustainable alternative fuels applicable to ships with high energy demand (e.g. long distance shipping) before 2030

To develop and demonstrate before 2030 solutions for the integration of high-capacity batteries solutions as single energy source for short distance shipping (up to 150 to 200 nautical miles)

To develop and demonstrate solutions for port based supply infrastructure (i.e. infrastructure for bunkering of alternative fuels and electricity) needed to enable zero-emission waterborn transport, to be implemented by 2030 at the latest

To develop and demonstrate solutions for clean and climate-neutral, climate-resilient inland waterway vessels before 2030

Fig.18 - Medium term innovation objectives – design and retrofitting’s priorities, reproduced from [R.12]

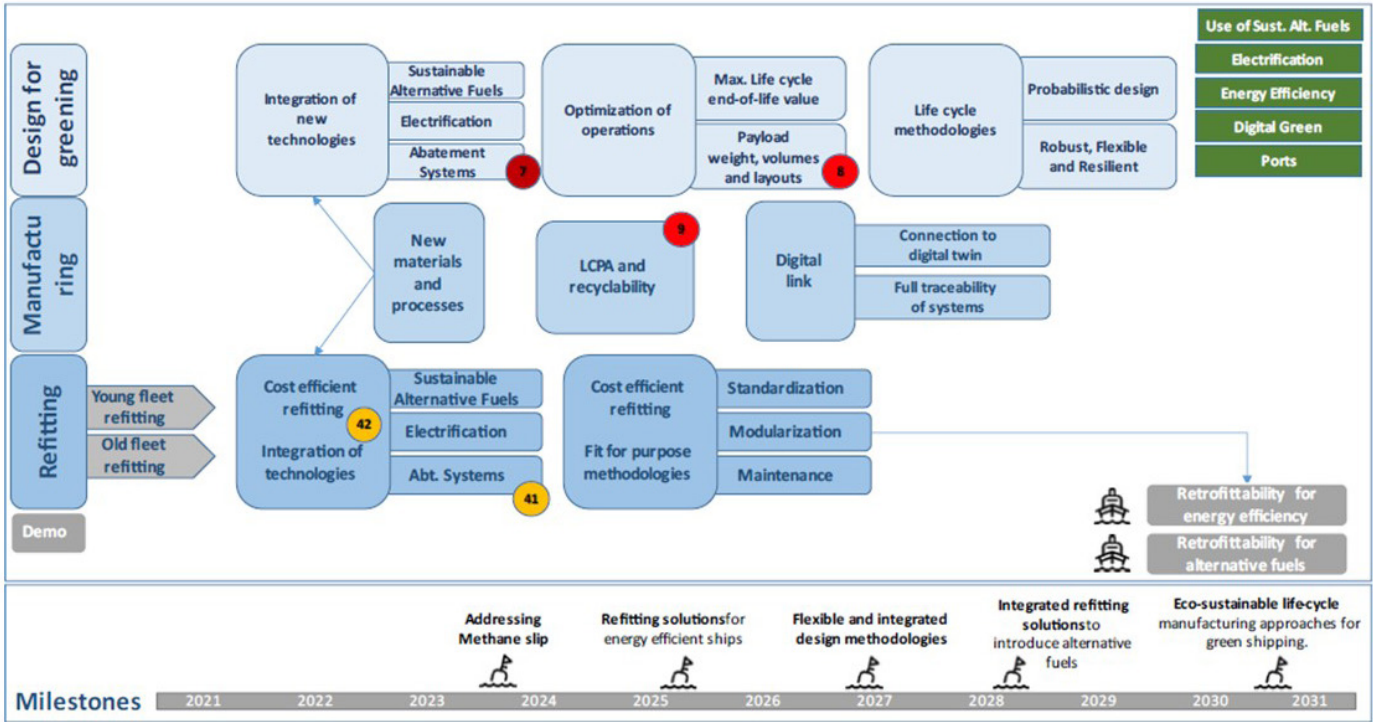


Fig.19 - Medium term innovation priorities – design and retrofitting’s priorities, reproduced from [R.12]

2.2 - Ports

Medium term innovation in ports is mainly related to the “technology enabler” role that, already in these days and more and more in the future, ports are taking: ports are no longer only a hub of goods, they are already hubs of data and related ICT solutions and are rapidly becoming hubs of alternative fuels. The concept of green and smart port is being rapidly being replaced by that of greening and digital enabling hub, a transformation that is expected to materialise by 2040 having been demonstrated by 2030. Worthless to remind, the main obstacle here is of economic nature: the level of investment required to adapt all ports being very significant, it will naturally happen gradually.

OPERATIONAL OBJECTIVES

✓

**Eliminating GHG emissions**

To develop and demonstrate solutions for port based supply infrastructure (i.e. infrastructure for bunkering of alternative fuels and electricity) needed to enable zero-emission waterborn transport, to be implemented by 2030 at the latest

✓

**Eliminating air pollution**

To develop and demonstrate solutions to cut coastal and inland pollution to air from inland waterway transport and maritime shipping by at least 50% by 2030, compared to current levels

✓

**Eliminating water pollution**

To develop and demonstrate solutions to eliminate pollution to water (including harmful underwater noise) from ships, by 2030

Fig.20 - Medium term innovation objectives – ports’ priorities, reproduced from [R.12]



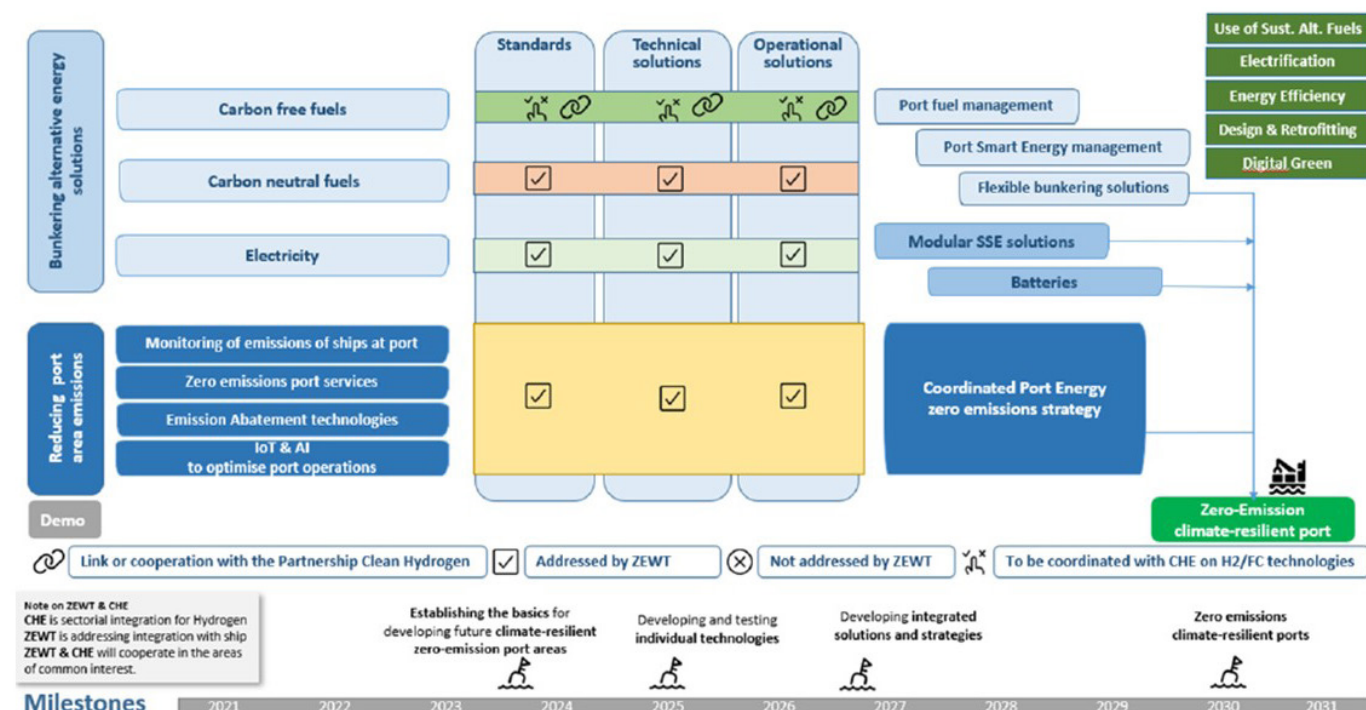


Fig. 21 - Medium term innovation priorities – ports' priorities, reproduced from [R.12]

## 2.3 - Mediterranean specificities

In the Mediterranean region, LNG has seen rapid adoption due to its availability and EU regulations promoting cleaner shipping. Ports are expanding LNG bunkering facilities, and investments in hydrogen infrastructure are growing, but challenges remain in scaling up ammonia and hydrogen solutions.

### Challenges & Outlook

- Infrastructure Gaps: Most ports are not yet ready to handle new fuels. Significant investments are required to make alternative fuel supply chains viable
- Regulatory & Cost Barriers: Higher costs and regulatory uncertainty slow the transition, with full-scale adoption of zero-carbon fuels likely only after 2040
- Technological Developments: Shipbuilders are prioritizing dual-fuel vessels as a bridge toward full decarbonization, indicating that the transition will be incremental rather than immediate
- Solutions for EU inland navigation (Danube, Rhine and Tago rivers, the latter also for urban transport in the metropolitan area of Lisbon) are of interest also for non-EU Mediterranean countries, specially Egypt for Nile river navigation

# Long term horizon – achieving net zero maritime transport

Although it is challenging to try and make forecasts with a 25-year horizon when dealing with green technologies as these might either very rapidly develop or suddenly slow down because of new/revised global (IMO) and/or regional (EU) policies not yet fully defined today.

This having said, it seems that at least three technologies will need a long term (2050) horizon to be deployed, namely On-Board Carbon Capture, Maritime Autonomous Surface Ships (MASS) and Nuclear Power. For the two latter, the reason for this is that:

- MASS, although technologically possible already today as far as ship systems are concerned, the related legal aspects suggest implementation will not necessarily be quick; just in view of example, for a MASS ship, totally unmanned and operated from remote including with at least some Artificial Intelligence, the “commanding officer”, “crew” and “seafarer certified skills” concepts will certainly have a significantly different meaning than now and this will require comprehensive review of almost all IMO conventions as well as of the way maritime transport insurance work.
- Nuclear Power also is technologically not far from deployment. The delaying factor here is the public perception that is potentially long to overcome.

## 3.1 - Innovation priorities in shipbuilding

### Small Nuclear Reactors (SMR)

As of today, nuclear power is not accounted for in the FuelEU Maritime Regulation, and is absent from the list of zero-emission technologies (Annex III), which is currently limited to fuels cells, on-board electricity storage, and on-board electricity production from wind and solar energy. The regulation does have a mechanism for the addition of new technologies to Annex III “where these new technologies are found equivalent to the technologies listed in that Annex in the light of scientific and technical progress.”

Should nuclear power be added to Annex III, it would fit the broader requirements of a zero-emission technology under the regulation as it does not emit:

- carbon dioxide (CO<sub>2</sub>)
- methane (CH<sub>4</sub>)
- nitrous oxides (N<sub>2</sub>O)
- sulphur oxides (SO<sub>x</sub>)
- nitrogen oxides (NO<sub>x</sub>)
- particulate matter (PM)

Moreover, EU ETS foresees pooling and allows owners to bring together ships that have been operated within a fleet, within a company or among companies. The objective is to encourage the deployment of new vessels using low- GHG-emission or zero-GHG-emission solutions, instead of focusing only on improving the performance of existing vessels. Pooling therefore allows the reduced GHG intensity of one vessel to be shared amongst a fleet to lower the GHG intensity of other ships in the fleet and reduce their exposure to financial penalties which can be incurred under FuelEU Maritime. This most likely will encourage the uptake of zero GHG fuels, such as nuclear.

Indeed, interest in the use of nuclear power for shipping is driven by its emissions reductions. Nuclear power offers a path to the end goal of emissions reduction in shipping – zero emissions operation – and does so without the uncertainty of fuel and bunkering infrastructure development. The future availability of green fuel to operate a ship is no longer a concern once an agreement is in place for the lease of a reactor.

As mentioned, the social acceptance and the current regulatory ambiguity are the primary challenges for the early adoption of small modular reactors (SMR) in the maritime industry.

According to LR [R.14], building upon decades of accumulated knowledge, SMRs represent a leap forward in reactor design, emphasising safety, efficiency, and modularity for streamlined production. The safety of nuclear power in shipping remains paramount. Stringent safety protocols and advanced reactor designs prioritise the protection of both crew and environment. As SMR technology matures and regulatory clarity increases, ship designs optimised for nuclear propulsion will emerge, ushering in a new era of efficient and environmentally friendly vessels.

### On board Carbon Capture

The concept of onboard carbon capture (OCC) is based on technology which captures the carbon on board the vessel before the CO<sub>2</sub> is emitted to the atmosphere through the exhaust. Studies show that the technology can be applied safely on vessels, but it still needs to be further developed and optimized for maritime use and integration. Key factors that affect the technical feasibility of onboard carbon capture for a dedicated vessel are the size, operational profile and trading pattern, the machinery capacity for power and heat production, and the space available.

The main challenge for this technology lies in the fact that development of infrastructure is needed. Sustainable ways to dispose of the captured CO<sub>2</sub> will be required, meaning that there needs to be a CO<sub>2</sub> value chain in place with reception facilities in various ports, as well as processes on managing and sustainable handling. It should be noted that the operating profile needs to be taken into consideration as it is strongly connected with the CO<sub>2</sub> tank sizes and impact on the voyages, and hence on techno-economics.

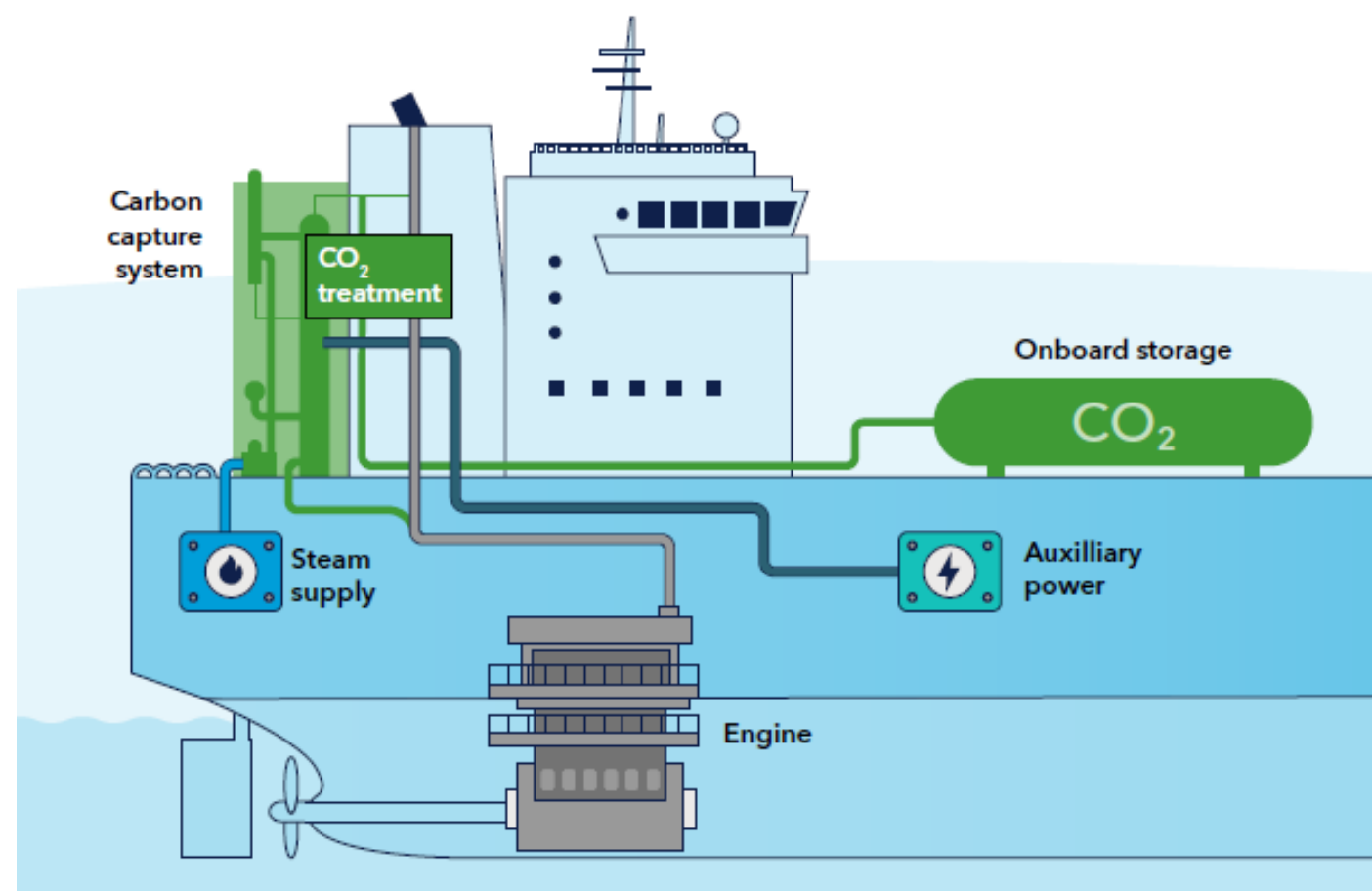


Fig. 22 - Simplified illustration of on-board CCS system, reproduced from [R.15]

Due to the technology's novelty in maritime, the IMO has not yet established any rules and regulations explicitly for carbon capture that address the possible safety implications for onboard implementation.

Retrofit of OCC can be a viable solution for vessels where there is space available for the capture plant as well as onboard storage. Onboard modifications are required to fit the system compartments (capture, treatment, storage, consumable facilities), their casings, and their structural foundations.

Specifying a «Ready» design at newbuilding stage will reduce implications and costs for a future retrofit.

## 3.2 - Innovation priorities in boatbuilding

The International Council of Marine Industry Associations (ICOMIA) published in November 2023 a very comprehensive study on the recreational marine industry decarbonisation [R.16] where the baseline fossil fuelled (gasoline & diesel) Internal Combustion Engine (ICE) is compared with five different propulsion technologies namely hybrid electric, hydrogen ICE or fuel cell, ICE with drop-in sustainable marine fuels<sup>7</sup> including HVO and e-gasoline, and battery electric. This was done for nine representative recreational crafts, all below 24 m. in length, as summarised in figure 23.

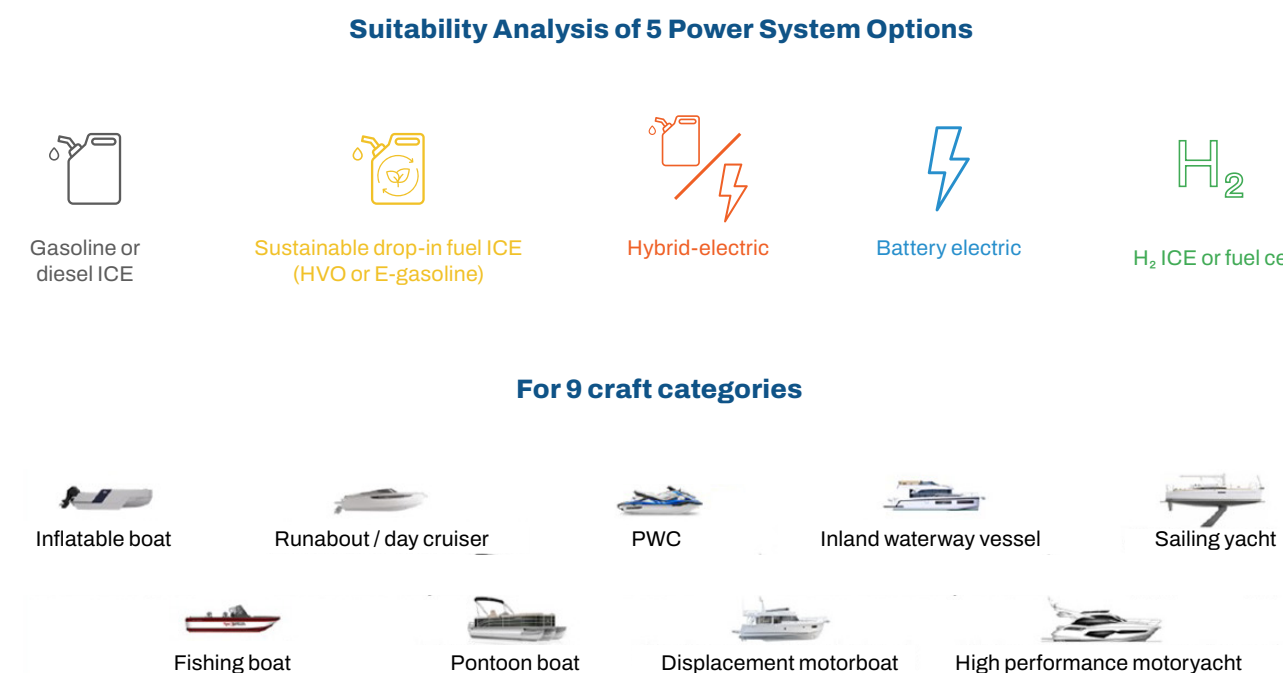


Fig. 23 - Scope of ICOMIA study (reproduced from [R.16])

Current technological challenges can be summarised, based on ICOMIA study, as follows:

1. Hybrid systems and sustainable fuel internal combustion engines (ICEs) can maintain the same range and power as current baseline ICEs with minimal to no impact to the vessel displacement and on-board space.
2. Pure battery electric and hydrogen propulsion craft will require a significant reduction in range and potentially also power to mitigate impacts on vessel mass, on-board volume and purchase price.
3. It is impractical to match the range and performance of baseline fossil fuels when sizing a hydrogen or battery-electric propulsion system as the H<sub>2</sub> tanks or batteries take up too much space within the craft or are simply too heavy to be practical. Therefore, because of the necessary reduction in hydrogen tank storage or battery pack size, the runabout/day cruiser's range is reduced by 80% relative to the baseline fuel. The fishing boat's range by 76%, and the displacement motorboat's range by 90%.

7. Drop-in fuel refers to alternative fuels, like biofuels or renewable hydrocarbons, that can be used as a direct replacement for conventional petroleum-based fuels without requiring any changes to existing engines, fuel systems, or infrastructure

One very specific aspect of the small leisure boats sector is that recreational craft engines are operated on average between 35 and 48 hours per year. In a LCA approach this makes it more difficult to achieve sufficient emission reductions in the use phase to outweigh the higher production and maintenance impacts of electric only, hybrid and hydrogen systems. These embodied impacts are especially associated with the battery and hydrogen (H2) storage components and are magnified if these components must be replaced in the lifetime of the craft. Keeping that in mind, the study identified, for each of the 9 types of crafts, the propulsion system having the lowest Global Warming Potential (GWP) relative to the baseline ICE+fossil fuels (current) solution. This is depicted in figure 24 and summarised in the study’s conclusions [R.16] as follows:

- Internal combustion engines (ICEs) powered by drop-in fuels are suitable candidates as they can provide significant GHG savings, especially for craft with low utilisation and long lifetimes which are highly susceptible to manufacturing and maintenance impacts. This is the case, however, only if low carbon electricity is used in drop-in fuel production.
- The pure battery electric propulsion system has a notably higher contribution from raw materials and manufacturing than other propulsion systems. Consequently, craft types with lower utilisation (which increases the relative importance of raw material and manufacturing impacts) are unlikely to find that the battery electric system results in a reduction in GWP compared to the baseline ICE.
- Hydrogen produced via electrolysis with zero fossil fuel electricity, also has a good GHG reduction potential.

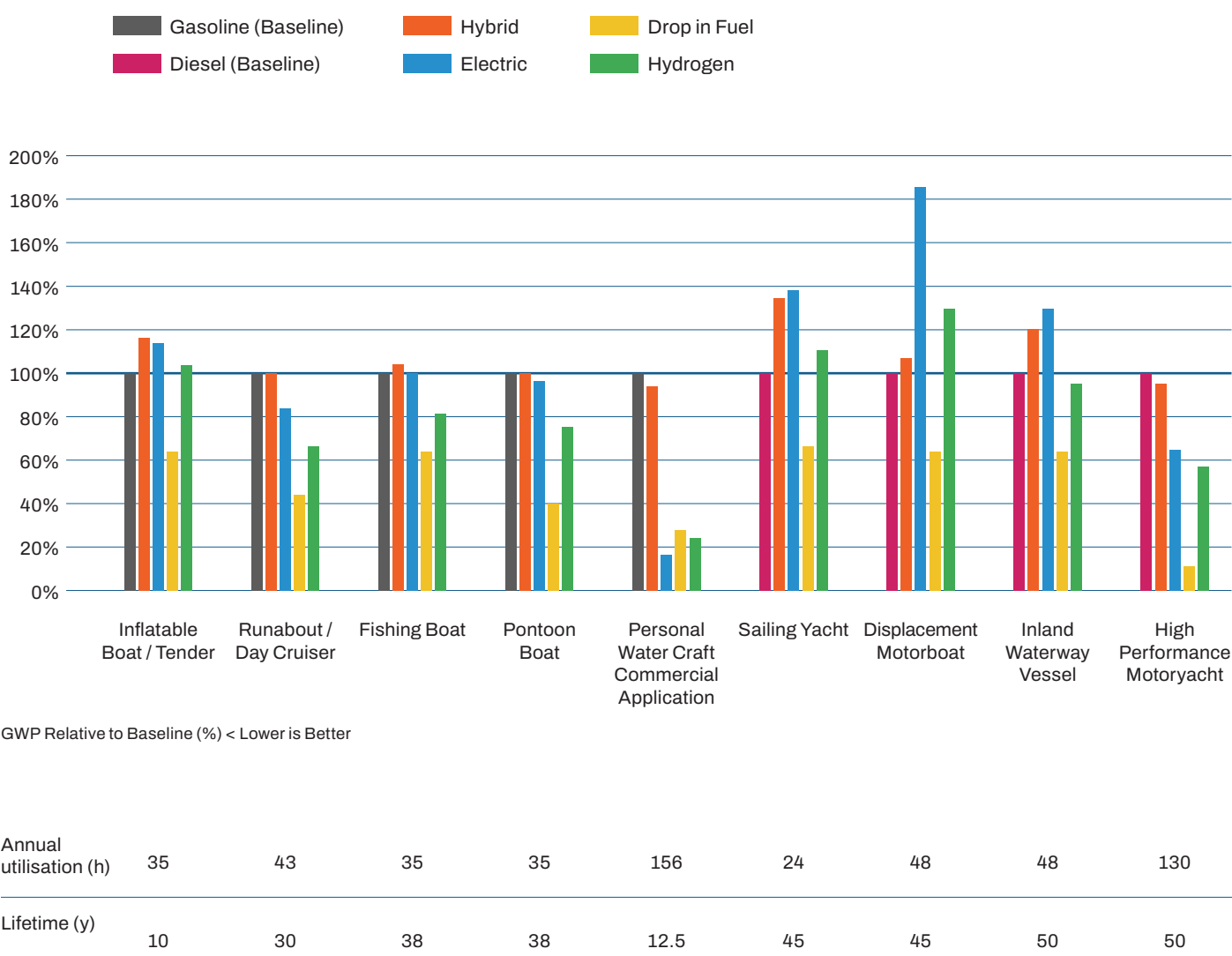


Fig.24 - Lowest GWP for each propulsion system compared to baseline (ICE+fossil). Lower values result in lower CO<sub>2</sub> emissions over the craft lifetime. (figure reproduced from [R.16])

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[R.6] lloydslist.com; bts.gov

[R.7] Homepage - Eca4Med

[R.8] LR – Shipping and Fit for 55, 2024

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[R.12] SRIA, EU ZEWT Partnership, 2024 (231229\_SRIA\_Zero\_Emission\_Waterborne\_Transport\_2.0\_clean.pdf)

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[R.14] LR Fuel or Thoughts – Nuclear, 2024

[R.15] DNV, Energy Efficiency Guidance Paper, 2025

[R.16] ICOMIA, Pathways to Propulsion Decarbonisation for the Recreational Marine Industry, Synopsis Report, November 2023

APPENDED SUPPORTING DOCUMENTS

The following documents and reports, recommended for further reading, are listed as follows:

S1 – 2024 Review of maritime transport – United Nations Conference on Trade and Development (UNCTAD)

S2 – Shipping and FIT FOR 55 – LR

S3 – Large Yacht Code, Part A, July 2024 edition – Red Ensign Group

S4 – Pathways to Propulsion Decarbonisation for the Recreational Marine Industry, Synopsis Report – ICOMIA

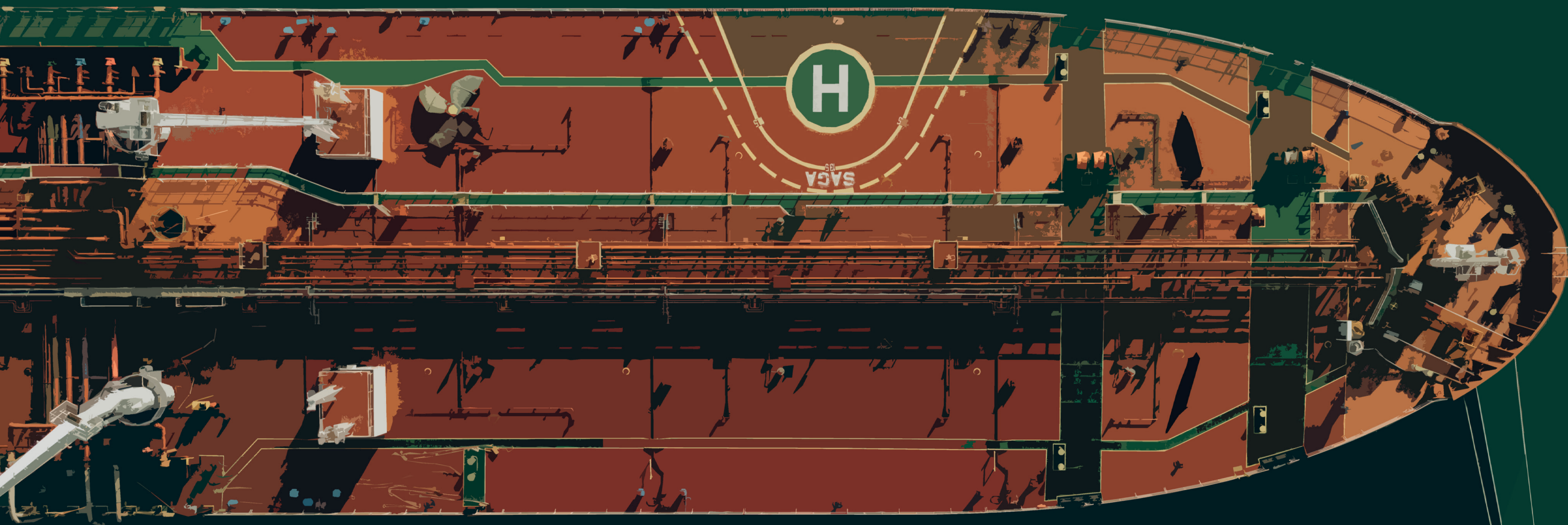
S5 – EUROPEAN MARITIME TRANSPORT ENVIRONMENTAL REPORT (EMTER) 2025 – EEA-EMSA Joint Report 15/2024

S6 – Strategic Research and Innovation Agenda (SRIA) for the Partnership on Zero-Emission Waterborne Transport, updated January 2024

S7 – Energy-efficiency measures and technologies - DNV



# Instruments of private finance for Green Shipping



2



# Research Objectives and Definition and Principles of Green Shipping

The increasing awareness of environmental impacts within the maritime sector, coupled with the urgent need to reduce climate-altering emissions, is profoundly transforming the ocean economy. Today, logistics and shipping operations are no longer evaluated solely in terms of efficiency and operating costs; the capacity to adopt sustainable technologies and practices has become crucial to maintain competitiveness. In this scenario, finance—both public and private—emerges as an indispensable lever to accelerate the transition towards “green shipping.”

