WATERBORNE

PARTNERSHIP PROPOSAL FOR ZERO-EMISSION WATERBORNE TRANSPORT

May 2020

DRAFT PROPOSAL FOR A EUROPEAN PARTNERSHIP UNDER HORIZON EUROPE ZERO-EMISSION WATERBORNE TRANSPORT

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The Partnership aims to create the foundations to transform waterborne transport into a net zero-emission mode of transport, through the demonstration of deployable zero-emission solutions suitable for all main ship types and services before 2030. It will contribute to maintaining and reinforcing Europe's global leadership in innovative, green waterborne transport solutions.

ABOUT THIS DRAFT

In autumn 2019 the Commission services asked potential partners to further elaborate proposals for the candidate European Partnerships identified during the strategic planning of Horizon Europe. These proposals have been developed by potential partners based on common guidance and template, taking into account the initial concepts developed by the Commission and feedback received from Member States during early consultation*. The Commission Services have guided revisions during drafting to facilitate alignment with the overall EU political ambition and compliance with the criteria for Partnerships.
This document is a stable draft of the partnership proposal, released for the purpose of ensuring transparency of information on the current status of preparation (including on the process for developing the Strategic Research and Innovation Agenda). As such, it aims to contribute to further collaboration, synergies and alignment between partnership candidates, as well as more broadly with related R&I stakeholders in the EU, and beyond where relevant.
This informal document does not reflect the final views of the Commission, nor pre-empt the formal decision-making (comitology or legislative procedure) on the establishment of European Partnerships.
In the next steps of preparations, the Commission Services will further assess these proposals against the selection criteria for European Partnerships. The final decision on launching a Partnership will depend on progress in their preparation (incl. compliance with selection criteria) and the formal decisions on European Partnerships (linked with the adoption of Strategic Plan, work programmes, and legislative procedures, depending on the form). Key precondition is the existence of an agreed Strategic Research and Innovation Agenda / Roadmap. The launch of a Partnership is also conditional to partners signing up to final, commonly agreed objectives and committing the resources and investments needed from their side to achieve them.
The remaining issues will be addressed in the context of the development of the Strategic Research and Innovation Agendas/ Roadmaps, and as part of the overall policy (notably in the respective legal frameworks). In particular, it is important that all Partnerships further develop their framework of objectives. All Partnerships need to have a well-developed logical framework with concrete objectives and targets and with a set of Key Performance Indicators to monitor achievement of objectives and the resources that are invested.
Aspects related to implementation, programme design, monitoring and evaluation system will be streamlined and harmonised at a later stage across initiatives to ensure compliance with the implementation criteria, comparability across initiatives and to simplify the overall landscape.

In case you would like to receive further information about this initiative, please contact:

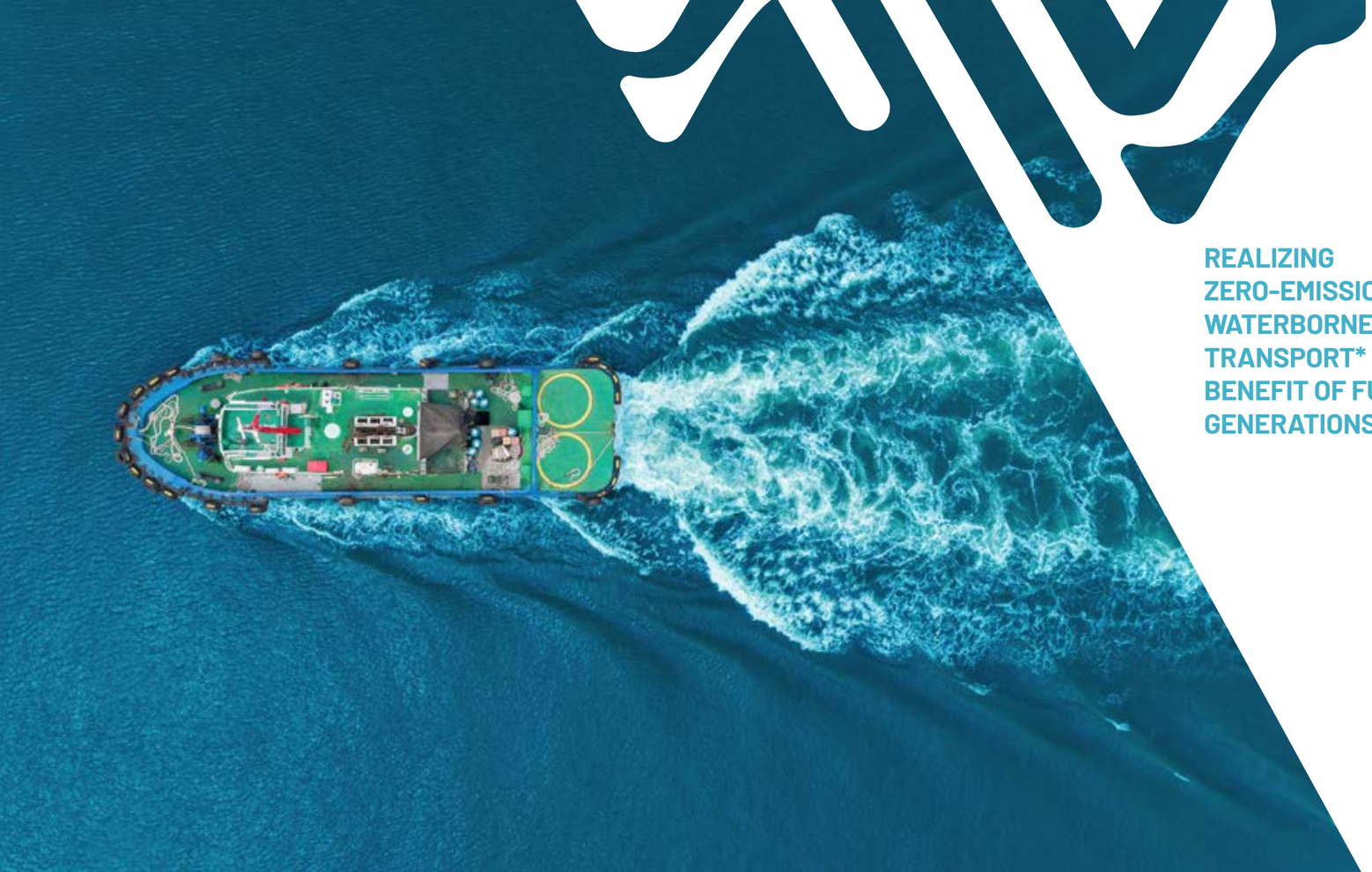
Lead entity (main contact):
Waterborne Technology Platform,
Jaap Gebraad, Executive Director
jaap.gebraad@waterborne.eu

Commission services (main contact):
DG for Research and Innovation,
RTD-CLEAN-WATERBORNE@ec.europa.eu

Partnership sector in DG R&I (overall policy approach for European Partnerships and its coherent application across initiatives),
RTD-EUROPEAN-PARTNERSHIPS@ec.europa.eu

Details of the strategy, including priority setting, activities and proposed Research and Innovation activities to be undertaken will be laid out within a subsequent Strategic Research and Innovation Agenda (SRIA) that will be subject to public consultation prior to finalisation by the end of the summer 2020. Additional information regarding the public consultations and progress of the development of the SRIA are available on www.waterborne.eu

* https://www.era-learn.eu/documents/final_report_ms_partnerships.pdf



REALIZING ZERO-EMISSION WATERBORNE TRANSPORT* TO THE BENEFIT OF FUTURE GENERATIONS

EXECUTIVE SUMMARY

Amid growing global and European societal pressure to resolve issues related to **climate change, air pollution** and the **degradation of the world's oceans,** political and regulatory attention has been increasingly directed towards waterborne transport, due to this mode of transport's high environmental and climate impact. The European Green Deal, the Paris Agreement Objectives, the Initial IMO Strategy on the reduction of GHG emissions from ships, and the CCNR Ministerial Mannheim Declaration are a number of key policy developments which provide a clear objective towards zero-emission waterborne transport.

The waterborne transport sector is committed to develop and demonstrate **disruptive** solutions for the aforementioned challenges. Research, development and innovation are key to be able to develop commercially viable solutions to **eliminate GHG emissions, air and water pollution.** These solutions should be applicable for both **new build and existing main maritime and inland navigation ship types and services.** Furthermore, the Partnership will develop solutions which will facilitate the envisaged **modal shift** of cargo from road to waterborne transport.

A **coordinated and joint approach** is needed to develop the disruptive solutions. The waterborne transport sector is composed of **many different stakeholders** in a **diversified sector** (many different sub segments, different ship types, etc.). Bringing and keeping them together requires a long term vision, strategy and programming. **Business as usual will not achieve the targets,** and the Partnership will be key to **coordinate** initiatives **to avoid duplication of efforts** and t**o speed up efforts by joining forces.**

The Partnership aims to create the foundations to transform waterborne transport into a net zero-emission mode of transport, through the demonstration of deployable zero-emission solutions suitable for **all main ship types and services before 2030.** It will contribute to maintaining and reinforcing Europe's global leadership in innovative, green waterborne transport solutions. The Partnership's objective is to

provide and demonstrate zero-emission solutions for all main ship types and services before 2030, which will enable zero-emission waterborne transport before 2050

In order to facilitate zero-emission waterborne transport, the Partnership will contribute to the **development of regulations and policies** at both national and international level including the development of standards to enable the implementation of technological solutions for zero-emission waterborne transport by 2030 at the latest.

Joining efforts through a Partnership approach is **essential** to realize zero-emission waterborne transport for the benefit of future generations.

* Waterborne transport: transport of cargo as well as passengers, at sea and oceans as well as on inland waters.

ABOUT THE LEAD ENTITY

The Waterborne Technology Platform (TP) will coordinate the preparation and execution of the Co-Programmed Partnership on zero-emission waterborne transport.

The Waterborne TP was created in 2005 as an industry-oriented Technology Platform to establish a continuous dialogue between all waterborne stakeholders and the EU Institutions and Member States (www.waterborne.eu).

The Waterborne TP is comprised of full members, as well as associate members from both maritime and inland navigation countries, from 17 EU Member States, the United Kingdom, Norway and Turkey. The members of the Waterborne TP include both European and national umbrella associations, as well as companies, public bodies, research organisations and universities. The European and national umbrella associations that are members of the Waterborne TP represent the broader waterborne community throughout Europe. New members are welcome, providing their activities are relevant and they are established in Europe.

The Partnership represents the broader waterborne transport sector and therefore includes all stakeholders from the maritime cluster and inland navigation, as well as the respective value chain, that are needed to facilitate the transition towards zero-emission waterborne transport. More details regarding the composition of the Partnership are available in paragraph 1.4.

The main contact person on behalf of the Waterborne TP is:

Jaap Gebraad
Executive Director of the Waterborne TP
jaap.gebraad@waterborne.eu
Tel: 0032-493835626

ABOUT THE INVOLVEMENT OF THE COMMISSION SERVICES

Zero-emission waterborne transport is a topic linked to the policies, legislation and programmes of various Commission Services. DG RTD, DG MOVE, DG CLIMA, DG ENER, DG ENV, DG GROW, SG, DG TAXUD, DG COMP and DG MARE undertake activities related to the objectives of this Partnership. The coordination of the involvement of the European Commission Services in the Partnership will be carried out jointly by co-creation. DG for Research and Innovation will act as the primary contact point for the preparation of the Partnership.

WATERBORNE

WATERBORNE TP has been set up as an industry-oriented Technology Platform to establish a continuous dialogue between all waterborne stakeholders, such as classification societies, energy companies, infrastructural companies, environmental non-profit organisations, manufacturers, research institutes, shipyards, ship-owners, waterway and port operators, universities, fisheries and citizen associations, as well as European Institutions and Member States.

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ACRONYMS

ACRONYM	MEANING
CCNR	Central Commission for Navigation of the Rhine
CEF	Connecting Europe Facility
CESNI	Comité Européen pour l'Élaboration de Standards dans le Domaine de la Navigation Intérieure
COP21	2015 United Nations Climate Change Conference
EMEP	European Monitoring and Evaluation Programme
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
MEPC	IMO Marine Environment Protection Committee
NECA	NO_x Emission Control Area
NO_x	Family of Nitrogen Oxides
RD&I	Research, Development and Innovation
SDG	Sustainable Development Goals
SO_x	Family of Sulphur Oxides
SRIA	Strategic Research and Innovation Agenda
TP	Technology Platform
UNDP	United Nations Development Programme
WMO	World Meteorological Organization

1. CONTEXT, OBJECTIVES, EXPECTED IMPACTS

1.1 CONTEXT AND PROBLEM DEFINITION

1.1.1 THE NEED FOR WATERBORNE TRANSPORT TO ACT NOW

Amid growing global and European societal pressure to resolve issues related to **climate change, air pollution** and the **degradation of the world's oceans,** political and regulatory attention has been increasingly directed towards waterborne transport, due to this mode of transport's high environmental and climate impact[1].

A number of major developments are illustrative in this respect:

- '**The European Green Deal"** (December 2019[2]), to ensure that Europe will be the first climate-neutral continent, thereby making Europe a prosperous, modern, competitive and climate-neutral economy, as envisaged in the Commission Communication **"A Clean Planet for All:** A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy" (November 2018[3]);
- The **Paris Agreement Objectives** (COP21[4]) and the scientific findings from the **Intergovernmental Panel on Climate Change (IPCC[5]),** which emphasises the need to limit global warming to 1,5°C above pre-industrial levels, and related global GHG emission pathways, in line with the Paris Agreement;
- The International Maritime Organisation's **(IMO) Initial IMO Strategy on the reduction of GHG emissions** from ships (April 2018[6]);
- The **EU and global sulphur cap**[7] as of 1 January 2020;
- The Central Commission for Navigation of the Rhine's **(CCNR)** Ministerial **Mannheim declaration** (October 2018[8]);
- The calls from the **European Council**[9] and **European Parliament**[10] to enhance the environmental track record of inland waterway transport;
- The calls from the **European Parliament**[11] to reduce global emissions from shipping and its resolution **declaring a climate and environmental emergency**[12] in Europe and globally;
- The **Sustainable Development Goals** (SDG) of the United Nations Development Programme (UNDP), in particular SDG 9 (Industry, Innovation and Infrastructure)[13], SDG 13 (Climate Action)[14] and SDG 14 (Life Below Water)[15].

The tell-tale signs and impacts of climate change – such as the rise in sea level, ice loss and extreme weather – increased during 2015-2019, which is set to be the warmest five-year period on record according to the World Meteorological Organization (WMO)[16]. There is an urgent need to accelerate action. Achieving a net zero-emission waterborne transport sector by 2050 at the latest, and at least 50% reduction of absolute emissions by 2030, entails a race against the clock, since the average age of a modern maritime vessel is **21** years[17], although this is not uniform across vessel types. Therefore, the transition towards **zero-emission waterborne transport** will need to address **existing, as well as new-build** ships. In addition, it will not only require research and development regarding (the use of) alternative fuels, but will also have to take into account all means to radically improve the ship's energy efficiency and related emission efficiency (both retrofitting and new build). As well as making **seagoing ships** and **inland vessels** zero-emission, the transition towards zero-emission waterborne transport will also require changes to infrastructure, ship

design, shipbuilding processes, maritime equipment production, ports, alternative fuel terminals and processing plants, the wider logistics chain and more energy-efficient operations. Measures will also need to be taken in different action areas such as **digitalisation** (e.g. to allow better energy monitoring and to increase energy efficiency) and the **education and training** of the current and future workforce in order to ensure that the implementation of new technologies and concepts is properly executed. To put this ambition and commitment into practice **whilst taking into account the timelines** set out in various regulations, there is a need to start the transition process now.

In order to achieve true net zero-emission waterborne transport, the waterborne transport sector is determined to address **all environmental challenges** in an integrated manner, whilst prioritising the impact on **climate change,** research, development and innovation will address the ambition **to eliminate the entire environmental footprint** of waterborne transport. This is a reflection not only of the sector's determination, but also of the urgent need to ensure a better planet and a healthier society. With regards to pollution (both to air and to water), the need to address these environmental problems is laid down in European and international regulations (adopted by the IMO for maritime transport) and/or in national, regional or local legislation. For inland navigation, the rules are set out by the European Union and, where applicable, are transposed into national legislation. The ambitions and targets for the EU are clear for climate change - with the global ambitions for international shipping to be reviewed upwards in 2023 - and efforts are now focussed on how to achieve these objectives. Besides the development of new technologies and concepts, there is a need for the development of coherent international and European regulatory frameworks, which will underpin climate change objectives, **ensure and facilitate the timely transition** to climate-neutral sustainable alternative fuels, technologies and concepts and, at the same time, ensure consistency between guidelines of different regulatory bodies or Member States. The regulatory framework should therefore support the modal shift as envisaged in the European Green Deal. Finally, the deployment of solutions should be stimulated by means of incentives.

