

GREENING MARITIME AND RIVER TRANSPORT

Opportunities in the French shipping and ferries market

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Executive summary

Maritime transport accounts for nearly 3 % of global emissions, and nearly 4% of emissions in the EU. The maritime and fluvial sectors must therefore do their share of greening if the world is to reach its climate targets.

France has set very high ambitions for its energy transition and climate emissions reductions. The country has banned all new oil and gas exploration and made legally binding commitments to reducing its energy consumption from fossil sources by 40% by 2030. France commits to fully decarbonise its transportation sector by 2050. France is also a major maritime nation, and has the largest number of navigable waterways in Europe but a very outdated fleet of ferries and barges. The energy and climate transition will necessarily involve a major transformation of the shipping and ferries markets. This represents significant opportunities for collaboration and export for Norwegian actors.

Whilst the general climate and energy goals have been translated into French law, there has until now been no coherent roadmap and very few dedicated funding schemes for greening the maritime and fluvial sectors. Unlike Norway's National Public Road Authority, there is no central state agency with the procurement mandate or financial muscle to create a market for low- and zero emission vessels on its own. The market, especially in the fluvial sector, is also much more fragmented than in Norway. However, several financial mechanisms and schemes exist for technology development and emission reductions in industry and transport at large, that are also available to maritime and fluvial actors, and to international actors on the French market.

Notably, several French regions and cities have developed more detailed roadmaps for greening their maritime and fluvial markets. Several regional and local projects exist or are under development for low- and zero-emission vessels, some of which already have Norwegian partners.

Most importantly, € 30 billion of the € 100 billion Covid recovery package called *France Relance*, has been earmarked for green transition, including € 7 billion for development of green hydrogen and hydrogen-based solutions, € 650 million for the maritime sector and € 175 million for modernisation of inland waterways.

Innovation Norway believes this represents important opportunities for Norwegian actors across the value chain, most notably in the design and engineering, equipment and services segments. The French market for green shipping and river transport is still relatively young, and Norwegian actors with ambitions in the market should be prepared to invest in building local market knowledge and partnerships, including collaboration on pilot projects and EU-proposals where possible. Notably, several of the French actors interviewed for this report were eager to learn more about the Norway policy and financing models, as well as the industrial and commercial actors and solutions in their ecosystem. The report will thus be followed up by a series of events and meetings facilitated by Innovation Norway and Team Norway France.

Specifically, the report describes major trends in the French maritime and ferry markets, selected segments, funding mechanisms and tender processes, as well a selection of actors and projects that may be relevant for Norwegian companies wishing to explore or expand their engagement in the French market. A similar report is under development on the German market and will be published early 2021.

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1.0 Background and scope

International maritime transport represents 2-3 % of global greenhouse gas (GHG) emissions, according to a study conducted by the International Maritime Organisation (IMO) (Erbach 2020). According to the calculations of the IMO, this share could increase to 17 % by 2050 if no measures are taken to reduce emissions (Nougué 2019).

To achieve the targets of the Paris agreement, all nations are required to green their waterborne transport sectors. In the face of increasingly strict environmental demands from the UN's maritime organization (IMO), global demand for environmentally friendly technology will only increase (Departementene 2019).

Norway's *National Transport Plan* aims for "a transport system that is safe, promotes economic growth and contributes to the transition to a low-emission society" (Samferdselsdepartementet 2017, p. 10). The ambition outlined in the Norwegian *National Action Plan for Green Shipping* is to cut emissions from domestic shipping and fisheries in half by 2030 and encourage zero- and low-emission solutions in all related sectors (Departementene 2019). The message is reiterated in the Ministry of Environment's White Paper to the Parliament on Norway's climate strategy towards 2030 (Klima- og miljødepartementet 2017). Ambitions and strategies have been operationalized into concrete regulatory and financial mechanisms that have contributed to market and technology development in Norway.

Norway is a global leader within green shipping and zero-emission ferries, with competitive solutions in nearly all segments of the industry. Norway can leverage this lead to take export shares in foreign markets.

France, as a leading maritime and shipping nation with an ambitious climate and energy transition policy, is also set on greening its shipping and ferries markets, but the country is behind in terms of concrete roadmaps and number of projects. Innovation Norway sees significant opportunities for French-Norwegian collaboration and Norwegian export to this market.

The National Low-Carbon Strategy is France's roadmap to achieving carbon neutrality in 2050

France has outlined very ambitious national climate plans: The *French Strategy for Energy and Climate* enacted in April 2020 by the Ministry of Ecological Transition consists of two components. First of all, **the National Low-Carbon Strategy is a roadmap to achieving carbon neutrality in 2050**, a target that is written into French law with this act (Ministère de la Transition Écologique 2020a). Secondly, the **Multi-year energy plan** lays out the energy trajectory for France for the next 10 years and defines several targets to be achieved by 2030, notably a 40 % reduction of all fossil fuel-driven energy, an increase in the share of renewables in the energy mix to 33 % and a 28 % reduction of emissions in the transport sector compared to

2015 levels – **aiming for a complete decarbonization of all transport by 2050** (Ministère de la Transition Écologique 2020b, p. 16).

The targets are mirrored by targets for the maritime sector which in 2018 announced their target to reduce their GHG emissions by 50 % by 2050 (Nougué 2019). France also has over 8,500 km navigable waterways, and a large fleet of inland vessels. Across the spectrum **there are substantive needs for fleet renewal and innovation in order to make these industries less polluting**. The public institution administering the French waterways, *Voies Navigables de France* (VNF), has laid out a trajectory to decarbonising the ferry sector by 2050, where rental recreational boats and small-scale urban logistic units are to be zero-emission in 2030, followed by sightseeing and overnight cruise ferries in 2040 and finally the entire freight transport fleet in 2050.

Across the spectrum there are substantive needs for fleet renewal and innovation in order to make maritime and river transport less polluting

This report identifies key market trends and drivers for the greening of the French ferries and shipping market, and potential collaboration- and export opportunities for Norwegian actors. Specifically, the report describes the size of the market, the most important national trends and initiatives and some of the most relevant sub-sectors, segments and key stakeholders in the value chain. In addition, the report provides an introduction to French tendering and purchasing, and identifies the most important potential for collaboration and export. This report is meant as a general reference for the key trends in the market, and we encourage actors in the different parts of the value chain or with interest in specific projects to get in touch for more targeted assistance with information or contacts.

The report treats the subjects of both ferries and maritime shipping, as these are in many ways overlapping and the overall trends are similar. However the ferry market is treated in more detail when it comes to comprehensive segmentation and mapping of projects and opportunities.

2.0 What Norway has to offer

A prerequisite for the green shift in the Norwegian ferry and shipping market has been the involvement and commitment from the national authorities, as outlined in the Maritime Strategy, the National Transport Plan, the National Budget and the White Paper on energy policy (Statens Vegvesen 2018). Norway has furthered zero- and low-emission technology through a combination of clear and continued political will, financial grant and loan schemes for innovation and commercialisation, and a conscientious public sector procurement process. Central to the electrification of the ferries segment in particular has been a public “leader firm” (the Norwegian Public Roads Administration, NPRA) with a generous budget and a highly professional procurement organisation that secures cost efficient procurement of ferry services. The public procurers in the ferry market have made a joint effort to ensure consistent requirements over time that has enabled the development of a functioning market with predictable framework conditions. Regions, counties and business development support systems are also well aligned with national ambitions, bundling environmental gains with technology and industry development, better transport services and urban development.

A big part of the Norwegian market has developed around the car ferries connecting communities on islands and along the fjords of a country with about 130 ferry routes (Statens Vegvesen 2020). In 2015, the world’s first electric car and passenger ferry, Ampere, went into production in Western Norway, and the world’s first hybrid fishing boat began operations off the Norwegian coast the same year (The Explorer n.d. a; b). Currently, the zero-emission, autonomous container ship MS Yara Birkeland is being built by the Norwegian fertilizer company Yara (The Explorer n.d. c). In the framework of the European Flagships project, a hydrogen-powered car and passenger ferry is under construction and will be operated by Norled (Norled 2019). By 2022, over 70 Norwegian ferry routes will be operated by battery or hydrogen powered ferries (Stensvold 2019). Given that about 90 % of the world’s traded goods are transported by sea with high polluting levels, these solutions have tremendous export potential as the need for sustainable shipping globally is urgent.

Norwegian solutions have tremendous export potential as the need for sustainable shipping globally is urgent

Norway can offer products and services across the entire value chain for maritime transport and has secured world leading positions within several of these segments (NHO 2020, p. 62). Within the ferry market, Norway draws significant benefits from having a central actor, the NPRA. The NPRA incorporates requirements for zero- and low-emission technology in their tenders on the 130 ferry routes, thereby stimulating market demand (Statens Vegvesen 2018).

According to a NHO report on *Green electric value chains*, Norway’s competitive advantage especially lies in **ship manufacturing** (design, concept development, approval of ships and propulsion systems, operation systems, component integration and component production for propulsion systems), **operation** (ownership and

commercial operation of low- and zero-emission fleets) as well as **infrastructure** (design, concept development, integration and operation of energy infrastructure for electricity, hydrogen and ammonia for ships) (NHO 2020, p. 64). Norwegian actors have a technological lead within hydrogen and battery solutions for ships and are amongst the very few with these types of solutions in the late development stages for commercial operation (NHO 2020, pp. 62-64). In general, Norway's competitiveness is higher within ships and infrastructure of a high complexity where the Norwegian high-tech competence is very relevant. The more expensive Norwegian labour makes Norway less competitive where the complexity of the ships and infrastructure is lower. **This report indicates that solutions and technology within all the three areas above will be in demand in the French market, with opportunities especially in the equipment, services and design/engineering segments.**

3.0 Context

3.1 EU Policy and Ambitions

The European Community Shipowner's Association (ECSA) represents the European shipping industry, and has stated its commitment to achieve the global IMO CO2 reduction targets. They expect a peak in emissions from international shipping shortly and an at least 50 % reduction in emissions by 2050 (ECSA 2018; IMO 2020). In its position paper *A Green Deal for the European Shipping Industry*, ECSA (2020) further states that this strategy will be revised in 2023 to incorporate concrete targets for full decarbonisation of the European shipping industry.