This section aims to provide a comprehensive overview of key financial instruments (green and blue bonds, venture capital, private equity, carbon credits), public policies, and international programs designed to support the ecological transition of fleets and port infrastructure. Through an examination of economic opportunities as well as investment risks and challenges, the report emphasizes the importance of an integrated and collaborative approach, where governments, financial institutions, and industry players cooperate to promote technological solutions that balance competitiveness with environmental protection.

This transformation goes beyond mere technical evolution. Adopting green technologies and new operational models in maritime transport involves regulatory, logistical, and financial complexities. The ongoing transformation can create competitive advantages and market opportunities for forward-looking companies, yet it simultaneously requires robust risk mitigation strategies, regulatory clarity, and structural economic support. In accordance with the overall objective of WP2 (Assess the Status Quo of Mediterranean Green Shipping) in the GREEN MARINE MED project, the following sections provide a detailed overview of the current “state of the art” in green finance and sustainable innovation in the maritime sector. They also offer recommendations and future scenarios for a sector that is strategically important not only economically but also for protecting marine ecosystems and combating climate change.



Fig.1 - CO<sub>2</sub> Emissions (million tonnes) from the Maritime Sector (2016-2021)

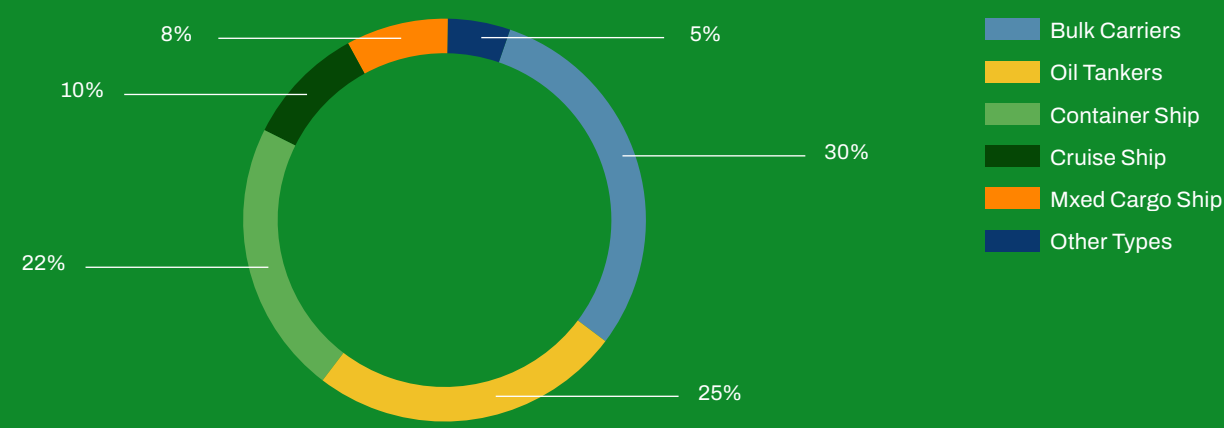


Fig.2 - Distribution of Maritime Sector Emissions by Ship Type

## Methodology

The methodology adopted in this report is based on an integrated and multidimensional approach, designed to thoroughly and comprehensively analyze the dynamics of the ecological transition in the maritime sector (Green Shipping), with particular focus on the strategic role played by public and private finance.

The initial phase of the research involved an extensive literature review (desk research), aimed at identifying and analyzing relevant international documents and scientific, institutional, and industry-specific publications. This activity enabled the collection of pertinent information on the state of the art regarding innovative financial instruments, environmental policies, and sustainable initiatives in the maritime sector. It facilitated an accurate mapping of current trends, international best practices, and the most effective instruments in terms of financing and supporting ecological transition.

The second phase consisted of conducting a structured survey administered to a representative sample of stakeholders from both the financial and maritime sectors, including public institutions, financial entities, investment funds, incubators, accelerators, and maritime companies. The survey, comprising both qualitative and quantitative questions, was designed to capture direct experiences, perceptions, financial instruments employed, encountered difficulties, and future expectations regarding the transition toward Green Shipping.

The analysis of data collected through the survey utilized descriptive statistical techniques to interpret results, highlighting regional differences and similarities, identifying common trends, and specific needs reported by respondents. Combining the primary data from the survey with secondary data gathered during the desk research phase ensured robustness and validity of the report’s conclusions.

Finally, the concluding phase involved a critical and interpretative synthesis of the obtained results, structured into practical and operational recommendations directed toward policymakers, financial institutions, and private operators. This synthesis aims to provide a solid foundation for future effective and sustainable strategies and decisions, concretely supporting the decision-making processes of stakeholders involved in the maritime sector’s sustainable transition.

# State of the Art of Private and Public Finance in the Maritime Sector

This chapter provides an in-depth overview of financial resources driving the ecological transition in the maritime sector, considering both private and public perspectives. Three significant types of financing will be discussed: Venture capital, that is private equity investment that is focused on start-up companies. VCs back entrepreneurs who have bright ideas but need finance and expertise to get their companies off the ground and grow. Private equity, that is a form of professional investment that involves taking an ownership interest (equity) in a company and holding it private hands – as opposed to on a public stock exchange”; and Green Bonds, which are fixed-income financial instruments specifically issued to raise capital for projects with positive environmental or climate benefits. Furthermore, the chapter explores public policies and government incentives, including international initiatives, supporting maritime operators in decarbonizing fleets and port infrastructures. The chapter will analyze the dynamics and actors involved in private finance, followed by an examination of instruments implemented by governments and multilateral organizations to support green shipping.

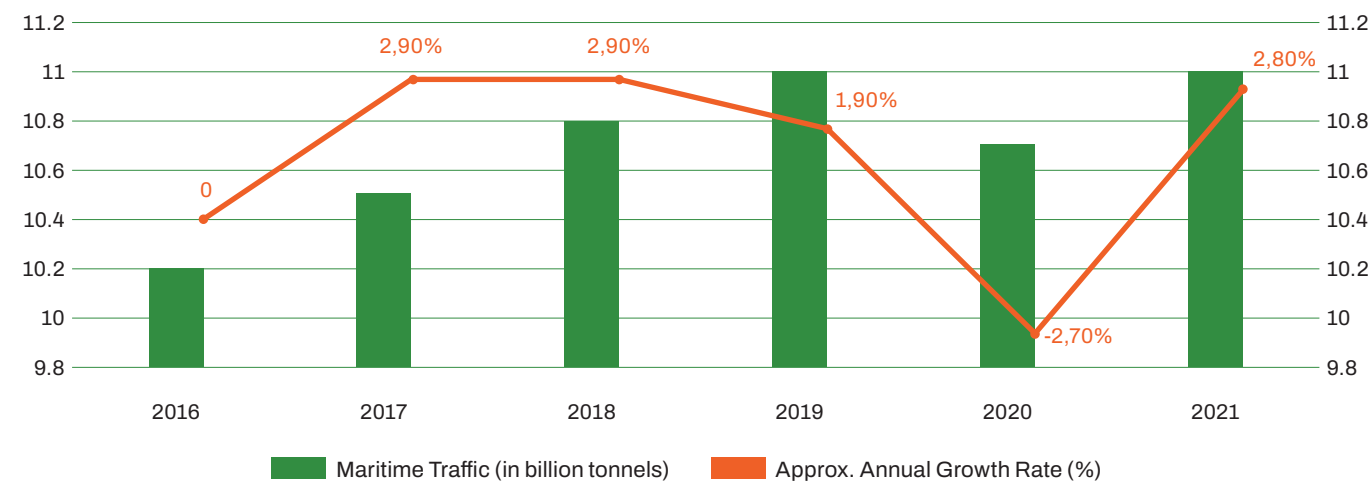


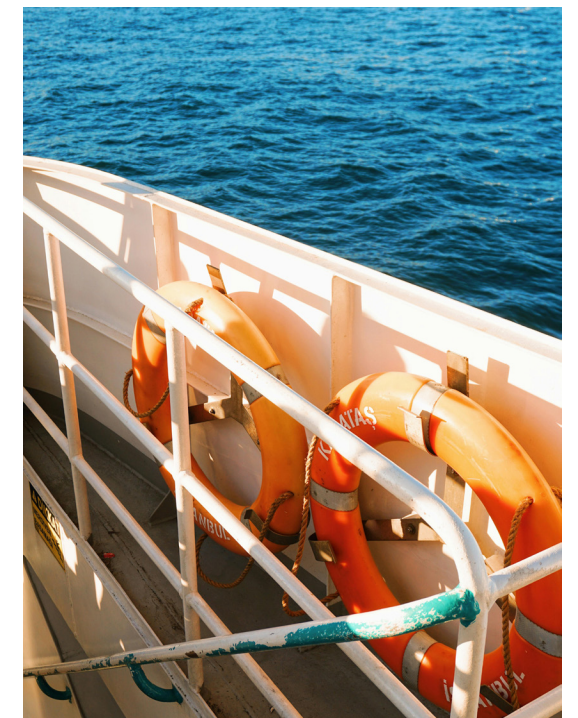
Fig.3 - Global Maritime Traffic Volumes (2016-2021)

## International landscape of private finance

Historically characterized by substantial capital investment and long-term financial cycles, the maritime sector is undergoing significant transformation due to green transition pressures and increased sustainability awareness. Within this evolving context, private finance plays an increasingly central role, with various actors—from venture capital to major private equity funds and green bond issuers—actively funding innovative, environmentally friendly solutions. Concurrently, financial institutions and traditional banks are realigning their strategies with decarbonization objectives, establishing “green” credit lines, and fostering partnerships with governments and maritime operators committed to greenhouse gas emissions reduction.

### 1.1 - Private investments: venture capital, private equity, and green bonds

This section examines the key approaches by which private finance supports the maritime sector’s green transition. Three essential financial instruments will be analyzed: venture capital, focused on early-stage startups and innovative technologies; private equity, which supports mature companies seeking growth or market consolidation through sustainable strategies; and green bonds, bonds specifically issued to finance environmentally impactful maritime projects.





## THE RANGE OF FINANCIAL INTERMEDIARIES

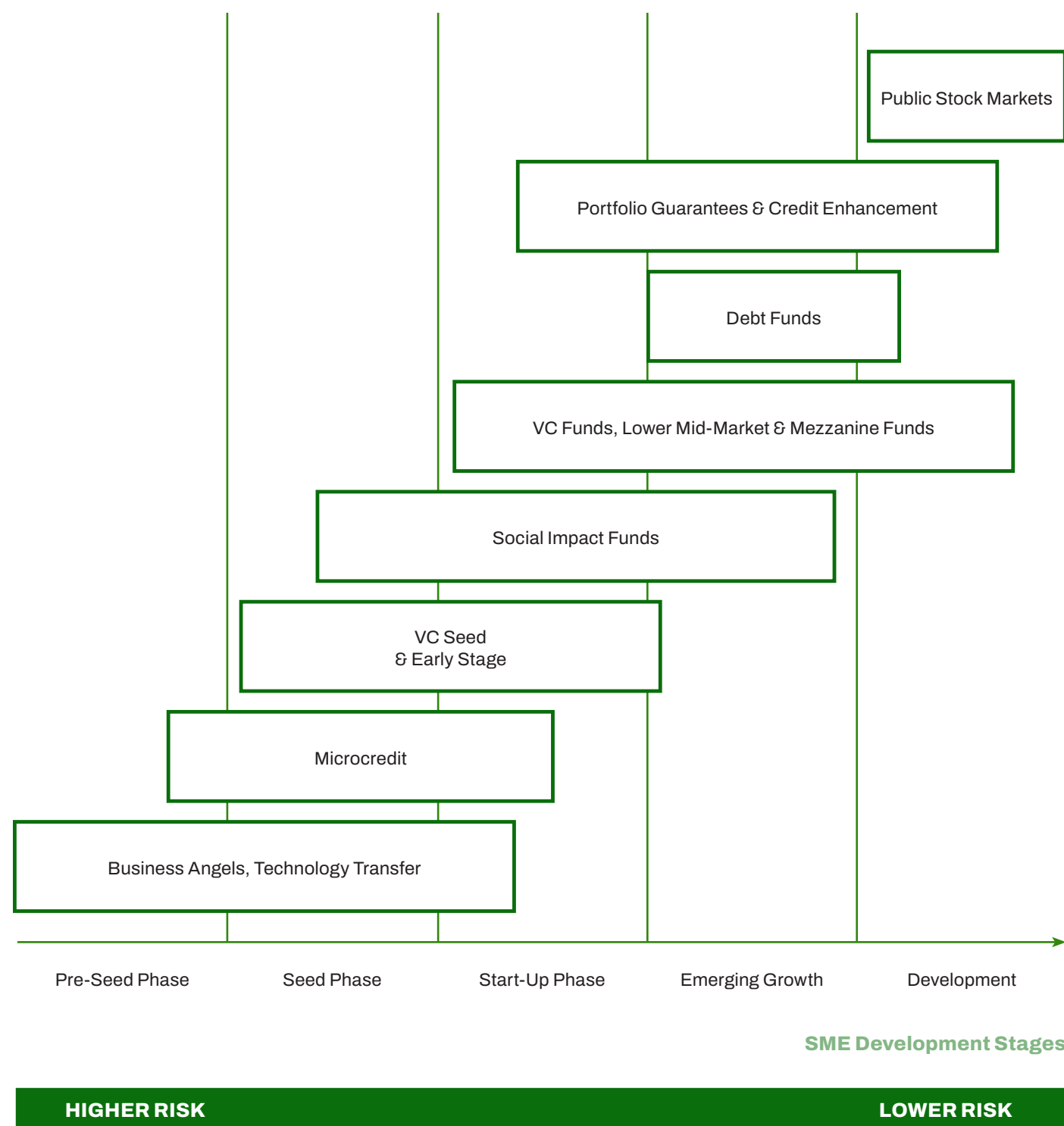
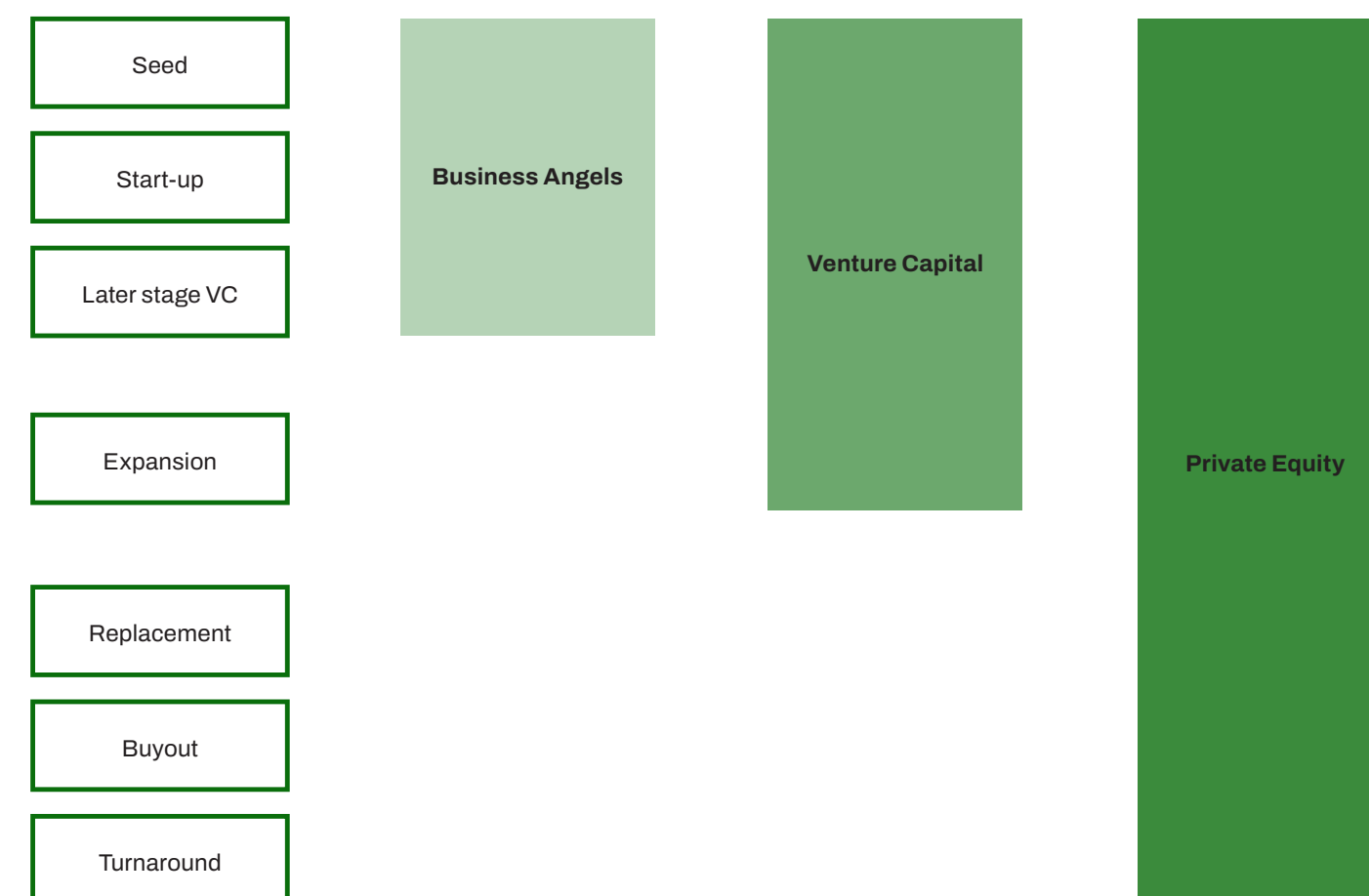


Fig.4 - Funding option for a startup/SME from [www.investeurope.eu/about-private-equity](http://www.investeurope.eu/about-private-equity)

Fig.5 - Investment Stages from [www.investeurope.eu/about-private-equity](http://www.investeurope.eu/about-private-equity)



### Venture Capital

#### Focus on disruptive technologies

In recent years, numerous maritime startups (“blue tech”) have emerged, developing innovations like electric and hybrid propulsion systems, artificial intelligence for route optimization, IoT sensors for real-time emissions monitoring, and predictive maintenance management.

Venture capital funds, traditionally focused on IT and biotechnology sectors, have progressively expanded into maritime markets, recognizing significant growth potential driven by sustainability initiatives.

#### Increasing early-stage funding rounds

Promising startups can secure capital at early stages (seed, Series A) due to interest from investors specializing in cleantech or blue economy.

Venture capital investments are often supplemented by public tenders or institutional funding programs (e.g., European Investment Bank or regional development programs), creating a mixed public-private financial ecosystem.

#### Focus on digital and low environmental impact solutions

Investors pay particular attention to innovations reducing fuel consumption, environmental impact, and operational costs. Artificial intelligence and machine learning solutions for route planning, big data analytics for vessel performance management, and data-sharing platforms among port operators represent key investment areas.

#### Concrete examples:

Venture capital funds like Plug and Play or Katapult Ocean (specialized in sustainability-focused oceanic startups) have invested in innovative businesses dealing with alternative fuels, emission monitoring devices, and route optimization software for maritime companies.

- *Plug and Play*: A venture capital fund and startup ecosystem that, in 11 years, became one of the world’s leading innovation platforms, connecting startups, investors, and large corporations, raising over \$5 billion in capital, and making more than 150 investments annually.
- *Katapult Ocean*: Invests in startups aiming for profitable businesses with a positive ocean impact, catalyzing capital, talent, corporations, and startups to accelerate blue change and achieve the UN Sustainable Development Goals, especially SDG 14 (Life Below Water).

Private Equity

M&A operations and buyouts

Private equity (PE) funds predominantly enter during the growth and consolidation phases of mature companies or shipping groups, providing significant capital in exchange for substantial equity stakes. Investments frequently target fleet retrofitting (green retrofits), acquisitions of technological companies, and market strengthening in segments with high growth potential (e.g., hybrid ferries, sustainable cruise ships, specialized shipyards).

Creation of “green shipping” thematic portfolios

Several large PE funds have begun establishing dedicated investment platforms for sustainable maritime sectors, diversifying risks across multiple assets: cargo ships, shipyards, propulsion systems, and eco-friendly port logistics. These funds target medium-to-long-term financial returns, benefiting from the ecological transition and tightening emission regulations. The anticipated rise in demand for low-impact environmental solutions drives value growth in portfolio companies.

Adoption of ESG criteria

PE funds increasingly incorporate ESG (Environmental, Social, and Governance) criteria in investment strategies, assessing the environmental and social impacts of target companies. Within maritime operations, factors like energy efficiency, emissions reduction, and transparent governance policies are critical in evaluating M&A opportunities. This trend is strengthened by growing interest from limited partners (LPs), demanding sustainability-focused investments.

Green Bonds

Bond issuances targeting the maritime sector

Green bonds are among the most utilized financial tools channeling funds towards decarbonization projects. While green bonds have been issued by governments and private companies for several years, their direct linkage to shipping has only recently solidified. Proceeds must finance specific investments: new low-emission vessels, retrofits (e.g., scrubber installation), hybrid engines, and cold ironing infrastructures (shore electrification).

Strict reporting standards

To qualify as green bonds, issuances must comply with Green Bond Principles (issued by ICMA – International Capital Market Association) or similar guidelines, necessitating clear reporting on the use of proceeds, environmental impact assessment, and third-party verification. Such transparency protects investors, mitigates greenwashing, and ensures funds are genuinely deployed for sustainable projects.

Interest rates and issuer benefits

Issuers of green bonds for sustainable shipping projects gain market reputation advantages, attracting specialized investors (ESG funds, ethical banks, environmentally conscious insurers). In some cases, this results in more favorable interest rates compared to traditional bonds, expanding the pool of potential subscribers interested in initiatives with positive climate impacts.

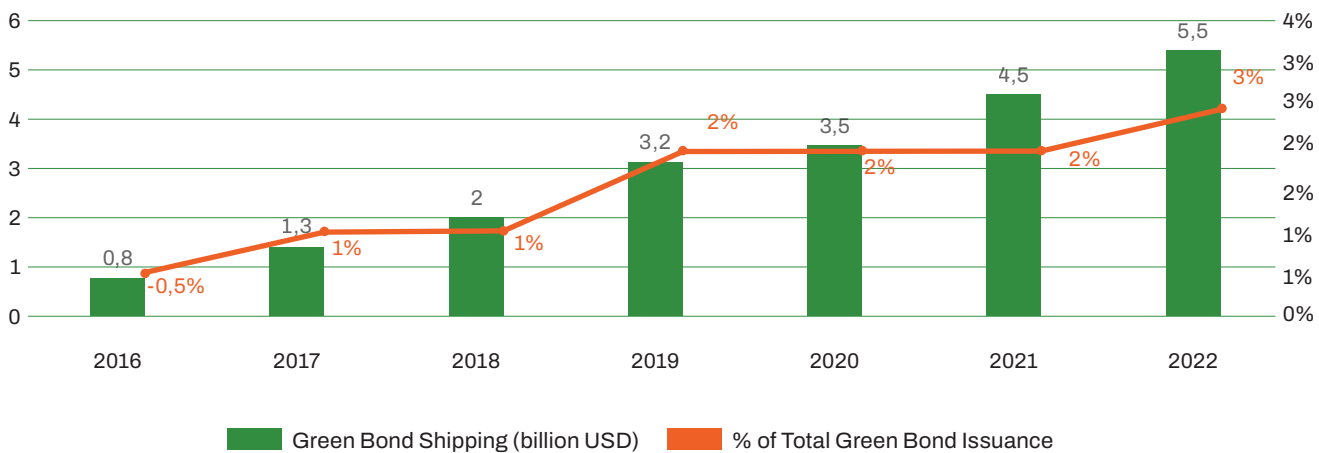


Fig.6 - Issuance of Green Bonds Related to Shipping (2016-2022)

1.2 - The Role of Financial Institutions and Banks

This section explores the strategic role financial institutions and banks are assuming in maritime sector decarbonization efforts. Particular attention will be given to the **Poseidon Principles** and ESG criteria, demonstrating how banks increasingly integrate sustainability into their lending decisions, thus significantly contributing to reducing the sector’s environmental footprint.

Commercial Banks and Specialized Credit Institutions

Concessional Financing for Retrofit and Decarbonization Projects

Commercial banks and specialized shipping finance institutions (particularly in Northern Europe and Asia) offer dedicated credit lines aimed at fleet modernization and the adoption of clean technologies. These loans often feature favorable interest rates or extended grace periods, especially when accompanied by state guarantees or credit insurance schemes backed by international organizations (e.g., European Investment Bank - EIB, European Bank for Reconstruction and Development - EBRD, Kreditanstalt für Wiederaufbau - KfW).

ESG Criteria and Reputational Risks

Numerous banks and financial institutions adhere to the Poseidon Principles, an initiative designed to align shipping finance with CO<sub>2</sub> emission reduction targets. Signatory banks calculate greenhouse gas emissions of vessels within their loan portfolios to verify compliance with IMO targets. Currently, 35 financial institutions have signed the Poseidon Principles, representing over 80% of the global maritime loan portfolio. Signatories commit to integrating these principles into internal policies, procedures, and standards, collaborating closely with clients and partners to achieve environmental compliance. Consequently, shipping companies with strong emissions reduction plans and sustainability track records can secure better financing conditions, while those failing to adapt may face increased capital costs or loan denial. Growing financial market awareness of climate risks compels banks to limit exposure to potential “stranded assets,” such as heavily polluting older vessels lacking retrofit plans.

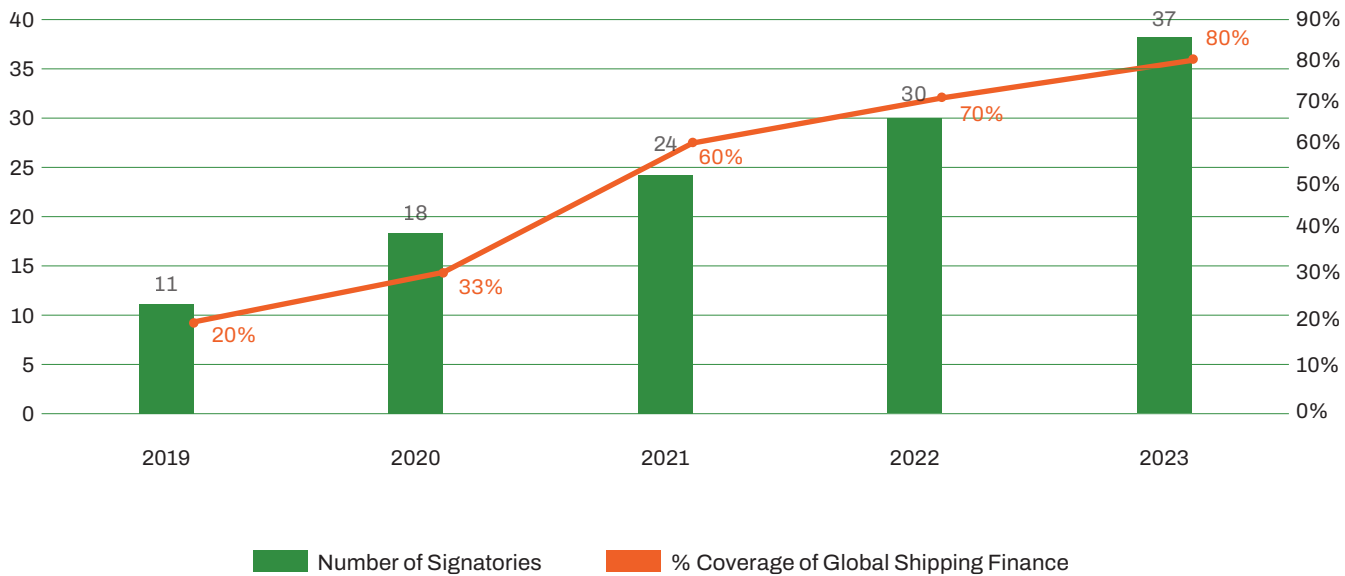


Fig.7 - Number of Institutions Signing the Poseidon Principles (2019-2023)

Consultancy Services and Partnerships

Credit institutions often extend beyond capital provision, offering consultancy services to help businesses navigate ecological transition. This includes assistance with business planning, feasibility studies for new technologies, and cash-flow analyses in carbon-pricing scenarios. Certain banks form strategic partnerships with shipowners and shipyards, promoting innovative hubs and co-investing in experimental projects (fuel cells, green ammonia, onboard CO<sub>2</sub> capture technologies, etc.).



### *Multilateral Development Banks and Other Institutional Actors*

#### **Catalytic Role of EIB, IFC, and EBRD**

Multilateral development banks primarily focus on poverty reduction and economic development. The European Investment Bank (EIB), International Finance Corporation (IFC, part of the World Bank Group), and the European Bank for Reconstruction and Development (EBRD) play a crucial role in financing green maritime projects, especially in emerging or transition regions.

They provide co-financing instruments, guarantees, concessional loans, and technical assistance, thereby reducing risk for private investors and facilitating the construction of “green” port infrastructures and adoption of low-carbon technologies.

#### **Concessional Loans for Strategic Projects**

Many countries collaborate with development banks to implement national maritime emission reduction plans, such as building LNG terminals, retrofitting public fleets (ferries, naval vessels), and installing cold ironing facilities.

These “critical infrastructure” projects typically receive priority funding given their strategic significance in meeting climate targets and enhancing economic competitiveness.

#### **Bilateral Initiatives and Blended Funds**

Certain banks and financial institutions create blended public-private funds dedicated exclusively to sustainable maritime projects. These funds aggregate resources from various stakeholders (states, multilateral institutions, pension funds, insurance companies, etc.), significantly enhancing investment capacity.

This risk-sharing model is particularly important for more experimental ventures, such as hydrogen-powered vessels or integrated green ammonia production and distribution networks.

### *Conclusions*

Private finance in the maritime sector is undergoing significant restructuring driven by emerging environmental needs and increasing demand for clean technological solutions. Private investments—from venture capital to private equity and green bonds—are crucial levers to accelerate the transition towards low or zero-emission shipping, particularly when combined with public and multilateral financial tools.

At the same time, financial institutions and banks are evolving their roles: traditionally based primarily on cash-flow analysis and asset valuation, lending decisions now incorporate ESG parameters and project sustainability profiles. Innovative banks not only provide capital but also strategic advisory services for fleet decarbonization, guiding the sector towards a greener future.

Looking forward, the synergy of private finance and institutional support (from multilateral banks and governments) will continue shaping the global shipping landscape. This dynamic will drive shipowners, shipyards, and technology providers to deeply integrate sustainability criteria into their growth strategies. Establishing clear environmental standards, common green bond protocols, and stabilizing “green” financial markets will be crucial for consolidating this trend and positioning maritime transportation as a leading player in climate change mitigation and ocean protection.



# Public Finance: Policies and Government Incentives

The decarbonization of the maritime sector requires substantial financial resources and a clear political commitment to support green initiatives. In addition to private investments (venture capital, private equity, green bonds), sovereign wealth funds, government subsidies, and international programs created and supported by multilateral organizations play a crucial role. This section explores the main public policy instruments, both at national and international levels, that help steer the market toward sustainable solutions and mitigate the economic risks associated with new technologies.

## 2.1 - Sovereign Wealth Funds and Subsidies

This section analyzes public sector interventions in maritime ecological transition through targeted policies and government initiatives. It highlights the primary types of public incentives and funding adopted at both national and international levels, focusing particularly on support mechanisms aimed at reducing the upfront costs of investments in sustainable fleets and innovative port infrastructure.