However, to fulfil the ambitions of the waterborne transport sector, it is obvious that much more research, development, innovation (RD&I) and investments will be necessary in the coming years to address and respond effectively to the current and future climate and environmental challenges, while taking into account a safe implementation of technologies and concepts.

At the same time, the emphasis on a **viable and evolving business case** is essential for the uptake of innovations. To that end, the Co-Programmed Partnership on zero-emission waterborne transport will be **an essential instrument**, as it will **enable** the entire European waterborne transport sector, including the European maritime technology sector, to provide a response to **societal, climate and environmental demands,** whilst at the same time enhancing Europe's global waterborne (technology) **competitiveness.**

Through the Co-Programmed Partnership on zero-emission waterborne transport, the waterborne transport sector will be able to **coordinate and ensure continuity between** the various (individual) initiatives (initiatives of the sector, Member States and links with other partnerships in the framework of Horizon Europe) that are necessary to form a **critical mass** of key waterborne transport stakeholders to transform waterborne transport into a zero-emission mode of transport. In doing so, the waterborne transport sector will be in a position to realise the sector's objective of demonstrating implementable zero-emission solutions before **2030,** so as to achieve a **zero-emission ambition before 2050**. In this way, the waterborne transport sector will greatly contribute to implementing effective responses to societal demands, political goals and regulatory requirements.

1.1.2 CONTEXT OF THE PARTNERSHIP AND DRIVERS FOR IT

Policies and regulations

Whilst the threats and risks of climate change and the harm from air pollution are known, policy actions have often failed to keep pace, despite increasing societal demand. To address this, the European Commission presented the **European Green Deal** in December 2019 with the objective for Europe to become the world's first climate-neutral continent by 2050, through the provision of a package of measures, which should enable European citizens and businesses to benefit from a sustainable green transition. The Green Deal sets out the Commission's commitment to **tackle climate and environmental challenges.** To achieve climate neutrality, the European Green Deal envisages **cutting transport emissions by 90%** by 2050 at the latest. In addition, it lays down the ambition to **reduce GHG emissions by at least 50% by 2030[18].** This communication builds upon a clear strategic long-term vision for a **prosperous, modern, competitive and climate-neutral economy (A Clean Planet for All),** as communicated in November 2018. This strategy confirms Europe's commitment to lead in global climate action and to present a vision that can lead to achieving **net-zero GHG by 2050** through a socially fair transition carried out in a cost-efficient manner. It defines pathways for the transition to a net-zero GHG economy and strategic priorities. Seven main strategic building blocks to achieve the objectives of this vision have been defined by the European Commission and **"clean, safe and connected mobility"** is one of these[19]. In March 2020, the European Commission adopted a proposal to enshrine in legislation the EU's political commitment to be climate neutral by 2050, to protect the planet and EU citizens[20]. The **European Climate Law** establishes a framework for the irreversible and gradual reduction of greenhouse gas emissions and it addresses the pathway to achieve the 2050 target.

The **Sustainable and Smart Mobility Strategy,** part of the European Green Deal, must set out the European Commission's approach to delivering the transport sectors contribution to the goal of climate neutrality by 2050[21]. The **FuelEU Maritime – Green European Maritime Space** initiative planned for 2020 aims to accelerate achievement of low-emission, climate-neutral shipping and ports by promoting the uptake of sustainable alternative energy and power[22].

In addition, the European Commission's Communication, "A Europe that protects: Clean air for all[23]", provides the policy framework for the reduction of air pollutant emissions such as NO_x, SO_2 and Particulate Matter. The 2018 Communication calls for further interventions in view of the infringements in many European countries related to limit values for air quality being exceeded.

Another example is the establishment of an Emission Control Area in the Mediterranean Sea for sulphur oxides under IMO rules which has been agreed in the Barcelona Convention framework[24] by the relevant riparian states. The implementation of such SO_x ECA will give access to clean air also to EU (and non EU) coastal citizens by addressing current inequality across the EU and to contribute to compliance with EU air quality standards in the Mediterranean basin which are persistently exceeded albeit being still well above the stricter limits fixed by the World Health Organisation.

NO_x emissions are covered by a wide range of EU legislation[25, 26, 27], in the field addressing range of pollutants, a wide range of sources, including various modes of transport.

For inland waterway transport, the **Council of Transport Ministers** in December 2018, and the **European Parliament** in February 2019, called upon the inland waterway transport sector to improve the sector's sustainability with a view to contributing to the **Paris agreement objectives** (COP21). In the Ministerial **Mannheim declaration** of October 2018, the CCNR stated its commitment to largely eliminate GHG and **other pollutants** by 2050 and to develop a roadmap for doing so and this was taken up by the **Inland Waterway Agenda for Europe of the Naiades II implementation EC expert group** in December 2019.

At the international level, **IMO's Marine Environment Protection Committee (MEPC)** adopted an initial strategy for the reduction of GHG emissions from (seagoing) ships in April 2018, setting out a vision to reduce GHG emissions from international shipping by at least 50% compared to 2008 figures by 2050 and to phase them out as early as possible this century. When the strategy will be **reviewed in 2023,** the level of ambition is expected to be considerably increased, not at least in light of recent scientific reports like the IPPC "Global warming of 1,5°C" report[28]. In October 2016, the IMO MEPC also adopted the decision to reduce the **sulphur content of marine fuels** down to 0.50% as of 1 January 2020 in order to address the negative effects of related **air pollution** on health and the environment.

Furthermore, the **Sustainable Development Goals** (SDG) of the United Nations Development Programme (UNDP) emphasize the importance of investments in infrastructure to achieve **SDG 9 (Industry, Innovation and Infrastructure),** call for urgent action to combat climate change and its impacts **SDG 13 (Climate Action)** and underline the need to conserve and sustainably use the oceans, seas and marine resources **SDG 14 (Life Below Water).**

The changing climate is already exposing waterborne transport and the entire maritime economy to multiple risks, which require significant investment in resilience-strengthening measures. Without urgent climate change mitigation action, the global sea level rise will be accelerated and the frequency of extreme marine events, such as marine heatwave and tropical cyclones, will increase, as stated in the latest **IPCC Special Report on the Ocean and Cryosphere in a Changing Climate** (November 2019[29]). Low water levels in European rivers are affecting the economy as well. Although Germany enjoyed an overall increase of its GDP in 2018 (+1.5%), this could have been higher if Germany's waterways had not experienced low water levels. Sinking water levels on Germany's rivers (used to transport industrial goods) probably shaved at least 0.7 percentage point off economic growth in 2018[30].

Industrial commitment and competitiveness

Turning to industry, in January 2019 the **Waterborne Technology Platform** launched its vision regarding zero-emission waterborne transport in 2050[31], whilst – in addition – , an emerging number of maritime and inland **ship-owners** have set net-zero CO_2 emissions in 2050 or earlier[32] as their target[33]. The European waterborne transport sector **welcomes the European Green Deal** and is **committed to reaching its objectives[34].** An initial group of shipowners have indicated that their fleet will be emission free in 2050, stating that RD&I will be key to reaching this objective[35]. The European maritime technology sector **annually invests 8-9% of its turnover in RD&I[36]** and is fully committed to develop the solutions needed and to invest accordingly[37].

Whilst putting forward clear environmental and climate-neutral targets, at the same time Europe needs to guarantee the waterborne transport sector's long-term economic resilience as global competition intensifies[38]. Seizing opportunities to **boost Europe's global competitiveness,** as well as developments at home to become **frontrunners in low-carbon and climate-proof technologies and embracing digitalisation,** whilst also implementing market mechanisms to promote their take up, is key.

Shipping is very different from other transport modes. First of all, because of its d**iversity of ship types and ship services,** combined with its **international character** by nature. Secondly, shipping transports nearly 90% of international trade and is thus of the utmost importance for **Europe's external and internal trade.** Following from this, shipping has a strategic dimension for Europe in terms of **security and defence,** as well as **access to trade and natural resources.** Because of its strategic dimension, many of Europe's global competitors have adopted dedicated, sectoral policies and programmes in support of their shipping and wider maritime community. Moreover, **shipping, shipbuilding, maritime equipment manufacturing and ports** are also political instruments in the hands of countries for geopolitical and geostrategic reasons (e.g. Made in China 2025[39] and China's Belt and Road Initiative[40]). However, despite the loss of main shipbuilding volume to Asia, the European shipbuilders and maritime equipment suppliers are still key players holding a large world market share, with a world-wide leadership in complex ships & high-end/complex product equipment. Indeed, most of Europe's maritime equipment companies are at the forefront globally in providing **innovative solutions to combat climate change, to reduce the carbon footprint of shipping, to minimise marine pollution or to make shipping better connected, more digital, automated or even autonomous[41].** These innovative solutions meet the highest standards, to the benefit of shipbuilders and shipowners in Europe and worldwide. So with these assets, Europe can play a leading role in the transition towards zero-emission waterborne transport. **Viable and evolving business cases** are essential for the uptake of innovations by European shipowners.

1.1.3 PROBLEMS AND/OR STRATEGIC OPPORTUNITIES TACKLED BY THIS PARTNERSHIP

The waterborne transport sector is strategic for Europe

Waterborne transport moves nearly **90% of all international trade,** more than **75% of external EU trade[42]** and **40% of internal EU trade. Oceans, seas, inland waterways and lakes** are key to our climate, shape our environment, generate water and are becoming increasingly important as a source of raw materials, food and energy. In addition, they form an **essential transport** route for the global and intra-continental trade flows and are places for living and recreation. Although less visible, waterborne transport is essential for the functioning of modern economies. Principally the most energy-efficient form of freight transportation, the quantity of goods moved by ship will not fall and is expected to increase in line with developing economies and global growth. In addition, waterborne transport is an essential means of passenger transport as well. For example, ferries are often key for local transport. Each year, more than 400 million passengers embark and disembark at European ports[43]. It is challenging to address this global growth whilst the globe strives to decarbonise every aspect of daily life. As a matter of priority for the European Green Deal, a substantial part of freight carried by road today should shift onto waterways to boost multimodal transport and the efficiency of the entire transport system. The urgency to reduce emissions, the conservation of resources and the need to use resources carefully are driving the increase of energy-efficiency. Furthermore, there will be a growing demand for clean energy - not only from shipping - that is expected to be more expensive and may be less available than their fossil alternatives. Increasing the energy-efficiency will be a key driver for waterborne transport.

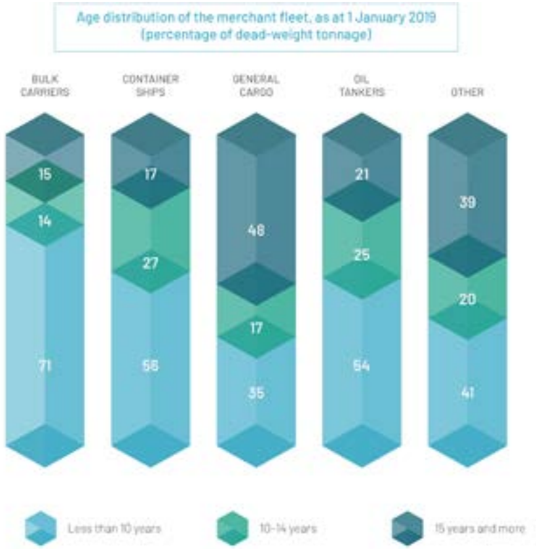
European-based maritime shipping companies control **around 36% of the global fleet[44].** The European maritime technology sector is a **global leader** in high-technology shipbuilding (for example maritime and inland cruise ships, electric ships, offshore support) and green shipping technologies (for example battery electric, clean engines, exhaust treatment systems, green equipment and smart technology for improved efficiency and operations). European companies supply **almost half** of global maritime equipment and have developed and designed the majority of the world's fleets' power systems. For two-stroke main engines, the market share of **EU-designed engines** was over **90% between 2015 and 2019.** For medium speed main engines, this was **around 70%[45].** The achievement of zero-emission waterborne transport not only represents a major challenge to Europe's waterborne transport sector, it also offers an excellent opportunity to further **enhance its global competitiveness.** This means that strengthening the EU's expertise in zero-emission technologies will enable European companies to provide innovative solutions to achieve the transition towards zero-emission waterborne transport. It will also enable European companies to compete in new markets and to regain lost markets which are currently dominated by competitors from the Asian regions. A prime example is the equipment delivery for, and construction of, merchant ships such as bulkers, tankers and general cargo vessels, as well as ferries which, until recently, were mainly built in Europe.

Challenge to transform to a zero-emission mode of transport: environmental impacts of shipping

In 2018, more than 130 million tons of CO_2 were emitted from seagoing ships above 5,000 gross tonnage visiting European ports[46], which represented over 13% of total EU transport emissions[47]. Globally, shipping annually emits around 940 million tons of CO_2[48], which accounts for 2-3% of total **GHG emissions[49].** Over two-third of the GHG emissions from ships sailing to or from European ports originates from **container ships, tankers, bulk carriers** and **passenger vessels[50].** To put this in perspective, if shipping was a country it would be the 6th biggest GHG emitter in the world. If no action is taken, these emissions are expected to increase by between 20% and 120% by 2050[51] (or by between 50% to 250% according to the third IMO greenhouse gas study[52], which will be soon updated), driven by economic growth and the resulting increased demand for transportation of goods and people.

Both inland waterway transport and maritime shipping are also a **significant source of air pollution,** particularly in coastal regions or cities with ports in their surroundings, as well as in the mainland. A well known example is the pollution from large passenger vessels in old inner cities and pristine areas. The proportion of air pollution from ships has increased as other sources on land have become cleaner, so that shipping has now become one of the largest sources of several pollutants. **SO_x, NO_x, PM, water pollution and noise (underwater as well as above water)** threaten public health and ecosystems and are a public concern, which is being increasingly addressed by policy developments [53,54]. Effective and affordable technologies are needed to significantly reduce emissions (including **retrofits** for existing vessels) to meet **regulatory requirements and targets,** as part of the efforts aimed at achieving zero-emission waterborne transport.

Radical change is required in order to be able to meet the 2050 climate targets, the 50% - 55% reduction of emissions by 2030 in line with the European Green Deal, as well as reduction of harmful air pollutant emissions, and this will not be possible through operational changes and incremental improvements alone. **New technologies need to be developed and deployed very soon.**



Source: UNCTAD secretariat calculations, based on data from Clarksons Research.

Figure 1: Age distribution of the merchant fleet, as at 1 January 2019

Challenge to transform to a zero-emission mode of transport: time-scale

Considering the average age of 21 years of a seagoing ship (see figure 1), the first radically changed new-build vessels need to be deployed **within 10 years,** with technology developed during the period of Horizon Europe. In addition, the relatively low turnover of the fleet requires zero-emission retrofit solutions to be deployed as soon as possible. This need is even more urgent for inland navigation, since the average lifetime of inland vessels is even longer (40-60 years) thus inducing outdated and lower energy & environmental efficiencies on such old vessels. Indeed, for inland waterway vessels, the western European market is characterised by a relatively old fleet. Half of the active fleet in Germany, the Netherlands and Belgium and 80% of the French fleet were built more than 50 years ago. 15% of the European fleet was built more than 75 years ago, in particular in the Netherlands. Switzerland is the country with the newest fleet (87% of the fleet was built in the last 35 years), which can be explained by its large share of cruise ships.

The Co-Programmed Partnership on zero-emission waterborne transport is the **most suitable** and primary instrument as it will help the waterborne transport sector to accelerate and support a rapid transition towards a zero-emission mode of transport.

The Partnership will also facilitate the sector's efforts designed to achieve important strategic objectives.