The EU offers funding through its Research and Innovation program Horizon 2020, to be succeeded by Horizon Europe (European Commission n.d. b; c). The funding program makes it a priority to support green innovations and industries. Within the transport sector, funding schemes focus on low-carbon technologies, clean vehicles and smart mobility systems (European Commission n.d. d). Norwegian companies are active in the Horizon 2020 program and have collectively received € 1.31 billion over the program period from 2014-2020, compared to e.g. a total of € 6.5 billion for French companies (European Commission 2020). Together with an increasingly strong focus from the EU on green technologies and climate-neutral mobility, this financial track record makes Norwegians attractive partners for French companies. This potential has already been illustrated by the pilot FLAGSHIPS project by a European consortium to deploy hydrogen-driven ferries in France and Norway (Norled 2019).

3.2 Key figures for France

France has the highest number of canals and navigable rivers in continental Europe with over 8,500 km navigable waterways (Ministère de la Transition Écologique 2019a). There is transport of goods (freight transport), passengers and recreational boating on all these waterways. The largest part of the French network is administrated by the public institution *Voies Navigables de France* (VNF), covering some 6700 km whereof 4,100 km is used for transport of goods and 2,600 km is mainly used for tourism. VNF assures the maintenance, exploitation and the modernisation of the waterways.

French ferry tourism experienced very positive results in 2019, with about 11.3 million passengers (+2.1% compared to 2018 and +16.2% compared to 2016) (VNF n.d. a). 65 % of these passengers were foreigners. Ferry tourism is a considerable source of income for French regions, and generated € 1.4 billion in economic benefits in 2019, of which 845 million went directly to the regions and municipalities. In terms of sightseeing cruises, the city of Paris is especially dominant, but cities like Strasbourg, Lyon, Toulouse and Bordeaux are also rapidly developing this industry.

The activities are especially dynamic in the Mediterranean Sea (Mehault 2019). Marseille Fos is the major French sea-ferry port, with about 1.5 million visitors in 2017. This market has also been rapidly growing in the ports in

the overseas French territories, **as the number of ferry passengers to these ports have tripled in the last 15 years** (ibid.).

As a share of the total inland shipping of goods, river transportation represents only 1.9 % – however, the volume of goods transported by river is growing (Mehault 2019). In 2019, river transport experienced a growth in tonne-kilometres of 10 % from 2018, reaching a total of 7.4 billion tonne-kilometres (VNF n.d. a). **In volume, 56.3 million tonnes of goods were transported on French waterways in 2019, representing a 9 % increase from 2018. The volume of merchandise handled in the French ports is also rapidly increasing, by 5.9 % from 2018 to 2019 (Mehault 2019). The growth is seen mainly in containerised and ro-ro cargo.** The large metropolitan ports (Marseille Fos, Le Havre, Dunkirk, Nantes Saint-Nazaire, Rouen, La Rochelle, Bordeaux) together with the major ferry port of Calais made up 87.3 % of port activity in 2019. The major seaport of Marseille is the largest French port in terms of transport of goods.

There is political commitment to move a larger share of inland transportation of goods onto barges and ferries, a policy backed by actors like the VNF and the French Electric Boat Association, and the French maritime clusters. Political actors and interest groups alike express the need to shift focus and funding rapidly to also intensify the renewal and greening of the fleet itself. This may represent market opportunities for Norwegian actors.

Increasing waterborne transport – key figures

- France has 8,500 km of navigable waterways – the highest number in Europe
- 56.3 million tonnes of goods were transported on French waterways in 2019, representing a 9 % increase from 2018
- River transport represents 1.9 % of inland shipping of goods – but the volume is growing and political efforts are ongoing to move freight from road to river
- French ferry tourism received 11.3 M passenger in 2019 (+2.1% compared to 2018 and +16.2% compared to 2016)
- Ferry tourism generated € 1.4 billion in economic benefits in 2019, of which 845 million went directly to the regions and municipalities
- Volume of merchandise handled in French ports increased by 5.9 % from 2018 to 2019

3.3 Existing French-Norwegian collaboration

Several collaborative projects for greening maritime transport already exist between French and Norwegian actors.

The FLAGSHIPS project is carried out by a European consortium to build and deploy two commercially operated zero-emission hydrogen fuel cell vessels, one in Lyon, France and one in Stavanger, Norway (Norled 2019). Both vessels will run on green hydrogen and the project will contribute to providing more hydrogen-powered ferries in the future. In France, a hydrogen ferry will be operated on the Rhône river by the *Compagnie Fluviale de Transport* (CFT), and in Norway, the hydrogen-powered ferry will be operated by Norled and act as a passenger and car ferry (Adelski 2019). The project is EU-funded and has been awarded 5 million euros through the EU's Research and Innovation program Horizon 2020 under the Fuel Cells and Hydrogen Joint Undertaking. The consortium includes nine European partners, with two ship owners Norled (NO) and CFT (FR), maritime OEM and design companies ABB (FI) and LMG Marin (NO & FR), fuel cell technology provider Ballard Europe (DK), vessel energy monitoring and management company PerSEE (FR), management and safety experts VTT (FI), and industry cluster NCE Maritime CleanTech (NO). Westcon Power & Automation (NO) has later joined the project.

The Virtual-FCS project is carried out by a European consortium coordinated by SINTEF (NO) and including partners Université Bourgogne Franche-Comté/FC Lab (FR), Ballard Power Systems Europe AS (DK), Westcon Power and Automation AS (NO), Vivarail Ltd. (UK) and Solaris Bus & Coach Spolka Akcyjna (PO). The objective of the project is to make the design process of hybrid fuel cell and battery systems easier, cheaper and quicker (SINTEF 2020). Fuel cells is a promising technology in a wide range of transport applications including ships. The project is funded by the EU Horizon 2020 programme and has been awarded 1.9 million euros.

The HySHIP project includes 14 European partners in the design and construction of a new ro-ro demonstration vessel running on liquid green hydrogen (LH2), as well as the establishment of a viable LH2 supply chain and bunkering platform (Gude 2020). The project is coordinated by Wilhelmsen (NO) and the ship will operate Norway's west coast, but aims to lower development and operational costs of a Europe-wide move to LH2 for ship propulsion. The project has been awarded 8 million euros from the EU Horizon 2020 program. French and Norwegian partners include Kongsberg Maritime (NO), LMG Marin (NO & FR), Equinor (NO), Norled (NO), PerSEE (FR), Air Liquide (FR), NCE Maritime Cleantech (NO) and DNV GL (NO).

Fret-CETAM is a joint-venture between the French shipowner Louis Dreyfus Armateurs and the Norwegian shipowner Leif Høegh (LDA Group 2020). In 2001 they signed a contract to deliver parts to Airbus' A380 to different production sites in Europe. Their RoRo vessel *Ville de Bordeaux* was built in 2004 at the Jinling shipyard in China for this purpose.

Examples of existing French-Norwegian projects

- **The FLAGSHIPS project** is carried out by a European consortium to build and deploy two commercially operated zero-emission hydrogen fuel cell vessels in Lyon, France and Stavanger, Norway. Partners include Norled (NO), CFT (FR), LMG Marin (NO & FR), PersEE (FR), NCE Maritime Cleantech (NO), Westcon (NO) and others. The project has been awarded € 5 M under the Horizon 2020 program.
- **The Virtual-FCS project** is carried out by a European consortium coordinated by SINTEF (NO) and including partners Université Bourgogne Franche-Comté/FC Lab (FR), Westcon (NO) and others, with the objective to make the design process of hybrid fuel cell and battery systems easier, cheaper and quicker. The project has been awarded € 1.9 M under the Horizon 2020 program.
- **The HySHIP project** includes 14 European partners in the design and construction of a new ro-ro demonstration vessel running on liquid green hydrogen (LH2), as well as the establishment of a viable LH2 supply chain and bunkering platform. The project is coordinated by Wilhelmsen (NO) and includes partners Kongsberg Maritime (NO), LMG Marin (NO & FR), Equinor (NO), Norled (NO), PersEE (FR), Air Liquide (FR), NCE Maritime Cleantech (NO) and DNV GL (NO). The project has been awarded € 8 M from the Horizon 2020 program.

4.0 Trends and opportunities in the French market

France is a strong maritime nation and home to some of the world's leading shipping companies such as Bourbon, CMA CGM and Louis Dreyfus Armateurs (Armateurs de France n.d.). Maritime transport ensures about 90 % of global freight transport and 78 % of French imports. The French maritime sector represents 22,000 direct and 80,000 indirect jobs. The French shipowners association counts about 50 members that operate almost 1,000 ships. The French fleet is very young with an average age of 10 years compared to 15 for the European and 17 for the global fleets.

Since 2000, the French commercial ferry fleet has remained stable in terms of capacity (about 1.1 million tonnes of heavy transport) but is steadily decreasing in terms of the number of units, entailing an increase in the capacity of individual ferries (VNF 2020a). **From 2000 to 2018, the number of ferries has decreased from 1 792 to 1 041. About 800 river transport companies are artisanal, while less than ten carriers are industrial, operating around 300 ferries.** In other words, the French ferry market is very fragmented, potentially making it difficult to achieve scale effects. Notably, the main objective and focus of Government and lobby groups till date has been to move freight and transport from road to river, and less on greening ferries and shipping itself. There is also common recognition that the ferry sector is particularly far behind when compared to the greening of other industries, indicating an urgent need for innovation and renewal of the ferry fleet. Although the market is very fragmented, about 90 % the French waterways are managed by the central public actor VNF, leaving opportunities for concerted public action in the renewal and greening of the ferry fleet.

The potential for French-Norwegian collaboration has been confirmed both on a political and industry level. President Macron and Prime Minister Solberg came to an agreement in the summer 2019 through a letter exchange to strengthen collaboration on climate and environment issues in a range of sectors including ocean industries and green shipping. Furthermore, Innovation Norway France has been in dialogue with several industrial and public actors in the research for this report. Several of these contacts express interest in a further exchange about the Norwegian model and its potential application for France, as well as contact and collaboration with companies in the Norwegian ecosystem. Innovation Norway will follow up these initiatives in early 2021.

4.1 National trends and initiatives

So far, France lacks a clear, over-arching strategy or roadmap for green transition in maritime and river transport. However, the *French Strategy for Energy and the Climate* sets the stage for a transition to low- or zero-emission technologies. Generally speaking, the green transition is driving innovation efforts in all sectors and France is far ahead in several areas. France's ambitions for the green transition are very high with targets of 40 % reduction of fossil fuel energy by 2030 and full carbon neutrality by 2050, and they are also enacted into law. France also prohibited all new exploration of oil and gas from 2017, with a ban on all production on French territory from 2040 (Lesaffre 2017). Importantly, the Covid recovery plan *France Relance* is firmly geared towards

accelerating the green shift. Within the stimulus package of € 100 billion, € 30 billion are dedicated to ecological transition projects (Ministère de la Transition Écologique 2020d). Along with several regional plans and initiatives, this is expected to be an important catalyst for the green shift in the French shipping and ferry market.