### *Creation of State Funds and Co-Financing Mechanisms*

#### **Green Sovereign Wealth Funds**

Some countries with sovereign wealth funds are progressively integrating ESG (Environmental, Social, and Governance) criteria and decarbonization objectives into their investment strategies.

These funds can support the transformation of the maritime sector by investing in shipyards specializing in low-carbon solutions or financing crucial infrastructure projects (LNG storage facilities, ammonia bunkering terminals, electric charging stations in ports).

#### **Non-Repayable Grants and Subsidies**

Many governments establish subsidy programs for companies adopting sustainable technologies in the shipping sector, covering part of the costs for research, development, or ship retrofitting.

These subsidies can fund the installation of pollution reduction systems (scrubbers, filters, CO<sub>2</sub> capture technologies) or promote the purchase of methanol, ammonia, LNG-powered engines, or electric batteries.

The availability of public funds at preferential rates or through grants stimulates innovation and reduces investment risks for private operators.

#### **Eco-Incentive Schemes and Tax Benefits**

Some maritime authorities offer port tax reductions for ships demonstrating superior environmental performance, such as lower CO<sub>2</sub> emissions per nautical mile traveled.

Governments may also implement tax credits or enhanced depreciation schemes for expenditures related to energy efficiency and alternative fuel use. These measures encourage early adoption of low-impact solutions while improving the competitiveness of local businesses in the international market.

### *Concrete examples*

- The **European Union**, through the **FuelEU Maritime Regulation**, has introduced progressive requirements to reduce the greenhouse gas intensity of fuels used by large vessels calling at EU ports. This measure incentivizes the adoption of alternative fuels and low-carbon solutions, supporting the green transition of maritime transport while enhancing the competitiveness of more sustainable operators.
- In several European countries, including Italy, France, and Denmark, **White Certificate schemes** have been implemented to reward companies that invest in energy efficiency. These certificates, which certify the amount of energy saved, can be traded or used to meet regulatory obligations, encouraging the maritime sector to adopt low-impact and energy-saving technologies.
- The **Norwegian government**, through the **Sovereign Wealth Fund** and **Enova** (an agency under the Ministry of Climate and Environment), has provided substantial subsidies for the development of fully electric ferries and LNG-hybrid vessels, making Norway a global leader in reducing emissions in short-sea shipping.
- In **Asia**, **Singapore** has established co-financing schemes for the digitalization and sustainability of ports, lowering the implementation costs of green technologies for shipping companies.



*National Transition Plans and Industrial Development Strategies*

**National Climate and Energy Plans**

Many governments incorporate specific maritime sector objectives into their national decarbonization plans (Nationally Determined Contributions – NDCs, within the Paris Agreement framework). These plans often include targeted measures, such as mandatory CO<sub>2</sub> emission reductions of a certain percentage by 2030-2040, alongside financial allocations to facilitate the transition. The definition of intermediate milestones and measurable targets provides certainty for investors, enabling them to plan interventions within a stable regulatory framework.

**Industrial Strategies for Shipbuilding and Research**

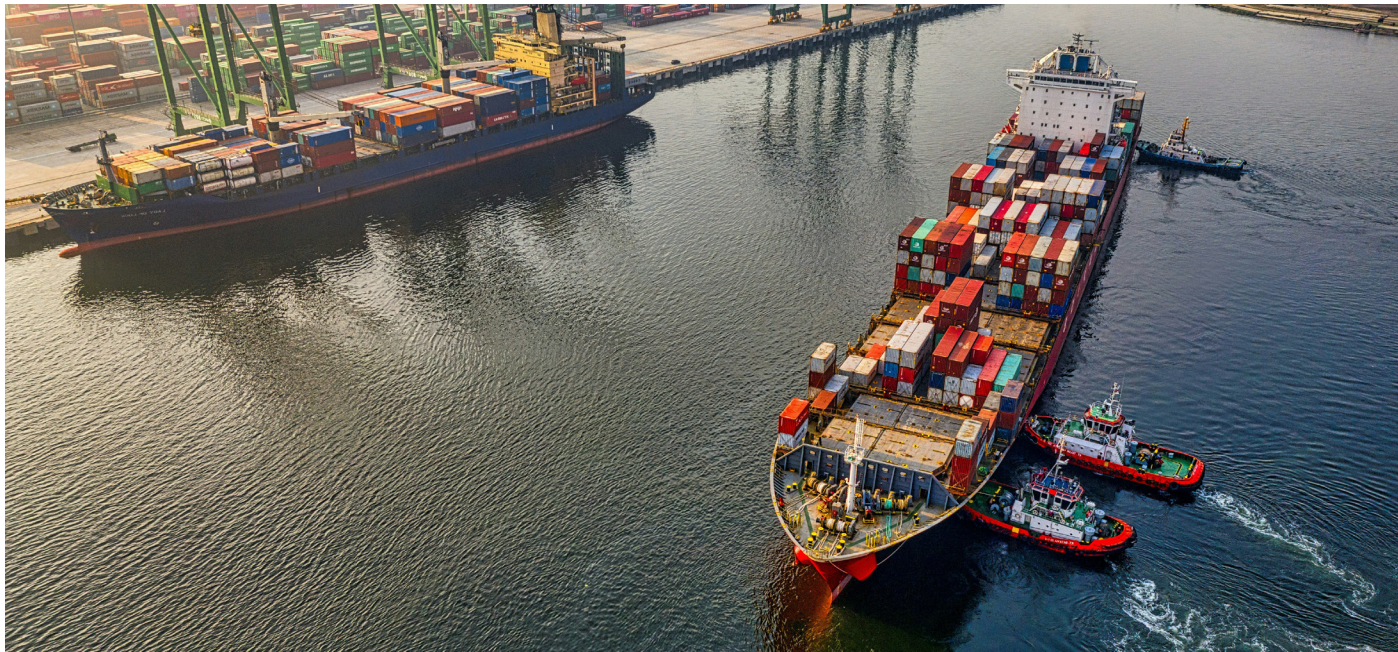
Governments aiming to develop a domestic supply chain for green shipyards and component manufacturing (hybrid engines, digital technologies, high-efficiency coatings, etc.) establish dedicated industrial plans, allocating public funds to R&D projects. This approach not only supports the modernization of national fleets but also enhances the international competitiveness of local companies, allowing them to export maritime technology and expertise.

**Emission Trading System (ETS)**

Under an **ETS**, each operator must hold a sufficient number of emission allowances (permits) to cover the amount of CO<sub>2</sub> (or equivalent greenhouse gases) emitted by their activities. A maritime company exceeding its allocated CO<sub>2</sub> emissions must purchase additional carbon credits from the market. Conversely, if it reduces emissions below its assigned cap, it can sell excess allowances, monetizing its environmental efficiency. In the short-to-medium term, many shipping companies will not be able to fully renew or retrofit their fleets to meet emission requirements immediately. As a result, purchasing carbon credits will become essential for compliance and avoiding penalties. This mechanism allows companies to gain time while completing investments in new technologies (hybrid engines, LNG, methanol, ammonia, hydrogen propulsion) or retrofit solutions. With the **introduction of the Emission Trading System (ETS) for shipping**, carbon credit purchases are becoming a strategic lever for maritime companies, incentivizing a faster transition to sustainable technologies (Further insights on ETS are provided in Section Innovative Financial Instruments for the Green Transition).

*Concrete examples*

- The German government has launched a **National Action Plan for Climate-Friendly Shipping**, providing the maritime industry with a coordinated roadmap for emissions reduction. The plan includes measures such as the development of alternative propulsion systems, the provision of climate-neutral energy sources, and the modernization of the national fleet. The objective is to strengthen the competitiveness of Germany’s maritime sector, demonstrating that climate protection and industrial development can advance hand in hand.
- The United Kingdom has developed a **Maritime Decarbonisation Strategy**, outlining a national plan to support energy innovation and emissions reduction across the shipping sector. The strategy includes incentive programs to accelerate the production and adoption of low- and zero-emission marine fuels, as well as grants to support retrofitting of vessels with modern, energy-efficient designs. These measures aim to promote the uptake of decarbonisation technologies while reducing cost-related barriers for industry stakeholders.



## 2.2 - International and Multilateral Programs

This section presents financial instruments and programs promoted by international institutions to accelerate sustainability in the maritime sector at a global level. It describes how multilateral organizations such as the **European Investment Bank (EIB)** and the **European Bank for Reconstruction and Development (EBRD)** support **green shipping** projects, facilitating cooperation among countries and the alignment of international standards.

*International Organizations and Financial Institutions*

**IMO (International Maritime Organization) and Related Initiatives**

The IMO is the specialized UN agency responsible for ship safety and the prevention of marine and atmospheric pollution from ships. The IMO’s work supports the United Nations’ Sustainable Development Goals (SDGs) and, while not a direct financier, promotes technical assistance programs and capacity building to help developing countries comply with environmental regulations, such as reducing sulfur oxides (SOx) and nitrogen oxides (NOx) emissions and implementing EEXI/CII efficiency requirements.

Since January 1, 2023, all ships are required to assess their compliance with the Energy Efficiency Existing Ship Index (EEXI) and to begin collecting data to report their annual Carbon Intensity Indicator (CII) rating. In this context, collaborations between IMO, the World Bank, and other financial entities can establish multilateral projects supporting the maritime transition through concessional loans or grants. Development Banks and Multilateral Organizations. Institutions such as the World Bank, International Finance Corporation (IFC), European Bank for Reconstruction and Development (EBRD), and European Investment Bank (EIB) offer credit lines, guarantees, or co-financing for green projects in the maritime sector. These institutions design specific programs, such as:

- **Green Shipping Guarantee Program**
- **Blue Economy Development Framework**
- **Clean Oceans Initiative**

These programs promote sustainable coastal development, encourage low-impact technology adoption, and support the creation of green port infrastructure.

Key References:

- **Green Shipping Guarantee Program**<sup>1</sup>
- **Blue Economy Development Framework**<sup>2</sup>
- **Clean Oceans Initiative**<sup>3</sup>

*Other Organizations (UNEP, GEF, GCF)*

The United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) fund marine protection and pollution reduction projects, including components dedicated to maritime traffic and fleet modernization. The Green Climate Fund (GCF), established under the United Nations Framework Convention on Climate Change (UNFCCC), provides non-repayable grants or concessional loans for decarbonization efforts in emerging countries, reducing fossil fuel dependency and fostering sustainable maritime solutions.

*Public-Private Partnerships and Pilot Projects*

**International Coalitions and Alliances**

Several global programs, such as the **Getting to Zero Coalition** (promoted by the Global Maritime Forum) and the **Poseidon Principles** partnership, bring together the public and private sectors along with civil society in a joint effort to achieve carbon neutrality in maritime transport. These coalitions facilitate the sharing of resources (both human and financial) and the implementation of large-scale pilot projects, which can serve as replicable models in other countries. In Europe, the **Waterborne Technology Platform** plays a pivotal role in uniting stakeholders across the inland and maritime waterborne transport sectors. Through the **Zero Emission Waterborne Transport (ZEWt)** partnership under **Horizon Europe**, several public-private pilot projects are being developed and co-funded to accelerate R&D and demonstrate innovative propulsion and fuel technologies.

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2. <https://thedocs.worldbank.org/en/doc/e5c1bdb0384e732de3cef6fd2eac41e5-0320072021/the-blue-economy-development-framework>  
3. <https://www.eib.org/en/publications/the-clean-oceans-initiative>



In the niche of high-end yachting, the **Water Revolution Foundation** is leading an industry-driven effort to accelerate the decarbonisation of the superyacht sector. By promoting cross-sector innovation, environmental awareness, and sustainable design principles, the Foundation provides a platform for public-private cooperation and technology transfer that aligns with global maritime climate objectives.

#### Demonstration Projects for New Technologies

Pilot projects funded by international organizations or through joint public-private partnerships aim to test real-world solutions such as hydrogen-powered ships, onboard fuel cell installations, ammonia-fueled engines, and carbon capture systems (CCS).

These projects provide a crucial showcase for industry stakeholders, lower entry barriers, and generate valuable data to improve the efficiency and reliability of technological solutions. Once a model is validated, businesses can scale up implementation with greater confidence and investor support.

A notable example is the **Hydrogen Pilot** launched within the **Vanguard Initiative**, a European interregional platform promoting cross-border industrial innovation. The hydrogen pilot includes a dedicated strand on maritime applications, with the goal of developing and scaling up hydrogen-based solutions for shipping and port ecosystems. By leveraging interregional cooperation and smart specialization strategies, this initiative fosters technology transfer and aligns industrial stakeholders across Europe to accelerate decarbonisation in the maritime sector.

#### Integrating the Value Chain: Ports, Land Transport, and Local Communities

The impact of maritime decarbonization extends beyond ships and encompasses the entire port and logistics ecosystem. Therefore, international programs often include elements such as shore power electrification (cold ironing), railway network development, and the adoption of electric or hybrid vehicles for port cargo handling.

Involving coastal communities and local governments ensures an integrated approach and reduces opposition to necessary infrastructure projects, as positive spillover effects—such as air pollution reduction and improved quality of life—are recognized and valued.

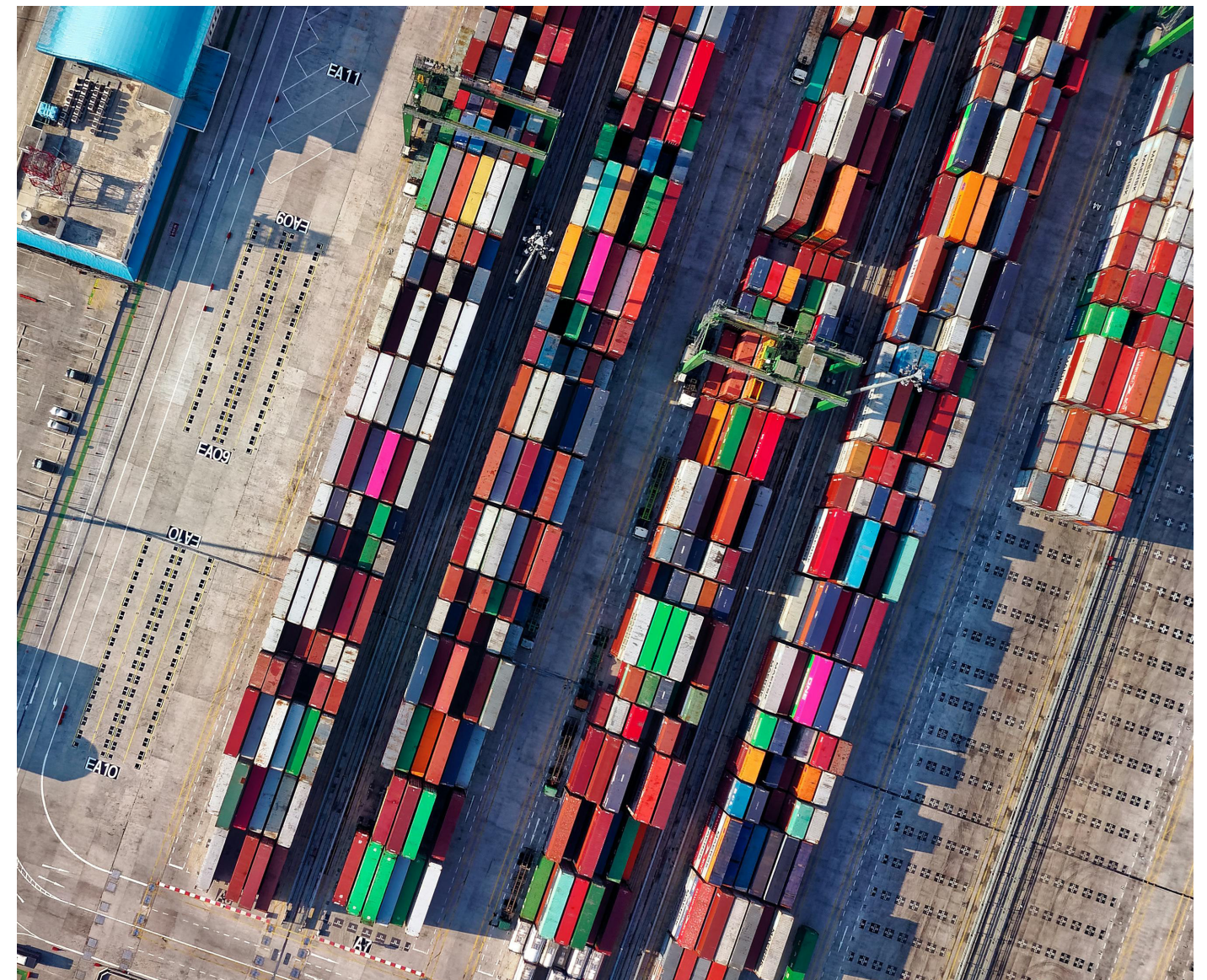
#### Conclusions

Public finance and international programs serve as critical levers in accelerating the ecological transition of the maritime sector. Sovereign wealth funds, government subsidies, and tax incentives ease the financial burden for companies investing in sustainable technologies, mitigating risks and making early adoption of green solutions more cost-effective. Simultaneously, multilateral institutions—such as the World Bank, European Investment Bank (EIB), and the International Maritime Organization (IMO)—provide resources and expertise for demonstration projects, strategic infrastructure development, and public-private partnerships.

This combination of instruments and policies is progressively shaping a financial ecosystem where environmental sustainability becomes a key determinant in investment priorities. While challenges remain—such as the need for unified technical standards and the reduction of alternative fuel costs—the joint commitment of governments, international organizations, and private actors is paving the way for a future in which shipping can balance economic efficiency with environmental responsibility.

# The Role of Finance in Green Shipping

This chapter delves into how finance, when properly structured and coordinated, can accelerate the development of low-environmental-impact shipping. First, in subsection “Innovative Financial Instruments for the Green Transition”, innovative financial instruments will be explored, including **carbon credits**, which represent one ton of CO<sub>2</sub> (or equivalent gases) that has not been emitted or has been removed, and **blue bonds**, bonds aimed at protecting and sustainably exploiting marine ecosystems. Then, in subsection “Public Financial Incentives and Their Impact”, the importance of public incentives will be explained, highlighting how they can reduce the initial costs for those investing in fleet renewal or adopting alternative fuels. Finally, subsection “Collaborations Between the Public and Private Sector” will present the **collaborations between the public and private sectors**, which are essential for overcoming the uncertainties related to technological innovation and sharing the risks of experimental projects.





# Innovative Financial Instruments for the Green Transition

The transition toward green shipping is one of the central challenges for the global maritime industry. According to the Fourth IMO Greenhouse Gas Study 2020 (IMO GHG, 2020), greenhouse gas (GHG) emissions from the maritime sector account for approximately 2.89% of global CO<sub>2</sub> emissions. Reducing this impact requires significant investments in research, development, and the deployment of clean technologies, as well as infrastructure upgrades in ports and along commercial routes.

In this context, finance plays a crucial role: through innovative financial instruments (such as green and blue bonds, carbon credits, etc.), targeted public incentives, and strategic collaborations between the public and private sectors, the decarbonization of the maritime industry can be significantly accelerated. Financial actors—banks, investment funds, and insurance companies—are progressively integrating environmental, social, and governance (ESG) criteria into their capital allocation decisions, in line with initiatives such as the Poseidon Principles (Poseidon Principles, 2019) and the European Green Deal (European Commission, 2019).

## 1.1 - Green Bonds and Blue Bonds

**Green Bonds** are debt securities issued to finance projects, assets, or activities with clear and measurable environmental benefits, in compliance with international standards and guidelines (for example, the *Green Bond Principles* issued by the International Capital Market Association - ICMA). The main difference from traditional bonds lies in the issuer's obligation to ensure that the funds raised are used exclusively for “green” purposes. In the maritime sector, this translates into investments for:

- **Retrofitting and ship conversion:** upgrading engines and onboard systems to reduce pollutant emissions
- **Development of low-impact fleets:** construction of ships powered by **LNG (Liquefied Natural Gas)**, **methanol**, **green ammonia**, or **hydrogen**
- **Sustainable port infrastructure:** cold ironing (shore power supply during port stops), electric charging stations, advanced waste and ballast water management systems

**Blue Bonds**, on the other hand, focus on the protection and sustainable development of marine ecosystems. Often issued by supranational institutions or governments of coastal countries, these instruments finance projects such as:

- Conservation of coral reefs and coastal habitats (mangroves, dunes, and wetlands)
- Low-impact fishing vessels and sustainable fishing technologies
- Removal of plastics and waste from marine and coastal waters
- Research projects on marine-derived biofuels (algae, microalgae)

## Blue Economy Debt Fund

The Blue Economy Debt Fund is Italy's first private debt initiative entirely dedicated to supporting companies operating within the maritime sector, excluding fisheries and extraction activities. Promoted by Consulinvest and Zenit SGR, the fund aims to foster the growth of SMEs through flexible and targeted debt instruments, with a clear focus on innovation, sustainability, and competitiveness.

The fund has set a fundraising target of €150 million, with the first investments expected to commence upon reaching at least half of the target amount, projected for Spring 2024. Key sectors eligible for financing include shipbuilding, port logistics, coastal tourism, offshore renewable energy, and marine environmental protection, as well as the broader field of technological innovation applied to the marine economy.

The overarching goal is to support the ecological and digital transition of Italy's maritime industries, contributing to the sustainable economic development of coastal and marine activities. The governance model includes an investment committee composed of leading industry stakeholders, ensuring strategic alignment with the priorities of the national maritime economy.

## Faros Accelerator

Launched in 2021 by CDP Venture Capital SGR, Faros is Italy's first accelerator exclusively dedicated to the Blue Economy. Managed by alcube and supported by the Ionian Sea Port System Authority (Port of Taranto) and Wylab (La Spezia hub), the program serves as a catalyst for innovation-driven growth in marine-related industries.

Faros provides startups with access to an extensive support system, including funding of up to €75,000 in convertible equity per project, with the possibility of follow-on investments up to €400,000 for the most promising ventures. The overall financial resources dedicated to the initiative amount to approximately €3 million from CDP Venture Capital, complemented by over €1 million from corporate and institutional partners.

The acceleration program, lasting four months, focuses on eight strategic areas: Smart Ports and Green Shipping, Ocean Data, Ocean Energy Systems, Sea Health and Restoration, Sustainable Aquaculture, Innovative Use of Marine Resources, Shipbuilding, and Coastal Tourism. Faros operates across two territorial hubs — Taranto and La Spezia — leveraging a network of prominent partners such as Eni (Joule), Fincantieri, RINA, Crédit Agricole Italia, and Duferco to enhance open innovation and facilitate pilot project development.

Through its integrated model, Faros aims to promote a resilient and sustainable ocean economy, nurturing new ventures that can drive technological advancement and environmental stewardship in the marine sector.

## BlueInvest Program

BlueInvest Program is a flagship initiative launched by the European Commission in 2019 with the goal of accelerating innovation and unlocking investment opportunities within the sustainable Blue Economy. Funded by the European Maritime, Fisheries and Aquaculture Fund (EMFAF) and embedded within the broader InvestEU framework, BlueInvest addresses the critical need for investment-readiness support and access to finance for ocean-based entrepreneurs. The platform benefits from a dedicated budget of €9.8 million and has led to the establishment of a specific equity investment initiative managed by the European Investment Fund (EIF), aiming to mobilize €500 million to support financial intermediaries investing in the sector.

BlueInvest provides a wide range of services including coaching for high-potential startups and SMEs, investment-readiness assistance, matchmaking events between investors and entrepreneurs, and the development of a specialized investor community focused on sustainable marine industries. To date, the program has supported over 200 SMEs, featured more than 2,400 projects in its online pipeline, and facilitated 24 successful investment agreements.

Through these activities, BlueInvest plays a pivotal role in building a strong, innovation-driven European blue economy, reducing risks for investors, and accelerating the adoption of cutting-edge technologies across marine sectors.

# CASE STUDY



# Baleària sustainable financing agreement

Baleària sustainable financing agreement in the country’s maritime sector. In 2022, an €80 million syndicated loan, coordinated by CaixaBank with participation from institutions like Abanca, Banca March, BBVA, Cajamar, and Santander, was structured as a sustainability-linked loan. The interest rate is tied to two key environmental performance indicators: the number of eco-efficient vessels in Baleària’s fleet and the proportion of ships equipped with shore-side electrical connections while docked. The financing supports Baleària’s ambitious decarbonization strategy, which includes the integration of cleaner propulsion technologies such as liquefied natural gas (LNG), electric batteries, and renewable fuels like biomethane and green hydrogen. Notably, the company has invested over €500 million in developing a fleet of 11 dual-fuel vessels capable of operating on LNG and prepared for future renewable energy sources. Baleària’s commitment to sustainability extends beyond fleet modernization. The company is actively working on establishing the first green maritime corridor between Europe and Africa, connecting Tarifa (Spain) and Tangier Ville (Morocco). This project involves the construction of two 100% electric, zero-emission fast ferries and the electrification of port infrastructure, representing a total investment of €160 million.

# Green Shipping Fund

Managed by PROW Capital, is a financing initiative dedicated to promoting environmentally sustainable practices in the maritime industry. The fund provides capital to shipowners and operators for projects that enhance energy efficiency, reduce emissions, and adopt green technologies, thus supporting the transition towards more sustainable shipping operations. The Green Shipping Fund (GSF) is a EUR 420 million private debt fund which provides tailor-made debt financing for new and existing vessels that comply with PROW Capital’s eligibility criteria, or for emissions-reducing retrofits. PROW Capital’s ambition is to make zero emission shipping a reality and become a viable long-term alternative to the traditional banks in the maritime sector.

# Global Cleantech Innovation Programme (GCIP) Türkiye

The Global Cleantech Innovation Programme (GCIP) Türkiye is a national initiative dedicated to fostering clean technology innovation, with a growing focus on solutions that can directly support the sustainable transformation of the maritime sector and the blue economy. Managed by the Scientific and Technological Research Council of Türkiye (TÜBİTAK), in partnership with the United Nations Industrial Development Organization (UNIDO) and the Global Environment Facility (GEF), GCIP Türkiye operates under the auspices of the Ministry of Industry and Technology. Through its structured acceleration program, GCIP Türkiye offers business training, tailored mentorship, and access to networks of investors and industry partners. Startups developing cleantech applications for the maritime sector, such as low emission propulsion systems, sustainable shipbuilding materials, smart logistics solutions, and coastal environmental monitoring technologies — are supported in scaling their solutions and reaching broader markets. By integrating the maritime dimension into its cleantech innovation strategy, GCIP Türkiye significantly contributes to the development of a more resilient, sustainable, and innovation-driven blue economy. Its approach aligns with global efforts to decarbonize maritime transport, protect marine environments, and foster sustainable economic growth linked to ocean resources.

# Blue Bonds - Seychelles

The government of Seychelles issued a \$15 million Blue Bond in 2018, with support from the World Bank, to finance the transition to sustainable fishing and the protection of marine The \$15 million bond was backed by a \$5 million guarantee from the World Bank and a \$5 million concessional loan from the Global Environment Facility (GEF), aiming to transition the country’s economy towards sustainable ocean-based activities. The proceeds from the bond were allocated to expand marine protected areas, improve governance of priority fisheries, and develop the Seychelles’ blue economy. Specifically, the funds supported the implementation of a Marine Spatial Plan covering the entire Exclusive Economic Zone (EEZ), aiming to designate 30% of it as protected areas by 2020. Additionally, investments were made to enhance the fisheries value chain, promote sustainable aquaculture, and support climate-resilient infrastructure projects. This innovative financing model not only provided critical funding for ocean conservation but also served as a blueprint for other nations seeking to leverage capital markets for sustainable marine initiatives. By aligning economic development with environmental stewardship, the Seychelles Blue Bond exemplifies how financial instruments can be structured to support the long-term health of ocean ecosystems while promoting economic resilience.

# Norway Green Bonds

The issuance of Green Bonds by Norwegian shipping companies (e.g., Østensjø Rederi - [www.hydrogenious-maritime.com](http://www.hydrogenious-maritime.com)) has supported the adoption of hybrid ships (diesel-electric) and the installation of lower-impact systems. Through the issuance of green bonds, the company has financed the development and retrofit of hybrid vessels, combining diesel-electric propulsion systems with battery technology to reduce emissions and enhance energy efficiency. One notable example is the retrofit of the offshore support vessels Edda Fauna and Edda Flora, which were equipped with Wärtsilä’s hybrid solutions. These upgrades led to significant reductions in fuel consumption, emissions, and maintenance costs, aligning with the International Maritime Organization’s (IMO) Tier III standards. The hybrid systems allow for optimized engine performance, particularly during dynamic positioning operations, contributing to a lower environmental footprint. Østensjø Rederi’s commitment to green shipping practices demonstrates the viability of sustainable technologies in the maritime sector. By leveraging green financing mechanisms, the company not only advances its environmental objectives but also sets a precedent for the adoption of clean technologies in shipping, contributing to the broader goals of decarbonizing the maritime industry.

Below is a list—as updated as possible and focused on the last three years—of Green Bond and Blue Bond issuances intended (or partially intended) for the maritime sector and environmental protection in the Mediterranean region. It should be noted that, as of today, there is no public and unified database that allows for a precise filtering of projects by geographical area and sector (maritime shipping). For this reason, the following list is based on a cross-analysis of data from institutional sources (such as *Climate Bonds Initiative*, *European Investment Bank*, *European Bank for Reconstruction and Development*), press releases from issuers, and research on specialized platforms (*Bloomberg*, *Refinitiv*, etc.).

## Important Notes

- Some of the listed bonds are multi-sectoral (financing projects in various fields, from transportation to renewable energy) but also include funding allocated to maritime operators or port infrastructure in the Mediterranean region.
- Detailed allocation information on the actual use of proceeds is sometimes partial or disclosed only in internal/confidential reports.
- Blue Bond issuances in the Mediterranean are still rare and are often more generally tied to the concept of “blue economy” (*ecosystem protection, sustainable fishing, coastal infrastructure*) rather than exclusively to “green shipping”.

# CASE STUDY

## Examples of Green Bonds for the Maritime Sector in the Mediterranean (Last 3 Years)

	Issuance Date	Amount	Purpose and Beneficiaries	Source
<b>Cassa Depositi e Prestiti (CDP) – Green Bond 2021</b> <i>Italy</i>	November 2021	€500 million	<ul style="list-style-type: none"> <li>– Energy efficiency, renewable energy, and sustainable mobility projects in Italy</li> <li>– Port infrastructure upgrades (particularly in Southern Italy) and ship retrofitting for operators engaged in Mediterranean cabotage</li> </ul>	CDP Green, Social and Sustainability Bonds Framework (CDP documentation)
<b>Intesa Sanpaolo – Green Bond 2021</b> <i>Italy</i>	December 2021	€1.25 billion	<ul style="list-style-type: none"> <li>– Ecological transition projects across multiple sectors (energy, transportation, construction)</li> <li>– A portion of the funds allocated to subsidized financing for the conversion of small and medium-sized shipping fleets (LNG and electric ferries) operating mainly in the Tyrrhenian and Adriatic seas</li> </ul>	Intesa Sanpaolo Green Bond Report 2021
<b>Institut Català de Finances (ICF) – Sustainable Bond 2022</b> <i>Spain</i>	June 2022	€300 million	<ul style="list-style-type: none"> <li>– Support for “green” and “social” initiatives in Catalonia</li> <li>– A small share (not precisely disclosed in reports) dedicated to upgrading some infrastructure at the Port of Barcelona (cold ironing) and co-financing research projects on alternative fuels (biofuels, LNG) for Spanish operators in the western Mediterranean</li> </ul>	ICF press releases and Catalunya Sustainable Bond Framework

	Issuance Date	Amount	Purpose and Beneficiaries	Source
<b>European Investment Bank (EIB) – Climate Awareness Bond (CAB) 2022</b>	Periodic reopenings of a bond platform (first in March 2022, followed by additional issuances in 2023)	Variable, over €1 billion in total	<ul style="list-style-type: none"> <li>– EIB invests proceeds in climate change mitigation and adaptation projects across the European Union</li> <li>– Part of the funds allocated to port efficiency projects and financing low-carbon technologies in maritime transport, focusing on projects in Spain, France, Italy, Greece, and Cyprus</li> </ul>	EIB Climate Awareness Bonds
<b>Grimaldi Group – Green Schuldschein 2023</b>	February 2023	~€200 million (Schuldschein = private debt instrument widely used in Germany)	<ul style="list-style-type: none"> <li>– Modernization of the ro-ro (roll-on/roll-off) and ro-pax (passenger and cargo) fleet operating in the Mediterranean basin</li> <li>– Installation of next-generation scrubbers and onboard energy consumption reduction systems</li> </ul>	Grimaldi Group press releases and Sustainalytics report on issuance framework



Examples of Blue Bonds in the Mediterranean Region (Last 3 Years)

The issuance of Blue Bonds targeted at the blue economy in the Mediterranean is still a limited phenomenon. While some countries (Seychelles, Fiji) have issued similar bonds in other oceans, in the Mediterranean, more recent initiatives have emerged, often supported by international organizations.