The Co-Programmed Partnership will enable the waterborne transport sector to meet the targets laid down in the **European Green Deal** and the **Initial IMO Strategy on the reduction of GHG emissions** from ships (and upcoming reviews) by globally providing knowledge, technologies and products. It will also enable the sector to meet the targets of the global sulphur cap for marine fuels and those set out in the **2018 Mannheim Declaration confirmed by the EU Naiades II implementation Expert Group.**

Challenge to transform to a zero-emission mode of transport: impact on the European transport system overall

Innovation within the waterborne transport sector will be key to decarbonising the transport system as a whole and decongesting the road network by **shifting the majority of 75% of inland freight carried today by road onto rail, inland waterways and short sea shipping**[55]**.** The transition towards a zero-emission waterborne transport sector not only requires actions aimed at seagoing ships or inland vessels. It also requires development and investments in innovative (zero-emission) infrastructure. **The availability of zero-emission fuels infrastructure and the ability of the European port and waterway authorities to provide zero-emission and climate-resilient infrastructure,** including onshore power supply, **as well as a lean port logistic chain** (i.e. reducing anchoring time and thus enabling ship speed optimization), will be essential to enable the introduction of zero-emission seagoing ships and inland vessels, to tackle the issue of reconciling emission reduction targets with a predicted increase **in European ports traffic** and to stimulate the modal shift.

Challenge to transform to a zero-emission mode of transport: the waterborne transport sector is a diversified but fragmented sector

The **diversified nature** of the waterborne transport sector has meant that it has been slow in its actions aimed at becoming a zero-emission mode of transport and industry. After a slow start, many initiatives are now taken, but a common innovation agenda has been missing. Furthermore, until recently the transition has not been supported by stimulating regulation and policies as well as low price levels of fossil fuels. The sector comprises shipyards, ship owners, maritime equipment manufacturers, flag states, waterway and port authorities and operators, classification societies, energy companies, infrastructure companies, environmental non-profit organisations, research institutes, universities, citizens' associations as well as various competent authorities, banks, insurance companies, etc.

Example of the complex character of the waterborne transport sector

A container ship, built in China, equipped with European engines, might be sailing from Shanghai to Rotterdam. The ship is flagged in Panama, insured in London, and sails with crew from the Philippines and officers from Russia. The ship is managed from Liberia, chartered from France, owned by a German shipowner, fuelled in Singapore and governed by a complex mix of international, European, regional and local regulations and treaties.

Variations exist within each **segment** of the waterborne transport sector. Business models also show a wide variety both within and between segments. These need to be taken into account as **drivers or inhibitors** of the **application and adoption of new technologies and concepts,** sharing both the (investment) burden and the economic benefit of the adaptation of green technologies throughout the value chain.

Furthermore, each segment of the waterborne transport sector has its own specificities and business models and therefore its own **specific needs and challenges** in coping with the transition towards zero-emission, both from a technological point of view, as well as from a regulatory perspective. A **"one-size-fits-all"** solution does not exist. Therefore, to become a zero-emission mode of transport or industry, alongside generic solutions, each segment of the waterborne transport sector will need to find the most suitable solutions for itself. It goes without saying that such diversified solutions will draw from a common pool of knowledge and scalable/modular (part) solutions developed by the industry as a whole.

Moreover, a coherent landscape of policies, rules and regulations will be required to achieve zero-emission waterborne transport. In this respect, coordination between **European, international**[56]**, national, regional**[57] **and private**[58] actions and bodies is needed to ensure a coherent approach towards achieving zero-emission waterborne transport.

1.1.4 DATA AND EVIDENCE ON THE STATE AND SCALE OF THE PROBLEMS AND/OR STRATEGIC OPPORTUNITIES

Waterborne transport is one of the most efficient modes of transport in terms of CO_2 per ton kilometer. However, due to its large scale, it still generates a substantial amount of emissions and each year seagoing ships consume around **300 million tons of fuel,** emitting approximately **1 billion tons of CO_2,** which is similar to global aviation[59]. In addition, as a result of residual fuel oils and the emission levels of existing older ships, it is a major source of **air pollution,** particularly within **coastal and port areas** with a high density of population, but also on the mainland along inland shipping routes, since as air pollution travels long distances. Shipping accounts for 18 to 30 % of the nitrogen oxide (NO_x) and 8% of the sulphur oxides (SO_x) of total global air emissions[60]. Just **15 of the biggest ships** emit more of the noxious oxides of nitrogen and sulphur **than all the world's cars put together[61].** Without any action being taken, by 2030 **NO_x emissions from shipping will exceed those from land-based sources in the EU[62].** Maritime shipping also impacts water quality due, for example, to oil spills, sewage discharges, spreading invasive aquatic species in ballast water, use of toxic hull coatings to avoid fouling, discharges from exhaust treatment systems, etc. **Noise** is impacting citizens close to shipping routes and destinations and underwater noise is impacting marine mammals and other marine species[63].

CO_2 emission

European CO_2 emissions from shipping are a major challenge. In 2018, more than **130 million tons of CO_2,** or around **13% of total EU transport emissions,** were emitted from **maritime ships over 5,000 gross tonnage visiting European ports.** International and domestic shipping dominates CO_2 emissions, whilst inland waterway transport cannot be ignored. The EU project, PROMINENT, calculated that inland waterway transport in the EU results in **3.8 million tons of CO_2 emissions per year[64].**

The world is not on course to achieve a temperature increase of well below 2°C and therefore urgent action is needed. Even if the energy mix used for waterborne transport is changed in accordance with the objectives of limiting the temperature increase and the economic developments are commensurate with this goal, shipping emissions are projected to increase by **20-50% between 2008 and 2050[65]** (or by between 50%-250% according to the third IMO GHG study, to be updated in 2021).

Increasing the energy efficiency of ships has its limits and would **not be sufficient to meet either the 2050 level of ambition of the European Green Deal or the targets of the Initial IMO Strategy on Reduction of GHG Emissions from Ships.** Only a combination of zero-emission innovative solutions, fuels, operational approaches and technologies, triggered by ambitious regulations, can bring about the change needed.

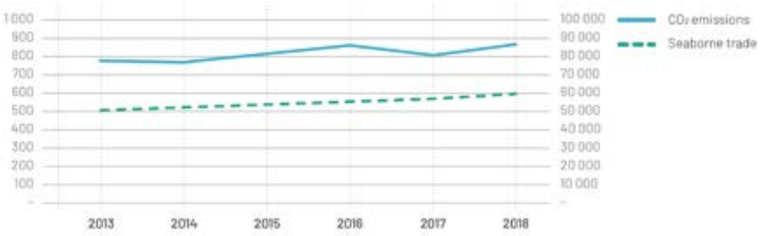


Figure 2: CO_2 emissions from the world fleet and seaborne trade (UNCTAD, 2018) from 2013 to 2018

SO_x, PM and NO_x emissions

Emissions of sulphur dioxide (SO_2) from maritime transport affect air quality in the EU and globally. SO_x emissions result from the onboard combustion of oil-based fuel products and are directly linked to the sulphur content in marine fuels used in maritime transport[66]. SO_x emissions are a precursor of PM2.5 and **a major cause of acid rain.** According to the European Environment Agency, shipping is responsible for 11.05% of EU NO_x emissions and 11.05% of SO_x emissions[67]. Nitrogen Oxides (NO_2) form smog, acid rain and eutrophication and are central to the formation of fine particles (PM2.5) and ground level ozone, both of which are associated with adverse health effects, including premature deaths. Concentrations of air pollutants from shipping can be much higher in coastal and port areas where it can be the dominant source of air pollution.

While current IMO and EU regulations **will reduce SO_2 emissions** from international shipping from 2020, emissions remain much higher than other transport modes. **After 2030, NO_x emissions from shipping are set to exceed all EU land-based sources[68].**

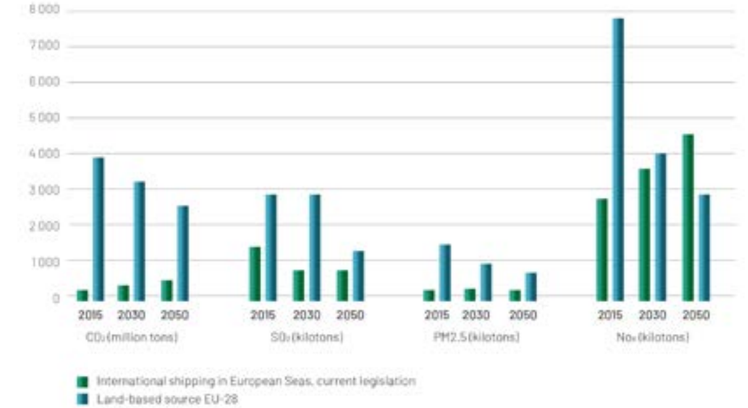


Figure 3: Emissions from shipping and projections

The sulphur in fuel requirements that have been agreed by the IMO will cut SO_2 emissions by **50-80 percent up to 2030** (figure 4), but in the absence of additional regulations, emissions will rebound afterwards. CO_2 and NO_x emissions are expected to further increase without additional measures[69].

The IMO has designated the North Sea and the Baltic Sea as a NO_x Emission Control Area (NECA) starting from January 1 2021. According to recent estimates by the European Monitoring and Evaluation Programme (EMEP), consisting of deposition modelling based on available emission scenarios, the annual reduction in total Nitrogen deposition in the Baltic Sea area will be 22,000 tons as a combined effect of the Baltic and North Seas NECAs and compared to a non-NECA scenario. However, a lengthy period of fleet renewal is needed before the regulation will show full effect, according to HELCOM (Baltic Marine Environment Protection Commission)[70]. Thus illustrating the need for retrofittable technologies as an essential tool to meet policy objectives.

Inland waterway transport plays an important role in the transport of goods in Europe. More than 37,000 kilometres of waterways connect hundreds of cities and industrial regions. Thirteen Member States have an interconnected waterway network. The potential for increasing the modal share of inland waterway transport is significant[71]. Inland waterway transport, however, should act urgently to increase its sustainable advantage. Passing through the centre of towns and cities, an inland waterway vessel will produce approximately **11,000 kg of NO_x** per year, whilst a modern diesel car within the same area may produce less than 1kg of NO_x per year. Other transport modes are becoming cleaner and inland waterway transport faces the risk of falling behind.

Studies have analysed average emissions of IWT vessels on tonne-kilometres (as in the PROMINENT[72] project).

Vessel information			Estimated current emissions per year		
Fleet families / Vessel type	Total number of vessels	Estimated fuel consumption in m3	NO_x [tons]	PM [tons]	CO_2 [tons]
Passenger vessels (hotel/cruise vessels)	2553	106516	3895	177	281201
Other push boats <500kw	890	28644	995	49	75620
Push boats 500–2000kw	520	81970	2966	125	216400
Push boats >=2000kw	36	74520	2647	116	196733
Motor vessels dry cargo >=110m	610	206740	6681	234	545794
Motor vessels dry liquid cargo >=110m	602	83168	6089	211	544582
Motor vessels dry cargo 80–109m	1801	291470	11386	551	769482
Motor vessels liquid cargo 80–109m	647	153209	5171	219	404473
Motor vessels <80m. length	4463	219456	8707	432	579363
Couped convoys	140	78155	2432	85	206328
Total	**12262**	**1323847**	**50969**	**2200**	**3819976**

Figure 4: Average emissions of IWT vessels[73]

PROMINENT calculated that 1.3 million m3 of gasoil fuel is consumed per year by inland waterway transport in the EU, resulting in **3.8 million tons of CO_2 emissions per year, 51 kilotons of NO_x and 2.2 kilotons of PM.** The total **external costs**[74] caused by the emissions to air add up to **1.09 billion EUR**, of which **825 million for NO_x, 140 million for PM and 126 million for CO_2.** It should be noted that inland waterway transport has been using low sulphur fuel since 2011.

Water pollution

Underwater noise and its impact on marine mammals

Underwater noise from shipping has a negative impact on the marine environment, in particular on marine life, including marine mammals. As such, levels of underwater noise are indicators of good environmental status within the scope of the European marine strategy framework directive[75] and are also addressed within the **non-mandatory guidelines on ship-quieting measures** issued by the IMO in 2014. The characteristics of the underwater radiated noise from a vessel depend on multiple factors such as **size, speed, horsepower, propeller depth,** etc. Levels of noise vary within a ship class due to **variability in design, maintenance and operational parameters, such as speed and displacement.**

Secondary pollution from emission reduction technology and fuels

As an alternative to using cleaner low sulphur fuels to reduce SO_x emissions, regulations allow ships to be fitted with an exhaust treatment device, a so-called scrubber. A scrubber effectively extracts the sulphur from the emission and either stores the residue in a wash-water tank (closed loop) or dilutes and discharges this mixture into the sea (open loop). These open-loop scrubbers are less expensive, and the ship owner is less reliant on port infrastructure to absorb the scrubber residue. But the discharge into the sea leads to secondary waste streams which have harmful environmental impacts. With the introduction of lower sulphur limits applicable to fuels from 2020, more than 4,000 mainly open loop systems have been fitted to date, which is a source of environmental concern[76].

Ballast water

Ballast water is essential for the safe operation of ships, ensuring stability and structural integrity, as well as safe manoeuvring[77]. However, ballast water can become a vector for the transfer of invasive organisms from one part of the world to another, causing damage and impacting natural ecosystems and the economy[78].

- **10 billion tonnes of ballast water is transported worldwide every year, which could fill 4 million Olympic sized swimming pools[79]**
- **7,000 species are transferred in ballast water every hour of everyday**
- **IMO Ballast water Convention requires the Control and Management of Ballast Water to prevent species transfer**

Courtesy: Wärtsilä

Hull coatings

Ship hulls and marine structures are coated to prevent sea life attaching themselves, thereby increasing friction, **slowing down the ship and increasing fuel consumption.** The fuel savings made by limiting the adhesion of marine organisms has been estimated **to be $60 billion** annually, **reducing GHG emissions by 384 million and SO2 by 3.6 million tons[80].** However, the antifouling compounds used may "leach" harmful substances into the sea, damaging **the environment** and possibly **entering the food chain.**

The Partnership will ensure that the solutions developed will not produce secondary waste streams (e.g. wastewater from scrubbers). In addition, the Partnership aims to mitigate (underwater) noise.

Strategic importance of the waterborne sector

The maritime transport sector **directly employs over 685,000** workers at sea and on shore[81]. It supports **2 million workers through indirect and induced employment.** The EU maritime shipping industry contributes a total of **€149 billion** to the EU's annual GDP[82]. EU companies own 36% of the world fleet, the largest single share in 2018[83].

Europe has **300 shipyards,** the largest of which build the most complex, innovative and technologically advanced civilian and naval ships and platforms in the world. Technologies for these ships form the basis for advanced zero-emission technologies to be further adapted for other ship types. Others maintain, convert, repair or retrofit existing (merchant) ship types. A third category builds, repairs or maintains smaller vessel types or boats. Together, these yards generate **annual production worth €42.9 billion and directly employ 285,000 people (EU28)[84].** Moreover, for each job they create, another six jobs are created in the supply chain.

Almost half of marine equipment is produced by European companies, including over 70% of the world's large marine engines. The majority of the European marine equipment sector are SMEs. With an annual production of €44.5 billion, the equipment sector produces and supplies all types of materials, equipment, systems, technologies and services. The companies can be **global, regional or local players.** Europe's maritime equipment companies are the leading providers of solutions to **combat climate change, to minimise marine pollution and to make shipping better connected, more digital, automated or even autonomous.**

Approximately 4 billion tons, representing **75% of all goods, and 415 million passengers pass through EU ports each year.** Ports are not only essential for the import and export of goods, but they also constitute energy hubs, bringing together infrastructure managers, shipping companies and energy suppliers who contribute to the uptake of electricity and clean fuels. Ports also link maritime transport with the hinterland through the different land transport modes, including inland waterways. Ports generate employment: **1.5 million workers** are employed in European ports, with the **same amount employed** indirectly across the 22 EU maritime Member States[85].

Europe's long-standing leadership in the maritime sector is coming under pressure. The EU's share of worldwide shipbuilding is also **in decline.** Europe's current global leadership position in maritime technology is once again challenged by Asia. This time, South Korea and China in particular have identified **complex shipbuilding, as well as advanced maritime equipment, as new markets** for themselves. They are therefore applying dedicated sectoral strategies which contain the same well-known "toolbox" of government-led policies, **financial incentives (including massive state aid)** and **unfair trade practices,** as the one that had already helped them to successfully conquer Europe's merchant shipbuilding and partly Europe's offshore building industry. Consolidating and further strengthening the EU's frontrunner role in RD&I and implementation of greening technologies and concepts will be essential to ensure the transition to a clean and competitive European waterborne transport sector and to **enhance the competitiveness** of the European sector across all market segments.