The VNF under the authority of the Ministry of Transport contributes to the formulation and implementation of national policy in the domains of the energy transition, the move of freight from road to river, territorial planning and tourism development, and the preservation of water supply and biodiversity (VNF n.d. c). The VNF centres its actions around a strategy consisting of four pillars: 1) build knowledge and public support for the social, economic and environmental importance of the waterways, 2) ensure investments for the renewal and modernisation of the waterways and fleet, 3) renew the economic model for waterborne transportation in France, and 4) adapt and develop new technology that contributes to the energy transition and a greener smarter fleet.

The VNF has laid out a trajectory to **fully decarbonising the ferry sector by 2050**, where **rental recreational boats and small-scale urban logistic units are to be zero-emission in 2030, followed by sightseeing and overnight cruise ferries in 2040 and finally the entire freight transport fleet in 2050**. VNF sees a strong need for innovation and emissions reduction in the sector and welcomes collaboration with international partners on this (VNF n.d. d). Here are several opportunities for Norwegian policy models, technical savoir-faire and export.

VNF has laid out a trajectory to fully decarbonizing the ferry fleet by 2050

The National Industrial Council (*Le Conseil National de l'Industrie, CNI*) is one of the principal measures for industrial development in France (CNI n.d. a). The Council is led by the Prime Minister and the Minister of Finance and aims to co-create an industrial policy between public authorities, representatives of the industry and employees. The Council is divided into 18 sectorial strategic committees (*Comités Stratégiques de Filière, CSF*) that for each sector define the issues at stake and the concrete solutions for the sector's future development (CNI n.d. b). **The CSF for the maritime industries was created in 2018 and has developed a roadmap for research and development (R&D) structured around four pillars; Green Ship, Smart Ship, Smart Yard and Smart Offshore Industries**. The committee has its own support body for R&D projects, Corimer, that has launched calls for tenders in 2018 and 2020 (GICAN 2018; 2020).

4.1.1 Funding programs

In addition to this general framework and in lieu of a more global vision for the sector, a number of financial incentives and directives nudge the shipping and ferry market in the direction of low- and zero-emission solutions. Actors like VNF, ADEME, energy distributors and regional authorities are central in providing such support.

Key funding figures

- VNF's funding scheme PAMI for the renewal and innovation of the ferry fleet 2018-2022: € 26 M supplied by VNF, the French state, Île-de-France, PACA and ADEME
- VNF's funding scheme PARM to incentivize the move of freight from road to river 2018-2022: € 12.5 – 20 M
- Energy saving certificates CEE granted by the energy distributors & size of funding is proportional to the amount of energy saved by the operation with **no upper limit**
- ADEME's Investments For The Future program channels public investments in various sectors. Includes a € 7 BN hydrogen strategy and significant funding for sustainable transport

The VNF has a funding scheme for the renewal and innovation of the ferry fleet (*Plan d'aide à la modernisation et l'innovation de la flotte, PAMI*) (Ministère de la Transition Écologique 2019b). The PAMI for the 2018-2022 period has been approved by the European Commission for a maximum amount of € 16.5 million, of which € 12.5 million to be supplied by the VNF and € 4 million by the French state. Additionally, the regions Île-de-France and Provinces-Alpes-Côte-d'Azur (PACA) will provide respectively € 1.5 million and € 3.7 million, and ADEME will contribute € 4.26 million. The subsidies are technology agnostic as long as the projects stimulate reduction of GHG emissions, and support is given to those who wish to explore alternative propulsion systems. **Foreign companies are eligible for all types of support under the PAMI program as long as they have activities in France or the boat will be in operation in France.** According to the VNF, the program has financed boats produced in other countries (e.g. China) as long as its operation is in France. River carriers, shipowners, shipyards, suppliers or research institutions are invited to submit their candidatures until 31 December 2022 (VNF 2020b).

Since the beginning of the 2018-2022 cycle, VNF have supported 151 projects (out of 184 applications) through the PAMI, which represents € 8,1 M in subsidies (VNF 2020b). Prevalent among the projects supported were a number of innovation projects designated to reduce energy consumption and pollution.

As part of their effort to move freight from road to river, the VNF also support companies that wish to integrate the waterways in their logistical chain through their modal shift assistance plan (*Plan d'aide au report modal, PARM*) (VNF n.d. k). € 12.5 million are allocated for this plan for the 2018-2022 period, and with the expected contributions of the regions the budget could reach € 20 million.

The energy saving certificates (*Certificats d'économies d'énergie, CEE*) are complementary and cumulative with the PAMI as they allow all river carriers located in France to receive funding for new ferry equipment (VNF n.d. j). River transport is a less polluting means of transport than by road, and CEEs therefore fund both the investments in new ferries as well as the installation of equipment that optimise the energy consumption of an existing ferry. The CEEs are granted by the energy distributors and the size of the funding is proportional to the energy that the operation saves with no upper limit.

ADEME is a public environmental agency that is active in the implementation of public policy in the areas of the environment, energy and sustainable development (ADEME n.d.). They provide expertise and advisory services as well as funding to companies' projects and initiatives related to the ecological transition. ADEME funds research, development and innovation projects through three programs: 1) the doctoral thesis program, 2) the funding program for research projects for which ADEME publishes a call for proposals every year, and 3) the investments for the future program (*Programme des investissements d'avenir, PIA*) that finances innovative projects of all sizes run by companies in several sectors, such as renewable energy, energy efficiency, energy storage, smart electricity grids, transport and sustainable mobility and circular economy (ADEME 2015; 2020). Calls for projects are launched regularly and at the moment there are several calls out (Gouvernement 2020). Details on upcoming calls are provided in section 4.4.

The French regions are important actors in the French innovation ecosystem and as drivers of industrial development. Several regions have indeed developed concrete plans for the greening of these industries and also offer a lot of funding. Especially active regions are Pays de la Loire, Brittany, Occitanie, Île-de-France, PACA and Hauts-de-France.

The research done for this report indicates that a lot will happen in the green transition of the French ferries and shipping market in the near future, and there are certainly great needs for renewal and decarbonisation of the fleet, in the ferry market in particular. However the transition is expected to happen in a much less centralised process than what has been the case in Norway, and often by regional, local initiative. There has been a lack of an overall, national vision for the green transition in maritime transport with a lot of the effort being ad-hoc and left to the initiative of the regions. However, a real game changer is the newly launched recovery plan that grants dedicated funds to the green transition in key sectors, in line with ambitious climate and energy transition policy.

4.1.2 The Covid recovery plan: France Relance

Like all European countries, the French economy has been hit hard by the Covid crisis. On 3 September 2020, the Government launched an exceptional economic recovery plan of € 100 billion called *France Relance*. The plan emphasises a ‘sustainable recovery’ and has earmarked € 30 billion for ecological transition projects (Ministère de la Transition Écologique 2020d). In addition, several of the other objectives and funding schemes linked to industrial modernisation and export stimulus have a strong green profile. Included in the plan are also dedicated funds for the green transition in the maritime and ferry sectors.

France Relance

- € 100 BN recovery plan with € 30 BN dedicated to the green transition
- € 650 M for the maritime sector to ensure decarbonised recovery, supporting projects to develop zero-emission ships
- € 175 M to the ferry sector for the modernisation of fleet and infrastructure
- € 200 M to maritime ports to deployment of alternative fuel solutions and investment in the modal shift
- € 7 BN to the hydrogen industry, including a focus on green hydrogen for mobility

The recovery plan includes a budget post of € 650 million for the maritime sector that will ensure a decarbonised recovery supporting projects to develop zero-emission ships (AFBE 2020).

France Relance will also support the ferry sector with € 175 million for the modernisation of waterway infrastructure on all of the VNF’s network in order to boost the utilisation of this means of transport. VNF is planning to realise over 100 maintenance and modernisation projects, including renovation work, restauration of dikes or banks, dam automation etc. The recovery plan raises the total investment capacity of the VNF to over € 300 million for each of the next two years, compared to € 155 million in 2019 and € 214 million in 2020.

Furthermore, maritime ports will receive € 200 million to reinforce measures in favour of their ecological transition through the deployment of alternative fuel solutions and investment in the modal shift (Deiss 2020).

Finally, *France Relance* grants massive investments to the hydrogen industry with € 2 billion to be allocated over the next two years, investments that are intended to reach € 7 billion by 2030 (Mazuir 2020). The focus will be on the development of green hydrogen for mobility, and envisioned projects are, amongst others, the usage of hydrogen for electric vehicles, heavy transport and the maritime sector (Ministère de l’Économie 2020).

4.2 Technologies and segments to watch

Globally, 90 % of all freight transport is ensured by sea (Armateurs de France n.d.). An approximate 1000 ships are operated and controlled by the Armateurs de France, the French shipowners' association. Currently 19 orders are placed by French shipowners for LNG-driven ships. Other solutions for the sector's transition are hydrogen propulsion, charging at the ports and ammonia.

As in Norway, it is expected that the French transition to zero-emission vessels will happen first with the small ships and ferries with relatively short routes as these are easier to decarbonise – preferably those with a set route as this to a greater extent justifies the instalment of infrastructure. Cruise ships and vessels carrying passengers, especially in the tourism segment, are also expected to lead way, as client expectations – and willingness to pay, for sustainable transport is growing.

The shipping segment serving France's rapidly growing offshore wind sector with equipment and technicians also has significant potential for greening, including through hydrogen propulsion.

The following sections describe key technology developments and trends in important market segments.

4.2.1 River transport

River transport represents only 1.9 % of total inland shipping of goods, but the volume is growing. With a clear national ambition of moving freight from road to river, this market can be expected to keep growing, and according to the VNF there is expectation that this needs to happen sustainably through increased use of low- and zero emission solutions.

The French waterway network dedicated to freight can be divided into three categories according to the boat size they are able to support: large (boats of >90 m, maximum gauge from 1000 to 5000 t), intermediate (boats from 38.5-90 m, maximum gauge from 400 to 1000 t) and small scale (boats of <38.5 m, maximum gauge from 250 to 400 t) (VNF 2019b). The most trafficked river basins are the Seine, the Nord-Pas-de-Calais, the Rhône Saône, the North East and the French part of the Rhine through Strasbourg. In 2018, imports represented 15 % of the river freight, exports 25 %, inland freight 47 %, river to sea 0.3 % and the Rhine transit 1 %. Germany, Belgium and the Netherlands were the principal commercial partners.