	Issuance Date	Amount	Purpose and Beneficiaries	Source
European Bank for Reconstruction and Development (EBRD) – “Blue Bond Pilot” (2022)	July 2022 (announced, finalized in early 2023)	€50 million (initial phase)	<ul style="list-style-type: none"><li>– Support for coastal protection projects, sustainable fishing, and marine pollution reduction in Southeastern Europe (Croatia, Montenegro, Albania, Greece)</li><li>– Possible extension to fleet renewal projects for eco-friendly fishing vessels</li></ul>	EBRD Press Releases
Banque Populaire du Maroc (with IFC) – Blue Bond Framework (2022)	December 2022	\$100 million (USD issuance, but funds allocated to projects in Morocco)	<ul style="list-style-type: none"><li>– Financing of blue economy projects along the Moroccan Mediterranean and North Atlantic coasts</li><li>– Coastal eco-tourism and modernization of artisanal fishing fleets with low-emission engines</li></ul>	IFC (International Finance Corporation) announcements
Provence-Alpes-Côte d’Azur (PACA) – Blue Economy Bond (Pilot Project)	October 2023 (announced, in structuring phase, not yet launched on the market at the time of writing)	€30-50 million (estimated)	<ul style="list-style-type: none"><li>– Coastal habitat restoration projects (Posidonia seagrass) and low-impact port infrastructure (ballast water recycling, cold ironing installations).</li><li>– Potential collaboration with regional ferry operators to reduce pollution in areas such as Marseille, Toulon, and Nice</li></ul>	Draft documentation reviewed at the PACA Regional Council; local press reports (Le Monde, Les Echos – PACA region)

Related Initiatives (Green and Blue Loans)

In addition to classic **bonds**, some **green loans** or **blue loans** of smaller scale, yet still relevant to **maritime operators in the Mediterranean**, are noteworthy:

- Green Loan by Banca Ifis (Italy) 2022: €20 million in financing for small navigation companies operating short-sea shipping (minor Italian islands)
- Blue Loan by Santander (Spain) 2022: a credit line dedicated to fishing cooperatives and blue economy initiatives in Andalusia and Murcia (*part of the regional post-Covid recovery program*)
- Blue Loan by National Bank of Greece (NBG) 2023: a low-interest loan for renewing part of the Greek fishing fleet, with traceability obligations and reduced impact on fish stocks

References and Further Reading

**Climate Bonds Initiative:**

- Global database of green and sustainable bonds (searchable by geography and sector, though often lacking detailed “Mediterranean shipping” filtering)

**European Investment Bank (EIB):**

- Climate Awareness Bonds
- Sustainability & Maritime Transport

**European Bank for Reconstruction and Development (EBRD):**

- Green & Blue Economy Financing
- Press releases on blue economy projects in Southeast Europe

**International Finance Corporation (IFC):**

- Blue Finance Initiatives

**Intesa Sanpaolo, CDP, Grimaldi Group:**

- Investor Relations / Sustainability sections on their websites, including *frameworks and reports* on the allocation of green/blue bond proceeds

**Mediterranean Reports and Studies:**

- *Union for the Mediterranean (UfM)*: Documents on the blue economy, cross-border projects, and sustainable finance initiatives in the Mediterranean
- *Plan Bleu (UNEP/MAP)*: Reports and statistics on economy and sustainability in the Mediterranean region

Conclusions

Rarity of Blue Bonds in the Mediterranean: Unlike other regions (*e.g., the Indian Ocean with Seychelles and Mauritius*), blue bond issuance in the Mediterranean is still in its infancy. Many initiatives remain in pilot or study phases, often coordinated with international institutions.

Multi-Sector Green Bonds: Most green bonds linked to the maritime sector in the Mediterranean finance multiple industries (*renewable energy, energy efficiency, road and rail transport*), with only a portion allocated to fleet retrofitting or port modernization.

Growth Prospects: With stricter European regulations coming into effect (*e.g., the extension of the Emission Trading System (ETS) to shipping from 2024/2025 and the approval of stricter environmental standards for ports*), a significant increase in thematic bond issuance (green/blue) and sustainable loans for maritime operators in the Mediterranean is expected.

Importance of Partnerships: Most projects are carried out through public bank cooperation (*EIB, EBRD*) and private entities, often within subsidized finance frameworks. This underscores the crucial role of public support policies in reducing risk for green/blue investments, incentivizing shipowners and ports to innovate.

Although the use of dedicated green and blue bonds for the Mediterranean maritime sector remains limited, significant examples of bond issuance and loans already contribute to the ecological transition of fleets and coastal ports. With evolving European and national policies on shipping decarbonization, further expansion of these sustainable finance instruments is expected in the coming years.

# 1.2 - Carbon Credits and Carbon Markets

Carbon credits represent a market-based tool designed to incentivize greenhouse gas emissions reduction. A carbon credit corresponds to one ton of CO<sub>2</sub> (or equivalent gases) that has been either prevented from being emitted or removed from the atmosphere through mitigation projects (*reforestation, renewable energy production, habitat protection, etc.*).

**How It Works:**

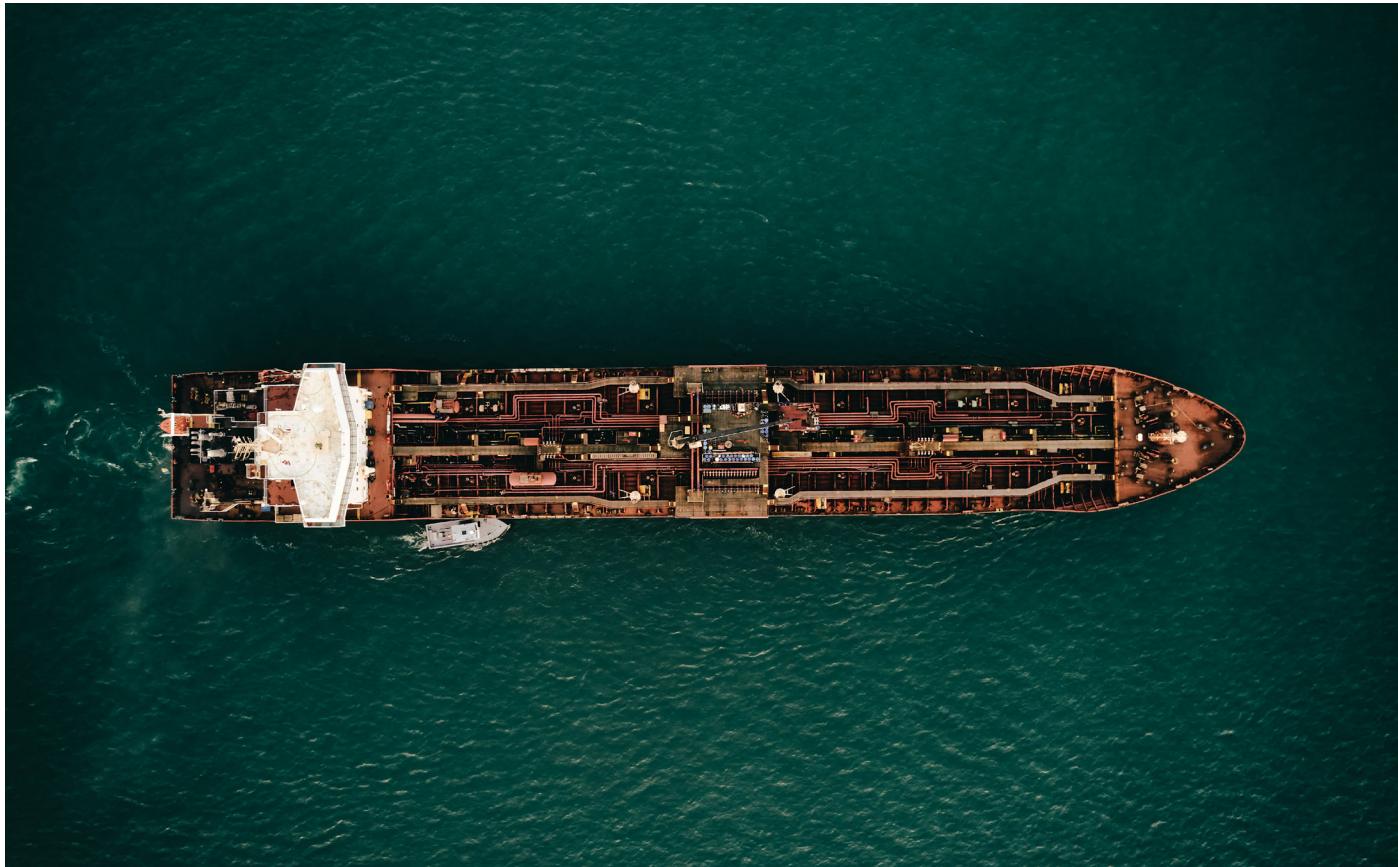
- A company exceeding a certain emissions threshold or wishing to offset its impact can purchase credits from projects that reduce or absorb CO<sub>2</sub>
- Credits are monitored and certified by international standards (*Gold Standard, Verified Carbon Standard, etc.*)
- Companies use these credits to partially offset emissions while they work on direct emission reductions through technological innovation and organizational changes

**Applications in the Maritime Sector:**

- Participation in the EU Emission Trading System (ETS), which is gradually extending to the shipping industry under the “Fit for 55” package (*European Commission, 2021*)
- Fit for 55 aims to cut net greenhouse gas emissions by at least 55% by 2030 and includes new legislative proposals ensuring that EU policies align with climate goals agreed upon by the European Council and Parliament
- Partnerships with NGOs and marine conservation projects, such as the creation of marine protected areas funded through blue carbon credit purchases

**RealWorld Example:**

- Maersk and CMA CGM, two of the world’s largest shipping carriers, have developed voluntary offset programs, investing in renewable energy projects and reforestation in Asia and Latin America (*Maersk, 2021*)
- Some cruise operators (e.g., MSC Cruises) are experimenting with partial carbon neutrality for their fleets, purchasing carbon credits from certified projects



# Public Financial Incentives and Their Impact

Public incentives play a crucial role in mitigating the high upfront costs associated with green technologies. They also help “internalize” environmental and social benefits that would otherwise not be properly valued in traditional markets (*Sustainable Shipping Initiative, 2020*).

## 1 Tax Breaks

- VAT, excise duty, or other tax reductions for companies using clean fuels (*LNG, biofuels*)
- Registry incentives for low-emission ships

## 2 Low-Interest Financing

- State-backed or public entity-backed loans at reduced interest rates to fund new zero-emission or low-emission vessels (*EIB, 2020*)
- Grants for green port infrastructure development (*cold ironing, solar panels, onshore wind turbines for dock power supply*)

## 3 Non-Repayable Grants

- Support for R&D programs in naval engineering (*hydrogen engines, hybrid propulsion systems, hull designs optimized for hydrodynamic efficiency*)
- Targeted funding for crew training on new eco-friendly technologies

## 4 Subsidies for Pilot Projects

- Funding for demonstration projects testing advanced fuels (*methanol, ammonia, green hydrogen*) in collaboration with universities and research centers
- Real-World Example:
  - The European Investment Bank (EIB) has launched low-interest credit lines for retrofitting commercial and passenger vessels, aiming to improve energy efficiency and reduce sulfur oxide (SOx) and nitrogen oxide (NOx) emissions
  - Norway has paired its carbon tax on shipping with investments in LNG bunkering infrastructure and the construction of electric ferries
  - The European Union’s Horizon Europe program funds integrated research projects focused on zero-emission technologies and digital route optimization systems

**The impact of these incentives is twofold:**

- They lower the cost barrier for adopting clean technologies, making green investments more accessible for businesses
- They create a “flywheel effect” of competitiveness and innovation, spurring the emergence of new sectors (*green component manufacturing, ESG consulting services, etc.*)



Public Financial Incentives for Green Shipping (Last 3 Years, Mediterranean Focus)

Below is a country-by-country breakdown of public financial incentives (*tax breaks, grants, low-interest financing, funding programs, etc.*) targeting the green shipping industry, enacted by major Mediterranean nations in the last three years. This list is not exhaustive but provides an overview of the most relevant initiatives, focusing on EU countries (*due to better data availability*) while also highlighting some non-EU initiatives.

Important Notes

- Some measures were introduced as pilot projects or via budget laws and later renewed.
- Some funding comes from EU programs (Recovery and Resilience Facility – RRF, Connecting Europe Facility – CEF, Horizon Europe, etc.) but is managed at the national level.
- The dates refer primarily to the year of approval or program launch. In some cases, funding rounds are ongoing or have been renewed.

ITALY

	Type of incentive	Objective	Legal reference	Status
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Energy Transition Fund for the Naval Sector (2021)	Non-repayable grants and subsidized financing	Promote fleet modernization with low-impact engines (LNG, hybrid-electric), installation of cold ironing systems in ports, and research on alternative fuels ( <i>hydrogen, ammonia</i> )	Ministerial Decree from the Ministry of Infrastructure and Transport (MIT) issued in 2021 ( <i>Budget Law 2021</i> )	Active, with funding windows open in 2022 and 2023
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	Type of incentive	Specific maritime measures	Start year	Status
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National Recovery and Resilience Plan (PNRR) – Mission 3 (Infrastructure for Sustainable Mobility)	Public grants and public-private investment partnerships	<ul style="list-style-type: none"><li>– Development of cold ironing systems in major ports (Genoa, Livorno, Naples, Palermo, Cagliari)</li><li>– Implementation of smart traffic management systems and purchase of green ferries for connections with smaller islands</li></ul>	2021 (with operational plans 2022-2026)	Ongoing implementation
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	Type of incentive	Beneficiaries	Reference
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Tax Credit for Ship Efficiency Upgrades (2022-2023)	Tax credit (up to 40-50% of costs incurred)	Shipowners and shipyards investing in emission reduction systems (scrubbers, high-efficiency propellers, hull coatings)	Extension included in the 2023 Budget Law, with implementation decrees issued by the Ministry of Economy and MIT
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SPAIN

	Type of incentive	Objective	Maritime measures	Status
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Plan for Recovery, Transformation, and Resilience (PRTR) – Component 6: Sustainable Mobility (2021)	Direct subsidies and competitive innovation grants	Decarbonization of transport, with a focus on state-managed ports (Puertos del Estado), including Mediterranean ports (Barcelona, Valencia, Algeciras, etc.)	<ul style="list-style-type: none"><li>– Installation of charging stations for electric or hybrid ships</li><li>– Incentives for LNG adoption as a transitional fuel</li></ul>	Active, with funds available until 2026
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	Type of incentive	Objective	Beneficiaries	Status
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Eco-Incentive Program for Short Sea Shipping (2022)	Tax breaks and subsidies for short-sea shipping operators	Shift cargo traffic from roads to sea, reducing overall emissions	Shipping companies operating in the Mediterranean that adopt low-emission ships or pollution-reduction technologies	Pilot program launched in 2022, refinanced in 2023
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	Type of incentive	Funding	Status
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Plan Renove Flota Verde (2023)	Non-repayable grants (20-30% of costs) for fleet renewal (passenger ships, cruise ships) with cleaner technologies	Co-financed through European funds (FEDER) and national resources	First funding round opened in H2 2023
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GREECE

	Type of incentive	Shipping focus	Status
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National Recovery and Resilience Plan – “Greece 2.0” (2021)	Public co-financing for port modernization projects and subsidies for ferry upgrades connecting the Aegean and Eastern Mediterranean islands	<ul style="list-style-type: none"><li>– Energy efficiency improvements for passenger ships (<i>cold ironing, hybrid engines</i>)</li><li>– Digital technologies for fuel consumption reduction and route optimization</li></ul>	Ongoing, with calls for proposals published between 2022 and 2023
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	Type of incentive	Beneficiaries	Status
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VAT Reductions on Green Engine Purchases (2022)	Reduced VAT rate (from 24% to ~13%) on imported low-impact marine engines	Shipowners, ship refitting companies	In effect, subject to annual renewal
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FRANCE

	Type of incentive	Maritime measures	Status
Recovery Plan for Energy Transition in Transport (2020-2022, renewed in 2023)	Subsidies, low-interest loans, and state guarantees	<ul style="list-style-type: none"><li>– Retrofit of commercial and passenger ships with hybrid engines and emissions reduction systems</li><li>– Cold ironing projects in Mediterranean ports (Marseille-Fos, Toulon, Nice)</li></ul>	Partially renewed under the 2023 Finance Law, in line with France 2030 strategy
	Type of incentive	Beneficiaries	Budget
Fonds d’Accélération de la Transition Écologique dans le Maritime (2021)	Funding for R&D and industrial demonstration projects on propulsion (hydrogen, ammonia) and digital efficiency solutions	Shipyards, shipowners, innovation clusters (e.g., Pôle Mer Méditerranée in Provence-Alpes-Côte d'Azur)	Approx. €200 million over three years (2021-2023)
	Type of incentive	Status	
Eco-Transport Maritime Tax Reduction (2022)	Reductions in port taxes and excise duties on low-sulfur fuels (mainly LNG)	Active, managed by the DGITM (Direction Générale des Infrastructures, des Transports et de la Mer), with annual guideline updates	

CROATIA

	Type of incentive	Beneficiaries	Funding	Status
Croatian Green Ports Initiative (2021-2023)	Subsidized loans and grants for green infrastructure in Adriatic ports (Rijeka, Split, Zadar, Dubrovnik)	Port authorities and private operators for the installation of: <ul style="list-style-type: none"><li>– Shore power (cold ironing) systems</li><li>– Renewable energy solutions</li><li>– More efficient ship waste management systems</li></ul>	Partially supported by the EU Recovery and Resilience Mechanism	Operational, program running until 2024
	Type of incentive	Objective	Status	
Fleet Modernization Grants for the Fishing Industry (2022)	Funding for more efficient engines, fuel consumption reduction, and lower environmental impact	Enhance sustainable fishing practices in the Adriatic Sea	First phase completed in 2022, with new calls expected for 2023-2024	

SLOVENIA

	Type of incentive	Status
“Green Koper” Program (2021-2025)	Public funding and partnerships with the Port of Koper Authority for emissions reduction projects	Multi-year program (2021-2025), co-financed by the EU CEF Transport Fund

MALTA

	Type of incentive	Objectives	Status
Malta Maritime Green Fund (2022)	Government-managed fund in collaboration with Malta Freeport and the Maritime Authority	<ul style="list-style-type: none"><li>– Support the green transition of Maltese-flagged shipping companies</li><li>– Cold ironing projects and alternative fuel use in the Grand Harbour of Valletta</li></ul>	Launched with an initial budget of €20 million. Calls opened in 2022 and 2023

TURKEY

	Type of incentive	Target areas	Status
Maritime Decarbonization Incentive Scheme (2021)	Port dues reductions for ships with low emissions and alternative fuels	Major Mediterranean ports (Mersin, Iskenderun) and the Bosphorus	Announced in 2021, renewed in 2022 with expansion planned in 2023
	Type of incentive	Status	
KOSGEB Green Shipping Grants (2022)	Non-repayable grants for SMEs in shipbuilding and repair for low-impact maritime technologies	Operational, with annual funding rounds	



## MAROCCO

	Type of incentive	Objectives	Status
<b>National Port Plan 2030 – Ecological Component (2021)</b>	State financing and tax incentives for the modernization of Mediterranean (Tangier Med, Nador) and Atlantic ports	<ul style="list-style-type: none"> <li>– Reduce the environmental impact of port operations (<i>waste management, noise pollution reduction</i>)</li> <li>– Promote LNG bunkering</li> </ul>	Active, with various implementation phases until 2030
	Type of incentive	Status	
<b>Maritime Green Transition Support Fund (2022)</b>	Grants and microcredits for small fleets (fishing, coastal transport) to purchase more efficient engines and install solar panels on tourist boats	Pilot program in collaboration with local banks and IFC (International Finance Corporation)	

## OTHER INITIATIVES EU PROGRAMS (2021-2027)

### Connecting Europe Facility (CEF) – Transport

is the European Union’s main funding instrument for cross-border transport infrastructure. In the maritime sector, the program supports projects aimed at enhancing connectivity between ports and European logistics networks, while facilitating the transition towards more sustainable transport systems. CEF provides co-funding for strategic initiatives such as port modernization, the deployment of infrastructure for alternative fuels (including LNG, hydrogen, and methanol), and shore-side electrification to reduce emissions from berthed vessels. It also promotes the development of multimodal logistics hubs that strengthen integration between maritime, rail, and road transport. Annual calls are open to both public and private stakeholders, with grants covering up to 50% of eligible costs.

### Horizon Europe

is the European Union’s flagship research and innovation program for the 2021–2027 period. It plays a key role in supporting the development of clean and digital technologies, with a strong emphasis on green transition across sectors, including maritime transport. The program funds industrial research and experimental development projects focused on zero-emission vessel technologies such as hydrogen and ammonia propulsion, fuel cells, advanced materials, and digital systems for energy efficiency and smart navigation. Horizon Europe fosters collaboration between companies, research institutes, and public authorities through dedicated partnerships, and supports real-world testing and pilot projects. It is a strategic tool to drive the maritime industry’s structural decarbonisation. Specific topics are implemented within the co-programmed European Partnership on ‘Zero Emission Waterborne Transport’ (ZEWI).

### Innovation Fund (European Commission)

is one of the most ambitious EU instruments for supporting large-scale climate innovation. It targets capital-intensive and high-risk technologies that significantly reduce greenhouse gas emissions. In the maritime domain, the Fund is particularly relevant for financing the production and use of alternative fuels, retrofitting of existing fleets with clean technologies, and the design of new energy-efficient vessels. Funded projects must demonstrate technological maturity, strong impact potential at EU level, and replicability across the industry. The Innovation Fund can cover up to 60% of the total project costs, accelerating the deployment of breakthrough solutions in maritime transport.

### European Innovation Council (EIC) – Pathfinder and Accelerator

under the Horizon Europe framework, plays a pivotal role in fostering breakthrough technologies with high market potential, including in the maritime sector. Through its two main instruments—Pathfinder and Accelerator—the EIC supports early-stage research as well as market-ready innovations that can drive the decarbonisation of maritime transport. Several funded projects focus on zero-emission propulsion systems such as hydrogen and ammonia, next-generation fuel cell technologies, and energy efficiency solutions for vessels. These initiatives not only contribute to reducing greenhouse gas emissions but also strengthen Europe’s competitiveness in clean maritime technologies.

## OTHER INITIATIVES EBRD GREEN LOGISTICS PROGRAMME

### For the Balkans and Southeast Mediterranean

Co-finances energy efficiency and emissions reduction in short-sea shipping (Adriatic and Ionian Seas).

### References and Sources

1. Official websites of each country’s Ministry of Transport/Infrastructure (Italy – MIT, Spain – MITMA, France – MTES, Greece – Yp. Naftilías, etc.)
2. National Recovery and Resilience Plan websites (Italy: PNRR, Spain: PRTR, Greece: Greece 2.0)
3. Official port authority announcements (e.g., Port of Barcelona, Marseille-Fos, Genoa, etc.)
4. National gazettes for budget laws, decrees, and public tenders
5. European Commission (DG MOVE & DG CLIMA): EU shipping decarbonization policies
6. EBRD (European Bank for Reconstruction and Development) – Project Summaries for Balkan and Mediterranean countries
7. Maritime news portals (Ship2Shore, Splash247, The Medi Telegraph, etc.) for updates on government incentives

### Conclusions

The framework of public incentives supporting green shipping in the Mediterranean is rapidly evolving, driven by:

- Decarbonization objectives set at the European and international levels (IMO, EU, Paris Agreement)
- Extraordinary post-pandemic funds (Recovery and Resilience Facility, Next Generation EU), which have allocated significant resources to the ecological transition in the transport sector
- Increasing environmental awareness among port authorities and local communities, aimed at reducing pollution and the impact on the marine and coastal ecosystem

In the coming years, a further increase and consolidation of these incentives is expected, accompanied by greater selectivity in fundable projects and a strengthening of public-private partnerships, which are essential for carrying out complex infrastructure projects and accelerating the transition towards more sustainable maritime transport.

# Collaborations Between the Public and Private Sector

Public-private partnerships (PPPs) are a key tool for accelerating the ecological transition in maritime transport, especially considering the complexity and costs of large-scale projects (*Global Maritime Forum, 2020*). Agreements between government agencies, financial institutions, and private operators allow for:

## 1 Sharing risks and costs

The high degree of technological uncertainty can be mitigated if risks are distributed among multiple stakeholders, reducing pressure on individual investors.

## 2 Encouraging specialization

The public sector provides regulatory expertise and a long-term perspective, while the private sector contributes technical know-how and project management capabilities.

## 3 Creating shared standards and regulations

The co-design of guidelines and environmental protocols, in synergy with international organizations (*IMO, ICS, etc.*), accelerates the adoption of sustainable practices.

## 4 Maximizing impact

By combining public funds (*such as structural, European, or national funds*) with private capital, it is possible to expand the scope of interventions and achieve greater scale.

### SUCCESS STORIES

## 1 Poseidon Principles (2019)

A coalition of banks and financial institutions committed to assessing the sustainability of shipping projects they finance, aligning them with the goals of the Paris Agreement (keeping global warming well below 2°C).

## 2 Research projects on green hydrogen

In ports such as Rotterdam, Hamburg, and Marseille, where local governments, energy companies, and shipbuilders collaborate to develop H<sub>2</sub> supply chains, including storage and distribution infrastructure.

## 3 Getting to Zero Coalition (Global Maritime Forum, 2020)

A partnership of over 200 companies, governments, NGOs, financial institutions, and international organizations aimed at promoting fleet decarbonization by 2030-2050.

## 4 Ship Recycling Transparency Initiative (SRTI)

Is an international non-profit organization focused on reducing the emission impacts of global freight transportation. As a disclosure-based initiative, the SRTI promotes transparency by publishing data from shipowners on their ship recycling policies, practices, and processes. This enables stakeholders (including cargo owners, investors and the broader public) to make informed decisions and drive market demand for responsible recycling.

### Conclusions

The high technological uncertainty surrounding innovative solutions such as hydrogen or advanced batteries poses a significant financial challenge, making public-private partnerships essential to breaking down initial investment barriers and accelerating the adoption of these technologies.

Data collected highlights that one of the main risks perceived by financial operators and industry companies is the **lack of dedicated and specific initiatives for green shipping** in some Mediterranean countries. This factor could represent a significant obstacle to investment and the development of technological innovations on a larger scale.

The intersection between finance and green shipping proves to be a strategic driver for guiding the sector's sustainable development:

- **Innovative financial instruments** (*Green and Blue Bonds, carbon credits*) channel resources toward emission reduction projects and the protection of marine ecosystems.
- **Public incentives** (*tax breaks, subsidized financing, non-repayable grants*) lower the cost of adopting green technologies, stimulating competitiveness and the creation of new markets.
- **Collaboration between the public and private sector** enables risk-sharing, knowledge and resource exchange, and the definition of common standards and guidelines to accelerate the ecological transition.

The synergy between these factors, combined with increasingly stringent environmental policies (*IMO, EU, international agreements*), is shaping a new development paradigm in maritime transport, where environmental protection and economic return are no longer opposing objectives but become complementary goals within a long-term vision.

In conclusion, finance is an essential catalyst for the transition toward a low- or zero-emission maritime sector, helping to mobilize necessary capital, offering solutions for risk management, and accelerating technological and organizational innovation.

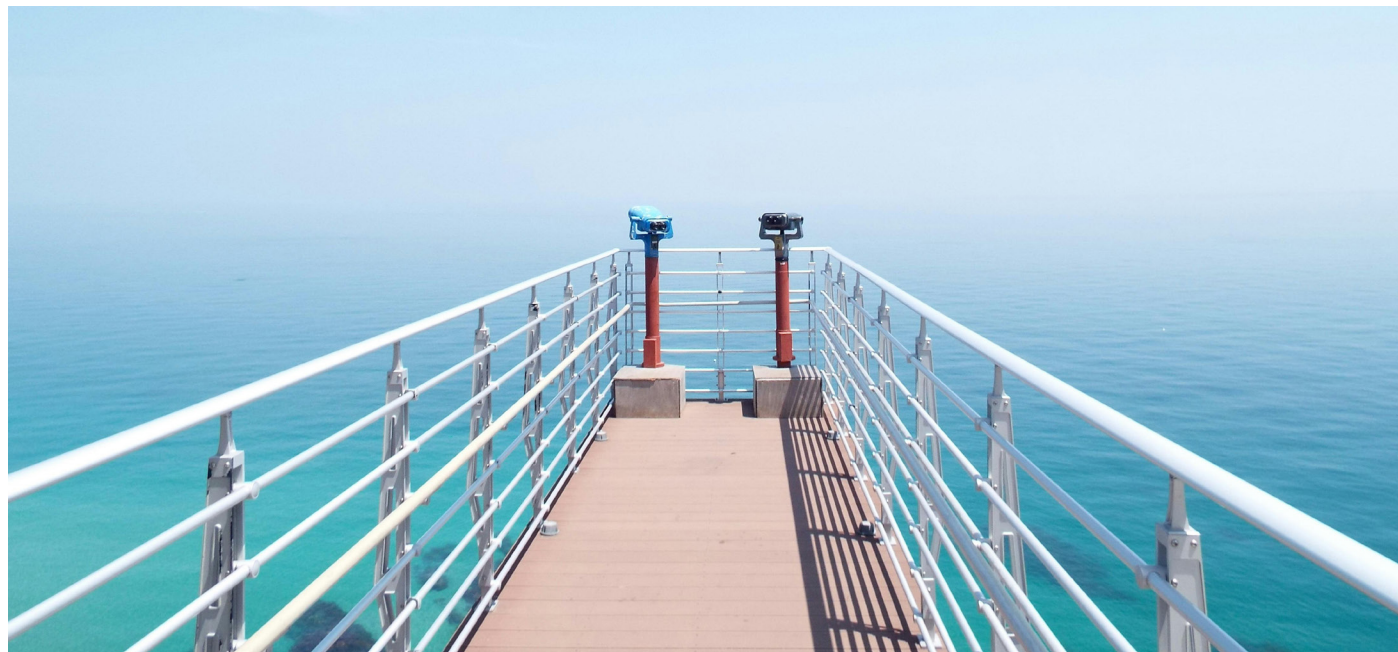


# Opportunities and Risks

The third chapter examines the growth opportunities and competitive advantages offered by green shipping, as well as the main financial and operational challenges that may hinder the ecological transition. In the first subsection, economic opportunities will be illustrated, including the design of next-generation ships, the supply of green fuels, and the development of digital technologies for emission monitoring. The second subsection will then address the risks and uncertainties related to investments in research and development, regulatory changes, and the high costs of fleet adaptation. Finally, subsection “Impacts on Sector Competitiveness” will present the impact of these dynamics on the competitiveness of the entire maritime sector, highlighting mitigation strategies and possible future scenarios.