Inland navigation and short sea shipping offer the potential for playing a key role in reducing congestion on European roads, as well as the GHG emissions from logistics chains. However, the integration of both inland waterway transport, as well as maritime shipping, in the logistics chains **should be further optimised.** Since the average lifetime for inland waterway transport vessels is between 40 and 60 years, challenges regarding the uptake of innovations should also be properly addressed. **Variations in water levels are** affecting the **reliability** of inland waterway transport, with low water conditions or floods hampering operations on the waterways. **Climate change will, in the medium to long-term, lead to more severe low-water and high-water phenomena, further hampering inland waterway transport.**

It is therefore important to have a **climate-resilient and zero-emission mode of transport** which can effectively play a role in the **modal shift** ambitions from road to waterborne transport as highlighted in the European Green Deal.

The Partnership aims to develop and demonstrate solutions for the elimination of GHG emissions from waterborne transport. When developing these solutions, a viable business case will be one of the key elements. This means that the Partnership will contribute to the competitiveness of the European waterborne transport sector.

Previous EU Framework Programmes – added value of the Partnership

FP7 and Horizon 2020 invested around 50 million EUR per year, enabling support to be provided each year to two to three topics to address **all aspects of waterborne transport research.** Addressing decarbonisation and environmental impact accounted for a substantial part of these research efforts. Nevertheless, these investments were insufficient to enable a coordinated programme of actions to tackle the urgent climate and environmental challenges facing the sector. In 2019, the **EU's European Political Strategy Centre** report, "Clean Transport at Sea"[86], called for more ambitious and coordinated R&I investment in Horizon Europe to address the environmental challenges encountered in the sector.

Under Horizon Europe, there is an **urgent need** to upscale and accelerate activities to reduce GHG emissions by at least 50% by 2030 and to phase out GHG emissions completely before 2050. Considering the sector's diversity and the urgent environmental challenge, it is essential **to mobilise a critical mass** and to **leverage coordinated private and public investment.** Currently, the investments being made to address the diverse challenges which have to be met to decarbonise are insufficient (e.g. just one topic in 7 years of Horizon 2020 regarding decarbonising long distance shipping). This urgency for action and the need for the Co-Programmed Partnership zero-emission waterborne transport in this perspective, was recently highlighted in the **Ministerial Declaration on the future outlook of EU Waterborne transport**[87].

1.1.5 THE UNDERLYING RESEARCH, INNOVATION, DEPLOYMENT OR SYSTEMIC BOTTLENECKS AND/OR MARKET FAILURES THAT ARE TO BE ADDRESSED BY THE PARTNERSHIP

Bottlenecks of the waterborne transport sector that are to be addressed by the Partnership

Research and innovation bottlenecks

To achieve the ambitious zero-emission goal by 2050, a radical change from "business as usual" will be required. Specifically, (EU) research and innovation will need to target **new solutions,** including new - potentially **disruptive - technologies,** including solutions which might only be applicable for certain segments of the waterborne transport sector. Furthermore, the focus should shift from the current fossil fuels to climate-neutral, sustainable **alternative fuel solutions** for which, moreover, **adequate infrastructures** (e.g. in ports) need to be put in place. For these alternative fuels, the respective technologies and relevant infrastructure **are not yet in place** for waterborne transport.

Furthermore, and in view of the long lifetime of ships, to achieve these ambitious goals, the waterborne transport sector will not only have to develop and build new zero-emission ships.

To accelerate deployment of zero-emission technologies, it will also need to develop solutions to **retrofit** existing ships. Ships that will join the fleet in the coming years, will have to be **designed with future retrofitting** to green technologies **in mind,** allowing for maximal uptake of new emerging technologies. For ships that are already existing now, the retrofitting process is likely to be the most complex and difficult part in the transition towards zero-emission waterborne transport. Retrofitting also concerns reducing polluting emissions in line with the European Green Deal, as well as cutting GHGs. Therefore, considering that ships now entering service could be operational until 2050, there is an urgent need for the development of **effective, efficient and affordable** deployable solutions. Decreasing the energy use of waterborne transport will be key as well, both in terms of reducing GHG emissions, as well as in order to ensure economically viable solutions. With the prices of alternative fuels probably being relatively expensive compared to fossil fuels, energy savings will be crucial.

All these efforts will have a positive impact on the modal shift to waterborne transport as well. On the one hand, by being a sustainable and climate-resilient mode of transport and thereby a preferred one. On the other hand, solutions deployed in our aim to reduce the energy needs will also increase the integration of waterborne transport in the entire logistics chain.

Due to the wide range of ship types and waterborne transport services, there is currently **no clear, single path to decarbonisation**[88]**.**

Systemic bottlenecks

Since it is highly diversified, the waterborne transport sector consists of many different segments, with - in turn - many sub-segments, which have **different interests, challenges,** opportunities and needs. This diversification is not only a wealth for the sector and society at large, it is also a **bottleneck for the sector.** The lack of a clear path towards zero-emission waterborne transport entails a high risk for individual companies to invest in RD&I activities. In addition, the specialised and competitive nature of the industry results in a **large number of SME companies** with limited access to research funding. Consequently, European research and innovation for the waterborne transport sector plays an essential role to **increase coherence** and to **develop concrete solutions.**

Regarding the shipowners, the shipowner and the charterer have diverging interests and this often results in complex decision making about future investments. In the inland waterway transport sector, the majority of the shipowners are SMEs (family-owned vessels), with limited investment capacity, leading to hardly any renewal or investment.

Deployment bottlenecks

Deployment of the outcomes of RD&I is hampered by the high capital cost of waterborne transport systems and consequently the risk of being a first adopter of a new technology or solution. This can be further exacerbated by a regulatory framework which assumes the presence of existing technology, as well as a conservative and reactive culture amongst the sector. EU RD&I activities and their communication provide the **technology demonstration** needed to provide assurances concerning the take up of new solutions, as well as a **foundation for EU and global regulation.**

One example is the implementation of LNG as a cleaner marine fuel; its development was hampered by a lack of regulatory safety to enable ships to sail using the fuel. Also, no fuel bunkering infrastructure was available and this, in turn, delayed demand to build LNG powered vessels. In addition, whilst LNG is a cleaner fuel, there are negative aspects concerning its inability to sufficiently decarbonise the fleet, which must be addressed when selecting future alternative fuels. The Partnership will provide the technology demonstration needed **to underpin the EU's position as a leading actor within discussions in the IMO** concerning alternative fuels and GHG neutral technology deployment. Timely implementation of supporting rules and regulations will be key to ensure the uptake of zero-emission solutions.

Furthermore, whilst new technologies and concepts may be technically ready for the market, there is often a lack of a business case to enable the frontrunners to implement these solutions. Support for deployment and a stimulating **regulatory environment** are necessary. Although support for deployment is outside the scope of the Partnership, the RD&I actions will be aligned with European, national and regional deployment instruments such as the Connecting Europe Facility (CEF). This will be facilitated through regular contacts with relevant European Commission Services, Member States and Associated Countries to ensure the support for deployment.

Finally, the Partnership will be responsible for the communication and dissemination of both the ambitious commitment of the European waterborne transport sector to address and solve societal challenges, as well as the development of solutions for broad implementation, so as to ensure that the outcomes of research are being taken up.

1.1.6 EXPERIENCE BUILT ON PREVIOUS PARTNERSHIPS

The Co-Programmed Partnership on zero-emission waterborne transport is a new initiative that does not build upon existing active Partnerships. It does, however, build upon the **Strategic Research Agenda** of the Waterborne TP as launched in January 2019[89], the Strategic Research Agenda for inland waterways and ports[90], as well as Waterborne TP's **Technical Research Agenda for Ships & Shipping[91].** The members of the Waterborne TP currently represent 65 companies and industrial representatives who reflect the majority of the European waterborne transport sector, as well as the entire value chain needed to transform the sector. The Partnership is founded upon the solid basis of the members and the associated members of the Waterborne TP. Membership is open and a proactive approach will be taken to engage any less represented categories (such as the involvement of more shipowners), as well as all interested EU Member States and Associated Countries.

1.2 COMMON VISION, OBJECTIVES AND EXPECTED IMPACTS

Research and Innovation activities to achieve the objectives, as well as timing, performance criteria and monitoring measures will be defined within a Strategic Research and Innovation Agenda (SRIA) that will be published and subject to public consultation prior to finalisation in summer 2020.

1.2.1 THE OBJECTIVE OF THE PROPOSED PARTNERSHIP: REALIZING ZERO-EMISSION WATERBORNE TRANSPORT TO THE BENEFIT OF FUTURE GENERATIONS

Vision

For Europe to lead and accelerate the transformation of the global waterborne transport sector into a zero-emission mode of transport which has eliminated all harmful environmental emissions **(including greenhouse gas emissions, as well as air and water pollutants, including (underwater) noise)** through innovative ship technologies and operations which underpin European growth and employment.

General objective

To provide and demonstrate zero-emission solutions for all main ship types and services before 2030, which will enable zero-emission waterborne transport before 2050.

Specific *scientific* objective

Against this background, the specific **scientific** objective of the proposed Partnership to be achieved **before 2030,** is:

- To develop and demonstrate deployable technological solutions which will be applicable for the decarbonisation and the elimination of other emissions of **relevant ships and services.**

Specific *economic* objective

- **By 2030,** implementation of economically viable **European** new technologies and concepts regarding zero-emission waterborne transport, to **strengthen the competitiveness** of European industries in growing green ship technology markets and provide the capability to re-enter markets, presently dominated by Europe's competitors.

Specific *societal* objectives

- To facilitate the development of regulations and policies at national and international level including the development of standards to enable the implementation of technological solutions for zero-emission waterborne transport by 2030 at the latest;
- To facilitate the uptake of innovative zero-emission waterborne transport technologies and solutions within the European waterborne transport sector supporting economic growth and European employment.

Operational objectives of the Partnership:

RD&I actions to achieve these objectives together with timing, performance and monitoring arrangements as well as complimentary activities will be laid out within a subsequent SRIA.

Elimination of GHG emissions (both for retrofitting as well as new build)

- To develop and demonstrate solutions for the **use of climate-neutral, 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),** as an additional energy source for all main ship types in environmentally sensitive areas, and to increase operational efficiency;
- To develop and demonstrate solutions to be able to reduce the (alternative) fuel consumption of waterborne transport, including by the use of renewable energy, 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 waterborne transport,** to be implemented **by 2030 at the latest;**
- To develop solutions for clean and climate-neutral, climate-resilient **inland waterway vessels before 2030.**

Eliminating air pollution:

Apart from the obvious contributions of the objectives for the elimination of GHG emissions to the reduction of air pollution, we set the target

- 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.

The achievement of these objectives will have three impacts:

- First of all, they will significantly reduce GHG emissions from shipping, in line with the EU's commitment to cut GHG emission by at least 50% in 2030 compared to 1990 levels and to achieve a 90% reduction in transport emissions by 2050. In addition, the deployment of solutions will stimulate the modal shift to waterborne transport;
- Secondly, they will cut pollution, significantly improving the quality of the **(European) environment and human health.** The external costs of the impact on human health from maritime transport in the EU28 has been estimated to be **€98 billion in 2016** and were **€3 billion**[92] for inland waterway transport;
- Thirdly, it will enable Europe's waterborne transport sector to enhance its **global competitiveness** in terms of innovative solutions, as well as its **global technological leadership in green ship technologies and solutions** over foreign competitors (in particular South Korea and China), which, in turn, will create higher added value and economic wealth, as well as innovative jobs.

1.2.2 QUALITATIVE AND QUANTITATIVE DATA UNDERPINNING THE NEED TO ACCELERATE EFFORTS TO MOVE TOWARDS A ZERO-EMISSION WATERBORNE TRANSPORT SECTOR

Strategic importance of the European waterborne transport sector

Waterborne transport is essential for the EU economy. Maritime transport has been a catalyst for economic development and prosperity throughout its history[93]. Maritime transport enables trade and contacts between all European nations. It ensures the security of supply of **energy, food and commodities** and provides the main vehicle for European **imports and exports** to the rest of the world. Almost **75% of the EU's external freight trade** is seaborne. Short sea shipping represents **one third of intra-EU exchanges** in terms of tonne-kilometres. Ensuring a good quality of life on Europe's islands and in peripheral maritime regions depends on good maritime transport services. Each year, more than **400 million passengers** embark and disembark at European ports. Overall, maritime industries are an important source of employment and income for the European economy.

Inland waterway transport plays an important role for the transport of goods in Europe[94]. More than **37,000 kilometres of waterways** connect hundreds of cities and industrial regions. On average, **each barge carries the equivalent of 100 trucks,** creating space on the road without occupying additional land, whilst being supported by smart information services that optimise transport[95]. The potential for increasing transport on inland waterways is substantial, as reflected in the European Green Deal, and this would serve to reduce the carbon footprint of intermodal transport and to ease congestion of the road infrastructure.

The total gross weight of goods handled in **EU ports,** which move over 70% of EU trade, has been estimated at being close to **4.0 billion tonnes** in 2017[96]. The number of **port calls from vessels** in main EU ports in 2017 was more than **2.1 million.**

Passenger transport is also a key part of our waterborne transport sector. For instance, the cruise industry contributes approx. **€47.86 billion**[97] to the European economy. In terms of employment, between 2015 and 2017 the cruise industry generated more than **43,000 new jobs across Europe,** with 403,621 now employed in cruise and cruise-related businesses. European shipyards are the heart of the world's passenger ship building industry and continue to build the world's most innovative and largest ships. **In 2017, passenger vessel operators spent €5.6 billion in European shipyards.**

Europe's maritime technology industry, which includes European shipbuilding, has an aggregated production value of **€115 billion** and directly and indirectly generates more than **one million jobs** in Europe, often located in remote regional areas[98]. All of this means that Europe has all the ingredients needed to develop and deploy zero-emission waterborne transport to the benefit of future generations.

Impact of waterborne transport on the environment and public health

Improving energy-efficiency alone will not even be sufficient to achieve the levels of ambition set out in the Initial IMO Strategy on Reduction of GHG Emissions from Ships, i.e. by at least 50% in 2050 compared to 2008; let alone the higher EU reduction targets. Therefore, in addition to traditional efficiency measures, **innovative, ground-breaking solutions** are required to reduce emissions. These solutions could take the form of new technologies, and climate neutral, alternative fuels. Additional regulatory measures to assist the application of these solutions may be needed.

Total premature mortality due to pollution from shipping is estimated at around 403,300 per year. Total avoided premature mortality in 2020 with the implementation of the low-sulphur fuel standards is expected to be 266,300 per year. Childhood asthma morbidity due to shipping declines by 54%; and the number of children with asthma related problems will decrease from 14 million children in the business-as-usual case, to 6.4 million children in the 2020 Action case[99].

Initial studies have estimated that the total cost of achieving the initial IMO Greenhouse Gas Emission reduction strategy goal to at least halve net GHGs by 2050, requires at least $1 trillion of capital investment within land-based and ship-related infrastructure[100].

According to this study, 13 percent of the investments needed are related to ships, whilst the majority is for alternate fuels. Onboard investment includes **machinery and onboard storage** required for a ship to run on low carbon fuels in new builds and, in some cases, for retrofits, as well as **improving energy efficiency,** which becomes more valuable due to the higher cost of low carbon fuels.

Policies

As indicated in the European Green Deal, a **90% reduction in transport emissions is needed by 2050,** to be able to achieve climate neutrality. Road, rail, aviation and waterborne transport will all have to contribute to the reduction[101]. The Green Deal envisages a basket of measures to ensure shipping fairly contributes to the climate effort, including the **increased deployment of carbon neutral and sustainable alternative fuels** and the extension of the European Emissions Trading Scheme to shipping, the revision of the Energy Taxation Directive as well as the **increased use of multimodal transport** to decarbonise the entire freight transport system. To substantially decarbonise, 75% of inland freight carried today by road should be shifted onto rail and **inland waterways** as more GHG efficient transport modes. **Automated and connected multimodal mobility** will also play an increasing role, together with digital and smart traffic management systems, to increase efficiency. These elements will be addressed in collaboration with other related European Partnerships.

At international level, IMO's Marine Environment Protection Committee (MEPC) adopted an initial strategy on the reduction of greenhouse gas emissions from (seagoing) ships in April 2018, agreeing to reduce GHG emissions from international shipping by at least 50% by 2050 compared to 2008 and the vision to phase them out as early as possible in this century. It is expected that even more stringent targets will be set in the international community in the coming years. However, even at the present level of ambition the global shipping industry will depend on sustainable alternative fuels to be introduced quickly, and the solutions that the Partnership will be able to deliver will also be helpful to achieve the goals of the Strategy.