The construction materials sector is the primary user of river transport in France, measured by transported tonnes (VNF n.d. i). Other major sectors are agro-foods, waste and recycling, containers, heavy transport and chemical and dangerous materials.

4.2.2 River tourism

The segment for river tourism can be further subdivided into three markets: sightseeing boats, river cruise ships and the recreational boat rental market.

Recreational boat rental: According to the French Maritime Cluster, this is a promising market for electric boats and surrounding infrastructure. The Mobility Law requires 1 % of boat spaces in marinas to be reserved for electric boats by 2023 and actors like the Maritime Cluster are working to raise these ambitions. In this market there are four major actors that together own 80 % of the boats, *i.e.* about 1600 boats: Nicols, Canalous, Locaboat and Le Boat. They all offer private boat rentals for recreational purposes on the many navigable waterways of France. Nicols and Canalous already have some fully electric boats in their fleets constructed at their own shipyards, [Nicols](#) and [Constructions Polyester du Centre \(CPC\)](#) in the Canalous Group. The motorisation system for Canalous' fully electric model [Péniche S](#) was delivered by Panda Fischer. A total of 120 boats on the market are electric as of 2020 (T2EM n.d.).

Sightseeing boats: This segment regroups the various types of cruises not offering overnight accommodation, the length of cruises varying from simple one-hour sightseeing trips to half- or full-day cruises offering meals and different types of experiences such as wine tasting etc. (VNF n.d. f). The activity of this sector is concentrated in the Île-de-France region where 125 of the 365 sightseeing boats on French waterways are navigating, and in particular in the city of Paris. However, this sector is prevalent in all the big French cities that are traversed by waterways, such as Strasbourg, Lyon, Bordeaux, Toulouse and Rouen. In contrast to the boat rental market, this market is quite dispersed among a high number of actors – in 2018 there were 198 companies operating a fleet of 326 boats (VNF n.d. g). This market is undergoing efforts of both electrification and hydrogen propulsion, and hybrid solutions are also prevalent. Opportunities may also arise in this segment in connection with the Paris 2024 Olympics that aims to be zero-emission (Paris 2024 n.d.).

River cruise ships: This segment regroups passenger ferries offering overnight accommodation with a capacity of between 50 and 200 passengers (VNF n.d. h). They navigate the large waterways of the Rhine-Moselle, Seine-Oise, Rhône-Saône and Garonne-Dordogne axes. The major companies enter directly into the market, otherwise the commercialisation happens largely through tour operators and travel agencies, often foreign (VNF 2020c). 26 river cruise ships run on LNG are under construction or in circulation as of 2020 (T2EM n.d.).

4.2.3 Fishery and aquaculture

The fisheries and aquaculture sector has a need for low-emission propulsion solutions and an energetic supply chain in the fishing ports. This is a sector that has not come far in its energy transition but that is getting ready to go, and where good project coordinators and collaboration partners are needed, according to the French Maritime Cluster. Some projects are already starting in Brittany and Normandy, which are important regions for this sector.

4.2.4 Smart and green port development

The ports provide essential infrastructure for electrification and hydrogen supply. France has 564 ports encompassing inland ports, marinas, military ports, fishing ports and commercial ports (T2EM n.d.). Despite its strategic geographic location and major maritime industry, France has suffered from European competition and

French ports have been late to start their digital and environmental transformation. However, major efforts are now being made to assert France's status as a globally competitive maritime destination. Green infrastructures and digitalisation are now major priorities for French ports. Several major French seaports have defined their own smart port strategies and are currently in the testing phase of various projects. Energy and green technologies are viewed as an integral part of the ports' smart strategy and developing a hydrogen value chain is a major priority. France also has several projects to electrify the infrastructure in small and big harbours, *e.g.* in Marseille Fos, Le Havre, Toulon and Sète.

The inland ports are essential for the development of ferry traffic (Ministère de la transition écologique 2019a). Being connected to the large seaports as well as the railway and road systems, they constitute important hubs in the transport system. Local authorities (*e.g.* regions, general councils, municipalities, unions, or public establishments for inter-communal cooperation) are or can become owners or operators of the parts of the river network that represent a local interest. The three most important inland ports in France are those located in Paris, Strasbourg and Lille. HAROPA is the leading port complex in France uniting the ports of Le Havre, Rouen and Paris into a single complex along the Seine axis.

4.2.5 Low- and zero-emission solutions in the French market

Norway has invested heavily in electric ferries in its effort to decarbonise waterborne freight and passenger transport, however several other solutions are being highlighted as relevant for the French market.

Electrification: As beforementioned, France has no centralised policy or large-scale industry incentive scheme for the development of fully electric ferries, and the technology may not have as many applications as in Norway where there are more short, fixed ferry routes. However, a number of pilot projects are ongoing for electrification. Electrification seems most relevant in the recreational boating (*i.e.* rental boats, yachts, etc.) and sightseeing cruise/city boat segments. There are also ambitions for the development of fully electric passenger transport on the Seine river. The Île-de-France region with the city of Paris appears to be the most active and promising geographical area. The cities of Paris and Le Havre are engaged in electrification projects such as the installation of charging stations along the Seine. Examples exist of fully electric boats in France, such as the recreational boats and river cruise boats operated by Nicols or Canalous.

Hydrogen: The French hydrogen sector is expected to grow significantly in coming years, with massive public investments. France launched its first national hydrogen strategy in 2018 already, a strategy now accompanied by € 7 billion in funds over the next few years. Some funds for using hydrogen as an energy carrier in transport are channelled through ADEME which currently has two calls for projects out related to R&D projects on hydrogen technologies. Several pilot projects, some publicly funded through *e.g.* ADEME and VNF's PAMI program, are currently under development. For details please see section 4.4. French actors are also paying close attention to the Norled project for a hydrogen powered ferry, which has contributed to raising awareness for the Norwegian competency and potential contribution.

Hybrid: Hybrid in a French context usually refers to diesel-electric solutions, but electric-hydrogen solutions are also gaining traction. Hybrid propulsion systems are deemed to have a higher commercial potential on the

French market than fully electric applications by many of the French industrial actors interviewed for this report. The ships can operate on either battery or hydrogen but with a reserve of fossil fuels, allowing for greater autonomy and capacity. Hybrid applications will also be most relevant for large ships that cannot be completely decarbonised, *e.g.* Corsica and canal ferries.

Liquefied natural gas (LNG): French actors also see LNG as an important interim solution for large ships, as it pollutes less than other fossil fuels and offers more autonomy than hydrogen. The major French shipowners such as CMA CGM, Ponant or Corsica Ferries all rely on LNG to green their fleets (Julian 2020). Onboard functions on these ships can still be driven by hydrogen or battery, and according to the French Maritime Cluster there are opportunities in the market for these auxiliary functions as they will be based on technologies developed in fully-electric ferry projects. This gives Norwegian companies a comparative advantage on the technology side.

Ammonia is also being mentioned as an alternative fuel for large ships that require more autonomy with potential applications for both service ships to offshore sites and various types of transport ships. There seems to be no concrete projects in this area, but the Norwegian case of an ammonia driven fuel cell to be tested on Eidesvik Offshore's supply vessel Viking Energy has risen interest among French actors. This experience could be leveraged by Norwegian actors to establish a dialogue with French actors.

Velic propulsion is mentioned by several as a possible emerging market that could entail opportunities for new actors. According to LMG Marin, this combined with other solutions such as hydrogen or batteries is very promising and a real possibility that could interest shipowners. The French shipowner Zéphyr & Borée is already operating the first modern sail cargo ship, Canopée.

4.3 Key stakeholders in value chain

For a detailed list of actors, please see Appendix II.

Shipowners: The French shipowners' association *Armateurs de France* counts 57 members operating about 1000 ships (Armateurs de France n.d.). Establishing a partnership with a French shipowner is a good way to enter the market. Some world leading French shipowners are Bourbon, CMA CGM and Louis Dreyfus Armateurs. French shipowners have so far mostly explored LNG as their 'green' fuel alternative. More innovative actors include Zéphyr & Borée that are designing and operating sail cargo ships, and major actors such as CMA CGM and Brittany Ferries that are exploring the possibility of using hydrogen propulsion. CMA CGM is also looking into fuel cells. The ferry owner CFT is also a driver in the green transition and especially engaged in hydrogen, for which it takes part in several projects such as Flagships where it also collaborates with Norwegian actors. Nicols, Canalous, Locaboat and Le Boat dominate the recreational boating market and have some fully electric models.

Yards: The French shipyards are a strong industry with technical skills supported by high-level maritime research, operational excellence, and a commercial dynamism that allows them to export over 60 % of their

production (Lenoir 2018). French naval construction employs between 42 000 and 90 000 people and are ranked 6th in the world. Their emblematic products and services are cruise ships, military ships, maintenance operations and recreational boats/yachts. Some of the major French yards are Chantiers de l'Atlantique and Naval Group. French domination is most firmly established in the yachting segment, with the shipyard Bénéteau as one of the world leaders. La Ciotat Shipyards completed the world's first hydrogen yacht in September 2020, which will serve as a demonstrator until commercialisation in the spring of 2021 (Epitropakis 2020).

Design and engineering: Engineering skills are essential in translating energy solutions into propulsion systems for ships. According to LMG Marin that is present both on the French and Norwegian markets, engineering expertise is in especially high demand within hydrogen solutions as it is an industry in the starting blocks. These actors especially need to be involved in the process now, as technological requirements will soon go down to a lower level once the market is past the initial introductory phase. Some actors in this segment that are directing their activities towards low-carbon technologies are LMG Marin, Air Liquide and ABB.

Equipment and service companies: According to actors such as the maritime industrial group GICAN, equipment and services are parts of the value chain that holds most potential for international actors as the supply chain for equipment manufacturers is global. In this segment a large group of SMEs are active in pushing the sector forward and coming up with new technologies, and often they have activities abroad where they develop their technologies. Examples of such companies are GTT, Saft Batteries, PerSEE (that is also involved in the Flagships and HySHIP projects), Barillec Marine and the R&D department at EDF.

Energy companies: French energy giants such as EDF, Engie and Total are all strengthening their engagements across the spectrum of renewable energy.. France already has a low-carbon electricity mix because of its nuclear power, but many reactors are reaching the end of their lifetime. France has a stated ambition to reduce the share of nuclear in its electricity mix from 75 % today to 50 % by 2035 (IEA 2020). Scaling up renewable energy production is therefore imperative, and France already has quite a large hydro-electricity production and is rapidly scaling up its offshore wind industry. Major actors such as Engie and EDF as well as a growing number of energy start-ups are also exploring hydrogen technologies, including for use in the maritime sector. There are a number of energy start-ups active within both hydroelectric and hydrogen technologies including companies like LHYFE, Hydroquest, Eolink and Sabella. La Compagnie Nationale du Rhône (CNR) is an electricity generation company that is supplying renewable power from hydroelectric facilities on the Rhône river, and is also in the process of developing a green hydrogen production in the Rhône basin using hydroelectricity (Berrier 2020).