## Economic and Market Opportunities in Green Shipping

The increasing regulatory and social pressure to reduce greenhouse gas emissions and environmental impact in the maritime sector is creating a favorable environment for new investments, partnerships, and technological solutions. The transition to more sustainable shipping not only presents regulatory and technical challenges but also opens up new economic and market opportunities that involve the entire maritime supply chain: from shipyards to alternative fuel suppliers, as well as companies specializing in propulsion systems, digitalization, and environmental engineering.



## Refitting and Retrofitting of Existing Ships

The modernization of operational ships through the installation of hybrid or liquefied natural gas (LNG)-powered engines, the replacement of outdated propulsion systems, and the implementation of scrubbers (to reduce sulfur oxides and particulates) represents a rapidly growing market. Shipyards offering turnkey packages (design + supply + installation) for energy efficiency solutions have the potential to attract shipowners seeking to comply with IMO regulations (e.g., MARPOL rules on sulfur oxides and nitrogen oxides (SOx and NOx), the Energy Efficiency Existing Ship Index - EEXI, and the Carbon Intensity Indicator - CII).

## Construction of New “Green” Ships

The emergence of alternative fuels such as methanol, ammonia, and green hydrogen requires new ship designs capable of accommodating appropriate storage tanks and safety systems (e.g., high-pressure containment systems for ammonia, cryogenic or solid-state storage technologies for hydrogen). Shipyards that develop integrated expertise (advanced naval design, safety engineering, knowledge of environmental regulations) will become key players for future ship orders. A niche market is also emerging for the modular design of ships with dual-fuel propulsion systems (capable of using more than one type of fuel) and hulls optimized for hydrodynamic efficiency.

## Innovation in Materials

The use of high-strength steels, composite materials, and special coatings to reduce water drag enables lower fuel consumption. Shipyards that integrate green technologies into their processes (non-toxic paints, water recycling systems) can enhance their brand reputation and gain easier access to green financing.

## Shipyards: From Fleet Upgrades to the Design of Next-Generation Ships

### Case Study

Shipyards such as Fincantieri (Italy) and Navantia (Spain) have already launched internal R&D programs for the construction of hybrid ship prototypes (diesel-electric) and the adoption of lighter, more durable materials.

## Digitalization and Route Optimization

Route optimization software, real-time consumption monitoring systems (smart sensors onboard), and data analysis platforms (Maritime IoT, Big Data analytics) are becoming essential for reducing operational costs and emissions. Companies specializing in digital technologies can collaborate with shipping companies to provide performance management services, contributing to more efficient fleet management and improving ships' environmental rankings.

## Hybrid Propulsion Systems

The emergence of alternative fuels such as methanol, ammonia, and green hydrogen requires new ship designs capable of accommodating appropriate storage tanks and safety systems (e.g., high-pressure containment systems for ammonia, cryogenic or solid-state storage technologies for hydrogen). Shipyards that develop integrated expertise (advanced naval design, safety engineering, knowledge of environmental regulations) will become key players for future ship orders. A niche market is also emerging for the modular design of ships with dual-fuel propulsion systems (capable of using more than one type of fuel) and hulls optimized for hydrodynamic efficiency.

## Treatment and Purification Systems

The use of high-strength steels, composite materials, and special coatings to reduce water drag enables lower fuel consumption. Shipyards that integrate green technologies into their processes (non-toxic paints, water recycling systems) can enhance their brand reputation and gain easier access to green financing.

# Maritime Technology Companies: Digital Solutions and Advanced Propulsion

**Case Study**  
Norwegian **Kongsberg** and Finnish **Wärtsilä** have established themselves as providers of digital solutions and advanced hybrid propulsion systems, working with global maritime operators to reduce consumption and pollution.

## LNG (Liquefied Natural Gas) as a Transition Fuel

With lower SOx, NOx, and particulate emissions compared to marine diesel (MGO/MDO), LNG has emerged as an intermediate solution to reduce local pollutants. The demand for LNG bunkering services in ports is increasing, creating opportunities for both companies managing LNG terminals and those producing storage, refrigeration, and distribution technologies.

## Methanol and Ammonia

Methanol and ammonia, if produced from renewable sources (biomass, wind, solar), can significantly reduce CO<sub>2</sub> emissions. Suppliers developing production and distribution infrastructure for green ammonia (e.g., starting from renewable hydrogen) will gain a competitive advantage in the future of naval propulsion. However, significant investments in safety are required due to the toxicity and flammability of these fuels, along with regulatory adjustments that open opportunities for specialized engineering consultancy.

## Hydrogen and Maritime Fuel Cells

Although still in development, hydrogen (especially “green” hydrogen, produced from renewable sources) represents a potential zero-CO<sub>2</sub>-emission solution for short-range ships (ferries, passenger ships, port services). Energy companies and maritime operators are forming consortia to design H<sub>2</sub> production plants near ports and to equip ships with high-efficiency fuel cells. This creates synergies with the renewable energy sector (offshore wind, solar, hydroelectric).

# Alternative Fuel Suppliers: LNG, Methanol, Ammonia, and Hydrogen

**Case Study**  
Maersk has announced orders for ships powered by green methanol, strengthening the supply chain for renewable methanol producers. Some Northern European ports (Rotterdam, Hamburg) and Southern European ports (Valencia, Barcelona) are investing in hydrogen production and storage infrastructure, anticipating a future expansion in the Mediterranean region.



**Increase in R&D investments**

The push for innovation in new propulsion solutions and “clean” fuels is attracting public capital (European and national funds) and private investments (venture capital, corporate venture), boosting research and development spending.

**Growth in skilled employment**

Technological advancements are generating demand for new professional profiles (naval engineers specializing in alternative fuels, data analytics experts for consumption optimization, etc.).

**Competitive advantages in international markets**

Companies and shipyards that position themselves as “green leaders” will be able to capture the growing global demand for low-emission ships and refitting services, particularly in light of IMO 2030 and 2050 targets.

**Ripple effect on the local economy**

The development of supply chains and distribution networks for alternative fuels (LNG, methanol, hydrogen) can revitalize ports and industrial areas, generating positive effects on logistics, transportation, and employment

**Overall Economic Impact and Growth Prospects**

**Public-Private Cooperation**

The implementation of pilot projects (demonstration projects) and the creation of dedicated infrastructure (LNG storage facilities, hydrogen terminals) require significant investments and coordination between governments, port authorities, and private operators.

**Financial and Regulatory Support**

Incentive programs, tax relief measures, and financing grants (at both national and European levels) are essential for facilitating the adoption of emerging technologies. The establishment of clear international regulations (IMO, EU) regarding emissions and alternative fuels reduces investment risks and strengthens market confidence.

**Development of Standards and Certifications**

The adoption of internationally recognized technical and environmental standards (e.g., for ammonia engines or hydrogen tanks) accelerates the deployment of these solutions. Voluntary certifications (e.g., ISO 14001, maritime Ecolabel) can serve as a competitive advantage and a key differentiating factor in the market.

**Training and Specialized Skills**

Investing in the training of engineers, naval technicians, and onboard operators capable of managing advanced technologies is crucial. Universities, research centers, and shipyards can collaborate to develop academic programs and master's degrees specifically focused on sustainable shipping.

**Challenges and Enabling Factors to Seize Opportunities**

### Conclusions

Economic and market opportunities in green shipping are expected to grow as environmental regulations become stricter and awareness and pressure from consumers, investors, and global stakeholders increase.

**Shipyards** can diversify their operations by offering refitting services and constructing new low-emission ships.

**Maritime technology** companies have significant growth potential in advanced propulsion, optimization software, and purification systems.

**Alternative fuel suppliers** will play a key role in the future reconfiguration of the maritime energy market, creating industrial clusters around ports.

However, fully seizing these opportunities requires a stable regulatory framework, adequate financing mechanisms, and an ecosystem of skills and collaborations capable of tackling the complexity of the decarbonization process.

Those who move early and invest in innovation will gain a competitive advantage while simultaneously contributing to the development of a more sustainable maritime future.

## Financial and Investment Risks Related to Maritime Decarbonization

The transition towards low or zero-emission maritime transport inevitably presents financial challenges. While, on the one hand, opportunities related to innovation and the opening of new markets (as seen in the previous chapter) are emerging, on the other hand, the adoption of “green” technologies entails significant risks and uncertainties regarding the return on investment (ROI). Specifically, shipyards, shipowners, and investors must navigate a series of variables that can impact the profitability and financial stability of their projects.



### Technological Risk

The rapid evolution of “green” technologies can quickly render installed systems or propulsion solutions obsolete. For example, green ammonia and green hydrogen are emerging solutions but are still not fully mature or standardized.

The lack of a globally shared standard (as previously seen with LNG engines versus other fuels) can create uncertainty in investment decisions, particularly considering a ship’s lifespan, which can exceed 20-25 years.

### Regulatory and Policy Risk

Environmental regulations, both at the international level (IMO) and regional level (EU with the “Fit for 55” package), are constantly evolving. This may require additional – and often costly – adjustments to emission parameters or fuel specifications.

The potential introduction of carbon taxes or increasingly stringent ETS (Emission Trading System) policies could significantly alter operating cost (OpEx) forecasts for a fleet, impacting the profitability of investments in retrofitting or new builds.

### Market Risk

Demand for green maritime transport services may not grow as expected, especially if “green” freight rates prove to be more expensive than conventional ones.

Fluctuations in the prices of alternative fuels (LNG, methanol, ammonia, hydrogen) depend on geopolitical factors and infrastructure development: if supply chains do not expand rapidly enough, costs will remain high, increasing margin volatility.

### Financial Risk

Resorting to debt capital (bonds, bank loans) or institutional investors involves financing costs that may rise in the presence of high perceived risks. Banks, for instance, could apply higher interest rates or require stricter guarantees for projects involving unproven technologies.

In the case of green bond issuance, the issuer must ensure transparency in fund allocation and the achievement of predetermined environmental goals; failure to meet these parameters could harm the company’s reputation and the value of the securities.

### Liquidity Risk and Return on Investment (ROI) Timelines

Installing a new propulsion system or adopting alternative fuels often requires significant upfront investments. The time needed to recover the capital spent (payback period) may extend if operational savings (fuel cost reduction, public incentives, etc.) do not materialize as expected.

In a highly uncertain technological and regulatory landscape, operators could experience delays in reaching “break-even” or even fail to achieve returns if more competitive technologies emerge in the meantime.

## Key Risk Categories in Decarbonization



Volatility of Alternative Fuel Prices

Although LNG is considered a transition fuel, its price is subject to fluctuations linked to the global gas market. Green hydrogen and green ammonia, on the other hand, depend on the cost of renewable energy needed to produce them (electrolysis, chemical synthesis), which is also subject to market variables and incentive policies. Companies investing in bunkering infrastructure or alternative fuel storage must carefully assess the risk of underutilization if demand does not grow as expected.

Infrastructure Gap

The availability of LNG, methanol, ammonia, or hydrogen supply facilities in ports remains limited, especially in certain geographical areas. The lack of adequate infrastructure can create a “bottleneck” for the large-scale adoption of these solutions, slowing the return on investment for shipowners. This issue often pushes investors to request public guarantees or public-private partnerships (PPPs) to mitigate the risk of capital immobilization.

Rapid Technological Progress

If significantly more efficient or cost-effective technologies emerge within a few years, those who have invested in previous solutions may find themselves with less marketable assets (risk of “stranded assets”). The uncertainty about which technology will prevail over a 10-15 year horizon makes long-term investment planning more complex, leading some operators to adopt a cautious approach.

Factors Increasing Financial Uncertainties and Risks

Gradual Approach

Some companies opt for a gradual fleet upgrade, initially choosing hybrid solutions (dual-fuel, diesel-LNG) to reduce impact while maintaining flexibility. This strategy allows investments to be spread over time and benefits from incentives and operating cost reductions as technology matures.

Use of Sustainable Finance Instruments

Issuing green bonds or adhering to frameworks like the Poseidon Principles allows access to more favorable credit conditions, provided ESG standards are met and emissions are progressively reduced. Green loans or subsidized loans guaranteed by public institutions (EIB, EBRD, national development banks) can lower financing costs, easing the cash flow burden.

Risk Diversification

Larger companies can diversify by investing in multiple types of technologies (LNG for certain routes, methanol for others, etc.) or by collaborating with industrial partners and research institutions to test innovative solutions. Creating joint ventures or consortia helps share R&D risks and costs, reducing the likelihood of being stuck with a non-competitive technology.

Advanced Analysis

Using financial simulation models and scenario analysis (with varying fuel prices, carbon tax rates, and demand fluctuations) can help make informed decisions and prepare contingency plans. Regular monitoring allows for investment adjustments if technology or market conditions change unexpectedly.

Public-Private Partnerships (PPP)

The construction and management of bunkering infrastructure, research on new fuels, and implementation of pilot projects often require significant investments and risk-sharing. PPP agreements may include state or regional co-financing, loan guarantees, and grants, reducing the financial exposure of private operators.

Strategies for Mitigating Financial Risks

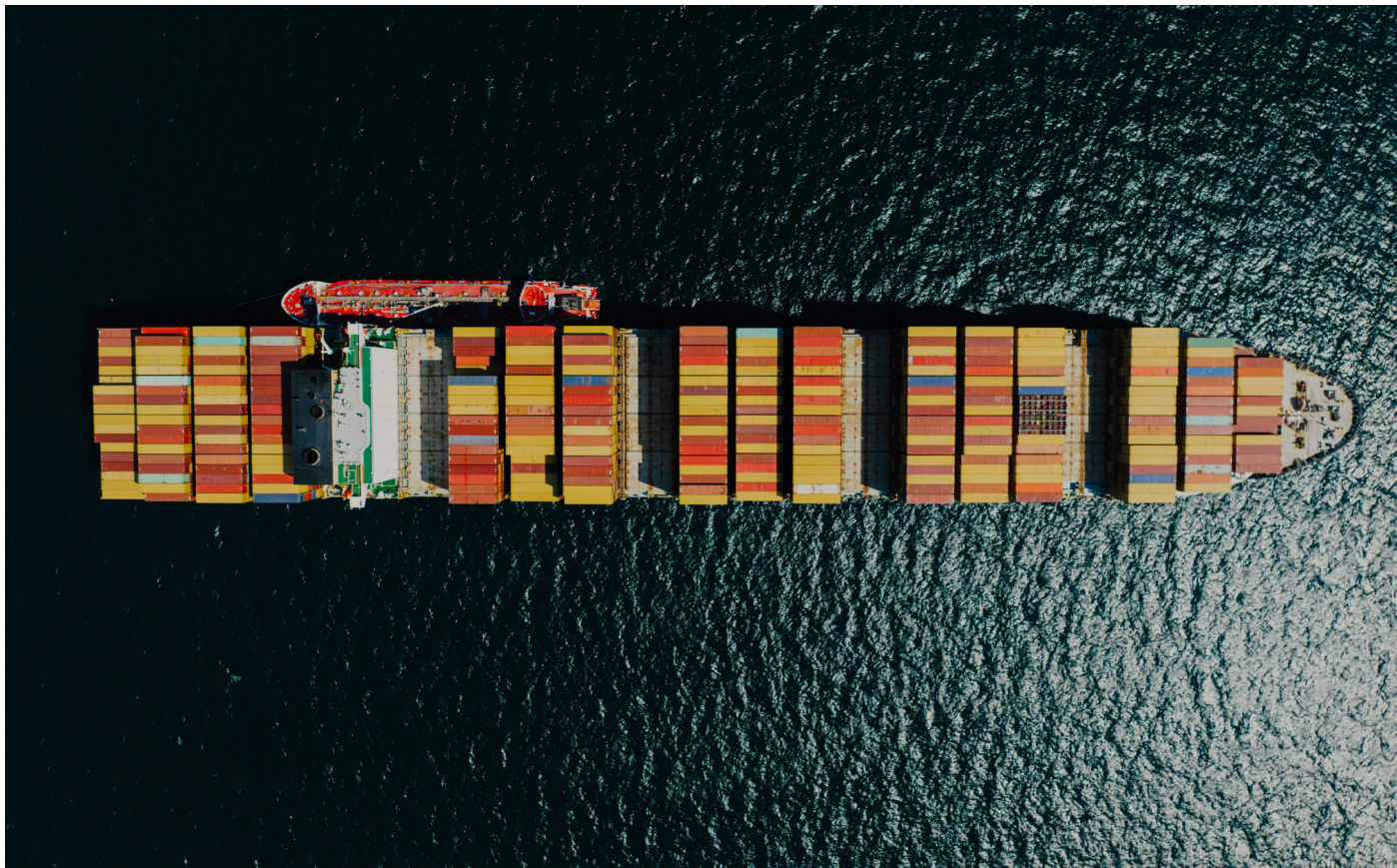
## 2.1 - Long-Term Outlook and Industry Sustainability

Despite the risks and uncertainties associated with maritime decarbonization, the global trajectory is moving towards stricter regulations and increasing customer and consumer awareness of low-carbon supply chains. This trend makes it increasingly likely that “green” investments will become competitive in the medium to long term, particularly if supported by:

- **Clear and long-term policies** (e.g., the gradual inclusion of maritime transport in the ETS, a stable regulatory framework for fuels and standards).
- **Economies of scale in sourcing and production of new fuels**, which will reduce unit costs.
- **Greater availability of specialized financial instruments**, such as green bonds and sustainable finance, which reward environmentally responsible companies and lower capital costs.

### Conclusions

Maritime decarbonization, while offering opportunities for innovation and business development, also entails significant financial risks. Technological uncertainties, fluctuations in alternative fuel prices, an evolving regulatory landscape, and the need for substantial upfront capital make it difficult to precisely estimate investment return timelines. However, stakeholders who effectively mitigate these risks through phased strategies, partnerships, and a forward-looking approach to sustainable finance will have a greater chance of remaining competitive and benefiting from the sector’s inevitable transformation. In a future increasingly oriented toward sustainability, the costs of non-compliance (penalties, market exclusion, reputational damage) could far exceed the initial costs of a “green” investment, making ecological transition not just an ethical obligation but also a sound financial decision.



## Impacts on Sector Competitiveness

The acceleration of maritime decarbonization processes and the adoption of sustainable solutions are profoundly reshaping the competitive dynamics of the naval sector. While green shipping entails financial and technological risks (as discussed in section 4.2), it also offers opportunities for differentiation and long-term competitive advantages. Specifically, companies that successfully invest in clean technologies, alternative fuels, and sound environmental management practices can:

- Access new markets and benefit from partnerships with international stakeholders increasingly focused on sustainability.
- Reduce long-term operating costs through lower fuel consumption and potential economic incentives.
- Strengthen their reputation among clients, investors, and authorities, gaining credibility and support in the global supply chain landscape.

Below is a more detailed analysis of the competitiveness impacts.

## 3.1 - Competitive Advantages of Early Green Solution Adoption

### Technology Pioneers

Companies that are among the first to introduce low-emission engines, hybrid propulsion systems, or alternative fuels (LNG, methanol, ammonia, hydrogen) can position themselves as “early movers.”

This allows them to develop an accelerated learning curve, gaining expertise in R&D and establishing privileged relationships with specialized suppliers.

This advantage can translate into improved operational efficiency and increased attractiveness to investors looking for ESG-compliant (Environmental, Social, Governance) projects.

### Priority Access to Sustainable Grants and Funding

Participating in pilot projects or innovation programs funded by public institutions (e.g., EU funds, European Investment Bank, national development banks) is easier for companies with an established ecological transition strategy.

Sustainable companies can benefit from preferential interest rates, state guarantees, or non-repayable grants, reducing uncertainty regarding investment returns.

### Strengthening Customer Relations

Many multinational corporations and major freight forwarders set carbon footprint reduction targets within their supply chains (Scope 3 Emissions). As a result, they seek out shipping companies that offer low-impact transportation solutions. Being able to provide “green” or sustainability-certified routes can help secure new contracts or retain environmentally conscious customers.

### Scope 1-2-3 Emissions

- **Scope 1 Emissions:** Direct emissions owned or controlled by a company (e.g., fleet emissions).
- **Scope 2 Emissions:** Indirect emissions from purchased electricity used by the company.
- **Scope 3 Emissions:** Indirect emissions resulting from the company’s supply chain, including upstream supplier operations and downstream product use.



## 3.2 - Access to New Markets and Differentiation Opportunities

### Markets with Strict Environmental Regulations

Certain regions (Northern Europe, North America, Asia-Pacific) are imposing stricter regulations on port emissions and vessel environmental performance.

A shipping operator already meeting high standards can enter and compete in these markets without facing restrictions or penalties, unlike competitors that have yet to comply.

### Specialized Routes and Cargo Sensitive to Environmental Impact

A growing number of industries (e.g., consumer electronics, automotive, retail) require sustainable transportation certifications as part of their marketing and ESG reporting strategies.

Sustainable shipping companies can specialize in transporting high-value-added goods under long-term contracts that reward CO<sub>2</sub> emission reductions and the use of clean fuels.

### Development of Ancillary Services and Vertical Integration

In the green economy context, shipowners or shipyards can evolve into integrated service providers, offering low-impact logistics solutions or emissions monitoring platforms.

This diversification strategy allows them to capture additional margins and create an ecosystem of services, positioning themselves as a “one-stop shop” for maritime decarbonization.

## 3.3 - Long-Term Operating Cost Reduction

### Energy Efficiency and Fuel Savings

Adopting more efficient engines, specialized hull coatings (anti-fouling coatings), and digital route optimization systems can significantly reduce fuel consumption.

While initial investment costs are high, in the medium to long term, operational savings can improve shipping profitability, especially in a context where traditional fuel prices fluctuate continuously.

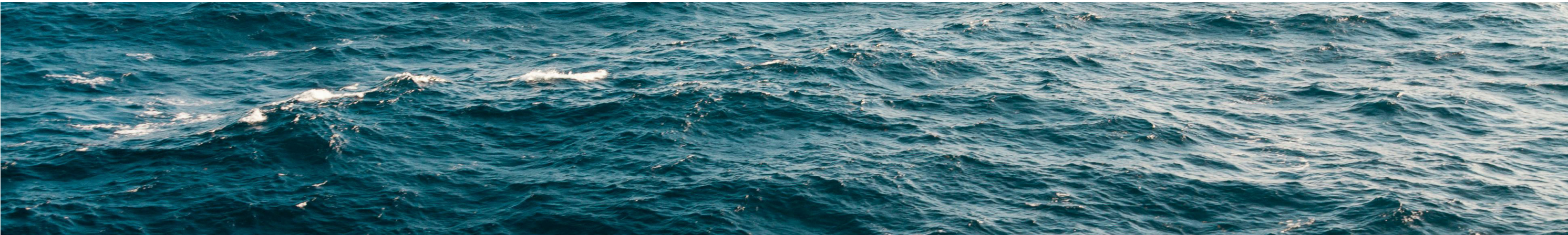
### Reduced Emission-Related Costs

The enforcement or tightening of carbon taxes and emission trading systems (ETS) in the maritime sector (e.g., the EU ETS expansion to shipping) will increasingly penalize polluting vessels, raising operating costs for non-compliant companies. More eco-friendly fleets, on the other hand, will benefit from lower expenditures on emission permits and reduced compliance costs, improving their price competitiveness.

### Lower Long-Term Maintenance Costs

Certain electric or hybrid propulsion systems, along with wear-reducing devices (e.g., high-efficiency propellers, advanced filters), can lower maintenance and component replacement costs over time.

While technologies such as fuel cells and LNG cryogenic tanks require specialized skills, proactive maintenance and digital monitoring reduce breakdowns and unplanned downtime, improving operational continuity.



## 3.4 - Reputational Value and Stakeholder Relations

### Brand Image and Corporate Social Responsibility

A “green” positioning strengthens the company's positive perception among both end consumers (who are increasingly environmentally conscious) and financial stakeholders (banks, investment funds, insurers).

Transparent communication of emission reduction goals and achievements (e.g., through sustainability reports and international certifications) becomes a competitive advantage as well as a corporate social responsibility commitment.

### ESG Compliance and Financing Advantages

Financial markets are rewarding environmentally responsible companies with better financing conditions and increased fund availability (green bonds, sustainable loans).

Banks adhering to the Poseidon Principles or similar initiatives evaluate a shipping company's sustainability profile to determine loan terms. Strong environmental performance can lead to lower interest rates, reducing financing costs.

### Relations with Authorities and Local Communities

Reducing noise pollution, sulfur oxide, and particulate emissions in port areas improves relationships with local communities, facilitating the acquisition of permits and licenses.

Maritime and port authorities often prefer to collaborate with operators proposing eco-friendly solutions, offering port tax reductions or assigning priority docking slots.

## 3.5 - Ripple Effects on Supply Chains and Collaboration Networks

### Supplier Engagement

In the decarbonization journey, maritime companies can also influence their supply chains by selecting partners and subcontractors that meet high environmental standards.

This contributes to creating a virtuous ecosystem where sustainability becomes a mandatory requirement for entering the supply chain.

### Green Industrial Clusters and Districts

The transformation of shipyards and the adoption of new propulsion technologies can foster innovation hubs (clusters), where businesses, universities, and research centers collaborate on integrated solutions.

This dynamic can enhance the competitiveness of entire regions or port districts, attracting additional investments and expertise (“magnet effect”).

### Collaboration for Standardization

Harmonizing technical standards (e.g., for ammonia, hydrogen, or synthetic fuel production) reduces development and implementation costs while facilitating the creation of common refueling infrastructure.

Companies participating in international consortia, classification bodies, and working groups (IMO, ICS, etc.) can influence regulatory evolution, protecting their interests and ensuring fair rules.

### Conclusions

The ecological transition's impact on competitiveness in the maritime sector is twofold:

- 1. In the short term**, companies and shipyards investing in “green” solutions face additional costs and financial and technological risks. This may initially impact margins, especially in the absence of a stable regulatory framework or sufficient incentives.
- 2. In the medium to long term**, however, such investments can translate into structural competitive advantages: lower operating costs (thanks to energy efficiency and reduced exposure to carbon taxes), better market and capital access (due to ESG compliance), enhanced reputation, and stronger customer loyalty.

In a global context increasingly pushing towards decarbonization and environmental responsibility, maritime companies that act with foresight and innovation capacity can secure a leadership position. Future competitiveness will increasingly depend on the ability to align profitability with reduced environmental impacts, creating a virtuous cycle that aligns economic and sustainability objectives.

The maritime sector's competitiveness will be significantly shaped by companies' ability to adopt innovative green solutions. Those that adapt quickly will benefit from financial advantages such as easier funding access and a stronger market reputation, while slower-moving companies risk losing market share to more sustainable competitors.

## Future Perspectives

The fourth chapter looks beyond the immediate horizon, outlining possible long-term developments in sustainable maritime finance. In the first subsection, future scenarios for shipping will be explored, considering both advancements in green technologies and the evolution of global markets. Subsequently, the second subsection will provide a set of policy and investment recommendations aimed at both governments and private operators to consolidate the decarbonization path. Finally, subsection “Impacts on Trade and Global Supply Chains” will examine how the entire logistics and production chain (supply chain) could undergo significant changes due to the broader adoption of green ships, analyzing the impact on international trade and the business models of maritime companies.

## Future Scenarios for Maritime Finance and Decarbonization

The convergence of increasingly stringent environmental regulations, technological advancements, and growing stakeholder awareness regarding climate change is shaping new scenarios for maritime finance and the entire green shipping ecosystem. In the coming years, an acceleration towards decarbonization is expected, driven by public and private initiatives as well as the evolution of financial markets towards more “green” investments.

### 1.1 - Strengthening Global Emission Reduction Targets

#### The International Maritime Organization and Global Standards

The International Maritime Organization (IMO) is gradually tightening regulations on ship emissions. Following the introduction of sulfur content limits in fuels (IMO 2020), the organization is preparing to update and further strengthen CO<sub>2</sub> emission reduction targets (EEXI, CII) by 2030 and, in perspective, by 2050.

Further lowering thresholds for nitrogen oxides (NOx) and particulates, as well as the potential introduction of new market-based mechanisms (such as carbon emission charges per transported ton), will significantly impact shipowners' strategies and the attractiveness of green projects.

#### Regional Regulations, Particularly in the EU

The European Union, through the “Fit for 55” package, has confirmed the gradual inclusion of maritime transport in the Emission Trading System (ETS) and the revision of energy taxation directives, encouraging the use of low-carbon fuels. The “FuelEU Maritime” mechanism will be introduced to promote the use of sustainable fuels (advanced biofuels, LNG, hydrogen, ammonia). These measures translate into an increasing “CO<sub>2</sub> cost,” which will push shipping companies to invest in lower-impact technologies.



**EU Regulation 2023/1805**<sup>4</sup> promotes the use of renewable, low-carbon fuels and clean energy technologies for ships. It will be fully applicable from January 1, 2025, except for Articles 8 and 9 on monitoring plans, which will be applied from August 2024. At the same time, numerous European ports (including those in the Mediterranean basin) are implementing stricter local regulations on emissions and noise, offering port fee reductions to “green” ships and penalizing polluting vessels.

**Key Factors in the FuelEU Maritime Regulation**

FuelEU Maritime sets maximum annual average greenhouse gas (GHG) intensity limits for energy used by ships over 5,000 gross tonnage in European ports, regardless of their flag. The targets ensure that GHG intensity in the sector gradually decreases over time, starting with a 2% reduction by 2025 and reaching an 80% reduction by 2050. The targets cover not only CO<sub>2</sub> but also methane and nitrogen oxide emissions, measured over the entire life cycle of fuels used onboard, following the Well-to-Wake (WtW) approach. To reduce air pollution in ports, passenger ships and container vessels at berth must use on-shore power supply (OPS) or zero-emission alternative technologies starting from January 1, 2030, in ports covered under Article 9 of the Alternative Fuels Infrastructure Regulation (AFIR), and from January 1, 2035, in all EU ports developing OPS capacity. Member States may choose to extend the obligation to non-AFIR ports from January 1, 2030. By adopting a technology-neutral approach, FuelEU Maritime allows for innovation and the development of new sustainable fuels and energy conversion technologies, giving operators the flexibility to choose fuels and technologies based on specific navigation profiles. The regulation also includes flexibility mechanisms, supporting existing fleets in finding appropriate compliance strategies and rewarding first-movers for their initial investments in energy transition.

**National Initiatives and Bilateral Agreements**

In addition to international and supranational regulations, several countries are implementing additional measures to accelerate the transition to zero emissions, including differentiated carbon taxes, targeted incentives, research funds, and the imposition of minimum sustainability requirements for nationally-flagged fleets. Some governments and port operators are forming bilateral or regional partnerships (e.g., in the Mediterranean) to coordinate investments in LNG, methanol, ammonia, or green hydrogen bunkering infrastructure, facilitating the creation of low-emission maritime corridors.

1.2 - Growth of Demand for Green Solutions

**Pressure from Carriers and End Consumers**

A growing number of companies are including transport emissions reduction in their ESG goals and supplier selection criteria. In sectors such as automotive, electronics, and agribusiness, environmental performance of shipments (carbon footprint) is increasingly evaluated in pricing and contract allocation. End consumers, influenced by media and corporate social responsibility campaigns, demand transparent and low-impact supply chains. Green shipping companies thus enjoy a reputational advantage, which can translate into market preference and higher margins.