The Partnership will be an essential tool to deliver the solutions to achieve the ambitious goals of the international policies. The Partnership will provide the technological solutions that both on a regional and global level are required to realize ambitious targets, and that can be used by ship owners once ambitious GHG reduction measures are in place and provide for the incentive required to overcome the price difference with fossil fuels. Without the partnership, it is uncertain that the necessary technological options become available sufficiently quickly, and at the scale required.

Needs of the European waterborne transport sector

The waterborne transport sector is globally diversified and has neither a coherent market nor the industrial coordination required to strategically address the challenges of eliminating harmful emissions from shipping. Consequently, European RD&I for the waterborne transport sector has an essential role to play to **increase coherence** and to **develop concrete solutions.** EU waterborne transport research can achieve a high added value by **overcoming fragmentation,** bringing together key stakeholders and tackling the **essential challenges** which would otherwise not be addressed.

The European waterborne transport sector, including the maritime technology sector, is operating on an international competitive playing field (although not always a level playing field). Therefore, it is of importance that the Partnership will focus on **commercially viable and deployable technologies and concepts,** including attention for business models. Special focus will be on technologies for retrofitting existing vessels in European yards. These business models will be strongly influenced by future EU and global legislative framework, as well as price mechanisms for the sustainable alternative fuels.

Urgent need to increase investments in a time of accelerating climate change

GHG concentrations in the atmosphere are now at record levels, locking in a global warming trend for generations to come. To transform to zero-emission waterborne transport, there is an urgent need to **coordinate and increase investments** in RD&I, taking into account the total cost of decarbonizing waterborne transport.

1.2.3 LINKS AND/OR COLLABORATION OPPORTUNITIES OF THE CO-PROGRAMMED PARTNERSHIP ON ZERO-EMISSION WATERBORNE TRANSPORT WITH OTHER PARTNERSHIP CANDIDATES AND EU PROGRAMMES

The Co-Programmed Partnership zero-emission waterborne transport will address waterborne transport aspects of achieving zero emissions, together with the linked infrastructure activities needed to achieve this goal. The partnership will develop, draw together and integrate the wide range of technologies needed to achieve this goal. ***The supply of energies and alternate fuels, including hydrogen and potential liquid carriers, will be outside the scope of this partnership.*** The development of solutions to work with the new supplies of energy (renewable energy fuels, electricity and other alternative fuels), though, is in scope of this partnership (i.e. bunkering, on-board storage and energy power conversion systems). Therefore, close coordination with other partnerships is envisaged and meetings will be held at least twice a year to ensure coherence and explore joint activities.

With regards to environmental impacts on water, this partnership will address the mitigation of these impacts, whilst the relevant activities addressing the sustainable marine environment will address the impacts on ecosystems. In the same way, coordination will be ensured.

In this respect, the Co-Programmed Partnership zero-emission waterborne transport will not overlap with the scope of the other Partnerships proposed. There will be, however, links, notably concerning interfaces with other transport modes, batteries and fuel cells, where coordination will maximise the benefits from all activities. **The practical implementation of collaboration with other partnerships is described in 2.1.3.**

From the existing Partnerships, there are synergies with the **"Fuel Cells and Hydrogen Joint Undertaking"** (FCH JU), which currently includes waterborne transport as one of the applications addressed. Presently, within Horizon 2020, maritime demonstrators developed by the FCH JU are characterised by **single technologies** and **small scales** and do not provide a full transferability of the solutions to the wider range of waterborne transport products, including integration within wider ship systems. At the next stage, within Horizon Europe, it will be necessary to scale up these deployments to impact on large scale shipping and these specialist development and demonstration activities will be undertaken within this Partnership.

Links and collaboration with other Partnerships

Coherence and collaboration with other Partnerships include (upstream):

- The proposed Partnership, **"Towards a competitive European industrial battery value chain for stationary and mobile applications",** which addresses battery development, with automotive as the largest target and biggest market. The Batteries Partnership will also address development for other markets, including for waterborne transport. In this respect, **it focusses on specialist battery technology, material and manufacturing,** including battery safety, whilst the Zero-emission waterborne transport Partnership will address **integration of a battery within the ship systems and enable pre-deployment in maritime and inland applications** (addressing, for example, charging infrastructure, certification process, etc.). This is reflected in the proposal for Batteries and cooperation between the two Partnerships will be maintained to ensure relevance and to generate synergies;
- The proposed **"Clean Hydrogen"** Partnership focuses on **green hydrogen fuel production, storage and supply, as well as some demand side technologies, such as heavy duty road transport, where there has been substantial prior activity, as well as the development of high-power fuel cells.** The Waterborne Partnership will address **technology integration, implementation and validation, for both maritime and inland shipping.** This includes **bunkering and onboard storage of non-hydrogen alternative fuels.** It would be important to collaborate with the "Clean Hydrogen" Partnership with a view to developing the multi MW fuel cell required for ship propulsion and the related fuel technology;
- The proposed Connected, Cooperative and Automated Mobility Partnership **"CCAM",** addresses mobility and safety for automated road transport. CCAM also mentions potential interfaces with other transport modes. In this context, within a zero-emission waterborne transport Partnership, **any efficiency improvements achieved through automated shipping and maritime/river traffic management** may be leveraged through synergies with CCAM for the efficiency of the wider multimodal mobility system as a whole;
- The proposed Partnership for **"A climate neutral, sustainable and productive Blue Economy"** is focused upon resilient marine ecosystems and marine resources, contributing to the realisation of a sustainable economy for maritime and inland waters. Waterborne transport is one of several influencers on the marine environment and, in this respect, cooperation between the Partnerships will be ensured. It is noted, that the 'Blue Economy' is planned as a Partnership with Member State participation, focusing on informing policy implementation. It is not expected, as such, to develop the solutions enabling zero-emission waterborne transport itself (e.g. new technologies, fuels, or any relevant bunkering infrastructure).

The following parts of Horizon Europe are of interest for the developments in the framework of the Partnership Zero-emission waterborne transport:

- **Cluster Climate, Energy and Mobility;**
- **Cluster Digital, Industry and Space,** addressing important aspects concerning **Key Enabling Technologies,** technological and industrial capacities for industrial competitiveness, digitized, circular, low-carbon and low-emission economy;
- **Cluster Food and Natural Resources,** addressing **healthy seas and oceans;**
- **Cluster Health,** by having an impact on reducing the impacts of waterborne transport emissions and health;
- Other research areas such as **innovative materials, advanced manufacturing and circular economy.**

Links with missions (upstream and downstream, which could be potentially useful in the context of demonstrations):

- **The Mission on Healthy Oceans, Seas, Coastal and Inland Waters.** The mission's focus is yet to be fully developed. Although the main focus of the mission is not on greening of transport, our targets for the reduction of water pollution including underwater radiated noise contribute to a healthier ocean;
- **The Mission on Climate Neutral and Smart Cities.** The mission's focus is yet to be fully developed. Although the main focus of the mission is not centred on greening of transport, our targets for reduction of harmful air pollution will contribute to clean living environment in port cities and their surroundings;
- **The Mission on Adaptation to Climate Change including Societal Transformation.** The focus for this mission is also yet to be fully developed. The mission will not focus on greening of (waterborne) transport, but may have influence on shipping through the protection of port cities from rising sea levels. The results of both the Partnership, as well as the Mission, might cross-fertilize each other.

Synergies with other EU Programmes (e.g. to support deployment)

A number of European programmes have synergies with the implementation of the technologies developed in the framework of the Partnership, notably:

- **Innovation Fund (DG CLIMA)**[102]: The Innovation Fund focuses on: 1) innovative low-carbon technologies and processes in energy intensive industries, including products substituting carbon intensive ones; 2) carbon capture and utilisation (CCU); 3) construction and operation of carbon capture and storage (CCS); 4) Innovative renewable energy generation; 5) Energy storage. This fund is essential to support the implementation of solutions developed by the Partnership;
- **Modernisation Fund (DG CLIMA)**[103]: support for modernisation of energy systems and transition in 10 beneficiary Member States. This fund is essential to support the implementation of solutions developed by the Partnership;
- **Connecting Europe Facility – Transport (DG MOVE)**[104]: which supports the roll-out of innovation in the transport system in order to improve the use of infrastructure, reduce the environmental impact of transport, enhance energy efficiency and increase safety;
- **Connecting Europe Facility Transport Blending Facility (European Commission and EIB)**[105]: It is currently envisaged that, via InvestEU, the CEF Transport Blending Facility will co-finance greening of maritime and inland waterway transport fleets in the period 2021 - 2027;
- **European Fund for Regional Development (DG REGIO)**[106]: The current ERDF focuses its investments on several key priority areas. This is known as 'thematic concentration'. This fund is essential to support RD&I in line with the Partnership at the regional/national level;
- **EIB Green Shipping Guarantee:** is a sector risk-bearing facility supported by the Connecting Europe Facility (CEF) and the European Fund for Strategic Investments (EFSI), designed for projects that will improve the environmental performance of transport vessels in terms of reducing the emission of pollutants, as well as increasing fuel efficiency[107];
- **LIFE (DG ENV): the LIFE Programme has four objectives** [108]**:**

1. Help the move towards a resource-efficient, low carbon and climate resilient economy, improve the quality of the environment and halt and reverse biodiversity loss;
2. Improve the development, implementation and enforcement of EU environmental and climate policy and legislation, and act as a catalyst for, and promote, the mainstreaming of environmental and climate objectives into other policies and practices;
3. Support better environmental and climate governance at all levels, including better involvement of civil society, NGOs and local actors;
4. Support the implementation of the 7th environmental action plan.

1.2.4 R&I INVESTMENTS NEEDED

The transition to zero-emission waterborne transport requires RD&I related to eliminating GHG emissions as well as to the elimination of air and water pollution. RD&I investment for decarbonisation will (indicatively) be around **70% of the RD&I budget,** a smaller share will be dedicated to **emissions to air (20%) and for water pollution (10%).** These activities include all solutions that contribute to the main objective of zero-emission waterborne transport. However, the impacts on GHG emissions, pollution to air and water pollution are interlinked, since when GHG reduction is achieved, the reduction of other types of emission are usually also achieved at the same time. Furthermore, increasing energy-efficiency has a substantial positive impact on the environmental performance of waterborne transport.

The partners assessment is that the achievement of the Partnership's objectives is estimated to require an overall mobilisation of resources of around **€5.5 Billion, co-financing by Horizon Europe** included. This will be achieved through the EU's support which will catalyse a **leverage of three to four times** to achieve this goal. Necessary Union contribution will be defined at a later stage, depending on the overall ambition, SRIA and scope covered by Horizon Europe intervention. During the lifetime of the Partnership, the Partnership will frequently exchange information with relevant Commission Services, as well as with Member States, in order to ensure that market implementation can be supported by downstream funding and financing opportunities (see 1.2.3), as well as to ensure synergies with relevant national and regional research and innovation funding programmes and to avoid duplication of the use of resources. Complimentary and near market activities, are foreseen to be supported outside the framework of Horizon Europe and to be enabled through activities supported by the private side, and/or national support, and/or complimentary EU support mechanisms.

Leverage effects and additionality

The following quantitative direct and indirect leverage effects are to be expected:

- The Partnership will collaborate with the upstream and downstream value chain, which will leverage research and innovation investments in order to ensure that fuels, energy carriers, ICT systems and tools and other components needed will be fit for purpose;
- The European maritime technology sector consists of about 300 shipyards and 22,000 maritime equipment manufacturers. With an annual investment of **8-9%** of its sales in RD&I solutions, **the sector is amongst the highest RD&I intensive sectors in Europe.** The Partnership aims to lead to additional significant investments in RD&I by the European maritime technology sector, due to the fact that there is no one-size-fits-all, both in terms of new builds as well as in terms of retrofitting the current fleet;
- The rapid development of new technologies requires additional investment in real-life demonstrations. These demonstrations on board vessels entail a large amount of hidden costs for the ship owners, as they make their vessels available. Costs include not only docking time, fuel costs, etc., but also lost revenues;
- Once a technology has been demonstrated successfully in an operational environment, the commercialisation of the technology requires a significant additional investment. The waterborne transport sector estimates that an approximate **additional investment of 150%** beyond that required for demonstration is needed. The sector is committed to undertake these investments for the technologies developed in the Partnership.

The Partnership will maximise impact through:

- Coordination with the broader waterborne transport sector, the EU Member States and Associated Countries, thereby multiplying efforts and avoiding duplication;
- Ensuring a strategic focus beyond the specific interests of particular companies, by focussing on ambitious strategic and objective driven RD&I.

Monitoring arrangements

- The governance model of the Partnership includes the "Research Review Group" of the Waterborne TP, which will analyse annually the RD&I and outcomes concerning zero-emission waterborne transport executed by the European and global waterborne transport sector. This will include an overview of the private investments made in RD&I by the stakeholders involved, including those linked directly with the Partnership objectives. Excluding investment details the review will be published on the website of the Waterborne TP;
- In line with the Partnership objectives reflected within the SRIA's 7 year strategy, the annual RD&I review will be used on a rolling basis to orientate the RD&I activities and proposed call topics within the following two years;
- The Governance Board of the Partnership, as well as the Board of the Waterborne TP, will together discuss the reports of the Research Review Group at fixed intervals at least two times per year in order to assess progress and provide recommendations towards achieving the Partnership's objectives;
- During meetings with Member State representatives and representatives from Associated Countries, the national and/or regional strategies and RD&I programmes related to zero-emission waterborne transport will be discussed, including opportunities for alignment and synergies;
- As part of the overall monitoring and reporting, the Partnership will publish an overview of total RD&I investments linked to the achievement of Partnership objectives by the European waterborne transport sector, the European Commission, the Member States and Associated Countries on a yearly basis.
- Each year the progress of the Partnership towards the achievement of its objective, including related KPIs will be assessed by the Governance Board of the Partnership and published, together with any recommendations. Further details will be elaborated within the SRIA

Transformational changes

There is no single solution to achieve zero-emission waterborne transport and the multiplicity of technologies (e.g. efficiency improvements, fully electric and hybrid propulsion, wind assistance, smart shipping technologies, renewable carbon-neutral, and zero-carbon fuels and their use, integration of fuel cell technology etc.) must be brought together and integrated within a single vessel and for different applications. This will be facilitated by the Partnership, which will ensure the deployment of **a coherent programme and mobilise substantial efforts.** This will be unlike previous initiatives, which have not principally focussed on waterborne transport and the integration of solutions, as well as the scale of the challenge.

The Partnership will allow the waterborne transport sector to develop the **necessary collaboration with other sectors and industries,** to fully exploit disruptive innovation in particular, as well as the potential of all innovative solutions across the entire waterborne transport sector. This will also lead to cross-modal research topics.

The Partnership is therefore an important tool to **mobilise the firm commitment** of all stakeholders (public and private), which is necessary to respond to a challenge of this scale. It will bring together **all relevant stakeholders,** including industrial players, the research community, academia and also requires the involvement of Member States (to ensure the necessary underpinning of policies, regulations and research activities). In this way, the Partnership will **avoid the duplication of RD&I efforts and funding, improve efficiency of efforts** and **increase leverage** from the EU's actions.

Sustainability of the action (Exit clause)

The Partnership should pave the way for the implementation of zero-emission waterborne transport technologies and solutions from 2030 onwards. The achievement of this goal would imply that there is no need to extend the duration of the Partnership after the lifetime of Horizon Europe, namely 2027 (although some projects will be granted in the last year of Horizon Europe, which will be closed after the final calls in 2027). However, the RD&I activities related to zero-emission waterborne transport are of key interest for the Waterborne Technology Platform and its members. The Waterborne Technology Platform will monitor the projects co-financed by Horizon Europe until the end of their lifetime and will form the key platform for exchanges of information regarding RD&I activities related to the Partnership, their implementation and possible barriers to implementation. The organisational structure of the Partnership will stay in place until the final project is finished, and the Waterborne TP will organise frequent meetings with all partners (both public and private) involved in the execution of the Partnership.