Important ports: France is the 5th biggest port nation in Europe, with approximately 360 million tonnes of goods processed and 30 million passengers per year. The most important French ferry ports are Paris, Strasbourg and Lille, and the port complex HAROPA is an important actor as it connects Paris to the ports of Rouen and Le Havre. HAROPA and VNF coordinate the project *Borne & Eau* in which 13 charging stations accessible to tourist and freight ferries have been deployed between Paris and Le Havre (HAROPA 2020).

The large seaports of Le Havre, Marseille Fos and Dunkirk are important both in a maritime context in addition to managing the river network situated inside their respective port domains (Ministère de la transition

écologique 2019a). The ports located by the entry point of a river also play an important role in the development of waterways as they tend to facilitate ferry transport by linking the arrival of great ships to inland transportation. Electrification efforts are ongoing in several seaports including Marseille Fos, Le Havre, Sète and Toulon. Marseille and Le Havre are particularly active in the hydrogen field and have it as a major priority to develop a hydrogen value chain. Both ports have ongoing projects to produce green hydrogen through electrolysis as well as capturing industrial CO₂, areas in which Norwegian expertise would be particularly welcome.

4.4 Purchasing and tendering processes

As previously described, there are a number of financial incentives and programs that aim to make it more attractive to produce and operate low- and zero-emission vessels. The French state, most notably through ADEME, the VNF, the regions and others also direct significant investments towards projects to green the maritime sector.

- All ADEME's calls for tenders can be found at: <https://agirpoulatransition.ademe.fr/entreprises/>
- All calls for tenders in the Investments for the future program, PIA, can be found at: <https://www.gouvernement.fr/les-appels-a-projets-en-cours>
- The public procurement consultations issued by VNF can be found at [PLACE](#) which is a public procurement platform (VNF n.d. l).

VNF administers the French waterways but the boats operated on the waterways are owned by private actors, so VNF does not purchase boats but mainly supplies as well as work and services in diverse areas such as infrastructure work, information systems and studies (VNF n.d. m). All procurement by the VNF is made to serve its three principal missions: the promotion of river logistics, support for regional development and overall water management. In furthering these missions VNF is very attached to the fundamental principles of public procurement relating to equality of access, equality of treatment and transparency of procedures. Amongst the prioritised axes on the VNF's procurement strategy are: environmental requirements, support to research and innovation, and the largest possible access of SMEs on the public market (VNF n.d. m).

The support body for maritime R&D projects, Corimer, recently closed its second call for manifestation of interest since its creation in 2018. Corimer manages the funding measures related to the CSF for the maritime industries' R&D program structured around the four pillars Green Ship, Smart Ship, Smart Yard and Smart offshore industries. The call closed 21 November 2020 – but opportunities will surely present themselves also in the future. <https://www.energiesdelamer.eu/2020/10/02/la-filiere-des-industriels-de-la-mer-lance-le-2eme-appel-a-manifestation-dinteret-du-corimer/>

4.4.1 Upcoming tenders

Some interesting upcoming calls for tenders are listed below:

- ADEME currently has two calls for tenders out related to hydrogen technologies in the framework of the national hydrogen strategy:
 - *Demonstration of hydrogen technologies*: Call for tenders to support innovative projects enabling the development and improvement of components and systems related to the production and transport of hydrogen, and its usages. To be carried out by one or several companies to develop an equipment, product or service, or to realise a pilot on national territory where hydrogen is employed. The call for tenders is open from 14 October 2020 until 21 December 2022. <https://agirpoulatransition.ademe.fr/entreprises/dispositif-aide/20201013/inodemo-h22020-176>
 - *Territorial hydrogen ecosystems*: Call for tenders to support the local implementation of hydrogen projects through investments in ecosystems that link production infrastructures/hydrogen distribution and hydrogen usage – more precisely industrial, mobility or stationary usages. The call is open for companies, consortia or local authorities from 14 October 2020 until 17 December 2020. <https://agirpoulatransition.ademe.fr/entreprises/dispositif-aide/20201013/ecosysh22020-165>
- In the PIA framework, a call for tenders is out seeking to support projects in transport, logistics and sustainable mobility sectors. The call is for R&D projects brought on by small, medium or large companies, alone or in a consortium, to be brought from the research to the demonstration phase. The call has intermediate deadlines 28 October 2020, 28 January 2021 and 28 March 2021, and closes 28 June 2021. <https://agirpoulatransition.ademe.fr/entreprises/dispositif-aide/20200804/adeip2020-20>
- In the framework of the PAMI program to support the renewal of the ferry fleet, VNF is accepting candidatures from river carriers, shipowners, shipyards, suppliers or research institutions until 31 December 2022: <https://www.vnf.fr/vnf/accueil/logistique-fluviale/naviguer-comme-professionnel/aides-et-financements-transporter/pami/>. Contact for the PAMI program: Mr Joffrey Guyot – Joffrey.guyot@vnf.fr

4.4.2 Ongoing projects and opportunities for expanding French-Norwegian collaboration

The following section provides a non-exhaustive overview of ongoing projects with low- and zero-emission solutions in the French maritime and ferry market. For more detailed information on project status, including on opportunities for Norwegian suppliers and -partnerships, please get in touch with the Innovation Norway Paris office.

Electric ferries

- Groupe Sodexo is a catering company that has a strong position in the ferry market on the Seine. They operate [Les Bateaux Parisiens](#) that engages in classic river cruises on the Seine, as well as Les Yachts de Paris that specialize in business travels and the organisation of events on river yachts. The group also operates several river shuttle services on the Seine and La Marne. Their fleet [Batobus](#) will be equipped with six diesel-electric hybrid ferries between 2020-2024. The operation of converting their fleet into hybrid ferries will be carried out by Barillec Marine, which is a branch of Vinci Energies – they are specialized in electric and hybrid propulsion systems for maritime and river transport.
- HAROPA and VNF coordinate the project *Borne & Eau* in which 13 charging stations accessible to tourist and freight ferries have been deployed between Paris and Le Havre (HAROPA 2020). The project received funding from the European Commission in July 2020 which together with the funding from VNF will allow for 78 new charging stations to be deployed all along the axis of the Seine by 2023.

Hydrogen projects

- The project *HyBarge* is financed by VNF in the framework of the PAMI, as well as ADEME and BPI France (Martin 2019). The company L'Equipage will run a study to validate a hydrogen fuel cell system that could become the propulsion system of a new or existing motor if the results are positive. L'Equipage will work with the research facility Orion Naval Solutions, a naval architecture firm specialised in ferries, ANIE-2R, and a fuel cell producer, Helion Hydrogen Power.
- The ferry operator CFT have a 50 meter diesel-electric freight ferry under construction and are hoping to produce another boat of the same model driven by hydrogen fuel cells to navigate on the Seine river (Berrier 2020).
- The Occitanie region has declared its intention to become the leading European region on green hydrogen (Merlet 2019). Their intention is to continue to co-invest in industrial projects via their agency Ad'Occ and Arec, while also supporting R&D projects. Total investments are projected to reach a billion euros.
- The aeronautics company ArianeGroup and the energy company Engie have entered into a partnership to produce liquified hydrogen for maritime and inland waterway transportation (Le Figaro 2020; Engie 2020).
- The electricity company CNR (*Compagnie Nationale du Rhône*) is developing green hydrogen production enabled by hydroelectric energy in the Rhône basin (Berrier 2020).
- CFT has presented a new project to the Auvergne-Rhône-Alpes region for the construction of two container carriers driven by hydrogen fuel cells to transport containers between Lyon and Marseille-Fos (Berrier 2020).
- Projects in Brittany and Pays de la Loire – very active regions on hydrogen:
 - In Nantes, the shuttle boat *Jules Verne 2* run entirely on hydrogen went into operation on the Erdre river in 2019 (Torregrossa 2019). *Jules Verne 2* is the fruit of several years of testing and R&D by a consortium coordinated by Semitan, the company responsible for the public transport network in Nantes, and involving the companies Mission Hydrogène, Bureau Veritas, Polytech Nantes, Matis Technologies, Navalu and Ship-ST. The project is financed by ADEME and the Brittany region and was a response to a call for tenders by ADEME to develop the hydrogen industry.

- Nantes also installed a multi-user hydrogen station entitled MuLTHy in Semitan's deposit in Saint-Herblain, ensuring the refuelling of the boats as well as Semitan's terrestrial vehicles and those of partners like EDF and the postal service (Torregrossa 2019).
- The port of Nantes Saint-Nazaire has announced that hydrogen will be at the core of their strategy for 2021-2026 that will be presented in the first trimester of 2021 (Le Journal Des Entreprises 2020). Their budget for this strategy is estimated to € 50 million and will amongst other things fund the installation of a manufacturer capable of producing several thousand tonnes of green hydrogen per year on-site at the port, and the conversion of one of their ships into hydrogen propulsion in 2021 or 2022.
- In the Golfe du Morbihan a hydrogen-driven passenger ship is planned to be operative from 2023 (Tiercin 2020). The boat Hylas will be the first ship in France with this capacity on hydrogen-electric propulsion and will navigate between the about 50 islands in the Golfe du Morbihan. The project is coordinated by Europe Technologies and their brand CIAM (Collaborative Integration for Alternative Motorization) and includes 25 supporting partners, most notably ADEME, the Brittany region and the territorial bank of Brittany that support the project financially (Europe Technologies 2020). The ship designer will be L2Onaval.
- The H2 Loire Vallée project aims to contribute to the development of an exemplary green hydrogen program in the Pays de la Loire region, in order to provide green hydrogen in the Loire estuary produced by renewable electricity sources in the Great West, and to contribute to the regional network of hydrogen production and distribution working with existing producers/distributors through customer supplier interoperability while ensuring safe supply (SMILE 2020). The project will provide production, storage, logistics and distribution of hydrogen along the estuary adapted to multiple mobility uses. The project is coordinated by SMILE (Smart Ideas to Link Energies), an inter-regional collaboration between the Brittany and Pays de la Loire regions. Sponsors of the project are CCI Pays de la Loire, the port of Nantes Saint-Nazaire, Sydela, the territorial bank, Neopolia, Hynamics (branch of EDF), MAN Energy Solutions and Europe Technologies. Partners are Enedis, Charier, IDEA Groupe, the Post in Pays de la Loire, Urby, Neoline, Zephyr & Borée, Boluda, EDF Renewables, Dalkia (branch of EDF) and Pilotes de Loire.