**Demand for Hybrid Fleets and Technologies**

Interest in ships powered by clean fuels (LNG, methanol, ammonia) or hybrid/electric propulsion systems is growing, favoring shipyard specialization in innovative solutions and fostering after-sales service markets (maintenance, retrofitting). In the short term, a diverse energy mix is likely (a simultaneous presence of LNG, biofuels, and electric solutions) before one or more technologies emerge as the dominant standard. This initial diversification requires large-scale infrastructure investments, creating business opportunities for service and technology providers.



**Sustainable Finance as a Driving Force**

The financial sector is rewarding projects aligned with decarbonization goals, facilitating the issuance of green and blue bonds, specialized private equity funds, and ESG-linked loans. Banks adhering to the Poseidon Principles (or similar initiatives) are channeling capital towards shipowners and operators with ambitious and credible emission reduction plans, creating a virtuous cycle between financing availability and green technology adoption. Additionally, the upcoming evolution of the EU Taxonomy criteria will make it easier to identify sustainable projects, further boosting demand for low- or zero-carbon solutions.

1.3 - The Growing Role of Public-Private Cooperation

**Bunkering Infrastructure and Alternative Fuel Distribution**

Developing refuelling networks for LNG, methanol, ammonia, and hydrogen requires collaboration among governments, port authorities, energy companies, and shipbuilders. The high costs and investment risks (due to still-evolving technology) make long-term partnerships and agreements essential, often supported by public incentives and financial guarantees.

**Demonstration Projects and Innovation Clusters**

The creation of industrial clusters where shipyards, technology providers, universities, and research centers collaborate accelerates the development of solutions, tested in small-scale pilot projects. These demonstration projects often receive funding from EU programs (CEF, Horizon Europe, Innovation Fund) and serve as showcases for involved companies, helping to spread best practices across the industry.

**Shared Regulations and Standardization**

Harmonizing regulations and technical standards at an international level (e.g., safety for onboard ammonia use, cryogenic hydrogen storage) is crucial to reducing uncertainty and increasing scalability of green solutions. Public and private institutions collaborate to define common specifications, lower certification costs, and simplify compliance procedures, facilitating faster adoption of green technologies.

4. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R1805>



# 1.4 - Medium- to Long-Term Prospects and Possible Scenarios

## “Green Acceleration” Scenarios

If regulatory pressure increases sharply (with more ambitious IMO 2050 targets) and carbon taxation systems become highly effective (expanded ETS and national carbon taxes), we could witness:

- A rapid fleet renewal
- A race to build ultra-low-impact ships
- The development of “green” port infrastructure
- In this scenario, carbon cost becomes a primary competitive driver, making the operation of obsolete or heavily polluting ships unsustainable.

## “Slow Transition” Scenarios

Conversely, if political or economic obstacles emerge (lack of funding, failure to reach international agreements, energy crises delaying green fuel investments), decarbonization may progress at a slower pace. The absence of a coherent global framework could lead to market fragmentation, with some countries and regions far ahead while others remain dependent on traditional fuels.

### Role of Disruptive Technologies

In the medium term (10-15 years), the emergence of new technologies such as:

- Large-scale fuel cells
- Synthetic fuels (e-fuels) from renewable sources
- Revolutionary propulsion systems (e.g., wind-assist with rigid sails or next-generation Flettner rotors), could radically transform the industry. A Flettner rotor is a smooth cylindrical structure with closed ends that rotates along its longitudinal axis. When exposed to airflow, it generates an aerodynamic force perpendicular to the flow due to the Magnus effect. The name comes from its inventor, German engineer Anton Flettner.

Companies investing early in R&D projects and specializing in these technologies will have a better chance of securing leadership positions in the market and achieving significant economic returns.

### Conclusions

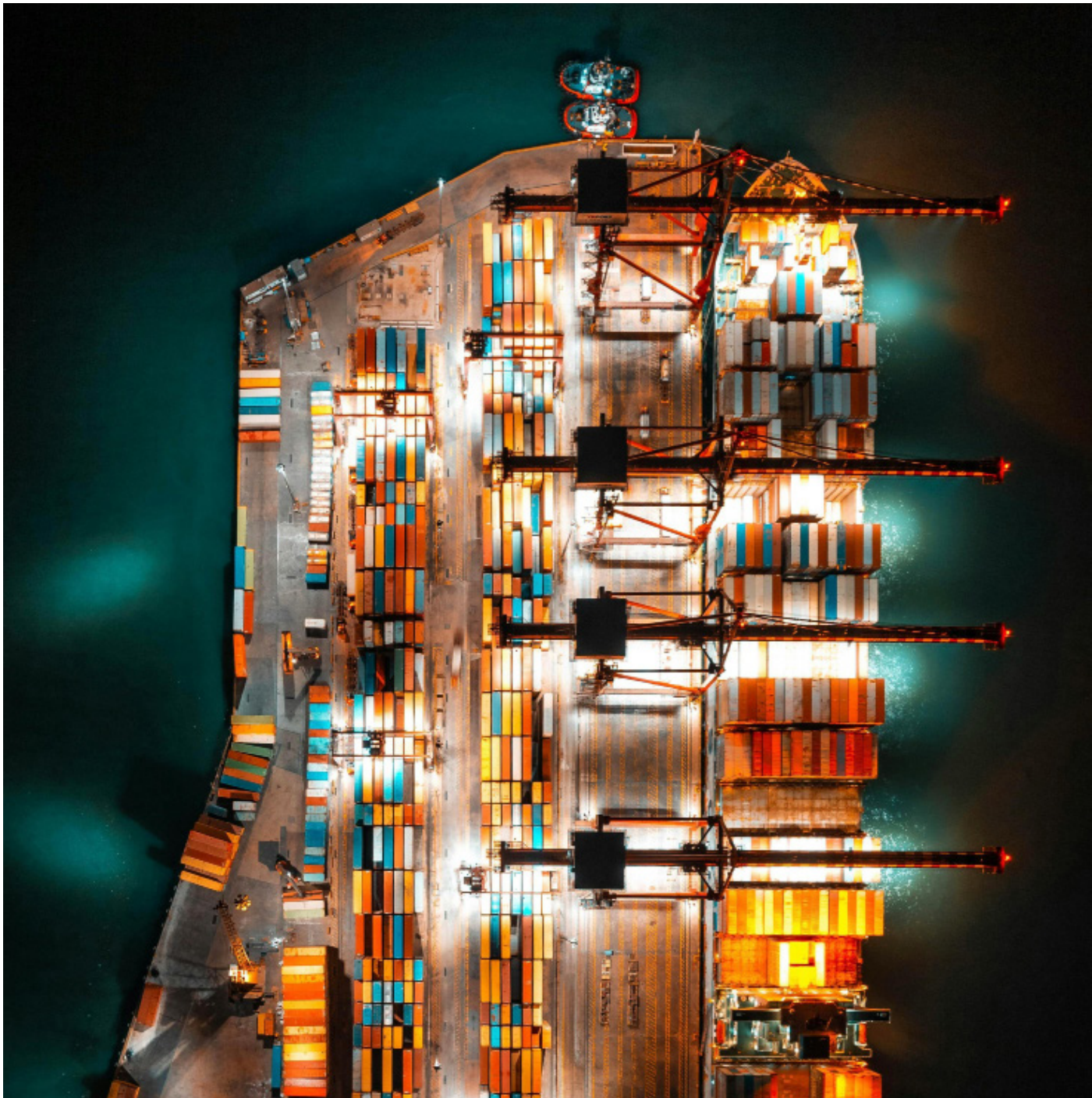
Future scenarios for maritime finance and decarbonization are defined by rapidly evolving regulations and a growing demand for green solutions and services in the shipping industry. This trend, supported by a wide range of sustainable finance instruments, is set to reshape the entire maritime value chain:

- Stricter regulations and emission-related costs will drive the replacement of polluting technologies with low- or zero-carbon solutions.
- Public-private collaboration, technological innovation, and infrastructure investments will play a key role in accelerating the transition.
- Integration of ESG criteria in financial strategies will make it easier to access capital for green projects, while simultaneously making it harder for operators who do not comply.

In conclusion, the maritime industry is heading toward a full transformation, where companies that anticipate change and innovate their business models will benefit from growth opportunities and gain a sustainable competitive advantage over time.

# Recommendations for Sustainable Policies and Investments

The need to accelerate the ecological transition in the maritime sector requires the adoption of a wide range of political and financial strategies capable of steering the entire supply chain toward decarbonization goals. National and international institutions, as well as private investors, can play a decisive role in facilitating the introduction of low-impact technologies and mitigating the risks associated with experimenting with new solutions. Below are key recommendations for promoting sustainable policies and investments.





## Strengthening Regulatory Harmonization and International Cooperation

### Institutional Coordination

Ensure consistent alignment between measures adopted by the IMO (Energy Efficiency Existing Ship Index - EEXI, Carbon Intensity Indicator - CII), EU initiatives (e.g., Fit for 55, FuelEU Maritime, inclusion of shipping in ETS), and national plans. Reducing regulatory fragmentation enhances long-term certainty for operators, allowing them to plan investments with lower uncertainty.

### Multilateral and Regional Agreements

Promote specific regional agreements (Mediterranean, Northern Europe, Asia-Pacific) to develop low-emission maritime corridors and share best practices. Support dialogue and cooperation platforms (IMO, Global Maritime Forum, Union for the Mediterranean, WestMED Initiative) to coordinate infrastructure projects and environmental standards, especially for alternative fuel bunkering.

## Improving Access to Green Financing and Encouraging Private Capital

### Developing Dedicated Financial Instruments

Encourage the issuance of green bonds, blue bonds, and sustainability-linked bonds targeting the maritime sector, through clear regulatory frameworks and transparent reporting mechanisms (e.g., Green Bond Principles, Blue Bond Guidelines). Promote the creation of specialized investment funds (private equity or venture capital) for green maritime technologies and sustainable port infrastructures.

### Facilitating Credit through Public Banks and International Institutions

Strengthen the role of institutions like the European Investment Bank (EIB), the World Bank, and the European Bank for Reconstruction and Development (EBRD), so they can provide low-interest loans, guarantees, or co-financing. Introduce state guarantees or credit insurance to reduce perceived risk for private investors, particularly in R&D projects or pilot projects involving still-experimental technologies (ammonia, hydrogen, e-fuels).

### Stimulating Competition and Rewarding Sustainability

Integrate environmental (ESG) criteria into public tenders and infrastructure project selection processes. For example, favoring companies that adopt low-impact technologies and commit to reducing emissions across the entire logistics chain. Introduce or reinforce emission pricing mechanisms (maritime ETS, carbon tax), using revenues to finance green projects.

## Implementing Tax Incentives and Reward Mechanisms

### Tax Breaks and Port Fee Reductions

Reduce or eliminate excise taxes on alternative fuels (LNG, biofuels, e-fuels) to offset their higher costs compared to conventional fuels, at least in the early transition phase. Offer port fee reductions or incentives to ships that meet higher environmental standards (low NOx, SOx, CO<sub>2</sub> emissions).

### Tax Credits and Super-Depreciation

Introduce tax credits (tax incentives) for investments in retrofitting, scrubber installation, hybrid engines, and energy optimization equipment (sensors, route optimization software). Provide fiscal incentives for research and development in the maritime sector, fostering the experimentation of hydrogen-, ammonia-, or synthetic fuel-powered engines.

### Non-Repayable Grants for Pioneering Projects

Establish dedicated funding programs for shipyards and shipping companies, covering part of the costs for highly innovative pilot or demonstration projects (prototypes of fuel cell ships, onboard CO<sub>2</sub> capture and storage platforms, etc.). Facilitate access to EU research funds (Horizon Europe, Innovation Fund) through one-stop-shops and specialized training programs.

## Supporting Research & Development and Demonstration Projects

### Creation of Technology Clusters and Industrial Districts

Promote the formation of innovation hubs around major ports, where shipyards, research centers, universities, and technology companies can share resources and expertise. Leverage the role of port authorities and shipbuilding industry players as incubators of new solutions (electric charging stations, cold ironing, testing of new propulsion technologies).

### Public-Private Partnerships (PPP)

Establish or strengthen partnerships between governments and industries for the construction of LNG, ammonia, hydrogen, and methanol bunkering infrastructures. Ensure that a portion of revenues from climate policies (carbon tax, ETS) is reinvested into a dedicated fund for R&D and the implementation of emerging technologies.

### Dissemination of Best Practices

Create platforms and databases to share positive experiences and lessons learned on retrofitting, route optimization, and the use of new fuels. Support events, workshops, and international symposia that connect startups, investors, shipowners, and shipyards interested in testing sustainable solutions.



Promoting Training and Awareness	
Specialized Professional Training	Invest in training programs for crews, technicians, and port operators, ensuring they develop the necessary skills to manage low-emission vessels, LNG refueling systems, and cryogenic tanks. Collaborate with universities and naval engineering schools to introduce specific courses on green technologies and regulatory aspects of decarbonization.
Stakeholder Engagement	Raise public and industrial awareness of the environmental and economic benefits of a more efficient fleet. Encourage supply chain managers (importers/exporters) to incorporate sustainability criteria into their transportation requirements, rewarding the most environmentally responsible shipping companies.

### Establishing Monitoring Systems and Performance Evaluation

Transparent Reporting of Environmental Impacts	Require shipping companies to publish sustainability reports with key indicators such as CO <sub>2</sub> emissions per ton of cargo transported. Mandate environmental classification of ships (e.g., energy efficiency rating systems) to increase transparency in the market.
Verification and Compliance Mechanisms	Strengthen monitoring of actual emissions both at port and at sea, using remote surveillance systems (satellites, drones, dockside sensors). Ensure that granted benefits (tax incentives, rewards, subsidies) are conditional on meeting clearly defined environmental standards, preventing greenwashing practices.

**Conclusions**  
Policies and financial measures aimed at the ecological transition in the maritime sector should focus on:

- Reducing investment risks in new technologies, aligning the objectives of governments, financial institutions, and private operators.
- Rewarding innovation and corporate foresight through incentives and favorable credit conditions.
- Encouraging public-private cooperation, which is essential for shared infrastructures and common standards.
- Supporting research, training, and the dissemination of best practices, to accelerate the large-scale adoption of the most effective solutions.

By following these recommendations, maritime finance and regulatory bodies can create a favorable environment for decarbonization, generating a virtuous cycle: lower pollutant emissions, increased competitiveness of the maritime industry, and ultimately, a substantial contribution to the global fight against climate change.

# Impacts on Global Trade and Supply Chains

The transition to more sustainable shipping does not only modify the internal dynamics of the maritime sector; it also has significant repercussions on global logistics and supply chains. The adoption of new fuels (LNG, methanol, ammonia, hydrogen), compliance with stricter environmental standards, and the development of innovative port infrastructures will impact costs, timelines, and operational models, triggering cascading effects on international trade. Below is an analysis of the main impacts and potential changes for global logistics.

### Reorganization of Shipping Routes and Logistics Hubs

Bunkering and Refueling Infrastructure	The widespread adoption of alternative fuels requires the development of dedicated infrastructures (LNG storage facilities, refueling stations for ammonia, methanol, hydrogen). Ports that upgrade early to offer these bunkering services could become strategic hubs, attracting more ship calls and strengthening their role in the global logistics network. Conversely, ports that delay their adaptation risk losing competitiveness, leading to a reallocation of trade routes toward hubs better prepared for the green transition.
Changes in Routes and Transit Times	Alternative fuels may impact vessel autonomy (e.g., larger storage tanks for LNG or ammonia), requiring more frequent refueling stops and/or route modifications to access ports equipped with appropriate infrastructures. During the initial transition phase, this could increase voyage times and transport costs, particularly on transoceanic routes. In the long term, however, global expansion of refueling infrastructure and technological advancements could stabilize or even reduce costs, providing more efficient vessels and optimized routes.

### Effects on Transportation Costs and Pricing Models

Initial Increase in Operational Costs	Green technologies and alternative fuels are often more expensive than conventional systems (fuel oil, Marine Gas Oil - MGO, Marine Diesel Oil - MDO). Additionally, new engines and structural modifications to vessels require high capital investments (CAPEX). Shipping companies may initially pass some of these costs onto freight rates, potentially affecting import/export prices. The implementation of instruments such as the ETS (Emission Trading System) or a maritime carbon tax will further increase cost pressures on more polluting vessels.
Long-Term Cost Effectiveness	In the medium to long term, the widespread adoption of clean technologies and energy efficiency improvements (route optimization, advanced hull designs, digitalization) could reduce fuel consumption and emissions, partially offsetting initial costs. The combined effect of economies of scale and competition among alternative fuel suppliers could drive price reductions, contributing to market stabilization. Shipping companies investing early in low-emission technologies could gain a competitive advantage, benefiting from public incentives or tax reductions.



<b>New Pricing Models and Contract Negotiations</b>	<p>The growing demand for “sustainable shipping” will drive the inclusion of environmental clauses in transport contracts, rewarding operators who can demonstrate lower CO<sub>2</sub> emissions per transported unit.</p> <p>Premium freight rates may emerge for certified low-impact routes, supported by companies that must meet strict ESG targets in their supply chains (e.g., automotive, electronics, apparel industries).</p>
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### Impact on Supply Chain Structures and Integrated Logistics

<b>Near-Shoring and Regionalization</b>	<p>Rising maritime transport costs, coupled with the need to reduce supply chain carbon footprints, could encourage near-shoring or reshoring trends, bringing certain production phases closer to final markets.</p> <p>Although globalized supply chains remain a pillar of world trade, industries with low margins or products highly sensitive to transport costs might consider shorter, more diversified logistics alternatives (regional hubs, manufacturing clusters closer to target markets).</p>
<b>Greater Vertical Integration</b>	<p>Leading companies are already considering the entire value chain, synchronizing production, storage, and land-sea transport to minimize waste and overall environmental impact.</p> <p>Integration across multiple transport modes (rail-sea or road-sea intermodality) and the selection of logistics hubs closer to consumption areas could help reduce the total carbon footprint, leveraging the benefits of a multi-faceted green logistics strategy.</p>
<b>Long-Term Planning and Risk Management</b>	<p>Companies will need to implement scenario planning to account for possible changes in fuel costs, regulations, and customer preferences.</p> <p>Applying risk management strategies (flexible contracts, route diversification, financial partnerships) will help mitigate uncertainty and volatility in the decarbonization journey.</p>

### Impacts on International Trade and Competitive Dynamics

<b>Differentiation of Ports and Trade Corridors</b>	<p>Some ports will evolve into true “green hubs”, equipped with comprehensive decarbonization infrastructures and services, attracting traffic and fostering industrial clusters focused on ship repair, offshore wind module manufacturing, and green hydrogen production.</p> <p>Ports that fail to adapt quickly risk exclusion from major trade routes, leading to significant economic consequences for affected regions.</p>
<b>New Market Entry Barriers and Potential Trade Tensions</b>	<p>The disparities in investment capacity and adaptation to environmental regulations may create imbalances between developed and developing countries, which may struggle to upgrade their infrastructures.</p> <p>This “double standard” risk could lead to trade tensions and calls for support measures (international funds, more accessible technologies) to prevent the green transition from widening the economic divide.</p>

<b>Greater Transparency and Corporate Social Responsibility</b>	<p>Sustainable supply chain practices will push companies to declare and monitor the origin and transport of goods, including emissions tracking across every segment of the logistics chain.</p> <p>Under pressure from regulations (such as the EU Corporate Sustainability Reporting Directive - CSRD) and stakeholder expectations, environmental reporting will become a key competitiveness and marketing tool, influencing corporate reputation on a global scale.</p>
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### Future Outlook and Adaptation Strategies

<b>Investing in Innovation and Partnerships</b>	<p>Shipping companies, freight forwarders, and logistics operators must collaborate to share the costs and benefits of the green transition, for example, by signing long-term agreements for alternative fuel supply or creating dedicated “green corridors.”</p> <p>Innovation (smart ships, digital twins, big data analytics) will be crucial to optimizing routes and reducing fuel consumption and emissions.</p>
<b>Adopting a Holistic Supply Chain Approach</b>	<p>Leading companies are already considering the entire value chain, synchronizing production, storage, and land-sea transport to minimize waste and overall environmental impact.</p> <p>Integration across multiple transport modes (rail-sea or road-sea intermodality) and the selection of logistics hubs closer to consumption areas could help reduce the total carbon footprint, leveraging the benefits of a multi-faceted green logistics strategy.</p>
<b>Long-Term Planning and Risk Management</b>	<p>Companies will need to implement scenario planning to account for possible changes in fuel costs, regulations, and customer preferences.</p> <p>Applying risk management strategies (flexible contracts, route diversification, financial partnerships) will help mitigate uncertainty and volatility in the decarbonization journey.</p>

<b>Conclusions</b>	<p>Maritime decarbonization is ushering in a new era for global supply chain management, significantly affecting transport models, trade flow geography, and port competitiveness. While complying with environmental regulations and adopting green fuels come with high initial costs and operational complexities, they also represent a unique opportunity to renew global logistics, improve process efficiency, and reduce the overall environmental impact of supply chains.</p> <p>In the long run, the ability to innovate, develop appropriate infrastructures, and foster collaboration between key stakeholders (governments, shipping companies, logistics operators, investors) will be crucial to ensuring that the transition to sustainable shipping occurs in a balanced manner, supporting both economic competitiveness and environmental protection.</p> <p>Resilient and responsible supply chains, adapting to these transformations, will combine efficiency and sustainability, positioning themselves at the forefront of future global trade.</p>
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# Conclusions

The growing focus on environmental impacts in the maritime sector, coupled with regulatory and social pressures to reduce greenhouse gas emissions, has made the transition to more sustainable operational models essential. Green Shipping is not only an ecological necessity but also a strategic lever for the global maritime industry's competitive repositioning. The adoption of clean technologies, fleet upgrades, and port infrastructure modernization emerge as fundamental steps to ensure both economic and environmental sustainability in the sector.

Throughout this document, several crucial aspects have been analyzed in detail, leading to the identification of key conclusions:

- Innovative financial instruments such as green and blue bonds have established themselves as primary channels for directing capital towards sustainable maritime projects, actively involving both private operators and international financial institutions.
- The growing interest of venture capital and private equity in “blue tech” startups—emerging companies focused on sustainable maritime innovation—demonstrates a clear investment trend, highlighting the value of technological innovation and environmental sustainability.
- At the same time, public finance plays a crucial role through mechanisms such as direct grants, tax incentives, and concessional credit lines. These tools are essential for mitigating the risks associated with the high initial costs of the technological and infrastructural interventions required for maritime decarbonization.
- Furthermore, public-private partnerships have proven to be fundamental for implementing large-scale projects, as they reduce uncertainty and facilitate the adoption of common and shared technological standards. Such collaborations foster a favorable investment environment, encourage knowledge-sharing between the public and private sectors, and accelerate the deployment of innovative technologies.
- Finally, the analysis highlights the importance of establishing clear and stable regulatory frameworks, which are essential for ensuring investment continuity, reducing uncertainties, and eliminating regulatory barriers that could slow the transition process.

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## *Chapter 3 – Opportunities and Risks*

- EBRD Green Logistics Programme (Balkans and Southeastern Mediterranean): Initiatives for energy efficiency and emission reduction in transport

## *Chapter 4 – Future Prospects*

- European Commission: Policy documents on maritime transport in ETS and EU taxonomy for sustainable finance
- IMO (MARPOL, EEXI, CII): IMO regulations and emission standards
- ICS, Interferry, Global Maritime Forum: Conferences and workshops on best practices in the maritime sector

## *Further References for In-depth Study*

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- European Investment Bank (EIB): Climate Awareness Bonds and Sustainability & Maritime Transport
- European Bank for Reconstruction and Development (EBRD): Green & Blue Economy Financing
- International Finance Corporation (IFC): Blue Finance Initiatives
- Union for the Mediterranean (UfM): Documents on blue economy and sustainable finance in the Mediterranean
- Plan Bleu (UNEP/MAP): Reports on Mediterranean economy and sustainability
- Ministries of Transport and Infrastructure Websites (Italy, Spain, France, Greece)



# ALBANIA

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

As of now, Albania does not have a dedicated national funding program specifically targeting green shipping. However, there are some relevant opportunities and mechanisms that could support green maritime initiatives indirectly:

- The Ministry of Infrastructure and Energy may include green initiatives within broader transportation or decarbonization strategies, though shipping-specific funding remains limited
- Albanian National Agency for Scientific Research and Innovation (NASRI), can support research national funding project to Albanian researcher addressing energy efficiency, environment, in which green shipping topics can be included in funding scheme of the agency

### Private Sector Involvement:

- The shipping sector in Albania is relatively small and mostly consists of short-sea shipping and ferry operators
- There is no structured mechanism or tax incentive yet for private companies to invest in green maritime technologies (e.g. electrification, hybrid propulsion, scrubbers, etc.)

Albania currently lacks a fully developed innovation and finance ecosystem specifically dedicated to green shipping. However, there are some institutions, and stakeholders that can contribute in this sector:

### Ministry of Infrastructure and Energy (MIE)

Central authority responsible for transport and energy policy.

### Albanian Maritime Administration (AMA)

Regulatory body with potential role in policy implementation and alignment with IMO/EU green transition frameworks.

### Albanian Register of Shipping (RDSH/ARS)

Albanian National Classification society; supports ship inspections, certifications and potential retrofitting activities in the maritime sector.

### National Agency for Scientific Research and Innovation (NASRI)

Supports national research and development (R&D) initiatives in which green shipping can be also addressed under different key priorities.

### Non Profit Organizations (NGO)

Such as AULEDA (Local Development Agency of Vlore) that have implanted initiatives related to green shipping that are financed by EU funding Program (IPA,INTERREG, Erasmus).

### Chambers of Commerces of Tirana and Vlora

Has take part in EU project initiatives (IPA,INTERREG), to promote green shipping in Albania.

### Universities

(e.g. University of Vlora/Department of Engineering and Marine Technology) Technical expertise and academic study programs in naval engineering, and its academic staff is involved in the topics addressing green shipping.

### Albanian Institute of Transport

Is a technical public body, under the authority of the Ministry of Infrastructure and Energy. Its activities include components related to green transition in sustainable mobility sector and participation in some EU-funded projects addressing also topics of decarbonisation and innovation in transport.

Main finance and innovation players that supports green shipping in your country? Consider clusters, finance/industrial aggregations, technology parks, trade associations.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

## PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

While Albania currently does not have dedicated funding and innovation programs specifically for green maritime transport, several existing national and regional initiatives can support green shipping.

- University of Vlora “Ismail Qemali”, Department of Engineering and Marine Technologies offer study programs in Naval Engineering and its academic staff is involved in R&D activities related to green shipping
- NASRI (National Agency for Scientific Research and Innovation) offers research funding that may support maritime sustainability topics if aligned with national priorities
- Occasional national-level events on energy transition, blue economy and sustainable transport are organized by ministries and universities and other public entities, as well as Non Government Organistaions
- Participation in EU funding programs (IPA, INTERREG, ERASMUS, etc) for examples SHIPMENT (Strengthening Intellectual Property and Technology transfer processes in green sea mobility), Zero C (Enhacing Knowledge and Skills in Preparation for Zero Carbon Maritime Transport and Logistics Society), Future 4.0 (ManuFactUring educaTion and training governance model for IndUstry 4.0 in the Adriatic-Ionian aREa)
- Modernizations of Albanian port infrastructure supported by EU and national funds

Although not yet focused on maritime, these intermediaries can play a key role in funding green shipping startups and technologies.

- **AULEDA (Local Development Agency)**  
Does not offers financial green shipping activities, but participate actively in EU funding programs.
- **Chambers of Commerce of Vlora and Tirana**  
Do not offer financial green shipping activities, but can help to connect start-ups with investors.

Some banks can offers green credit lines in general in which green shipping funding can be included.

There is currently no public institution in Albania exclusively dedicated to green Shipping. However the following institutions are involved or have the potential of involvement in green shipping activities.

- **Ministry of Infrastructure and Energy (MIE)**  
Defines national transport and energy strategies, including maritime sustainability goals and port decarbonization.
- **Albanian Maritime Administration (AMA)**  
Implements maritime regulations, supervises safety and environmental compliance in navigation.
- **Port Authority of Main Albanian Ports**  
Currently involved in modernization and green port infrastructures.
- **National Agency for Scientific Research and Innovation (NASRI)**  
Supports R&D programs, including potential projects in green maritime technology.
- **Municipalities of port cities (e.g. Durres, Vlora, Saranda)**  
Involved in local sustainable transport planning and port-city interface.
- **University of Vlore, Department of Engineering and Maritime Technologies**  
Offers Study programs related to naval engineering.

## REFERENCE BANK AND FINANCIAL INTERMEDIARIES

Procredit Bank Albania, Raiffeisen Bank, Intesa San Paolo Bank, Banka Kombetare Tregtare can offer some green financing in general, in which green shipping financing could be included.

## REFERENCE GREEN MARINE MED CONTACT

University of Vlora Ismail Qemali  
Department of Engineering and Marine Technology  
univlora.edu.al

# BULGARIA

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

### National recovery and sustainability plan of Republic of Bulgaria:

#### Operational Programmes

- “Competitiveness and Innovation” 2021-2027
- “Research, innovation and digitization for intelligent transformation” 2021-2027
- “Environment” 2021-2027
- “Maritime, Fisheries and Aquaculture” 2021-2027
- Regional Development Programme 2021-2027 – priority 1 Integrated urban development

#### Other funding opportunities

- **National Innovation Fund**  
Supports applied R&D and technological innovation, including projects related to energy-efficient transport, logistics optimization, and green technologies.
- **Fund of Funds**  
Manages EU-backed financial instruments (equity, guarantees, loans) and channels support through intermediaries to SMEs and infrastructure projects aligned with the green and digital transition.
- **Bulgarian Ports Infrastructure Company (BPI Co.)**  
Contributes to decarbonization in the maritime sector by investing in green infrastructure.
- **Marine Cluster Bulgaria (MCB)**  
Acts for strengthening the Bulgarian Blue economy bringing together science, industry and policy makers. Since 2024, it has also joined the Shipbuilding Alternative Fuels Propulsion Systems Alliance (S3 platform).
- **Bulgarian Ship Hydrodynamics Centre (BSHC)**  
Conducts cutting-edge research in ship hydrodynamics, energy efficiency and eco-friendly vessel design, including low-emission propulsion systems and fuel-optimized hull forms.
- **Nikola Vaptsarov Naval Academy**  
Equips students with competencies in AI, cybersecurity and smart technologies to support the maritime industry’s transition to green shipping.

- **Operational Programme “Regions in Growth”**  
Projects for improving infrastructure, there are successfully funded projects for purchasing of electric tourist boat (Burgas Municipality)
- **Operational Program on the Environment 2021-2027**  
Provides USD 1.77 billion in EU funds for environmental projects, including climate change mitigation and air pollution control
- **Programme Interreg V-A Romania – Bulgaria 2014-2020 – NAVY T - WAY**  
Improving safety of navigability on Danube river in the Calarasi - Silistra cross-border region. Purchase of electric boat for crossborder connection.
- Bulgaria’s **National Recovery and Sustainability Plan**  
Supports sustainable transport through investments in rail infrastructure, electric mobility, and low-emission urban transport. These measures create a broader framework that could indirectly support future green maritime initiatives.

#### Fairs/ exhibitions:

- **Green Transition Forum**  
The largest green transition forum in Central and Eastern Europe, held annually in Sofia, Bulgaria. It brings together innovators, investors, and policymakers to discuss sustainable development, including green shipping.
- **Bulgarian Small and Medium Enterprises Promotion Agency (BSMEPA)**  
Stimulates business to develop innovations and new technologies. The Agency supports SMEs to improve their export positions and international partnerships through funding participation at international blue economy fairs and exhibitions.

Business angels’ networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

## PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

### Accelerator Programmes:

- **Black Sea Accelerator for Sustainable Blue Economy under BRIDGE – BS project**  
Designed to support innovative projects aimed at promoting a sustainable blue economy in the Black Sea region.