1. 3 NECESSITY FOR A EUROPEAN PARTNERSHIP

The waterborne transport sector is highly diversified and consists of many different segments, which, in turn are comprised of many subsegments with different interests, challenges, opportunities and needs. This diversification is not only a wealth for the sector and society at large, but also a bottleneck for the sector. The lack of a clear path makes it very extremely risky for individual companies to make investments in RD&I and the fragmented and competitive nature of the industry results in a **large number of SME companies** with limited access to research funding.

Due to the diversified nature of waterborne transport, there is currently **no clear-cut path to zero-emission waterborne transport and in particular to decarbonisation[109].** The flexible and modular design of ships and powertrains, so that they can be more easily adapted to technological developments and more resilient to climate change, will be key in achieving zero-emission waterborne transport and will facilitate uptake of technologies and concepts not known today. It is likely that the transition towards zero-emission waterborne transport will require a combination of solutions, including the use of alternative fuels, an upgrade of onshore (port) infrastructure and a reduction of fuel demand by **improving operational performance. Smart shipping** for improved energy-efficiency will play a role in reducing fuel consumption and therefore the need for alternative fuels, as well as emissions, whilst energy management, new propulsors and energy storage will be other important areas of intervention. Possible alternative fuels (depending on safety, sustainability and availability) include conventional and advanced biofuels and bioliquids/biogases as well as renewable synthetic and electro fuels (fuels produced through electrolysis and chemical catalysis or biological synthesis, such as methane (LBG), methanol, alcohols, hydrogen and ammonia (NH3)) all strengthened in their applicability through **efficiency improvements** achieved by harnessing of other renewable energy sources, such as wind and solar.

All alternative fuel options have advantages and disadvantages. The ultimate choice of one or more alternative fuels in waterborne transport will therefore likely boil down to the particular **social, economic, technical and environmental** implications linked to each fuel option. This situation is another illustration of the **urgent need to coordinate** the actions of all key stakeholders from the waterborne transport sector. This coordination will be needed to ensure a viable way forward, which leads to zero-emission waterborne transport for all segments of the sector, **implementing commercially viable ships as soon as possible and at the latest from 2030 onwards.**

Besides RD&I in technological innovations, RD&I will also be necessary for developing **new non-technological innovations, new operational concepts and services, as well as new business models,** both within the waterborne transport sector itself and within the wider multimodal mobility and logistics systems. Achieving zero-emission waterborne transport by 2050 not only requires actions at the level of a ship and the ship's operations, but also requires onshore solutions **(e.g. in ports and along waterways, where adequate zero-emission refuelling infrastructures needs to be in place)** and solutions throughout the entire logistics chain (i.e. **by also achieving zero-emission door-to-door freight and passenger transport**). There is also a need to address the role of shippers and forwarders and related industries and service suppliers such as banks, shipyards, energy suppliers and equipment suppliers and to prove future proof infrastructure (e.g. waterways).

In addition, upskilling or re-skilling the current workforce and properly preparing youngsters for their entry into the European waterborne transport sector should be adequately addressed in the RD&I projects in order to enable this workforce to work with new technologies and concepts.

With several key stakeholders from the waterborne transport sector having expressed a clear commitment to transform waterborne transport into a zero-emission mode of transport (ranging from energy suppliers to shipowners, shipbuilders, maritime equipment manufacturers, ports, shippers, classification societies, infrastructure companies, environmental non-profit organisations, research institutes, citizens' associations and authorities), the Partnership will be key to **coordinate** initiatives **to avoid duplication of efforts and/or to speed up efforts by joining forces.**

The commitment of the waterborne transport sector to deliver solutions for societal challenges and the urgent need for coordination will be further strengthened by the Partnership's joint, structured approach. Whilst a Strategic Research and Innovation Agenda (SRIA) will be developed, the waterborne transport sector will contribute resources, both in terms of the execution of RD&I projects and the facilitation of demonstrators, as well as by providing the means to ensure a proper "back office" for the Partnership, which provides essential support to ensure coordination between all stakeholders (both public and private), synergies, as well as the monitoring of progress and adjustments in direction where needed.

The Partnership will be a fundamental tool to successfully implement sectoral specific policies, such as the objective of the European Green Deal to shift to sustainable and smart mobility, the initial Greenhouse Gas Reduction Strategy of the IMO (to be revised), as well as inland waterway transport policies. Furthermore, the Partnership will be key to achieve the objectives of the political guidelines of the European Commission, in which the competitiveness of the European industries is one of the key elements, including the creation of quality jobs.

This is in line with the main objectives of Horizon Europe:

- to strengthen science and technology;
- to foster industrial competitiveness and
- to implement the sustainable development goals in the EU.

Finally, when discussing the European Green Deal, the European Council recently recognised the need to put in place **an enabling framework** that benefits all Member States and encompasses **adequate instruments, incentives, support and investments** to ensure a **cost-effective, just, as well as socially balanced and fair, transition,** taking into account different national circumstances in terms of starting points. **Member States have indicated their broad support** for the co-programmed Partnership zero-emission waterborne transport and have also recognised that there is a clear link with national/regional strategies and programmes.

The Partnership is essential to accelerate transition towards zero-emission waterborne transport through a clear vision shared and committed to by partners. It will mobilise additional resources beyond EU co-financed research and innovation. In addition, the Partnership will continuously analyse research and innovation activities executed by the broad waterborne transport sector or (co-)financed by the waterborne transport sector, including national or regional programmes. This broader overview allows to better identify gaps and set priorities.

In order to create synergies between the Partnership and relevant national (sectoral) policies, programmes and activities, close cooperation with Member States and Associated Countries will be initiated from the start. For inland waterway transport, close cooperation will be established with the River Commissions, which play a key role in coordination with their Member States on technical and legislative matters for inland navigation. There are a number of areas of attention which are of importance to streamline developments of the partnership with relevant policy developments, as well as research initiatives:

- Create synergies between the Partnership and national **research and implementation** strategies and programmes and vice versa;
- Coordinate between the Partnership (including research outcomes) and regulatory actions at regional, national and international level.

The interaction between the Partnership and Member States is described in more detail in Chapter 2.

1.4 PARTNER COMPOSITION AND TARGET GROUP

A key element in transforming the waterborne transport sector is the involvement and commitment of all relevant stakeholders. The Partnership will involve the broad spectrum of stakeholders from the start of the project in different ways, enabling the Partnership to interact with the relevant stakeholders at the appropriate moment in time. The following types of Partners will form the core membership of the Partnership:

- Shipowners, as end users of the technologies and concepts developed within the framework of the Partnership;
- Ship operators, which are responsible for managing vessel performance, bunker quality and quantity pricing and ship routing and are therefore essential decision makers in selecting vessels with certain technologies;
- Shipbuilders, which will have a key role in retrofitting the current fleet, as well as building zero-emission vessels;
- Cargo owners, selecting the type of transport;
- Equipment suppliers, which will have an essential role in retrofitting the current fleet, as well as developing the equipment for building zero-emission vessels;
- Inland waterway infrastructure authorities, which are essential for the maintenance and development of inland waterway transport infrastructure;
- Authorities (international, European, national, regional, local), developing policies, legislation and strategies and monitoring its implementation;
- Academia, crucial for scientific research;
- Research Institutes, essential players in research and testing of new technologies and concepts;
- Inland and maritime port authorities and operators, which will provide the key infrastructure needed to reduce emissions;
- Classification Societies, non-governmental organizations that establish and maintain technical standards for the construction and operation of ships and offshore structures;
- Engineering offices, essential for the design of new solutions and retrofitting;
- Energy Suppliers, which will develop energy solutions for waterborne transport;
- Shipping agents, managing port calls (representing the shipping company at ports) and acting as cargo brokers;
- Freight forwarders and Logistics Service providers (organising and selecting the best transport option).

An overview of current composition of partners is in Annex A.

From the start of the Partnership, the inclusion of end-users in the Partnership is key. The European shipowners' association[110] has confirmed its participation, whilst the European association representing owners of inland navigation vessels also actively participates in the activities of the Waterborne TP. A geographical balance, as well as a balance between umbrella organisations and individual companies, will be ensured.

Cooperation with public entities is key t**o ensure alignment of research, innovation and deployment strategies and programmes, as well as legislative developments, in order to maximize impact.** Besides the national administrations, an interactive exchange and progress validation process with the European Commission, European Maritime Safety Agency, IMO, the European Environment Agency and the River Commissions is of utmost importance for the success of the partnership.

Finally, it is important to involve non-governmental organisations in developing the SRIA, as well as its yearly update. Representatives of NGOs will be invited to regular meetings of the Partnership, as well as to contribute to the envisaged online public consultations.

International cooperation

The Partnership will establish links with the IMO. On the one hand, to anticipate upcoming changes of the regulations and GHG targets. On the other hand, to establish cooperation and to create synergies with the International Maritime and Development Board (IMRB), as recently proposed to be established. This cooperation will avoid duplication of efforts and will stimulate the development of necessary rules and regulations. Alignment of research investments in efficient and effective innovation are crucial, and future plans at IMO for the establishment of an IMO GHG reduction research and development programme to accelerate the introduction of low-carbon and zero-carbon technologies and fuels can have an influence on the strategic execution of the Partnership's SRIA.

Cooperation with other regions than EU member states will also be pursued. The international nature of the waterborne transport sector requires cooperation with other research-oriented countries and flag states. Of course, cooperation is subject to requirements on IPR protection, as well as fair treatment of investments and public procurement.

2. PLANNED IMPLEMENTATION

2.1 ACTIVITIES

2.1.1 OUTLINE OF THE PORTFOLIO ACTIVITIES TO ACHIEVE THE OBJECTIVES

Problems

AIR POLLUTION
Current use of Heavy Fuel Oil pollutes air in port cities and coastal areas with SO_x, No_x, particulate matter, and creates harmful effects on environment and human health.

CLIMATE CHANGE
Shipping emits approximately 1 billion tons of CO_2. Emissions are projected to increase by 20-50% between 2008-2050. Ships entering EU ports emit 13% of the total EU transport emissions.

DEGRADATION OF WATERS
Waterborne transport is damanging seas and rivers: underwater noise, Sulphur-dioxide from scrubbers, ballast water transfers organisms and hull coatings relese chemicals.

Problem drivers

DIVERSITY
The large diversity of ship types and operations hinders the development of standardised solutions.

LACK OF ALTERNATIVE FUELS
No alternative for fossil fuels in waterborne transport, leading to GHG emissions and other pollutants.

HIGH ENERGY NEEDS
Ships require a huge amount of power over a long time frame to be able to sail internationally.

INTERNATIONAL SECTOR
The sector is global by nature and subject to different international regulatory frameworks.

AGE VESSELS
The lifetime of vessels is long, slowing down the uptake of new technologies.

INFRASTRUCTURE
Operational integration with ports and hinterland is not harmonised internally.

Specific objectives by 2030

Scientifc Objective: Develop and demonstrate deployable technological solutions which will be applicable for the decarbonization and elimination of other emissions of relevant ships and services.

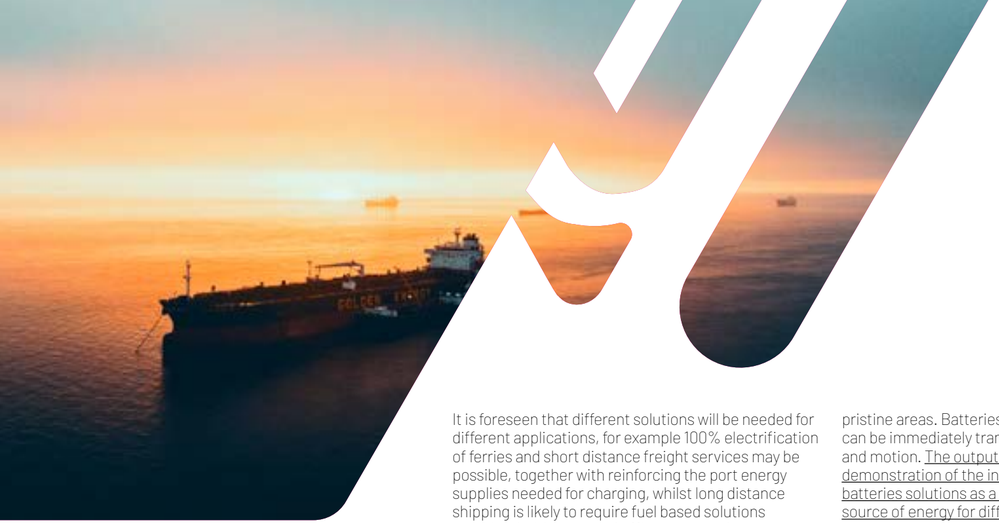
Economic Objective: By 2030, implemention of economically viable European new technologies and concepts regarding zero-emission waterborne transpost to strengthen the competitiveness of European industries in growing green ship technology markets and provide the capability to re-enter markets, presently dominated by Europe's competitons.

Societal Objectives: To facilitate the development of regulations and policies at national and international level including the development of standards to enable the implementation of technological solutions for zero-emission waterborne transport; To facilitate the uptake of innovative zero-emission waterborne transport technologies and solutions within the European waterborne transport sector supporting economic growth and European employment.

General objectives by 2030

To provide and demonstrate zero-emission solutions for all main ship types and services before 2030, which will enable zero-emission waterborne transport before 2050

Figure 5: Objective tree



Eliminating GHG Emissions

The Partnership's core of the RD&I activities are focussed on developing and demonstrating solutions to eliminate GHG emissions from waterborne transport. Even if the waterborne transport is very diversified, most of technologies to be developed and demonstrated are applicable on most ship types, and the Partnership will ensure in the process that the main polluters are addressed (i.e. two-third of the GHG emissions from ships sailing to or from European ports being originated from passenger vessels and large merchant vessels).

In terms of activities, the Partnership will explore the following research areas: (Use of) Alternative fuels, Electrification, Energy Efficiency including use of renewable energy sources, Design & Retrofitting, Sectorial Integration, and Ports infrastructure for refueling and recharging.

It is foreseen that different solutions will be needed for different applications, for example 100% electrification of ferries and short distance freight services may be possible, together with reinforcing the port energy supplies needed for charging, whilst long distance shipping is likely to require fuel based solutions combined with improved efficiency to reduce energy needs and alternative energies such as wind.

The first research area aims for a wider adoption of **Alternative Fuels** in waterborne transport applications. Many external constraints exist (from fuel availability to distribution network and a capillary network of bunkering in ports) but at the same time these external constraints cannot be overcome if there's no demand for alternative fuels from waterborne transport. At the moment limited technologies exist to store, distribute and convert alternative fuels into energy. In addition a regulatory framework needs to be developed. The output of this activity will be the demonstration of the technical capability to integrate alternative fuels on-board and to develop fuel flexible energy systems for the prime mover.

Electrification may represent a solution for short range shipping. Electrification is also a necessary complement to power generation based on alternative fuels, for instance while entering ports or sailing in pristine areas. Batteries offer a form of power that can be immediately transformed into ship's power and motion. The output of this activity will be the demonstration of the integration of high-capacity batteries solutions as a single or complementary source of energy for different ship ranges.

Energy efficiency will be addressed across all applications since it reduces the energy demands on emerging new technologies. Furthermore, it will reduce operational costs as the use of more expensive climate neutral fuels would lead to higher operational costs. Power generation solutions based on alternative fuels are relatively new for waterborne transport applications. In addition alternative fuels are generally characterized by a lower energy density, thus requiring more volume to ensure the same autonomy in operation. At the same time electrification becomes unfit to long ranges. The research area Energy Efficiency aims to significantly reduce the power and energy needed to operate a ship, enabling both alternative fuels and electrification for larger applications. Reducing the energy need for propulsion of the vessel, enhancing the efficiency of operations, reducing the onboard power demand, harvesting energy, and the support of renewable sources like wind are different ways to achieve this operational objective. The output of this activity will be a significant reduction of the energy needs.

As aforementioned, it is clear that different technologies need to be developed and adapted to different operational needs and ships. This means that apart from the new technologies, the industry needs to master the optimization of the new onboard systems. This requires special capabilities in Design and Retrofitting in order to address new ships and existing ships already in operation. **Design and Refitting** consists of the onboard integration of different technologies through a modular approach, innovative solutions for significantly reducing the ship's weight, and the development of short-term solutions for components and equipment abating emissions onboard existing ships. The output of this activity will be the development of modular, cross sectorial solutions and methodologies for easy retrofit or construction.