Smart and green port developments

- The port of Sète is developing a zero-emission barge that thanks to a green hydrogen battery can supply ships with electricity when they are at dock (Cerema 2020). This solution is being developed in collaboration with the Occitanie region, Add'Occ, Pôle Mer Méditerranée, Nexeya, Europe Technologies, Seiya Consulting, CIAM and Jiemar.
- In the port of Marseille, a system of electrical connection allows boats that are docked in the port to be powered without using their engines (Franceinfo 2020). The system has been in operation since the beginning of 2017, and was financed with the help of the French state and the PACA region.
- The port of Toulon announced in 2019 that it would be the first port in the Mediterranean to electrify all its docks in order to combat the pollution of the Corsica ferries (Marquès 2019). The project is carried out in collaboration with Enedis.

LNG propulsion



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- The shipowner CMA CGM now operates seven LNG-powered containerships and will have a fleet of 26 containerships by 2022. The ports of Rotterdam and Marseille Fos are expected to become the gas bunkering hubs for the group's LNG-vessels. The shipowner has stated their goal to be carbon neutral by 2050 amongst others by the help of biofuels and they are also looking into how they can use hydrogen and fuel cells for this transition (Crozel 2020).
 - Brittany Ferries are engaging in a strategy of energy transition and are undergoing a process of renewal of their fleet. Three environmentally-friendly ships are currently being constructed in the shipyard CMJL in Weihai, China, two of which will be powered on LNG and will be in operation from 2022 and 2023.

Automation

- A pilot project for an autonomous ship navigated by satellite from Paris was launched from the port of Toulon on 10th September, 2020 (Visseyrias 2020). The ship is designed by the French company SeaOwl, and ADEME has financed 50 % of the € 4 M for research and development. The project has also received support from the companies Naval Group and Total (Chodorge 2020). Bureau Veritas ensures the analysis and certification of data (Boudet 2020). If the demonstration is successful, SeaOwl plans to manufacture about 20 electric autonomous ships between 2023-2028 that will carry out surveillance of offshore oil and gas fields and wind parks.

5.0 Conclusion

France is a proud maritime nation and has the longest navigable waterways in Europe, and a ferry fleet in need of renewal. The country has set extremely ambitious, law-bound targets for its energy transition and emission reductions, including for the transport sector. General targets also exist for the greening of the maritime and ferry sector. Unlike in Norway however, France has so far not had a detailed road map or specific funding scheme for the green transition of the sector, but a number of general funding schemes coupled with more ambitious policies and plans at the regional and city level. Several pilot projects for electric propulsion, hybrid and hydrogen-based vessels already exist, including projects with strong Norwegian participation.

Most importantly, there is general recognition amongst key stakeholders in the market that the French maritime sector, and the ferry sector in particular, is lagging behind other industries and transport modes when it comes to emission reduction. Notably, there is significant interest to learn more about Norwegian policy models, technologies and services amongst the same stakeholders. Many of the existing funding schemes are also technology agnostic and indiscriminatory of the origin of products or services. In other words, actors such as ADEME, VNF and the regions may co-fund renewal initiatives in the shipping and ferry markets supported by foreign suppliers provided these solutions contribute to reduced emissions.

With the recent Covid recovery package and more than € 30 billion earmarked to green transition projects over the next few years, it is expected that the French market for green shipping and ferries will see rapid and significant growth. *France Relance* includes a € 650 million package for the decarbonisation of the maritime sector, some € 175 million for the upgrading of waterway infrastructure, and € 200 for upgrading and greening of ports. Perhaps most significantly, France has set aside some € 7 billion for the development of a hydrogen industry under a detailed hydrogen strategy, with a strong focus on green hydrogen for ships and ferries.

The French market for green shipping and ferries is thus not expected to be driven by single policy or public entity defining the procurement process, but a combination of factors: Strong emission reduction policies and targets; an outdated ferry fleet; significant public investments in green projects in the transport sector as well as the upgrading of infrastructure and ports; and massive investment in the building of a national hydrogen industry. Most notably, several key actors express keen interest in furthering French-Norwegian collaboration and trade in this market.

As this report has detailed, several concrete tenders and renewal plans are already open to international and Norwegian providers. Opportunities exist in all segments, from ship manufacturing to operation and infrastructure, but opportunities are probably most significant in the equipment, services, design and engineering segments. Solutions for electric and hybrid propulsion will be in high demand, but given France's heavy investment in hydrogen, solutions for hydrogen- and hybrid vessels are expected to present particular opportunities. In France, solutions for small ships, ferries, and auxiliary solutions for bigger ships are expected to scale first, with propulsion solutions and charging infrastructure for recreational boats/yachts and fishing vessels following suit. Low-emission solutions for offshore wind supply vessels are also expected to grow in the near future. Velic propulsion has also been mentioned as a possibly emerging market.

As in all foreign markets, it is important to build relations over time, and to partner with French actors wherever possible. One important way to establish such relation is through the application for joint EU/Horizon projects, where both Norway and France have a very strong track record.

5.1 How Innovation Norway and Team Norway may contribute

Innovation Norway has a long-standing presence and engagement in the French market, working closely with its Team Norway partners the Norwegian Embassy, Norwegian Energy Partners (Norwep) and the French-Norwegian Chamber of Commerce (CCFN). The maritime sector has been a priority for the team, along with clean energy and offshore wind, and green and electric transport more generally. The office draws on a significant, professional network of French stakeholders, including public institutions, clusters and companies. Innovation Norway France supports French-Norwegian trade and collaboration, and Norwegian export efforts through capital, networks and advisory services for Norwegian companies, including market surveys, delegations at national events and support to groups or individual companies. The office also works closely with other Innovation Norway offices abroad. This report has been developed as a collaboration with the German office, and a parallel report is under development for the German market.

As a continuation of this report, Innovation Norway France is planning a series of events and meetings in 2021. Please contact the office if you want more information or support in the French market.

Appendix I: List of interviewees and contributors

In France

Cluster Maritime Français: Marie-Noëlle Tiné-Dyèvre, Deputy Director & Emmanuel-Marie Peton, Head of Innovation and Transformation

French-Norwegian Chamber of Commerce: Ludovic Caubet, Managing Director

GICAN: Timothée Moulinier, Head of R&D, Innovation and Digitalisation & Arnaud Martins da Torre, Head of Business Internationalisation and Export

LMG Marin France: Vincent Rudelle, Managing Director

Pôle Mer Bretagne: Philippe Monbet, Deputy Director

Royal Norwegian Embassy in Paris: Ragna Fidjestøl, Senior Advisor

Voies Navigables de France, VNF: Eloi Flipo, Head of Cargo Transport and Modal Shift Department & Joffrey Guyot, Head of Innovation, Funding and Multimodal Transport

In Norway

Innovation Norway: Roger Martinsen, HUB Leader Ocean Industries; Sølve Fauskevåg, HUB Leader Smart Societies & Tim Genge, Senior Advisor Vestland

Innovation Norway EU Team: Eirik Velle Wegner Lønning, Senior Advisor

LMG Marin: Torbjørn Bringedal, Managing Director

NCE Maritime Cleantech: Håvard Tvedte, Project Manager

Rederiforbundet: Gunnar Malm Gamlem, Environmental Director

Westcon Power & Automation AS: Frode Skaar, Director of Marketing and Business Development

Appendix II: List of actors

Below follows a non-exhaustive overview of actors in the French maritime and ferry markets. If any of the actors or projects mentioned hold specific interest to you, IN France would be happy to facilitate contact.

Shipowners

Armateurs de France is the French shipowners' association. They represent 57 companies, 26 000 jobs and about 1000 ships. Website: www.armateursdefrance.org

Bateaux Parisiens is the leading operator of sightseeing cruises and catering on the Seine in Paris with almost 50 % of the market. Website: www.bateauxparisiens.com

Bateaux-Mouches is a sightseeing cruise operator on the Seine in Paris and the main competitor to the Bateaux Parisiens. Website: www.bateaux-mouches.fr

Bourbon is a world leader in marine services for offshore oil and gas organised into three distinct affiliates: Bourbon Marine & Logistics that offers a wide range of support services in continental and deep offshore; Bourbon Mobility that is dedicated to high-speed passenger and light cargo transport services for offshore oil & gas clients; and Bourbon Subsea Services that handles complex Subsea operations. Website: www.bourbonoffshore.com/en

Brittany Ferries operate cruise ships between four countries: France, Spain, Great Britain and Ireland. Today Brittany Ferries is the leading maritime carrier in the Western and Central Channel and the largest employer of French sailors. They are engaging in a strategy of energetic transition and are undergoing a process of renewal of their fleet. Three environmentally-friendly ships are currently being constructed in the shipyard CMJL in Weihai, China, two of which will be powered on LNG and will be in operation from 2022 and 2023. Website: www.brittanyferries.com

CMA CGM is a shipping company with global expertise in maritime transport and logistics with a presence in 160 countries serving 420 of the world's 521 commercial ports and operating 285 shipping lines. In France they have agencies in Dunkirk, Le Havre, Paris, Marseille and Montoir. CMA CGM now operates seven LNG-powered containerships and will have a fleet of 26 containerships by 2022. The ports of Rotterdam and Marseille Fos are expected to become the gas bunkering hubs for the group's LNG-vessels. The shipowner has stated their goal to be carbon neutral by 2050 amongst others by the help of biofuels and they are also looking into how they can use hydrogen and fuel cells for this transition (Crozel 2020). Website: www.cmacgm-group.com/en/ How to become a supplier? www.cmacgm-group.com/en/procurement/how-to-become-a-supplier

Le Comité des Armateurs Fluviaux (CAF) is a cluster for the small, medium and large companies engaged in river transport in France. They represent the interests of the profession vis-à-vis public authorities and work for the recognition of river transport as an important instrument for sustainable development. Website: www.caf.asso.fr

La Compagnie Fluviale de Transport (CFT) is the primary French ferry owner and river transporter with 210 ferries in their fleet. They also operate 8 marine ships. CFT is part of the Sogestran group and specialises in industrial river transport. They offer transport and delivery services in all types of goods transport, as well as logistical services. Website: www.sogestran.com

Corsica Ferries operate cruise ships between destinations in Italy and France, and the islands Corsica, Sardinia, Elba, Sicily, and the Balearic islands. Website: www.corsica-ferries.fr