In 2023, Impetus Capital launched the **Kármán Line program**, targeting early-stage startups in space, mobility, and commerce sectors. The program offered €300,000 investments to selected companies, aiming to foster innovation in the movement and interaction of people, goods, and services.

**Morningside Hill Capital Management** is interested in venture capital, private equity, hedge funds and mutual funds across a wide range of industries, including sectors within the blue economy.

- **Ministry of Transport and Communications**  
Oversees national transport policies and infrastructure development, including initiatives for green transport.
- **Ministry of Innovation and Growth (MIG)**  
Is working to build a competitive economy that will ensure the growth and development of the regions in Bulgaria, promote and accelerate innovation and investment throughout the country and in all sectors of the economy. General Directorate “European Funds for Competitiveness” is part of MIG.
- **Ministry of Regional Development and Public Works (MRDPW)**  
Oversees regional development and infrastructure projects, including those related to transport and sustainable development. MRDPW plays a role in coordinating with other ministries on projects that intersect regional planning and green transport initiatives.
- **Ministry of Agriculture and Food - Management Body of Operational Programme “Fisheries and Aquaculture”** in support of eco-innovations, including retrofitting of fisheries vessels
- **Executive Agency for Fisheries and Aquaculture (IARA)**  
A body under the Ministry of Agriculture and Food, IARA is responsible for implementing fisheries policy, including the sustainable management of fish stocks, control of fishing activities, and oversight of infrastructure used by fishing vessels.  
It plays a supporting role in projects related to the environmental modernization of fishing ports, vessel efficiency upgrades, and enforcement of environmental standards in marine and inland waters.
- **Ministry of Environment and Water**  
Leads national environmental policy, including climate change mitigation, marine water protection, and coordination of environmental impact assessments for infrastructure projects.
- **Bulgarian Ports Infrastructure Company**  
Manages the development and modernization of port infrastructure, aiming to reduce CO<sub>2</sub> emissions and improve efficiency.
- **Executive Agency “Maritime Administration” (EAMA)**  
Responsible for implementing state policy in maritime transport, ensuring safety and environmental protection in Bulgarian maritime spaces. EAMA plays a crucial role in regulating and promoting sustainable practices within the maritime sector.
- **Local Authorities - Black Sea and Danube river municipalities**

Main finance and innovation players that supports green shipping in your country?  
Consider clusters, finance/industrial aggregations, technology parks, trade associations.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

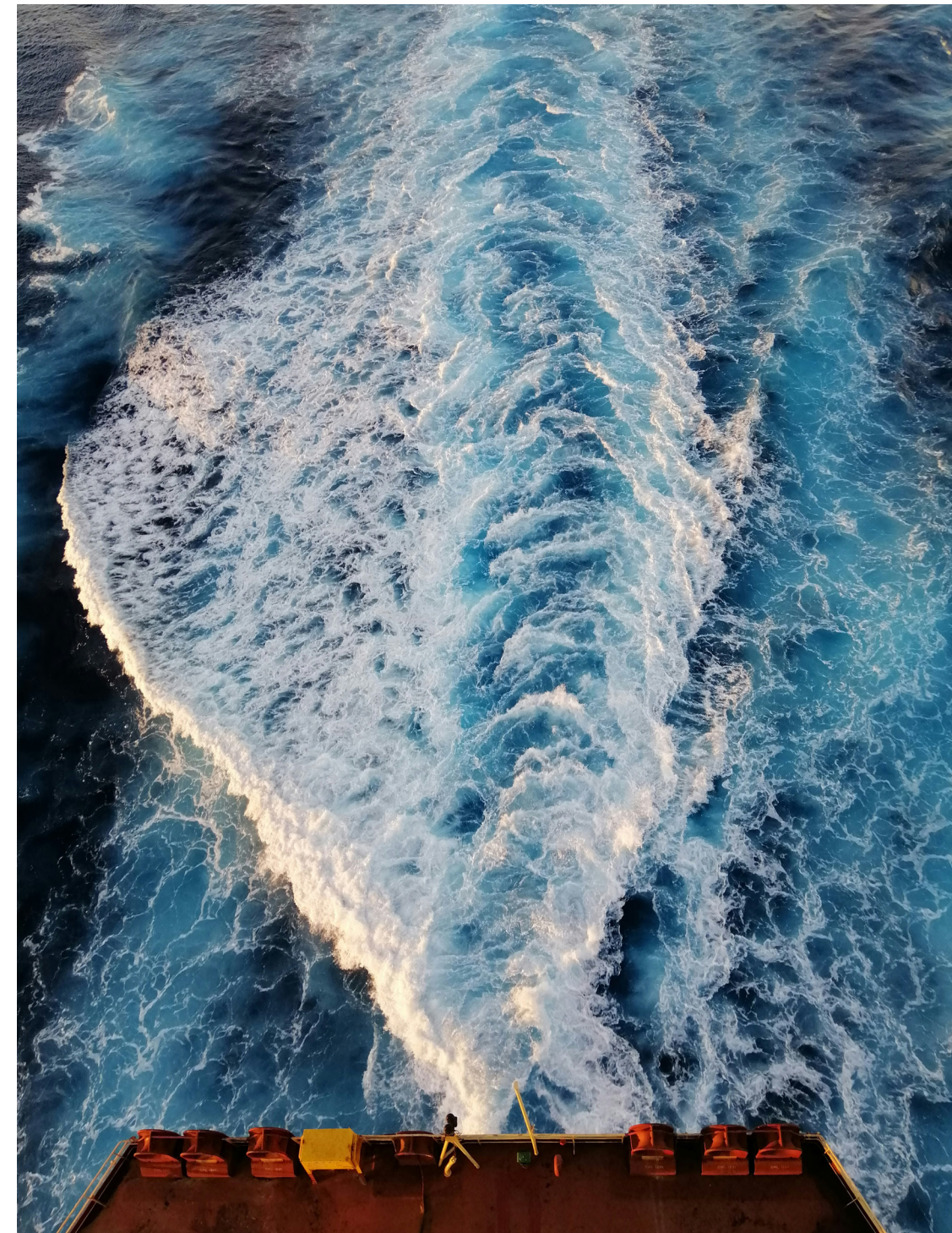


REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES

- **Bulgarian Development Bank (BDB)**  
State-owned bank financing SMEs and strategic projects, with a dedicated green transition portfolio supported by the EIB.
- **National Guarantee Fund (NGF)**  
Offers loan guarantees for SMEs, including a special scheme under the Fisheries and Aquaculture Programme for vessel and port modernization.
- **Fund of Funds (FoF)**  
Manages EU financial instruments to support startups and SMEs through providing equity, loans, and guarantees through intermediaries to support innovation and sustainability.
- **European Investment Bank (EIB)**  
Co-finance sustainable mobility and maritime infrastructure in Bulgaria via programs like InvestEU and CEF.
- **InvestEU (via Postbank & ProCredit Bank)**  
Supports green transport and energy efficiency through loan guarantee schemes delivered by local banks.

REFERENCE GREEN MARINE  
MED CONTACT

Marine Cluster Bulgaria  
[marinecluster.com](http://marinecluster.com)  
[office@marinecluster.com](mailto:office@marinecluster.com)





CROATIA

PUBLIC AND PRIVATE  
FUNDING AT NATIONAL LEVEL

**Croatian Green Ports Initiative**  
Subsidized loans and grants on green infrastructures.

**Fleet Modernization Grants** for the Fishing Industry

**Green Shipping Fund (GSF)**  
Managed by PROW Capital, €420 million private debt fund providing tailored financing for new and existing vessels that meet environmental standards. It supports European shipowners, including those in Croatia, in adopting green technologies and reducing emissions.

**Croatian Bank for Reconstruction and Development (HBOR)**  
HBOR - role in financing green projects. In collaboration with the European Investment Bank (EIB), it secured a €200 million loan to expand green financing for Croatian businesses, including those in the maritime sector.  
Innovation Norway – Bilateral Cooperation Program - This program fosters long-term business cooperation between Croatia and Norway in green industry innovation. It offers grants ranging from €25,000 to €100,000 for projects in areas like renewable energy, circular economy, and zero-emission transport, including green shipping.<sup>1</sup>

**HAMAG-BICRO**  
The Croatian Agency for SMEs, Innovations, and Investments (HAMAG-BICRO) provides financial support to small and medium-sized enterprises for research and development. It plays a crucial role in funding innovative projects, including those aimed at advancing green shipping technologies.

**DIH InnovaMare**  
A central figure in Croatia’s maritime innovation landscape. It focuses on developing autonomous and sustainable marine technologies. . It collaborates with international partners, such as Norway’s Ocean Autonomy Cluster, through initiatives like the Adriatic Green Autonomous Transport Initiative (AGATI), aiming to advance autonomous maritime transport in the Adriatic region.

**SDEWES Centre (Zagreb)**  
Research center on sustainable energy, water, and environmental systems.

**Croatian Shipowners’ Association Mare Nostrum**  
Represents commercial shipowners advocating for environmental compliance and green shipping strategies.

**Centre of Excellence MARBLE** is a leading hub for maritime robotics and sustainable blue economy innovation, advancing research and solutions in robotics, green endurance, IoT, and digital twins

**MARINN** Innovation Cluster is a maritime cluster established in Primorsko Goranska Region, active in blue innovation.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

**4th International Maritime Conference “Naše More”**  
– Date: September 18–19, 2025  
– Location: Dubrovnik, Croatia  
– Focus: Sustainable, green, and resilient maritime industry, covering topics like maritime safety, environmental protection, and innovation  
– Organizer: Faculty of Maritime Studies, University of Dubrovnik  
– Details: [iamu-edu.org](http://iamu-edu.org)[iamu-edu.org](http://iamu-edu.org)  
**Green Energy Expo Zagreb**  
– Date: June 3–4, 2025  
– Location: Zagreb, Croatia  
– Focus: Renewable energy, waste-to-energy, and wind energy sectors. While not exclusively maritime, it presents opportunities for green shipping technologies.  
– Details: [10times.com](http://10times.com)

**ZICER – Zagreb Innovation Centre**  
– Stage: Supports startups from ideation to market launch.  
– Offerings: Mentorship, office space, and access to investor networks.  
– Details: [femaleswitch.com](http://femaleswitch.com)<sup>2</sup>

**SORTA - Symposium on the Theory and Practice of Shipbuilding:**  
Contribute to the integration of the existing knowledge and experience in the context of modern scientific and professional achievements in the field of shipbuilding, offshore engineering, maritime and inland navigation, through invited lectures, scientific and professional papers, panel discussions and round tables.

Business angels’ networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

**CRANE – Croatian Business Angels Network**  
Established in 2008, CRANE connects private investors with early-stage companies. It offers not only capital but also mentorship and strategic guidance. Notably, Davorin Štetner, a prominent investor and entrepreneur, serves as its president.

**Fil Rouge Capital**  
Based in Zagreb, Fil Rouge Capital focuses on early-stage investments ranging from €10,000 to €2 million. They support startups from incubation through to exit, providing both capital and mentorship.

**CroInvest**  
– Croatia’s first crowdfunding platform, supporting various models: donations, rewards, loans, equity, and profit-sharing.  
– Focuses on entrepreneurial, infrastructural, and socially beneficial projects, with an emphasis on those competing for EU funds.  
– Website: [croinvest.eu](http://croinvest.eu)

PUBLIC INSTITUTIONS  
WORKING IN GREEN SHIPPING

– Ministry of Maritime Affairs, Transport and Infrastructure (MMPI)  
– Hydrographic Institute of the Republic of Croatia (HHI)  
– Croatian Bank for Reconstruction and Development (HBOR)  
– Croatian Agency for the Environment and Nature (HAOP)  
– Central State Office for Public Procurement

REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES

**Zagrebačka banka d.d. – private<sup>3</sup>**  
**Croatian Bank for Reconstruction and Development (HBOR)**  
**Fine’sa Grupa** Croatian financial and investment group involved in various sectors, including green energy and fisheries

REFERENCE GREEN MARINE  
MED CONTACT

HAMAG-BICRO  
Croatian Agency for SMEs, Innovation and Investments  
[hamagbicro.hr](http://hamagbicro.hr)

1. [https://eea.innovationnorway.com/article/28052024%3A-open-call-for-bilateral-cooperation-in-green-and-blue-sector?utm\\_source=chatgpt.com](https://eea.innovationnorway.com/article/28052024%3A-open-call-for-bilateral-cooperation-in-green-and-blue-sector?utm_source=chatgpt.com)  
2. <https://www.femaleswitch.com/playbook/tpost/rmlkzb4mu1-top-15-startup-incubators-in-croatia-in>  
3. <https://www.zaba.hr/home/mali-poduzetnici/eif-innovfin>



CYPRUS

PUBLIC AND PRIVATE  
FUNDING AT NATIONAL LEVEL

**Public Funding**  
– Deputy Ministr of Shipping, Ministry of Energy  
– Commerce and Industry (MECI) supports energy transition initiatives and maritime decarbonisation through EU co-financed schemes

**Research Promotion Foundation (RPF)**  
– Offers national calls and manages EU-funded projects like “RESTART 2016–2020”

**EU Funds**  
– Cyprus leverages Horizon Europe  
– CEF (Connecting Europe Facility)  
– LIFE programme  
– EMFAF for blue economy and green shipping innovation

**Private Funding**  
– Maritime companies (e.g. MSC, Bernhard Schulte Shipmanagement, Interorient, Columbia Shipmanagement) often co-invest in decarbonisation pilots and digitalisation projects

**Cyprus Marine and Maritime Institute (CMMI)**  
A leading RTDI organisation active in EU projects and national collaborations. Also serves as a Commonwealth Blue Charter Centre of Excellence.

**Cyprus Shipping Chamber (CSC) and Cyprus Union of Shipowners (CUS)**  
Facilitate innovation and decarbonisation dialogue.

**Cyprus Employers and Industrialists Federation (OEB)**  
Promotes industrial innovation and climate finance awareness.

**Cyprus Energy Agency (CEA)**  
Supports sustainable energy and maritime decarbonisation initiatives.

**Cyprus Chamber of Commerce and Industry (CCCI) and the CCI of Limassol, Larnaka, Famagusta and Nicosia and maritime-related clusters (e.g. CyFOS)**  
foster green business and maritime technology development.

**Events and Conferences:** provide platforms for knowledge exchange and funding matchmaking  
– East Med Marine and Offshore Exhibition  
– Maritime Cyprus  
– CMMI Blue Innovation Conference

**Accelerators/Incubators:** support cleantech and maritime tech start-ups  
– Cyprus Seeds  
– Gravity Ventures  
– IDEA Innovation Centre  
– ARIS A Really Inspiring Space

**R&D Initiatives**  
– Projects under Horizon Europe and CEF such as SEANERGY, GreenMed and FLAGSHIPS involve Cyprus-based actors.

**EU & National Innovation Programs**  
– Green shipping tech trials, electrification pilots, and data-driven emissions monitoring are fostered.

Main finance and innovation players that supports green shipping in your country?  
Consider clusters, finance/industrial aggregations, technology parks, trade associations.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

**Business Angels & VC**  
33 East, Kinisis Ventures, CyRIC’s Equifund-backed partners, and Cyprus Business Angels Network (CYBAN).

**Crowdfunding**  
GrowVC and international platforms open to Cypriot SMEs.

**Private Debt/Equity Funds**  
Hellenic Bank SME-focused green finance instruments.

Maritime insurers and private advisory firms like Thomas Miller & Partners also play a role in sustainable finance for shipping companies.

PUBLIC INSTITUTIONS  
WORKING IN GREEN SHIPPING

- **Ministry of Transport, Communications and Works**  
Maritime administration under Deputy Ministry of Shipping (DMS).
- **Deputy Ministry of Shipping (DMS)**  
Leads maritime strategy and implementation of decarbonisation regulations.
- **Ministry of Energy, Commerce and Industry (MECI)**  
Supports energy-efficient technologies.
- **Research & Innovation Foundation (RIF)**  
Provides grants for maritime R&D.
- **Department of Environment**  
Regulates marine emissions and environmental compliance.
- **Deputy Ministry for Research, Innovation and Digital policy (DMRID)**

REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES

- **Bank of Cyprus**  
Green loans and ESG products for shipping.
- **Hellenic Bank**  
Green and innovation-focused SME instruments.
- **Alpha Bank Cyprus**  
Offers sustainability-linked credit lines.
- **European Investment Bank (EIB)**  
Provides financing for Cyprus-based green maritime infrastructure.
- **EIF via Cyprus intermediaries**  
(e.g., through Equifund) facilitates venture co-investments.

REFERENCE GREEN MARINE  
MED CONTACT

CMMI – Cyprus Marine and Maritime Institute  
www.cmmi.blue  
risu@cmmi.blue

# EGYPT

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

- **Suez Canal Economic Zone (SCZone) Green Initiative & Incentives**  
Incentives for investments in green hydrogen, green ammonia production, green bunkering, and related sustainable industries. This includes potential tax breaks, land allocation, and streamlined permitting.
- **Sovereign Fund of Egypt (TSFE)**  
Actively seeks and co-invests in strategic sectors, including green hydrogen, renewables, and infrastructure, which can support green shipping projects.
- **Government-led Green Hydrogen/Ammonia Projects**  
Significant national push for developing Egypt as a green energy hub, with MOUs and partnerships signed with international companies for production facilities, often located within or near port areas (e.g., SCZone). Funding involves a mix of public investment, private sector, and international finance.
- **National Climate Change Strategy 2050 & Egypt Vision 2030**  
Allocate significant focus and indirectly, resources, towards sustainable development, including green transport and energy transition, which benefits green shipping.
- **Green Bonds**  
Egypt has issued sovereign green bonds, proceeds of which can be channeled into eligible green projects, including clean transportation.

### International Climate Finance & Development Partner Funding

- **EBRD (European Bank for Reconstruction and Development)**  
Significant investments in Egypt's green economy, including port modernization, renewable energy, and support for green hydrogen.
- **EIB (European Investment Bank)**  
Provides financing for sustainable transport, renewable energy, and environmental projects.
- **World Bank Group (IBRD & IFC)**  
Supports infrastructure development, climate resilience, and private sector investment in green technologies.
- **African Development Bank (AfDB)**  
Funds infrastructure and energy projects.

- **National Bank of Egypt (NBE)**
- **Financing Sustainable Development in Egypt**
- **International Finance Corporation (IFC)**
- **European Bank for Reconstruction and Development (EBRD)**
- **The World Bank**
- **Suez Canal Economic Zone (SCZone)**  
The primary industrial and logistics cluster actively developing green fuel production (hydrogen, ammonia) and green bunkering infrastructure. Acts as a one-stop shop for investors in these areas.
- **Suez Canal Authority (SCA)**  
Implementing strategies for a “Green Canal,” including incentives for eco-friendly ships, investments in canal-side green infrastructure, and exploring alternative fuels for its own fleet.
- **Arab Academy for Science, Technology & Maritime Transport (AASTMT)**  
Leading regional institution for maritime education, research, and consultancy, involved in R&D for green shipping solutions and capacity building.
- **Egyptian Chamber of Shipping**  
Represents the interests of shipping companies and can play a role in promoting adoption of green technologies and practices.
- **The Sovereign Fund of Egypt (TSFE)**  
Co-invests in green hydrogen and other strategic green projects.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- **Hosting and Participating in International Fairs and Conferences (i.e. COP27)**
- **Incubation and Acceleration Programs for Green Shipping Startups**
- **Research and Development (R&D) Programs for Green Technologies**
- **Public-Private Partnerships (PPPs) for Innovation in Green Shipping**
- **SCZone Green Fuel Hub Development**  
Large-scale projects for green hydrogen and green ammonia production involving international consortia, with significant investment in infrastructure.
- **Port Modernization and Greening Projects**  
Investments in major ports (Alexandria, Damietta, Port Said, Sokhna) include elements of energy efficiency, potential for shore power, and improved logistics to reduce emissions.
- **MARLOG (International Maritime Transport and Logistics Conference)**  
Annual conference organized by AASTMT in Alexandria, increasingly featuring sessions on green shipping, decarbonization, and sustainable port development.
- **Egypt Energy Show (EGYPES)**  
Major energy exhibition and conference in Cairo, with a growing focus on energy transition, hydrogen, and decarbonization technologies relevant to the maritime sector.
- **COP27 (Sharm El Sheikh, 2022)**  
While a global event, it spurred numerous green initiatives and partnerships in Egypt, including for green hydrogen and maritime decarbonization.
- **AASTMT Research & Development Programs**  
Conducts research on alternative marine fuels, ship efficiency, and environmental impact of shipping. Collaborates with industry and international bodies.
- **Pilot projects for green bunkering and alternative fuels** within SCZone and major ports.
- **The Solar Heating for Industrial Process (SHIP) project**  
Funded by the Global Environment Facility (GEF).

### Incubators/Accelerators (General, with potential for green tech)

- **Falak Startups:** Accelerator that supports early-stage tech companies; could include cleantech/sustainability.
  - **Flat6Labs:** Regional accelerator with a presence in Egypt, supporting various tech startups; has had green-focused cohorts or portfolio companies.
  - **AUC Venture Lab (American University in Cairo):** University-based incubator/accelerator, potentially supporting innovative solutions.
- (Note: Dedicated “green shipping” accelerators are less common, but broader sustainability or tech accelerators may support relevant innovations.)

Main finance and innovation players that supports green shipping in your country? Consider clusters, finance/industrial aggregations, technology parks, trade associations.





Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- **Financing Sustainable Development in Egypt**
- **African Development Bank Group**
- **Cairo Angels**  
Prominent angel investor network in Egypt.
- **Alexandria Angels**  
Angel investor network focused on Alexandria and the Delta region.
- **Sawari Ventures**  
VC firm investing in technology and knowledge-driven companies in Egypt and MENA.
- **Algebra Ventures**  
Leading Egyptian VC firm focusing on technology startups.
- **Egypt Ventures**  
Government-backed investment firm supporting startups and SMEs, with potential for green tech.
- **EFG Hermes**  
Leading investment bank in MENA, involved in project finance and M&A, potentially including green infrastructure.
- **Commercial International Bank (CIB)**  
Egypt's largest private sector bank, increasingly incorporating ESG principles and offering green finance products.
- **National Bank of Egypt (NBE) & Banque Misr**  
Large state-owned banks providing corporate finance, potentially for larger green projects.
- **International Finance Corporation (IFC)**  
Provides equity, debt, and advisory services to private sector projects, including those in sustainable infrastructure and cleantech.
- **Hint**  
Crowdfunding for large-scale green shipping infrastructure is less common but could support smaller tech solutions or community-based environmental projects.

PUBLIC INSTITUTIONS  
WORKING IN GREEN SHIPPING

- **Ministry of Transport**  
Oversees maritime transport policy, port development, and integration of green shipping principles into national transport strategies.
- **Ministry of Environment & Egyptian Environmental Affairs Agency (EEAA)**  
Set environmental regulations, promote green initiatives, and oversee compliance.
- **Ministry of International Cooperation (Facilitates international funding and partnerships)**
- **Ministry of Planning and Economic Development (Oversees Vision 2030)**
- **Ministry of Electricity and Renewable Energy (Key for green hydrogen production)**
- **Ministry of Petroleum and Mineral Resources (Involved in energy transition, including blue/green hydrogen/ammonia)**
- **Suez Canal Authority (SCA)**
- **Suez Canal Economic Zone (SCZone)**
- **Sovereign Fund of Egypt (TSFE)**
- **General Authority for Investment and Free Zones (GAFI)**
- **General Authorities for Port Economic Zones (e.g., Alexandria Port Authority, Damietta Port Authority, Red Sea Ports Authority)**
- **Red Sea Ports Authority and Alexandria Port Authority**

REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES

- **National Bank of Egypt (NBE)**  
Key financier for national projects, including infrastructure.
- **Banque Misr**  
Major state-owned bank involved in corporate and project finance.
- **Commercial International Bank (CIB)**  
Leading private bank with growing ESG finance portfolio.
- **African Export-Import Bank (Afreximbank)**  
Headquartered in Cairo, finances trade and projects across Africa, including infrastructure.
- **European Bank for Reconstruction and Development (EBRD) Egypt Office**  
Green projects.
- **European Investment Bank (EIB) Regional Office**  
Provides loans for strategic projects.
- **International Finance Corporation (IFC) Egypt Office**  
Supports private sector green investments.
- **HSBC Egypt**  
International bank with green finance expertise.
- **Arab African International Bank (AAIB)**
- **Egyptian Environmental Affairs Agency (EEAA)**

REFERENCE GREEN MARINE  
MED CONTACT

Arab Academy for Science, Technology & Maritime Transport (AASTMT)  
aast.edu

## FRANCE

### PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

- Call for projects financed and coordinated by the CMA CGM Fund for Energies to support innovative solutions for decarbonization of French shipping sector.
- Eco-Transport Maritime Tax Reduction (2022).
- Fonds d'Accélération de la Transition Écologique dans le Maritime (2021).
- France 2030 aims to help key industries transform faster using innovation as their driver, and to position France not just as a player but as a leader in tomorrow's world. €54 billion investment until 2030.
- Green Fund (Fond Vert) supports local investments to accelerate the ecological transition in the regions.
- Interreg Italy-France Maritime 2021-2027 programme focuses on fostering cross-border cooperation between Italy and France in the maritime regions. It aims to address common challenges such as environmental protection, economic development, and sustainable tourism. The programme supports projects that enhance connectivity, innovation, and the sustainable use of maritime resources, promoting a more integrated and resilient maritime area.
- Maritime intervention fund (FIM) aims to support the sustainable development of marine activities, in accordance with the political ambition of the Secretary of State for the Sea and Biodiversity.
- Recovery Plan for Energy Transition in Transport.
- 2025 Work Programme describes the actions and calls for proposals proposed by the French National Research Agency (ANR) for the coming year. Aimed at all scientific communities and all public or private players involved in French research.

Main finance and innovation players that supports green shipping in your country?  
Consider clusters, finance/industrial aggregations, technology parks, trade associations.

- **Agence de développement économique AD'OCC Occitanie**  
Supports R&D project development in the region Occitanie.
- **APER**  
Is the national eco-organization approved by the Ministry of Ecological and Inclusive Transition to manage the deconstruction and recycling of end-of-life pleasure and sports boats.
- **Bureau Veritas**  
Classification society operating in maritime sector for certification purposes.
- **Fédération des Industries Nautiques (French leisure marine industries federation)**  
Defends and promotes the different sectors of the French leisure marine industries.
- **French Maritime Cluster (CMF)**  
Brings together all stakeholders in the maritime ecosystem, from industry to maritime services and activities of all kinds. It is currently made up of nearly 500 entities.
- **GICAN - French Maritime Industry Association**  
A trade association representing over 300 manufacturers and organizations in the French maritime sector.
- **Ifremer**  
The French research institute dedicated to knowledge about the ocean.
- **Pôle de compétitivité Capenergies**  
Clean Energy Cluster.
- **Pôle EMC2 Additive Manufacturing**  
Innovation cluster focussing additive manufacturing.
- **Pôle Mer Méditerranée**  
Sea innovation cluster located in South of France.
- **Pole Mer Atlantique**  
Sea innovaton cluster located in Bretagne.
- **Technopôle de l'Environnement Arbois-Méditerranée**  
Technology pole.
- **TVT Innovation**  
Agence de développement économique de la Métropole Toulon Provence Méditerranée: development agency.
- **World Ocean Council (WOC)**  
International alliance of ocean business and innovation leadership, working together to build a thriving, sustainable and regenerative blue economy.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- **Euromaritime 2026**  
Maritime innovation event.
- **Journée Mer & Défense 2025**  
Fair and conference.
- **EURONAVAL**  
National fair on navy and defence.
- **French Tech Mission**  
Responsible for supporting the structuring the french French start-up ecosystem's growth both locally and internationally.
- **Investments for the Future programme (PIA)**  
Aim to stimulate employment, boost productivity and increase the competitiveness of French businesses by encouraging investment and innovation in priority sectors to drive growth.
- **Maritime Economy Conference**  
A major event in Europe, bringing together more than 1,500 political, economic and military decision-makers involved in all sectors of maritime activity, both in mainland France and in overseas territories.
- **Nautic**  
International boatshow of Paris.
- **Cannes Yachting Festival**

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- France Angels – French Federation of Business Angels
- Auvergne Business Angels
- BPI France
- GO CAPITAL: is an independent management company managing seed capital and venture capital
- Mer Angels
- Provence Angels
- Sophia Business Angels

### PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

**Conseil d'orientation de la Recherche et de l'Innovation de la filière des Industriels de la mer (CORIMER)**  
Maritime research and industrial innovation institution.

**French National Research Agency (ANR)**  
Commissioned "to manage major government investment programs in the fields of higher education and research and to oversee their implementation.

- Nice Côte d'Azur Metropolitan Area
- Ministry de la Transition écologique, de la Biodiversité, de la Forêt, de la Mer et de la Pêche: national ministry
- Région Sud Provence Alpes Cote D'Azur
- Région Occitanie

### REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- Amundi Asset Management
- Banque Bleue: formalize the approach of Banque Populaire Grand Ouest and Crédit Maritime in favor of the maritime economy, coastal protection, and initiatives that energize the regions.
- Banque Populaire Méditerranée
- BNP Paribas
- Caisse d'Epargne – Nautibanque
- CIC Bank
- CO VEA Société de groupe d'assurance mutuelle
- Crédit Agricole: within maritime sector responds to the challenges of blue economy players and supports the growth of maritime activities
- Société générale

### REFERENCE GREEN MARINE MED CONTACT

World Ocean Council  
worldoceancouncil.org  
info@worldoceancouncil.org



## GREECE

### PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

#### Hellenic Foundation for Research & Innovation

Programmes supporting the acquisition of research equipment, and advancing the research work of PhD candidates, Postdocs, Scholars.

#### General Secretariat for Research & Innovation

Special Unit for Managing and Implementing Research & Innovation Actions. The latter manages the R&D program ‘Research-Innovate 2021-2027’.

#### ‘Greece 2.0’ National Recovery and Resilience Plan

Offering funding opportunities as well as business loans.

#### VAT Reductions on Green Engine Purchases (2022)

- **Hellenic Chamber of Shipping**  
Funds actions supporting its members (e.g. issued a guide to ESG reporting).
- **Maritime Hellas**  
The Greek shipping cluster.
- **Piraeus Chamber of Commerce & Industry**  
Supports its members (shipping value chain) also through its engagement in R&D programs.
- **Hellenic Marine Equipment Manufacturers & Exporters**  
Promotes the interests and solutions / services of Greek maritime technology specialists.
- **Hellenic Marine Environment Protection Association**  
Focuses more on innovative methods for training seafarers and maritime professionals on a variety of issues related mainly to the environment (decarbonization, sustainability, ESG/CSR, regulatory developments, pollution prevention, safety, crew wellness, etc.)
- **Lloyds Register Maritime Emissions Reduction Centre**  
Goal is to remove technical, investment and community barriers for the uptake of solutions to reduce GHG emissions.
- **Hellenic Institute of Transport / Centre for Research and Technology Hellas**  
Supports the industry through R&D&I actions involving new technology building pilot testing, policy support, strategy formation, etc.
- **Athena Research Center**  
Supports the industry through R&D&I actions focusing mostly on digitalization.
- **Corallia**  
Hellenic Technology Cluster Initiative.
- **Found.ation**  
Technology and innovation enabling platform.