The waterborne sector is fragmented, and digital technologies have an enormous potential in ensuring efficient operation of vessels and fleets. Consequently, **Sectorial Integration** may be boosted by higher levels of digitization where digital environment is mirroring in real time operations, ports, ships, traded goods, passengers and crews, ensuring the optimization of the entire ecosystems. The output of this activity will be the development of digital tools and twins for the seamless integration of the sector across multiple stakeholders.

Port reception facilities are essential in the operations of vessels. With the electrification of vessels, the need arises for high-power charging facilities. The use of alternative fuels needs to be facilitated with bunkering technologies. A special focus will be on the safety of these bunkering or recharging operations. The potential of near-shore bunkering or ship-to-ship bunkering will also be investigated. Finally, solutions will be developed of the offloading of chemical or biological residue from new systems onboard the vessels. The output of this activity will be the development of technological solutions for clean and safe facilities enabling zero-emission waterborne transport.

Eliminating air pollution

Air pollution is closely linked to GHG and the use of fossil fuels which actually are the main cause of SO_x, NO_x and PM emission. Whilst regulations to introduce limitations on the use of highly polluting fuels have reduced the environmental impact of waterborne transport operations, they have yet to fully solve the problem. While working on fuel shift or higher degrees of electrification, there will be the need to filter or clean emissions to avoid the pollutants being released from existing or hybrid vessels. Therefore, easy-to-implement solutions need to be deployed on existing ships in this transitional phase. In addition, the ongoing adoption of LNG requires solutions to reduce methane slip when using internal combustion engines (ICEs). Similar problems could arise when using e-fuels in the future. This objective will be tackled in the **Design and Retrofitting** research area.

Eliminating water pollution

In the recent past, examples have shown that regulatory restrictions on air pollution have led to an increase in water pollution. Furthermore, whilst it is possible to increase the energy-efficiency of a ship through the use of a more efficient propulsion system, this can lead to the generation of more underwater radiated noise. These examples demonstrate the need for avoiding water pollution when developing solutions for zero-emission waterborne transport. Within the research area on **Energy Efficiency,** new anti-foulings without harmful substances will be developed, as well as solutions to reduce the noise levels of propulsion systems. In addition, the research area on **Ports** will deal with ship pollutant offloading that could emerge when developing solutions for eliminating GHG emission or air pollution emission reduction.

Strategic implementation approach

Europe's waterborne transport value chain is a frontrunner in the development of innovative and technological solutions and is engaged on a daily basis in implementing technologies to reduce and ultimately eliminate GHG emissions from waterborne transport. New-build short-sea vessels and high-end complex ships (such as cruise/ferry passenger ships and other complex special ships) as well as retrofitting offer Europe the most suitable and practical basis to develop, test and demonstrate the new emission reduction technologies. It is thereby important to remark that these innovative solutions will be applicable to all other market segments (such as container ships, bulkers, etc.). Therefore, the Partnership will create a critical mass for the development and demonstration of innovative solutions and create a win-win scenario in which emissions are reduced in European and global waterborne transport services whilst reinforcing the European technological industrial base in its competition on a global scale.

However, due to the size of these vessels, their operational profiles and thereby the solutions needed to decarbonise, the development and validation of solutions will be carried out through wider vessel types. The pathway needed to be able to develop solutions for the biggest polluters could be from small ships with short range, through high-value, high-tech long-range vessels, to low-tech long range vessels. It will be essential to develop these same solutions also for retrofitting, to cut emissions from the existing fleet. Solutions will use a modular approach to lower the costs for these retrofittings.

A strategic, objective driven approach will be taken, focussed on building a strong portfolio of activities[111] that will ensure viable impacts for both inland and maritime transport, as well as deployable zero-emission solutions for **all main ship types and services before 2030.**

Within the first two years of the Partnership it is foreseen to undertake a combination of lower TRL activities setting the foundation for later development, as well as potential "quick wins" with high short-term environmental impact and which will reinforce Europe's competitiveness as it emerges from the consequence of the coronavirus pandemic. These will be elaborated within the SRIA. Examples of lower TRL RD&I can be found in proving the feasibility and safety of emerging, less market ready, alternative fuels. Examples of higher TRL "quick wins" can be found in the development and large-scale testing of solutions to improve energy efficiency. They will be elaborated within the SRIA and will be chosen according to the capability to trigger the transformation of the sector in the short and long term.

The Strategic RD&I programme will provide scientific knowledge to enable informed choices concerning the optimal pathway to achieve zero-emission solutions that are climate neutral and which eliminate harmful pollution to air and water. **These will be appropriate for the main ship types and services which have the largest impacts on pollution and GHG emissions,** including towards the large intercontinental merchant ships, coastal vessels, inland waterway transport, and passenger vessels.

As the programme starts off with a mix of low and high TRL RD&I, some technologies can already be demonstrated at relevant scale during the mid-year's of the programme. The developments starting off at a lower TRL, will be developed and consolidated into smaller scale demonstrations in these mid-years. This could include smaller scale applications such as inland waterway vessels and other ship types, providing that the solutions can be a basis for a technology pathway for large scale deployment.

The programme will aim to conclude with demonstrators in the final two years, which will prove the viability of the developed solutions towards all main ship types and services. Whilst some solutions may for example be applicable to large merchant ships such as container vessels, demonstration could take place in the context of a different but similarly relevant ship type. For example cruise ships have long autonomy and employ energy systems of similar scale to the large merchant ships.

In line with this strategy, detailed RD&I activities will be developed in the SRIA on a rolling two-year basis. This SRIA is developed in the Partnership jointly between the Partnership and the European Commission, in consultation with **EU Member States, Horizon Europe Associated Countries**. A transparent process will be deployed, including an opportunity for public comments as well as from stakeholders, industry, Member States and societal interests (see 2.1.2).

Throughout this process, the Member States, Associated Countries and several European Commission DGs will be involved. This ensures avoiding unnecessary duplication with national programmes and it enables synergies between national programmes, policy developments and Horizon Europe.

Preparatory activities are supported by STEERER (Structuring towards Zero-emission Waterborne Transport), a CSA project launched on 1 December 2019, which focuses on RD&I strategy and gives due consideration to business models and the regulatory and market incentives needed to achieve zero emission waterborne transport. To enable massive transition to achieve zero-emission performance in 2050, STEERER helps Waterborne TP to identify promising candidate solutions, to **tackle barriers** to their further development and deployment and to coordinate the establishment and communication of a **Strategic Research and Innovation Agenda** and an **Implementation Plan.** This project is an important tool to facilitate the start-up of the Partnership.

The Partnership will ensure broad impact by communicating its activities widely within prominent fora for the sector such as IMO, ESSF as well as large industry events and conferences. An annual assembly will be held in Brussels to engage with European and industry stakeholders. Member states will be encouraged to cooperate with the Partnership and to align their activities to ensure maximum added value. The Partnership will facilitate the take-up of the outcomes from RD&I actions with mechanisms to accelerate their deployment and wider take up, for example via the Connecting Europe Facility, Enterprise Europe Network, climate change innovation fund, education and training initiatives, venture capital and other mechanisms. In the portfolio of deployment activities, the Partnership will also strive to have balance in terms of geographical coverage.

Assisted by the activities of STEERER, Waterborne TP will develop the SRIA underpinning the objectives of the partnership[112], ready for the Partnership's start in 2021.

The additional activities to achieve the objectives of the Partnership will include the following actions:

- Drafting topics supported within Horizon Europe calls, programmed in accordance with the SRIA, ranging from fundamental research to demonstration;
- Facilitate deployment by the partners/associations, as well as knowledge management, communication and dissemination activities and promotion;
- Support the development of regulations and standards, safety aspects, synergies, including engaging with regulatory fora such as the IMO etc.;
- Seeking additional investments to demonstrators through EU/private schemes, but also;
- Establish synergies with other partnerships and programmes (e.g. financial instruments, loans, or social funds to support skills development);
- Promote and increase awareness of the Partnership's activities, thereby increasing impact;
- Monitor progress of achievement towards the policy objectives (incl. developing adaptive strategies and anticipating changes).

Call topics will include a requirement for the project to deliver recommendations for policy, regulations, future research and education and training (where relevant). Examples could be recommendations on creating demand for the new technology, incentives to invest, etc. Recommendation for future research will be collected and used in updates of the Partnership's SRIA. The same also applies to subsequent requirements related to skills development to facilitate deployment. For example, with respect to training and upskilling: these may be addressed in different ways, such as through national and European skills development programmes, Erasmus+, ESF+ etc.

2.1.2 PROCESS TO UPDATE THE RESEARCH AGENDA

For the update of the SRIA and the input to multi-annual calls, we envisage applying an open but manageable process.

- The Partnership will undertake a **broad assessment of the current state-of-the-art** and challenges for the different ship types and services. On this basis, a SRIA will be developed for 7 years, addressing the **main objectives and activities. Each year** the SRIA will be updated taking into consideration the results achieved (within and outside the Partnership), the technological developments available in the market and the immediate priorities of the sector;
- The Partnership will create and maintain an overview of **ongoing projects** and **research outcomes (including policy recommendations).** This overview will not be limited to EU funded research, but through its members and its contact with the Member States, the Partnership will acquire information on **relevant national or industrial projects,** as well as assess reports within the wider press and journals. A summary of this overview and the main trends will be published each year;
- The Partnership will continuously liaise with relevant bodies and working groups[113] and integrate the work being done in the framework of the Strategic Research Agenda for inland waterways and ports[114]. Following the execution of research projects, the policy recommendations will be discussed during dedicated meetings with EU Member States and Associated Countries (see governance) and/or during the relevant meetings of the bodies and working groups identified;
- The Partnership will organise conferences on a yearly basis to present the progress towards strategic objectives, research outcomes as mentioned above and to discuss necessary updates to the SRIA. These conferences will target dedicated audiences, such as European Commission Services, MEPs, Representatives of EU Member States and Associated Countries, as well as representatives of the waterborne transport sector and other interested stakeholders;
- The proposed update to the SRIA for the Partnership's full 7 years will be put forward in an **open consultation** through the Partnership's website yearly. Discussions on priorities will be facilitated on this website. **EU Member States, Associated Countries, NGOs and civil-society organisations** will be invited to participate in the discussions and to encourage their local stakeholders to participate in the consultation;
- On the basis of the SRIA, and taking into account emerging developments, **each year** experts from the Partnership's members will evaluate the portfolio of activities, taking into account the most recent developments and consultations for new RD&I topics, as well as types of research (e.g. TRL levels may need to be revised), actions needed to facilitate deployment, actions concerning dissemination and communication etc., in order to ensure the maximum impact of results. Following this update, the portfolio of activities for the following two years will be drawn up in order to ensure the maximum impact of results. These proposed actions will be discussed with the European Commission Services, representatives of EU Member States and Associated Countries.

Throughout this process, the EU Member States, Associated Countries and the European Commission DG RTD will be involved. This ensures avoiding unnecessary duplication with national programmes and enables synergies between national programmes, related national initiatives such as MarTERA[115], policy developments and Horizon Europe.

2.1.3 LINKS WITH OTHER EU (OR INTERNATIONAL) INITIATIVES

The Waterborne TP has recently created synergies and signed an MoU with Hydrogen Europe[116], as well as with ALICE[117]. In preparation for the Partnership, the Waterborne TP **will nominate interlocutors** who will act on behalf of the Partnership to liaise on the developments of the Partnership with the other relevant initiatives in order to **avoid duplication of efforts,** as well as to discuss **necessary prioritization. Finally, the representatives of the Partnerships, Missions, Technology Platforms and other relevant initiatives** will be invited to attend meetings with the Waterborne TP on a regular basis to discuss the **issues at stake,** the creation of **possible synergies,** to **develop joint work plans** and **common calls** (where possible) and any other issues relevant to the execution of the tasks of the Partnership. The envisaged areas of intervention of individual Partnerships and their relationships have been set out in paragraph 1.2.3.

Cooperation with Member States and Countries Associated to Horizon Europe

In order to align the developments of the Partnership with relevant national (sectoral) policies, programmes and activities, close cooperation with EU Member States and Associated Countries will be established from the start. For inland waterway transport, close cooperation will be established with the River Commissions, which play an important role in coordination with their Member States on technical and legislative matters for inland navigation. There are a number of areas of attention, which are of importance to streamline the Partnership's developments with relevant policy developments, as well as research initiatives:

- Create synergies between the Partnership and national **research and implementation** strategies and programmes and vice versa, which will be discussed in a Member State advisory body (so-called States Representatives Group);
- Coordinate between the Partnership (including research outcomes) and regulatory actions at regional, national and international level (see paragraph 2.1.2);

For this reason, the Member States and Associated Countries will be involved in the governance of the Partnership (see paragraph 2.3).

2.2 RESOURCES

The Partnership members are fully committed to its goals: zero-emission is a necessity for society, crucial for the sector to remain leading as a mode of transport, and an important driver for innovation and market opportunities.

To achieve the Partnership's objectives it is estimated that an overall mobilisation of resources of around €5.5 Billion, co-financing by Horizon Europe included, will be required. This will be achieved through the EU's support, which is expected to catalyse a **leverage of three to four times** to achieve this goal.

Resources contributed by the private side will be:

- In-kind contributions to the projects funded by the Union contributions (on the basis of non-reimbursed eligible costs);
- In-kind contribution for additional activities foreseen in the SRIA not covered by Union funding;
- Investments in operational activities that is spend beyond the work that is foreseen in the SRIA.

This will be achieved through the alignment of industrial RD&I strategies with the operational activities of the Partnership described in SRIA, supporting the additional costs necessary to deploy full scale demonstrators, alignment of product development cycles so as to underpin the commercial deployment of solutions emerging from the Partnership, providing the foundation for emerging international & EU standards and regulations, which will provide the necessary market conditions for global deployment. Pending on the agreement on the final SRIA, it is expected that the yearly RD&I contribution from the industry will amount to €200 - €250 M during Horizon Europe's timeframe. In addition it is expected that the additional costs for demonstration of technologies in the different ship types will amount to €750 M. For the commercialisation of successful demonstrators the partners will contribute €1.5 B, to reach a successful deployment into the market.

The Partnership also aims to mobilise additional investments through the use of **finance investment mechanisms** including, for example, any emerging **climate change investment banks,** innovation **investment guarantees** and performance based schemes where innovative technology is leased on the basis of assured performance guarantees.

In addition to this, the Partnership's activities will mobilise further resources within the Member States, several of which have indicated that they expect to orientate their national R&I programmes to ensure complementarity with the Partnership and further increase leverage. Also, mechanisms supporting first of a kind deployment to provide market reassurance will be implemented to complement the outcomes from the Partnership. These include those available from private foundations, as well as European instruments such as CEF, ESIF, climate change innovation fund, etc.

Furthermore, members of the Partnership will provide resources to ensure a proper staffing of the Secretariat of the Partnership, as well as other bodies needed to execute the Partnership's tasks (contribution in kind or in cash).

Finally, the deployment of technologies and concepts requires a patchwork of **regulatory and financial incentives** in order to stimulate first movers. For this reason, it is vital that the Partnership establishes close links with competent administrations to ensure that the necessary rules and regulations are developed in order to ensure market introduction is facilitated. The partners in the Partnership will have an active role in providing support for the development of the required policies and regulations. In addition, synergies with regional, national and European funding schemes for first movers should be ensured.

2.3 GOVERNANCE

The governance presented below is based on the assumption that the current Waterborne TP Association can be the private partner in the Partnership. Another option would be the establishment of a separate association, as has been done in the past for cPPPs. The development of the governance structure also depends on the final MoU or contract laying down the requirements of the Partnership. An ad-hoc working group is currently exploring possible solutions to guarantee the most efficient governance and operation for both the Waterborne TP and the Partnership. The proposed governance scheme described below may have to be adjusted in light of the results of this on-going work.

The Partnership will be concluded between the European Commission and the Waterborne TP Association, representing the entire waterborne transport community.

The Waterborne TP is established as an Association under Belgian law with the role of representing its members with regards to RD&I strategies defined within its statutes. It is a membership-based organisation; it is open to newcomers, on the basis of a small paid subscription (€3,000 annually as of 2020). Other parties can also participate as observers at no cost, subject to board approval; these may include civil society organisations and representatives of national administrations.

The Partnership will be governed by a Partnership Board. This board will steer the Partnership towards achieving its SRIA, supervise the process of interaction with industry and member states, approve the research programme as set out in the SRIA and the specific topics to be addressed in Horizon Europe calls. The actual decision on the calls to be published is taken following comitology procedure.