Groupe Sodexo is a catering company that has a strong position in the ferry market on the Seine. They operate [Les Bateaux Parisiens](#) that engages in classic river cruises on the Seine, as well as Les Yachts de Paris that specialize in business travels and the organisation of events on river yachts. The group also operate river shuttle services on the Seine and La Marne. Their fleet [Batobus](#) will be equipped with six hybrid ferries between 2020-2024, running on both diesel and electricity. Website: fr.sodexo.com

Louis Dreyfus Armateurs (LDA) Group offers maritime transportation and services in dry bulk transportation, logistics and transportation, and offshore and onshore industrial solutions. The LDA Group has collaborated with Norwegian shipowner Leif Høegh through their joint-venture Fret-CETAM that in 2001 signed a contract to deliver parts to Airbus' A380 to different production sites in Europe with their RoRo vessel *Ville de Bordeaux*. Website: www.lda.fr/en/

MSC Croisières is the world's largest private cruise company that navigates all year in the Mediterranean and the Caribbean, and proposes a wide range of seasonal cruises to Northern Europe, the Atlantic Ocean, South America, South Africa, China, Dubai, Abu Dhabi and Qatar. Website: www.msccroisieres.fr

Nicols, Canalous, Locaboat and Le Boat dominate the recreational boating market. They all offer private boat rentals for recreational purposes on the many navigable waterways of France and together own 80 % of the boats in this market, *i.e.* about 1600 boats. Nicols and Canalous already have 100 % electric boats in their fleets constructed at their own shipyards, [Nicols](#) and [Constructions Polyester du Centre \(CPC\)](#) in the Canalous Group. The motorisation system for Canalous' 100 % electric model [Péniche S](#) was delivered by Panda Fischer. Websites: www.nicols.com ; www.lescanalous.com ; www.locaboat.com ; www.leboat.com

Ponant operates luxury cruises to destinations all over the world. The company has taken several initiatives to limit their GHG emissions, utilising biofuels, equipping ships with electric connection and dockside connection is equipped ports, and developing hybrid solutions for their ships. Website: www.ponant.com

Zéphyr & Borée is a sail shipping company that designs and operates innovative vessels to offer low-carbon transport services. They have designed the Canopée vessel, the first modern sail cargo ship. Website: www.zephyretboree.com

Yards

Bénéteau is a world leader in the production of yachts, sailboats and motorboats. In addition to being a shipyard the group also has a team of ship designers and naval architects in their team. From R&D to industrialisation,

the brand and the group have been working for over 130 years to build innovative, reliable and competitive boats. Website: www.benetau.com

Chantier Bretagne Sud is specialised in aluminium shipbuilding and also offer reparation and maintenance services. The shipyard is in the process of building its two first [electrically propelled catamarans](#) which will be equipped with a hydrogen engine. Website: www.chantier-bretagne-sud.fr

Chantiers de l'Atlantique is one of the world's largest shipyards located in Saint-Nazaire, constructing a wide range of commercial, naval and passenger ships. Website: <https://chantiers-atlantique.com/en/>

La Ciotat Shipyards is a Local Public Company (SPL) whose shareholders are the Department of Bouches-du-Rhône (50%), the Provence-Alpes-Côte d'Azur Region (25.8%), the Metropole Aix-Marseille-Provence (19.9%) and the city of La Ciotat (4.3%). The shipyard has witnessed the success of a voluntarist and partnership based policy of the reindustrialisation of the site formerly geared towards the construction of large industrial units through a repositioning in the sector of repair, servicing and maintenance of large yachts. La Ciotat Shipyards completed the world's first hydrogen yacht in September 2020, which will serve as a demonstrator until commercialisation in the spring of 2021. Website: www.laciotat-shipyards.com

Naval Group is a European leader in naval defence with a presence in 18 countries, and serves the strategic operations of more than 50 navies. *Blue Ship* is one of six axes of their R&D strategy, the purpose of which is to bring together all the environmental topics of interest to the group in order to combine innovation, new operational capacities and sustainable growth. Website: www.naval-group.com

Navalu is a shipyard specialized in designing and building custom-made aluminium ships up to 35 meters. The company is recognized for the quality of construction and the long-lasting welding quality. Navalu has constructed the first hydrogen vessel to be approved for European navigation with the shuttle boat NAVIBUS operating on the Erdre river in Nantes since 2019. Website: www.navalu.fr

Socarenam is a leading French shipyard that started out specialised in fishing vessels fabrication and now delivers a wide range of vessels. Socarenam is the French reference in the fabrication of fast crafts, Patrol vessels and Special ships dedicated to Sea Countries Protection and Customs. Website: www.socarenam.com

Design and engineering

Air Liquide is a world leader in gases, technologies and services for industry and health with a presence in 80 countries. Oxygen, nitrogen and hydrogen are at the core of the company's activities. Their portfolio includes hydrogen and LNG for maritime transport solutions, and Air Liquide is taking a lead role in the development of such technologies e.g. through its participation in the HySHIP project led by Norwegian maritime industry group Wilhelmsen. Website: www.airliquide.com

Airseas is a spin-off of the aeronautical company Airbus that has created Seawing, an innovating wing that can tow commercial ships. Website: www.airseas.com

ANIE-2R is a naval architecture firm specialised in ferries that participates in the HyBarge project financed by VNF to validate a hydrogen fuel cell system. Website: <https://sites.google.com/site/irlanie2r/>

Europe Technologies offers its expertise for the industrialization, manufacturing and maintenance of composite, metallic and plastic parts and sub-assemblies. Their brand CIAM (Collaborative Integration for Alternative Motorization) offers manufacturing and integration of the complete electrical propelling system of ships based on a hydrogen or LNG. Europe Technologies coordinates the Hylas project for a hydrogen-driven passenger ship in the Golfe du Morbihan, to be operative from 2023. Website: www.europetechnologies.com

L2Onaval is a naval architecture firm that can take on an expert role in third party projects (hydrodynamic calculation, structure, etc.) as well as undertake complete ship studies from start to finish. The common denominator for all their projects is a decisiveness to reduce the environmental impact of river and maritime activities, and they work with both electric, hybrid and wind propulsion. They are the ship designer in the Hylas project for a hydrogen-driven passenger ship in the Golfe du Morbihan. Website: www.l2onaval.com

LMG Marin is one of Europe's leading naval architect and ship design houses, with a highly dedicated organization of skilled engineers and naval architects. Originally a Norwegian company, they also have offices in Toulouse, France. They are at the forefront of exploring alternative propulsion technologies such as 100 % electric, hydrogen, LNG and hybrid, and are also exploring velic propulsion in collaboration with Airbus. LMG Marin is a partner in both the Flagships and HySHIP projects. Website: www.lmgmarin.no

Ship-ST is a ship designer based in Lorient and Nantes in Western France that benefits from a network of partners to meet specific needs and extra loads. Since its foundation, Ship-ST has assisted owners, shipyards, operators, scientists and institutional structures with more than 1,000 projects, for sea and river. Ship-ST participated in the project for a hydrogen shuttle boat on the Erdre river in Nantes that went into operation in 2019. Website: www.ship-st.com

Verhaaren Naval Architects is an independent naval architecture and design studio that offers shipowners all the care, skill and experience needed for the design and management of their projects. Website: www.tvan-france.fr

Equipment and service

ABB is an industrial equipment supplier at the forefront of the evolution of sustainable shipping with a presence both in France and Norway. Electrical propulsion, data-driven decision support and integrated solutions for ship and shore from ABB are paving the way to a zero-emission marine industry. Website: <https://new.abb.com>

Barillec Marine is an electricity subcontractor that is a branch of Vinci Energies specialised in electric and hybrid propulsion systems for maritime and river transport. Barillec Marine will carry out the operation of converting the Batobus fleet of river shuttle services on the Seine into hybrid ferries. Website: www.barillec-marine.com

Bureau Veritas is a world leader in testing, inspection and certification. Amongst other things, they carry out missions of control and surveillance and can be an important partner in the development of waterways and ferry

transport. For instance, Bureau Veritas ensures the analysis and certification of data in a pilot project for an autonomous ship initiated by the French company SeaOwl. Website: www.bureauveritas.fr

GTT is a leading engineering company in containment systems for the shipping and storage in cryogenic conditions of LNG (liquefied natural gas). GTT offers engineering, consultancy, training, maintenance support and technical design services. Website: www.gtt.fr

Matis technologies is a technology consulting and engineering firm based in Rennes. Their activity consists of strengthening the skills of companies and managing projects. Matis technologies participated in the project for a hydrogen shuttle boat on the Erdre river in Nantes that went into operation in 2019. Website: www.akka-technologies.com

Mission Hydrogène is a non-profit association finance by ADEME, the DIRECCTE and the Pays de la Loire Region. It gathers economic actors around the hydrogen and fuel cell technology. The Mission Hydrogène has developed a unique competence on hydrogen uses for marine and ferry applications. It contributes to the French hydrogen platform AFHYPAC (*Association Française pour l'Hydrogène et les Piles A Combustible*). At the European level, Mission Hydrogène is the French referent for the MHFCA (Marine Hydrogen and Fuel Cell Association). Mission Hydrogène has initiated many demonstrators projects and ensures a proper level of communication (technical workshops, technology watch). Website : www.mh2.fr/en/

PersEE supports the digitalisation of the hydrogen economy through a Hy-suite of digital products ranging from diagnosis tools to real-time optimisation software. These products uniquely blend industry 4.0 techniques with an in-depth understanding of hydrogen. PersEE provides vessel energy monitoring and management in both the Flagships and HySHIP projects. Website: www.pers-ee.com

Saft Batteries is a wholly-owned subsidiary of the French energy company Total. Saft serves a large range of market sectors from aerospace to marine, from rail to telecoms and health, offering battery solutions for many different types of applications. Saft has a wide range of marine battery systems to meet the needs of many different players in the industry including tug boats, dredgers, ferries, offshore platforms, large ocean cruise-liners, private yachts, and cargo vessels. Website: www.saftbatteries.com

Siemens operates in the domains of electrification, automation and digitalisation. They have a strong presence in the naval and maritime world, and with its unique digitalisation skills offer a large portfolio of solutions including automation of shipping, transport and distribution of energy, equipment and infrastructure services. www.siemens.com