Main finance and innovation players that supports green shipping in your country? Consider clusters, finance/industrial aggregations, technology parks, trade associations.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- **Posidonia**  
The International Shipping Exhibition.
- **Panathenea Festival**  
Tech, Business, Art Festival.
- **Blue Growth Piraeus competition**  
Start-up competition addressing all established and emerging sectors of the Blue Economy.
- **MENA Maritime Accelerator**  
Provides participating startups funding, training, peer-to-peer coaching and theme-specific mentoring.
- **Enso XL MaritimeTech Accelerator**  
Seed stage maritime accelerator by Optima X dedicated to create an investor and entrepreneur maritime ecosystem within the Athenian maritime ecosystem.
- **EGG – Enter, Grow, Go**  
Business incubation and acceleration program ran by Eurobank in partnership with Corallia supporting startups within financing and advice through 2 platforms: Start Up and Scale Up.

Business angels’ networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

### PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

- **OK!Thess**
- **Athens Center for Entrepreneurship and Innovation**  
Incubation and acceleration center of the Athens University of Economics and Business offering a variety of programs.
- **R&D program ‘Research-Innovate 2021-2027’**  
4 actions: R&D of businesses, Partnership of companies with research centers, Commercialization of research results, Seal of excellence for businesses. Relevant thematic areas include: (4) Environment & Circular Economy, (6) Transport and supply chain, and (7) Sustainable Energy.

- Hellenic Business Angels Network
- Signal Ventures
- Metavallon
- Loggerhead Ventures
- VentureFriends
- Marathon Venture Capital
- Starttech Ventures
- Genesis Ventures
- Uni.Fund
- Corallia Ventures

- Ministry of Maritime Affairs & Insular Policy
- Ministry of Environment and Energy
- Hellenic Republic Asset Development Fund: issued studies (as shareholder) for cold-ironing in the ports of Lavrio, Kavala, Rafina, Kerkyra, Patra and Alexandroupoli
- Public port authorities

### REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- Hellenic Development Bank;
- Eurobank
- Piraeus bank
- Alpha Bank
- National Bank of Greece
- Aegean Baltic Bank
- Pancreta Bank
- Association of Banking and Financial Executives of Hellenic Shipping

### REFERENCE GREEN MARINE MED CONTACT

Hellenic Institute of Transport (HIT) – Centre for Research and Technology Hellas (CERTH)  
www.certh.gr



## ISRAEL

### PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

- IIA (Israel Innovation Authority)
- SNC (Startup Nation Central)
- INCC

Main finance and innovation players that supports green shipping in your country?

Consider clusters, finance/industrial aggregations, technology parks, trade associations.

- Blue Economy (HiCenter – Haifa)
- EcoMotion
- SeaNovation
- KerenYam – VC
- IOLR (research)
- Haifa University – Leon H. Charney School for Marine Sciences
- PLANETech
- Ashdod Port CVC
- ZIM CVC
- CAMERI

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- DLD annual conference
- EcoMotion annual conference
- BlueEconomy annual conference
- Haifa University demo day
- PLANETech annual conference
- SeaNovation accelerator
- Quantum (Taavora) accelerator
- Ashdod Port accelerator

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- OurCrowd (VC crowdfunding)
- theDOCK VC
- ZIM CVC
- Ashdod Port CVC
- DriveTLV VC
- Cardumen Capital
- Viola VC
- Vintage VC
- Tau Venture – Tel Aviv University
- Cactus Venture – Ben Gurion University
- Tal Ventures
- JAL VC

### PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

- Zalul Org
- IOLR Org
- Israel Ministry of Environmental Protection
- Israeli Ports – public org
- Haifa Port
- Ashdod Port
- Jafa Port

### REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- Hapoalim Tech
- IIA – Israel Innovation Authority
- Bilateral international programs (IIA)

### REFERENCE GREEN MARINE MED CONTACT

the DOCK Innovation  
[www.thedockinnovation.com](http://www.thedockinnovation.com)





# ITALY

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

### Energy Transition Fund for the Naval Sector (2021)

Non-repayable grants and subsidized financing.

### National Recovery and Resilience Plan (PNRR)

Mission 3 (Infrastructure for Sustainable Mobility)- Public grants and public-private investment partnerships.

### Tax Credit for Ship Efficiency Upgrades (2022-2023)

Tax credit (up to 40-50% of costs incurred).

### Regional funds for Research, Development and Innovation collaborative projects

Region Friuli Venezia Giulia, Liguria.

### CPR Blue Economy Fund

Debt fund to support growth of enterprises operating in the blue economy sector.

Main finance and innovation players that supports green shipping in your country? Consider clusters, finance/industrial aggregations, technology parks, trade associations.

- **Blue Italian Growth (BIG)**  
The national maritime technology cluster fostering R&D, sustainability, and innovation in the blue economy.
- **Cluster Trasporti Italia 2020**  
A national platform uniting research centers and industries in sustainable transport, including maritime.
- **RINA**  
National classification society actively involved in ship retrofitting and maritime decarbonisation projects.
- **Port Authorities of Genoa and Trieste**  
Key drivers of energy transition through electrification of docks and green infrastructure.
- **Federazione del Mare**  
Italy's maritime federation promoting competitiveness and environmental sustainability in the sector.
- **Maritime Technology Cluster FVG**  
Regional technology cluster on maritime technology based in Friuli Venezia Giulia.
- **DLTM**  
Regional technology cluster on maritime technology based in Liguria.
- **NAVTEC**  
Regional technology cluster on maritime technology based in Sicily.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- **PNRR – National Recovery and Resilience Plan (Mission 2)**  
Investments in green technologies and clean fuels including hydrogen for maritime applications.
- **Participation in Horizon Europe projects**  
e.g. “SEANERGY”, “FENIX” (green fuels, ship electrification, smart logistics).
- **ZES and ZLS Expo (Special Economic and Logistics Zones)**  
Tax and investment incentives for sustainable development in southern ports.
- **Port Community System modernisation**  
Digitisation and automation initiatives supported by EU and national funds.
- **ShipMag / Green Ports Conference**  
Annual events focusing on green port and shipping solutions.
- **EcoMondo**  
Event for green and circular economy in Rimini.
- **SeaFuture**  
Exhibition focusing marine innovation.
- **Zero Emission Mediterranean**  
Trade show for green technologies and decarbonization.
- **Tech4Planet (PoliHub – Politecnico di Milano)**  
Accelerator for sustainability-focused startups.

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- EBRD's Green Maritime Sector Initiative
- The European Bank for Reconstruction and Development (EBRD)
- Salone della Nautica (Genova, Venezia)
- Green Logistic Expo (Genova)
- NauticSud (Napoli)
- Faros Accelerator, CDP (La Spezia- Taranto)

- CDP Venture CapitalGreen Transition Fund
- IBAN: Italian Business Angel Networks Association
- BlueInvest Italia (with Invitalia support)
- Italian Angels for Growth (IAG) – angel investor club
- Club degli investitori
- Angels 4 Impact
- ENEA Tech and Biomedical Foundation – Supporting innovation and green industrial technologies.
- Crowdfunding platforms – e.g. Crowdfundme, Mamacrowd (used by cleantech and green startups).
- Clean Technology Fund (CTF)

## PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

- Ministry of the Environment and Energy Security (MASE)
- Ministry of Infrastructure and Transport (MIT)
- Ministry for Enterprises and Made in Italy (MIMIT)
- Cassa Depositi e Prestiti (CDP)
- ENEA – National agency for new technologies, energy and sustainable development.
- Regional Authorities (Liguria, Friuli Venezia Giulia, Campania): Managing EU funds for sustainable port development.
- Port System Authorities: Especially Genoa, Trieste, Naples, Venice – with active decarbonisation roadmaps.

## REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- **Intesa Sanpaolo**  
Green Bonds and ESG Finance Division.
- **Unicredit**  
Project finance for clean transport.
- **Banco BPM**  
Sustainable finance for logistics and energy efficiency.
- **BPER Banca**  
ESG credit lines for maritime and port businesses.
- **Cassa Depositi e Prestiti (CDP)**  
Financing large-scale green infrastructure including port electrification.
- **SACE**  
Export and investment insurance with green criteria.
- **European Investment Bank (EIB)**  
Loans and guarantees for low-carbon maritime and port projects.

## REFERENCE GREEN MARINE MED CONTACT

Maritime Technology Cluster FVG  
www.marefvg.it  
info@marefvg.it



# MOROCCO

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

- Morocco Investment Charter
- Hassan II Fund for Economic and Social Development
- FDII (Funds for Industrial Development and Investment)
- Innov Invest Funds
- Damane Capital Risque
- Intelak Al Moukawil (Private funding)
- National Port Plan 2030
- Maritime Green Transition Support Fund

Main finance and innovation players that supports green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- Cluster Maritime Maroc (CMM)
- Moroccan Agency for Sustainable Energy (MASEN)
- Technoparks Morocco
- National Ports Agency (ANP)
- Casablanca Finance City (CFC)

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

There are currently no specific initiatives dedicated to supporting financing and innovation activities in Green Shipping in Morocco but Organize an annual “Morocco Green Shipping Summit” in collaboration with international organizations like the International Maritime Organization (IMO) to establish a “Morocco Green Shipping Fund and to create a “Green Shipping Innovation Lab” in partnership with Moroccan universities.

Business angels’ networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- Business Angels’ Networks: Morocco Business Angels Network (MBAN) and AfriMAB (African Business Angels Network )
- Crowdfunding Platforms: Aflamnah
- Venture Capital Funds: Outlierz Ventures, UM6P Ventures (Mohammed VI Polytechnic University) and GreenTec Capital Partners
- Private Equity and Debt Funds: CDG Capital Private Equity, MedZ (Mediterranean Investment Partners) and AfDB (African Development Bank)

## PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

- Ministry of Equipment
- Ministry of Energy Transition and Sustainable Development
- Tanger Med Port Authority
- Moroccan Agency for Sustainable Energy (MASEN)
- National Ports Agency
- Moroccan Institute for Research in Solar Energy and New Energies (IRESEN)

## REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- Attijariwafa Bank
- Banque Centrale Populaire (BCP)
- BMCE Bank of Africa
- Caisse de Dépôt et de Gestion (CDG)
- Société Générale Maroc 6. Moroccan Agency for Sustainable Energy (MASEN)
- European Bank for Reconstruction and Development (EBRD)
- African Development Bank (AfDB)

## REFERENCE GREEN MARINE MED CONTACT

Indegate Consulting  
indegate.com





# SLOVENIA

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

- **Slovenian Climate Fund**  
grants and subsidized loans for the transition to low-carbon technologies, including energy efficiency and renewables.
- **Eco Fund**  
subsidies and soft loans for companies for sustainable investments.
- **Recovery and Resilience Plan of the Republic of Slovenia (NOO)**  
measures for sustainable mobility and infrastructure projects.
- **Ministry of Infrastructure of the Republic of Slovenia**  
Participates in public-private partnerships (PPPs) for sustainable mobility projects.
- **Tax contribution for research and development (RRI)**  
Allows for a reduction in the tax base for companies investing in energy efficiency, innovation, digitalization.
- **Contribution for investments** in environmentally friendly technologies is included in the legislation on corporate income tax.
- **SPIRIT Slovenia / Ministry of the Economy, Tourism and Sport**  
Calls for tenders for RRI projects (EUREKA, EUROSTARS, calls for cooperation with research organizations).
- **Slovenian Agency for Research and Innovation (ARIS)**  
Supports collaborative research projects.
- **SID Bank – Sustainable Economy Funds**  
Provides loans to companies operating in environmental sectors (including the blue economy).
- **Fisheries Fund (European Maritime, Fisheries and Aquaculture Fund - EMFF)**  
Aimed at developing sustainable maritime, fisheries and aquaculture in Slovenia.
- **Slovenian Enterprise Fund (SPS)**  
Microfinance and seed capital for companies developing sustainable or innovative solutions.

Main finance and innovation players that supports green shipping in your country?  
Consider clusters, finance/industrial aggregations, technology parks, trade associations.

- **Tehnološki park Ljubljana (TP Ljubljana)**  
Technology park in Ljubljana is a leading institution in innovation in Slovenia, active in collaborative projects addressing decarbonization and maritime technologies (reference NEORION project).
- **Luka Koper**  
The unique large port in Slovenia connecting international routes. Actively involved in decarbonization and greening actions.
- **INNO2MARE**  
Collaborative project supporting greening and digitalization of maritime sector in Slovenia and Croatia.
- **European Investmen Bandk**  
Has signed in 2023 new commitments in Slovenia totalling €359 million in 2023, with a special focus on sustainable transport and decarbonisation.

### Recovery and Resilience Plan (NOO) – Mission 2: Green Transition

The NOO is a key document guiding investments in sustainable technologies and clean fuels, including hydrogen for maritime applications. Programmes such as the Eco Fund and the Slovenian Enterprise Fund (SPS) provide grants and subsidized loans for companies investing in energy efficiency and green technologies.

### Participation in Horizon Europe projects – e.g. SEANERGY, FENIX

Slovenia actively participates in European research projects such as SEANERGY and FENIX, which focus on green fuels, ship electrification and smart logistics. Slovenian institutions such as the University of Maribor - Inštitut za celulozo in papir participate in these projects.

### Green and Logistics Zones (ZES and ZLS Expo)

Slovenia encourages the development of special economic and logistics zones that offer tax and investment incentives for sustainable development in ports.

### Modernization of port community systems

Slovenia is investing in the digitalization and automation of port systems, supported by EU and national funds. Luka Koper has implemented electrification of docks and green energy solutions such as solar power plants and electric vehicles for internal logistics.

### European Investment Bank (EIB)

The EIB supports projects that contribute to sustainable development, including the maritime sector.

### Key events and initiatives

- **Logistics Congress 2025**  
The largest logistics event in the region, bringing together all stakeholders in logistics, transport and production. The event will take place between 2 and 4 April 2025 in Portorož. The organizer is the Slovenian Logistics Association (SLZ).
- **Moving Slovenia 8.0**  
Conference on logistics, infrastructure and mobility, taking place on 9 October 2024 at the Brdo pri Kranju Congress Centre. The event is organised by Advantage Austria Ljubljana and Časnik Finance.
- **Keep IT Simple 2024**  
Conference on information technology in logistics and production, taking place on 3 October 2024 at the Hotel Rose in Bled. The event is organised by the Slovenian Logistics Association (SLZ).
- **SEEnergy 2025**  
An event focused on the green transition and energy solutions, taking place on 5 and 6 November 2025 in Celje. The event is organized by Celje Fair.
- **5th International Logistics Summer School**  
Summer school that will take place from September 2 to 10, 2024 at the Faculty of Logistics in Celje. The program includes theoretical content and practical challenges with an emphasis on sustainable logistics.

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- **Poslovni angeli Slovenije (PAS) Business Angels of Slovenia**  
The oldest and largest business angel club in Slovenia. It connects ambitious entrepreneurs with qualified investors, both domestic and international. They offer smart investments of up to €500,000, with a focus on the growth and internationalization of startups.
- **4NGELS – European Business Angel Program**  
The 4NGELS program connects business angels from Estonia, Finland, Poland and Slovenia. It enables knowledge exchange, international investments and training for startups.
- **ALFI Renewables**  
Specialized fund for investments in renewable energy sources in Southeastern Europe. It is aimed at decarbonization and sustainable development, especially in sectors such as solar and wind energy.<sup>1</sup>
- **ALFI PE – Private Equity Fund**  
The largest private equity fund manager in Slovenia. It participates in the Slovenian Enterprise Growth Investment Program (SEGIP), financed by SID Bank and the European Investment Fund. It is intended for the growth of Slovenian companies in various stages of development.
- **Adrifund**  
The first Slovenian crowdfunding platform. It enables the collection of funds for projects in the early stages of development, including innovations in the field of green technology.

1. <https://alfi.si/slo/>

PUBLIC INSTITUTIONS  
WORKING IN GREEN SHIPPING

- Tehnološki park Ljubljana, projekt NEORION
- Luka Koper, projekt CLEAN BERTH
- Evropska investicijska banka (EIB)
- Ministry of Infrastructure of the Republic of Slovenia
- Ministry of the Economy, Tourism and Sport
- Slovenian Agency for Research and Innovation (ARIS)

REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES

**Slovenian institutions and financial intermediaries supporting green maritime**

– **NLB (Nova Ljubljanska banka)**

One of the largest Slovenian banks, actively involved in financing sustainable projects, including green bond issuance and ESG financing, offers various financial products designed to support green and sustainable projects.

– **SKB Banka**

Member of the Société Générale group and focuses on sustainable financing. The bank offers various financial products that support projects in line with ESG principles.

– **SID Banka (Slovenian Export and Development Bank)**

Specializes in financing infrastructure projects, including green projects. The bank participates in financing projects that contribute to sustainable development, including the modernization of the Divača–Koper railway connection.

– **EIB (European Investment Bank)**

Key partner of Slovenia in financing sustainable infrastructure projects. The bank participated in financing the upgrade of the Divača-Koper railway line, which contributes to reducing CO<sub>2</sub> emissions and improving infrastructure for sustainable transport.

REFERENCE GREEN MARINE  
MED CONTACT

Regionalni razvojni center Koper – Regional Development Center Koper  
rrc-kp.si





# SPAIN

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

### European Union Public Funds & Programs

- **Connecting Europe Facility (CEF)**  
European funds (public-private); supports port decarbonization within the Trans-European Transport Network (TEN-T).
- **European Union Innovation Fund**  
Public funding for the demonstration of innovative low-carbon technologies.
- **Horizon Europe 2021–2027 Program**  
EU public funding for research and innovation.
- **NextGenerationEU Funds**  
EU recovery and resilience initiative after COVID-19.

### Spanish National Government Programs & Public Funding

- **Government of Spain National Recovery, Transition and Resilience Plan (PRTR)**  
Funded by NextGenerationEU (2019), focused on public-private collaboration.
- **Government of Spain – Sustainable and Digital Transport Support Program (PATSYD)**  
Supported by NextGenerationEU public funds.
- **ICO-Mitma Financing Lines**  
Collaboration between the Official Credit Institute (ICO) and the Ministry of Transport for sustainable mobility.
- **Plan Renove Flota Verde 2023**  
Non-repayable grants for fleet renewal.
- **Ports 4.0 Program**  
Provides grants to support sustainable technological innovation in the port and logistics sectors.

### Private & Public-Private Initiatives

- **Green Corridor between Spain and Morocco**  
Financed through private funds, aimed at decarbonized shipping and port connectivity.
- **Connecting Europe Facility (CEF)**  
(also listed above as EU public-private), relevant here due to its hybrid funding structure.

### Maritime and Blue Economy Clusters

- **Maritime Cluster of Cantabria – MarCA**  
Promotes sustainability and fosters the blue economy.
- **Maritime Cluster of Spain**  
Promotes the development of the blue economy and drives technological innovation.
- **Maritime Cluster**  
Barcelona Cluster Nàutic.
- **Maritime Cluster of the Balearic Islands**  
Encourages collaboration among economic, social, and administrative stakeholders; promotes marine renewable energy for energy transition in the nautical sector.
- **Maritime-Marine Cluster of Andalusia (CMMA)**  
Promotes R&D in technologies to reduce the environmental impact of maritime transport.
- **Euskadi Mobility and Logistics Cluster**  
Focused on sustainable mobility and logistics solutions.

### Technology & Innovation Centers / Support Organizations

- **ACCIÓ (Catalonia Trade & Investment)**  
Public agency supporting business competitiveness and innovation.
- **CDTI (Centre for the Development of Industrial Technology)**  
Supports industrial R&D and technological innovation.

Main finance and innovation players that supports green shipping in your country?  
Consider clusters, finance/industrial aggregations, technology parks, trade associations.

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

Business angels' networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- **Cleantech for Iberia**  
Advocacy and network for clean tech innovation in the Iberian Peninsula.
- **Naval and Maritime Technology Center (CTN)**  
Develops technological solutions and manages national/international R&D&I projects.

### Ports & Infrastructure

- **Port of Barcelona**  
Integrating renewable energy and green technologies in port operations.

### Private Sector Initiatives & Green Investment

- **BALEARIA**  
Funds eco-sustainable vessels to reduce maritime emissions.
- **Moeve (formerly Cepsa)**  
Invests in biofuels and green hydrogen solutions.

### Alliances & Policy Initiatives

- **Net-Zero Alliance MAR**  
Focuses on green corridors, port electrification, and maritime transport decarbonization.

### Grants and Funds

- **Baleària Sustainable Financing Initiative**
- **Barcelona Investment Fund**
- **B-Blue entrepreneurship programme**
- **Eco-incentive Grant Program**  
To boost maritime freight transport
- **Innovation Fund**  
Supports R&D of technologies for greener shipping, including onboard carbon capture.
- **Net-Zero Fund**  
Supports decarbonization initiatives including clean tech manufacturing and solutions development.

### Events and Conferences

- **Blue Economy and Finance Forum (BEFF) 2025**  
Promoting the Sustainable Blue Economy
- **Exhibition Vigo 2026**
- **International Shipbuilding and Maritime Industry**
- **Mediterranean Ports and Logistics Exhibition and Conference 2025**
- **Palma International Boat Show (Balearic Islands - Palma, Spain)**
- **Tomorrow Blue Economy World Congress**
- **Smart Ports: Piers of the Future Conference**  
Showcasing sustainable port solutions
- **Valencia Boat Show (Valencia, Spain)**
- **World Maritime Week 2025 (Bilbao, Spain)**

### Innovation and Technology Hubs

- **Blue Economy Innovation Hubs**  
Supporting startups and international maritime trade fairs highlighting green technologies.
- **High Technology Marine-Maritime Incubator (Canarias, Spain)**
- **Logistics & Automation Bilbao**

- **Incubazul**  
Technological and innovative projects: Business Angel Networks – FEDER Funds.
- **BANIB**  
Business Angels Network of the Balearic Islands.
- **Angels Capital**  
Also functions as a business angel network.

- **MentorDay**  
Blue Economy Acceleration Program: Business Angel Networks – Venture Funds.
- **Ship2B**  
Focused on social impact and sustainability; supports blue economy startups.
- **Aquila Capital**  
Sustainable investments, including in environmental sectors.
- **BeAble Capital**  
Venture capital focused on deep tech and industrial technologies.
- **BlueNet Cat**  
Open innovation platform.
- **Faber**  
Venture capital firm.
- **Faber Blue Pioneer**  
Specializes in blue economy startups.
- **Goteo Foundation**  
Advisor to BlueCrowdMED, initiatives, administrations, and campaigns to contribute to the development of public crowdfunding policies.
- **Ocean Capital Partners**  
Investments in maritime and port infrastructure.
- **The Crowd Angel**  
Equity crowdfunding platform.
- **Angels Capital**  
Spanish venture capital investing in innovative startups.
- **Enisa / ENISA**  
Public financing entity supporting SMEs and innovative startups.

**PUBLIC INSTITUTIONS  
WORKING IN GREEN SHIPPING**

- Barcelona Activa (Barcelona City Council)
- CDTI Innovacion
- Company Government of the Balearic Islands
- Ecology and Development Foundation
- Government Of Andalusia, Directorate of Coastal Development
- ICEX Spain Trade and Investment
- IDEA (Institute for Energy Diversification and Saving)
- Industrial Holdings Company Government of the Balearic Islands
- Interministerial Commission for Climate Change and Energy Transition
- Ministry for the Ecological Transition
- Ministry of Finance
- Ministry of Transport and Sustainable Mobility - Promote the transport of goods by sea as an alternative to road transport
- Net-Zero Alliance MAR
- Official Credit Institute (ICO)
- PierNext - Innovation by Port of Barcelona
- Ports and Maritime Affairs of the Basque Country
- Spanish Office for Climate Change
- Spanish state Ports
- State Secretariat for Transport and Sustainable Mobility
- The Climate Change Policy Coordination Commission (CCPCC)

**REFERENCE BANK AND  
FINANCIAL INTERMEDIARIES**

- Abanca Bank
- BBVA (Banco Bilbao Vizcaya Argentaria)
- CaixaBank
- Galicia Bank
- ICO Official Credit Institute
- Sabadell, Santander
- Triodos Bank
- EIB (European Investment Bank)

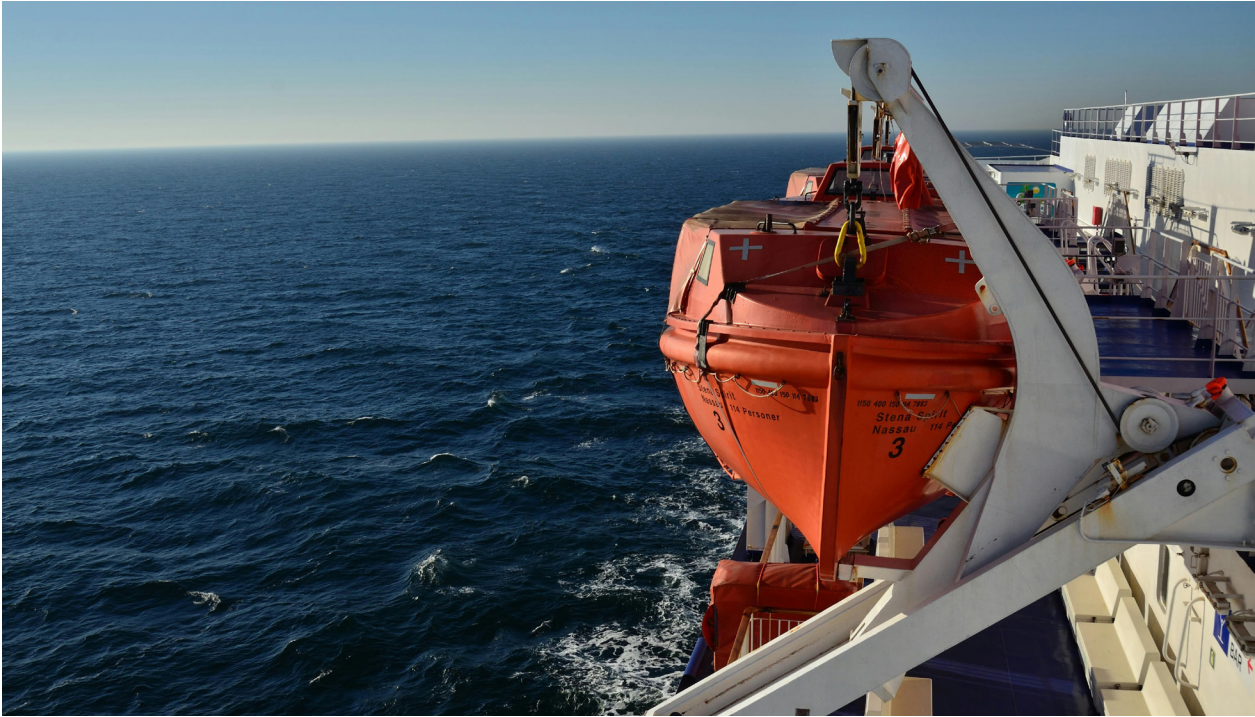
**REFERENCE GREEN MARINE  
MED CONTACT**

Barcelona Activa  
barcelonactiva.cat

Escola Europea Intermodal Transport  
escolaeuropea.eu

Maritim Cluster of the Balearic Islands  
clustermib.com

Port de Barcelona  
portdebarcelona.cat





# TURKEY

## PUBLIC AND PRIVATE FUNDING AT NATIONAL LEVEL

**Maritime Decarbonisation and Green Shipping Programme**  
combines European Bank for Reconstruction and Development (EBRD) loans with European Union (EU) grants.

**Turkish Growth and Innovation Fund (TGIF)**  
Launched in partnership with the European Investment Fund, Undersecretariat of Treasury, KOSGEB, and TSKB, TGIF aims to invest in companies with high growth potential and innovative technologies.

**Technology Development Foundation of Turkey (TTGV)**  
This foundation supports R&D and technology development, focusing on areas like technology commercialization, industrial creativity, and venture capital.

**High Technology Investment Program (HIT-30)**  
A government-led initiative with a large budget (USD 30 billion) aimed at boosting high-tech investments in Turkey.

Main finance and innovation players that supports green shipping in your country? Consider clusters, finance/industrial aggregations, technology parks, trade associations.

- EBRD – European Bank for Reconstruction and Development
- Ministry of Transportation and Infrastructure
- Regional Development Agencies
- Chamber of Shipping (IMEAK DTO)
- Turkish Shipowner Association
- Coaster Owners and Operators Association (KOSDER)
- Turkish Shipbuilders’ Association (GİSBİR)
- Shipbuilding Industry Incorporation, (GİSAŞ)
- Turkish Port Operators’ Association (TÜRKLİM)
- Maritime Association of Shipowner and Agents (VDA)
- Scientific and Technological Research Council of Türkiye (TÜBİTAK)
- Türkiye’s Long-Term Climate Strategy
- The Ministry of Industry and Technology of Türkiye

Main finance and innovation activities to support green shipping in your country? Consider fairs/exhibitions/ international conferences, incubation and acceleration programs, R&D and innovation programs.

- **The European Bank for Reconstruction and Development (EBRD)**
- **EU Instrument for Pre-accession IPA financial assistance to Türkiye**
- **Horizon Europa**
- **Expomaritt Exposhipping İstanbul 2025**  
Scheduled for 18-21 February 2025 at the Istanbul Expo Center, this biennial international maritime exhibition serves as a pivotal meeting point for the shipbuilding and sub-industry sectors.
- **Global Cleantech Innovation Programme (GCIP) Türkiye**  
Managed by TÜBİTAK, GCIP Türkiye is dedicated to empowering clean technology startups.
- **Frontier R&D Laboratory Support Programme (1515 Program)**  
This initiative encourages leading firms to establish advanced R&D laboratories in Türkiye.
- **EBRD’s Green Maritime Sector Initiative**  
Blending finance with EU Pre-accession grants.

Business angels’ networks, crowdfunding platforms, venture capital funds, private debt/equity funds, other financial intermediaries

- Galata Business Angels (GBA)
- Earlybird Digital East Fund
- Türkiye Teknoloji Geliştirme Vakfı (TTGV)
- Clean Technology Fund (CTF)

## PUBLIC INSTITUTIONS WORKING IN GREEN SHIPPING

- Ministry of Industry and Technology
- Ministry of Transport and Infrastructure
- The Scientific and Technological Research Council of Türkiye (TÜBİTAK)
- Union of Chambers and Commodity Exchanges of Türkiye (TOBB)
- Chamber of Shipping (IMEAK DTO)
- Investment Office of the Presidency of Türkiye (TYDTA)
- Ministry of Transport and Infrastructure
- Ministry of Environment, Urbanization, and Climate Change
- Scientific and Technological Research Council of Türkiye (TÜBİTAK)
- Türkiye Development and Investment Bank (TKYB)
- Türkiye Wealth Fund

## REFERENCE BANK AND FINANCIAL INTERMEDIARIES

- **DenizBank**
- **Türkiye Kalkınma ve Yatırım Bankası (TKYB)**
- **Türkiye Sürdürülebilir Enerji Finansman Programı (TurSEFF)**
- **European Bank for Reconstruction and Development (EBRD)**
- **Finansbank**  
In collaboration with the EBRD, QNB Finansbank issued a green bond, with the EBRD investing \$50 million.
- **Türkiye İş Bankası (İşbank)**
- **World Bank**

## REFERENCE GREEN MARINE MED CONTACT

NAVTEK Naval Technologies  
navtek.net

Bandirma University  
bandirma.edu.tr

THE GREEN MARINE MED PROJECT PARTNERSHIP





**GREEN MARINE MED: MediterraneAn GReen ShIpping NETwork:  
Linking Ports, Industries, Investment and Innovation for Monitoring  
and Technology Foresight on Green Shipping in the Mediterranean**

This document has been designed and realized with the perspective of facilitating improved access to Green Shipping Finance in the framework of task 4.1 of the GREEN MARINE MED project. The project strives to bring together the Green Shipping Finance Community in the Mediterranean and develop a clear and accessible overview of Green Shipping Finance status, challenges and opportunities in the Mediterranean.