The Partnership Board will consist of representatives of the Commission services, together with representatives of the Partnership. The Commission will have several representatives. Currently, the intention is to include representation from DG RTD, DG MOVE, DG CLIMA and DG ENV. If deemed necessary / pending on the topic then there might be a need to include additional representatives from DG MARE, DG ENER, DG TAXUD, DG COMP, SEC GEN and DG GROW. The Partnership's representatives will be (a subset of) the Waterborne TP board and technical experts for relevant topics. The Waterborne TP representatives will be proposed by the association following a vote in its General Assembly and appointment by the European Commission.

EU Member States and Associated Countries will be involved in the Partnership through an advisory body (States Representatives Group or similar). All Member States are invited to participate. The aim is to ensure two-way information flow between the updates of the SRIA and research proposals from industry and national priorities, policies and programmes. This is seen as a crucial step in the priority-setting process, and will facilitate discussions in the Transport Programme Committee. In addition, it will facilitate the take-up of results and the development of necessary policies and regulations.

The Partnership will be assisted by a secretariat which will be provided by the Waterborne TP association.

The private side of the Partnership will be organised within the Waterborne TP association. Within the Partnership's working groups, members of the Partnership will discuss the technical requirements and research progress for the Partnership. Representatives of EU Member States, Association Countries and European Commission services will be invited to participate in the technical meetings of the working groups.

The actual division of the industrial research discussions in working groups will be aligned with the final subdivision of topics in the SRIA.

The research requirements and associated research activities for the Partnership are a subset of the activities of the existing Waterborne TP association. There is a close link between topics in the Partnership's research agenda and topics that, although outside the scope of the Partnership, are part of collaborative research. Examples of this include digitalization for greening vs digitalization for safety, or fire/explosion/toxicity risks and passenger safety on vessels using new fuels and layouts. Proper coordination of needs and activities is therefore of paramount importance and will be ensured by the Waterborne TP Coordination Group and Board.

Furthermore, the Waterborne TP will organise activities to maintain an overview of ongoing research in the waterborne sector and to ensure the appropriate communication and dissemination of the findings of the results of the Partnership, such as creating brochures, maintaining a website, social media activities and organising events.

The involvement of the wider waterborne transport sector is described in the following section on openness and transparency.

Preparation of the Partnership

During the preparation of the Partnership, there has been intensive contact with the European Commission Services. As well as reviewing several versions of the proposal, joint meetings with relevant Commission Services have been organised to exchange views regarding the proposal, to discuss its scope and objectives and to enable alignment with EU policy objectives. Relevant Commission Services (mainly DG RTD, DG MOVE, CLIMA, ENV, MARE, GROW, ENER, COMP, SG and DG TAXUD) have been involved in the proposal review process. In addition, the European Commission Services have been instrumental in setting-up joint meetings with related Partnerships so as to discuss synergies between Partnerships and boundaries.

2.4 OPENNESS AND TRANSPARENCY

The waterborne transport sector by its very nature is a highly diversified sector and an objective of the Partnership is to bring together the sector's diverse activities and focus efforts more efficiently on zero-emission waterborne transport. As a consequence of this diversity, the Partnership will have a broad composition and will be open to new members. From the beginning, the Partnership will include all members of the Waterborne TP which, in turn, includes relevant European associations representing, for example, shipowners and operators, as well as industrial representatives within the maritime and inland navigation sectors. Furthermore, leading companies from all stakeholders will sign the Partnership agreement.

As the Partnership is for co-programming, participation in calls for proposals is open to all by definition

Participation

Stakeholders in the waterborne transport sector and in zero-emission transport can participate in the Partnership in two ways:

Associations, companies, academia and research institutes can join the Waterborne TP Association. There is a low annual membership fee for this association (3,000 EUR for 2020) which allows as broad a participation in the association as possible. Benefits of being a member of the Waterborne TP Association include:

- Direct involvement in in-depth discussions on all technical issues;
- Participation in other relevant waterborne issues, such as safety of ships, digitization and automation, production processes, Blue Growth and logistics;
- Automatic membership of the Partnership;
- Networking and collaboration;
- Direct access to the additional activities performed by the Partnership related to establishing synergies with relevant initiatives/ programmes as well as information on applicable financial instruments.

Members can participate in events organised by the Partnership and/or the Waterborne TP Association. Events may include conferences to present the latest RD&I results or open discussions on the technical research agenda.

Governmental and non-governmental organisations can join the Partnership at all levels as observers, without having to pay a fee. Observers will be invited to strategic and detailed programming workshops.

It is well understood that many stakeholders in the waterborne transport sector are small companies far away from Brussels. Whilst travel to and from Brussels may hinder participation, interaction with Commission Services and Member State representatives is done mostly in Brussels. The Partnership will therefore organise **outreach events** to specific maritime and inland navigation regions (such as Bulgaria, Romania, Ireland) to allow a balanced participation from all Member States. Furthermore, meetings of the Partnership will be **live-streamed** and live feedback to the participants in the meeting will be possible. In addition, a number of Associations involved in the Partnership represent a broad base of SMEs. These SMEs will be involved via discussions in their relevant associations, online consultations and national outreach events and will be able to represent their umbrella organisations during meetings.

Access to information

The Partnership will launch a **dedicated website** which will give an overview of its research agenda and of ongoing and finished projects. For finished projects, the website will detail the main results and deliverables for everyone to use. The website will also offer the possibility to provide feedback on the Strategic Research and Innovation Agenda and the rolling detailed activity plans through surveys and will show what feedback has (or has not) been taken up and why.

The Partnership will establish a visual identity to stimulate participation in its activities by **organising conferences, workshops, social media accounts e.g. Twitter, newsletters and press releases.** As the main European branch organisations will be taking part in the Partnership, the broader waterborne transport community will be informed through them, thereby ensuring an appropriate level of visibility for the Partnership, including its visual identity.

The Partnership will undertake actions that will increase the impact of its activities and the supported RD&I, including ensuring broad awareness within key bodies such as **IMO and the European Sustainable Shipping Forum.**

Recruitment policy

The Partnership will actively recruit new participation by analysing the evolving waterborne transport stakeholders and the representation of relevant sectors. We will invite new members or industrial sector through our European and national branch organisations. The Partnership will also be open to direct expressions of interest and, in this respect, membership will only be rejected for exceptional reasons, such as lack of European added value or applications from non-European competitors.

ANNEX A
CURRENT COMPOSITION OF THE PARTNERSHIP

(A) Academia
- University of Southern Denmark, DK
- Aalto University Foundation, School of Engineering, FI
- Kühne Logistics University, DE
- Universidad de Cádiz, ES
- University College London and Southampton Marine and Maritime Institute, UK
- RISE Research Institutes of Sweden, SE
- WEGEMT, EU

(CS) Classification Society
- Bureau Veritas, FR
- Lloyd's Register, UK
- DNV GL, NO
- RINA, IT

(ES) Energy Suppliers
- European Petroleum Refiners Association, EU

(E) Engineering
- MEC Marine Engineering, EE

(IO) International Organisations
- CCNR, FR

(MC) Maritime Cluster
- Irish Maritime Development Office, IE
- Lighthouse, SE

(MCO) Maritime Cluster Organisation
- Deutsches Maritimes Zentrum e.V., DE

(MCR) Maritime Cluster Representatives
- Fondazione CS Mare, IT

(MEM) Maritime Equipment Manufacturer
- Wärtsilä, Norsepower, ABB Oy Marine and Ports One Sea Ecosystem and NAPA Safety Solutions, FI
- Airseas, FR
- MAN Energy Solutions and Orcan Energy AG, DE
- Eekels Technology and Bosch Rexroth, NL
- Kongsberg Maritime, NO
- IB Marine, IT

(PR) Port Research
- Fundación Valenciaport, ES

(P) Ports
- Port of Le Havre, FR
- Port of Amsterdam and Port of Rotterdam, NL
- European Federation of Inland Ports (EFIP), Federation of European private port companies and terminals and European Sea Ports Organisation, EU

(R) Research
- Schiffbautechnische Versuchsanstalt in Wien, AT
- Magellan Association, BE
- Bulgarian Ship Hydrodynamics Centre, BG
- Engitec Systems International Ltd, CY
- VTT Technical Research Centre of Finland, FI
- CEREMA, FR
- Centre of Maritime Technologies, BALance and HSVA, DE
- Centre for Research and Technology Hellas, EL
- CNR and Cetena, IT
- MARIN and TNO, NL
- Aimen, Soermar and Fundacion Valenciaport, ES
- SSPA Sweden AB, SE
- Sintef, NO
- ECMAR, EU

(SO) Shipowner
- Royal Association of Netherlands Shipowners, Van Oord, Wagenborg Shipping, Jumbo Maritime, Spliethoff, NL
- UK Chamber of Shipping, UK
- Royal Belgian Shipowners Association, BE
- Croatian Shipowners Association, HR
- Joint Cyprus Shipowners' Association, CY
- Maersk, DK
- Finnish Shipowners' Association, FI
- Ponant, Armateurs de France, FR
- Union of Greek Shipowners, EL
- Malta International Shipowners' Association, MT
- The European Inland Waterway Transport Platform, European Tugowners Association, European Community Shipowners' Association, European Dredging Association and CLIA, Intercargo, EU

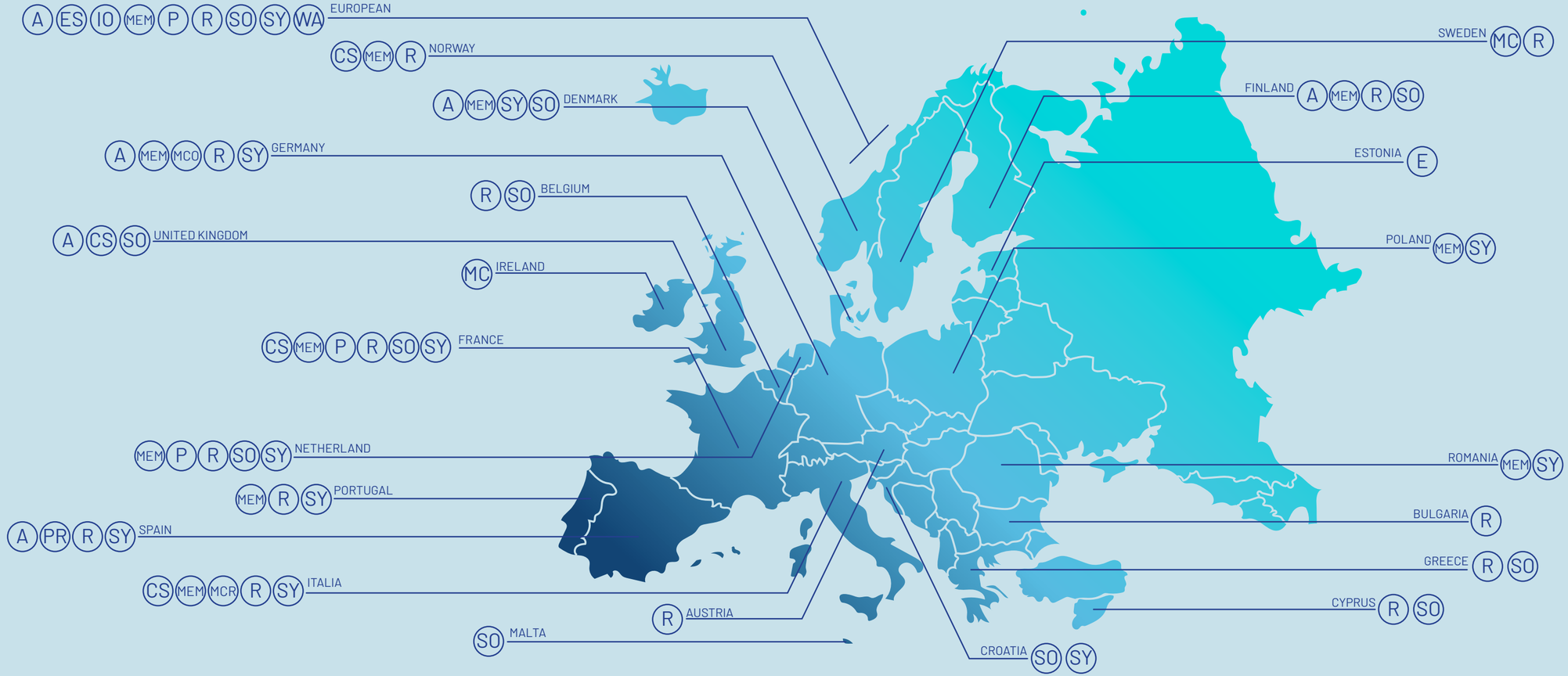
(SY) Shipyard
- Uljanik Shipyard Group, HR
- Naval Group and Chantiers de l'Atlantique, FR
- Meyer Werft Shipyard Group, MV Werften, DE
- Damen Shipyard Group and Royal IHC, NL
- Navantia, ES
- Fincantieri and Cantiere Navale Vittoria, IT

(SY) (MEM) Shipyards and Maritime Equipment Manufacturers
- Danish Maritime, DK
- GICAN, FR
- VSM, DE
- Assonave, IT
- Netherlands Maritime Technology, NL
- Polish Maritime Technology Forum, PL
- Associação das Indústrias Navais, PT
- ANCONAV, RO
- SEA Europe, EU

(WA) Waterway Authorities
- Inland Navigation Europe, EU

EUROPEAN MAP

- A Academia
- CS Classification Society
- ES Energy Suppliers
- E Engineering
- IO International Organisations
- MC Maritime Cluster
- MCO Maritime Cluster Organisation
- MCR Maritime Cluster Representatives
- MEM Maritime Equipment Manufacturer
- P Ports
- PR Port Research
- R Research
- SO Shipowners
- SY Shipyard
- WA Waterway Authorities



ANNEX B
EUROPEAN GREEN DEAL – ACTIONS RELATED TO WATERBORNE TRANSPORT

- The European Commission has proposed the first **European 'Climate Law'** in March 2020;
- **Transport accounts for a quarter of the EU's greenhouse gas emissions.** The European Commission aims to reduce 90% of transport emissions by 2050 and waterborne transport will have to contribute to the reduction;
- **Multimodal transport needs a strong boost.** The modal shift of the majority of cargo transport to rail and inland waterway transport is foreseen;
- **Automated and connected multimodal mobility.** The EU transport system and infrastructure will be made fit to support new sustainable mobility services that can reduce congestion and pollution, especially in urban areas;
- **The price of transport must reflect the impact it has on the environment and on health.** Fossil-fuel subsidies should end and, in the context of the revision of the Energy Taxation Directive, the European Commission will look closely at the current tax exemptions, including those for aviation and maritime fuels, and at how best to close any loopholes. The European Commission will propose to extend the European Emissions Trading System (ETS) to the maritime sector. This will be coordinated with action at global level, notably at the International Maritime Organisation;
- The EU will, in parallel, **ramp-up the production and deployment of sustainable alternative transport fuels.** The European Commission will consider legislative options to boost the production and uptake of sustainable alternative fuels for the different transport modes. The European Commission will also review the Alternative Fuels Infrastructure Directive and the TEN-T Regulation to accelerate the deployment of zero- and low-emission vehicles and vessels;
- **The pollution generated by transport should be drastically reduced, especially in cities.** A combination of measures will address emissions, urban congestion and improved public transport. The European Commission will also take action in relation to maritime transport, including measures to regulate access of the most polluting ships to EU ports and to oblige docked ships to use shore-side electricity. The FuelEU Maritime – Green European Maritime Space initiative planned for 2020 aims to accelerate achievement of low-emission, climate-neutral shipping and ports by promoting the uptake of sustainable alternative energy and power;
- **New technologies, sustainable solutions and disruptive innovation are critical to achieve the objectives of the European Green Deal.** To keep its competitive advantage in clean technologies, the EU needs to significantly increase the large-scale deployment and demonstration of new technologies across sectors and across the single market, building new innovative value chains. This challenge is beyond the means of individual Member States. **Conventional approaches will not be sufficient.** By placing an emphasis on experimentation and working across sectors and disciplines, the EU's research and innovation agenda will take the systemic approach needed to achieve the aims of the Green Deal. The Horizon Europe programme will also involve local communities in working towards a more sustainable future, in initiatives that seek to combine societal pull and technology push.

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WATERBORNE

WATERBORNE TP
c/o SEA Europe
Rue de la Loi, 67 (4th floor)
B-1000, Belgium

+32 2 230 2791
waterborne@seaeurope.eu
www.waterborne.eu