Energy companies

La Compagnie Nationale du Rhône (CNR) is an electricity generation company, mainly supplying renewable power from hydroelectric facilities on the Rhône. CNR is also responsible for the development of navigation on the Rhône, and has developed a 330 km long navigable waterway connecting Lyon to the Mediterranean sea and the big maritime port in Marseille. The company is 50,05 % state owned and its capital is structured around three poles: Suez Electrabel (the energy branch of the GDF-Suez group), Caisse des Dépôts et Consignations, and

local authorities. CNR is committed to being an EU partner for the implementation of the ecological transition in the regions. This takes the form of close collaboration with EU institutions and investment in various European projects. The CNR is also developing green hydrogen production enabled by hydroelectric energy in the Rhône river basin. Website: www.cnr.tm.fr

EDF is a French electric utility company largely owned by the French state. EDF is working to strengthen its engagement for the climate and invests heavily in renewable energy. As a means to diversify its low-emission transport, EDF is strengthening its presence in the river transport sector, and in 2019 entered into a partnership with VNF to this end. Website: www.edf.fr

Engie is a French industrial energy group and the second largest provider of electricity in France after EDF. Engie invests in renewable energy projects all over France and is France's largest provider of green electricity. They also have their own "green mobility" program, Mobility Today, that aims to develop new and smart solutions for climate-friendly mobility. Website: <https://www.engie.com/en>

Helion Hydrogen Power is a key player in the hydrogen and fuel cell industries. In their facilities in Aix-en-Provence they design, manufacture and commercialise PEM fuel cell stacks and fully-integrated hydrogen systems with a power range from kW to MW. Website: www.helion-hydrogen-power.com

Hydroquest is a leading turbine technology provider & independent producer of renewable power. They use the natural, constant and predictable water flows from canals, rivers and oceans to deliver the cleanest energy source. Website: www.hydroquest.net/

LHYFE is an energy start-up with ambitions to become Europe's leading actor on green hydrogen. They conceive, develop and operate industrial sites for green hydrogen production. Website: www.lhyfe.com

Naval Energies is a leader in the field of marine renewable energy. They contribute to the development of alternative, renewable and environmentally-friendly energy, originating from the sea. Website: www.naval-energies.com/en/

SABELLA develops tidal stream turbines to harness the clean energy from marine currents. Website: www.sabella.bzh

Total is a leading international oil & gas company and a major player in renewables and electricity. Website: www.total.com

WPD is an energy company that exploits both solar PV power as well as onshore and offshore wind. Website: www.wpd.fr

Ports

L'Association française des ports intérieurs (AFPI) is the association for French inland ports with 20 member ports¹ representing the principal navigation hubs in France. AFPI seeks to consolidate the position of inland ports as essential players for transport and mobility.

HAROPA ports, the 5th largest port complex in Northern Europe, is a joint venture between the ports of Le Havre, Rouen and Paris. It is connected to every continent owing to a first-rate international shipping offer (linking around 700 ports worldwide). It serves a vast hinterland the centre of which is in the Seine valley and the Paris region forming the biggest French consumer market area. With around 10 Normandy and Paris area partner ports, HAROPA now forms in France a global transport and logistics system, capable of providing a comprehensive end-to-end service. HAROPA handles over 120 million tons of cargo by sea and waterway each year. HAROPA business represents 160,000 jobs. Website: www.haropaports.com

The inland ports are essential for the development of ferry traffic. Being connected to the large seaports as well as the railway and road systems, they constitute important hubs in the transport system. Local authorities (*e.g.* regions, general councils, municipalities, unions, or public establishments for inter-communal cooperation) are or can become owners or operators of the parts of the river network that represents a local interest. The three most important inland ports in France are those located in Paris, Strasbourg and Lille.

The large seaports of Le Havre, Marseille and Dunkirk are important both in a maritime context in addition to managing the river network situated inside their respective port domains. The ports located by the entry point of a river also play an important role in the development of waterways as they tend to facilitate ferry transport by linking the arrival of great ships to inland transportation. Marseille is the most important port for ferry transport by sea.

Medlink ports is a port network that is engaged in the development of waterways and logistics involved in the creation of port “axes” connecting different ports. This operational entity of harbour platforms is the primary river-port entity in France. Notably, they are developing activity and transport on the axis between the Mediterranean Sea, the Rhône and Saône, working towards more efficient systems for connecting these areas to the South of Europe. Medlink ports was created in 2008 upon the initiative of the Grand port maritime de Marseille, the VNF and 9 inland ports of the Rhône-Saône basin. The project gradually grew more comprehensive, leading to the incorporation of the port of Sète, the maritime entry point to the Rhône-Saône basin, in 2012. Website: www.medlinkports.fr

¹ Aproport, Port fluvial d'Arles, Port d'Avignon Le Pontet, Port de Châlons-en-Champagne, Port Rhénan de Colmar Centre-Alsace, Plate-forme Delta 3 Dourges, DPHP (Développement Portuaire de Haute-Picardie), Port d'Elbeuf, Port de Givet, Ports de Lille, Lyon Terminal, Ports de Mulhouse Rhin, Pagny Terminal (CCI Beaune), Port de Paris, Port de Reims, Ports de Moselle, Port de Strasbourg, Port de Valence, Port de Vienne Sud and Port de Villefrance-sur-Saône. VNF is an associated member.

Public actors

Add'Occ is the Occitanie region's agency for economic development. An advocate in public processes for on behalf of industrial actors, the agency works to influence the region to make battery or hydrogen solutions required in calls for tenders. Website: www.agence-adocc.com

ADEME (Agence de Environnement et de la Maîtrise de l'Energie) is a public environmental agency under the authority of the Ministry of the Ecological Transition and the Ministry of Education. ADEME is active in the implementation of public policy in the areas of the environment, energy and sustainable development. They provide expertise and advisory services to businesses, local authorities and communities, government bodies and the public at large, to enable them to establish and consolidate their environmental action. As part of this work the agency helps finance projects, from research to implementation, in its areas of action. Website: www.ademe.fr Calls for tenders: <https://agirpoulatransition.ademe.fr/entreprises/>

BATELIA is a centre for innovation in the ferry sector launched by VNF and is one of the tools used by VNF to modernise and develop French river transport. BATELIA will assist actors that have concrete projects proposals and also offer technical advice on electric, hydrogen and other gas propulsion for ferries. Contact: Mr Eloi Flipo – eloi.flipo@vnf.fr. Website: www.batelia.eu

BPI France is a central actor in the French business support system. They have close partnerships with banks, investors, regions and public institutions to fund entrepreneurial efforts. Website: www.bpifrance.fr

The strategic committee for the maritime industries (Comité stratégique de filière des industriels de la mer) defines the issues at stake and the concrete solutions for the sector's future development. The committee has developed a roadmap for research and development (R&D) structured around four pillars: Green Ship, Smart Ship, Smart Yard and Smart Offshore Industries. The committee's R&D support body **CORIMER** funds projects to reduce the emissions from the maritime sector. Website : www.conseil-national-industrie.gouv.fr/comites-strategiques-de-filiere/industriels-de-la-mer

The Ministry of Ecological Transition prepares and implements the French government's policies in the areas of sustainable development, the environment, protection of nature and biodiversity, green technologies, the energetic and ecological transition – especially in the areas of taxation, climate, the prevention of natural and technological risks, industrial security, transport and its infrastructure, and maritime industries. Website: www.ecologie.gouv.fr

The regions are important actors in matters of innovation, financing and industrial development. The regions Pays de la Loire, Brittany, Occitanie, Île-de-France, PACA and Hauts-de-France are especially active in the greening of maritime transport.

The river safety instructor services (Les services instructeurs de la sécurité fluviale) are decentralized public services that grant the necessary papers and certificates for the navigation of commercial boats on inland waterways.

SMILE (Smart Ideas to Link Energies) is an inter-regional collaboration between the Brittany and Pays de Loire regions after winning a national call for projects. Officially launched in the spring of 2016, **the SMILE project is part of a plan for the operational implementation of energy transition and sustainable growth on a regional and national level.** The main goal of SMILE is to create interaction between **companies** developing solutions and the **territories** wishing to roll out smart grid technologies, in order to create a region wide smart grid. SMILE coordinates the H2 Loire Vallée project to provide green hydrogen in the Loire estuary produced by renewable electricity sources. Website: www.smile-smartgrids.fr

Voies Navigables de France (VNF) is the central public actor in the French ferry sector and manages both the transport- and the tourism-related ferry operations. Their public mission is threefold: ensure the waterway logistics, contribute to territorial development, and oversee the water management. About 90 % (*i.e.* 7000 km) of the French waterways are managed and maintained by the VNF – however, the boats who navigate on the waterways are private-owned, either by craftsmen (artisans) or merchandise companies. The VNF works to collect data on the utilization of the waterways, to increase the amount of goods transported by the waterways, and they make efforts to try to orient industrial operators towards the ferry system. They are therefore financing programs to upgrade the ferry fleet and surrounding infrastructure to meet environmental standards, as herein lies a huge potential for climate-friendly transportation of people and goods. Website: www.vnf.fr

Clusters

The French association for electric boats' (*Association française pour le bateau électrique, AFBE*) main ambition is to develop the image and the market for electric boats both in France and abroad. The association has about 30 members including both companies and institutional actors. The association engages in lobbying efforts to influence government policy, conducts and publishes market research, and participates at marine policy events. Website: www.bateau-electrique.com

The French Maritime Cluster (*Cluster Maritime Français, CMF*) brings together all the actors in the maritime ecosystem and service industry. The CMF consists of 430 members, including companies of all sizes, clusters, associations, laboratories and research centres, education institutions, local economic actors and the French navy. The cluster takes initiative in the formulation of ambitions and roadmaps to green transition for its many member companies. Talks with the CMF have uncovered an interest in contacts with Norwegian companies or clusters, and IN France would be happy to facilitate such contact. Website: www.cluster-maritime.fr

GICAN, the French Marine Industry Group, affiliates more than 200 industrialists in the maritime industry. It brings together shipyards, system and equipment manufacturers, subcontractors, engineering and architect businesses that are involved in the design, construction, maintenance and implementation of military and civilian vessels, and those who work in the domain of maritime security and Marine Renewable Energies. Talks with GICAN have uncovered an interest in contacts with Norwegian companies or clusters, and IN France would be happy to facilitate such contact. Website: www.gican.asso.fr

Pôles Mer consists of two clusters, *Pôle Mer Bretagne Atlantique* and *Pôle Mer Méditerranée*, that work to encourage the growth of maritime companies in the Brittany/Loire regions and the Mediterranean area, respectively. The two clusters work to increase the competitiveness and dynamism of the coastal and maritime

industries. To this end, they encourage collaborative projects within research and development and guide their member companies through their growth and development. Website: www.pole-mer.com

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