TRENDS
MARITIME TRANSPORT

The energy transition in international shipping remains at the dock

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After years of low profits, the maritime transport sector has benefitted greatly from the upswing in trade that followed the lifting of lockdowns. A commitment to reducing sulphur and greenhouse gas emissions has seen the sector increasingly turn to scrubbers and liquid natural gas (LNG) – a trend confirmed in 2021. But international shipping is still struggling to make these transformations on a large scale, and needs to resolve the negative externalities of some of its technological choices.

DATA OVERVIEW

Major shipowners reap benefits from the pick-up in international maritime transport

The pick-up in freight following the progressive end of lockdown polices saw greenhouse gas emissions from international shipping shoot up by 8%, to reach 661.9 $MtCO_2$ in 2021, compared to 612.5 $MtCO_2$ in 2020, according to Enerdata figures.[a] That level is however lower than the 2019 figure (682.9 $MtCO_2$). Domestic maritime traffic (river transport, ferries, coastal navigation, etc.) went up by 7.3% over 2021 (177.83 $MtCO_2$), following a 3% drop in 2020. In this area too, emissions were below pre-crisis levels.[1] According to the fourth study by the International Maritime Organization (IMO) on greenhouse gas (GHG) emissions, 98% of GHGs emitted were carbon dioxide (CO_2). However, for the period 2012-2018, the study observes a particularly sharp increase (150%) of methane (CH_4) emissions, which have a global warming potential (GWP) 86 times higher than CO_2 over 20 years.[2]

According to the latest report by the Intergovernmental Panel on Climate Change (IPCC) on climate change mitigation, international maritime transport emissions are the second highest source of emissions from the transport sector after road transport of passengers and goods, and represent about 9% of the transport sector's total emissions.[3] Emissions related to international transport of freight grew faster than emissions related to the transport of passengers, mainly due to increased trade and an organization of logistics chains that involves very long distances.[4] In 2023, the IMO is set to revise its GHG reduction strategy, while numerous voices are calling to step up ambition and action and consider all possible options for the sector **(SEE BOX 1)**.

The UNCTAD Review of Maritime Transport published in November 2021 announced a 4.3% upswing in the volume of trade by ship, with different regional profiles. This return to growth in activities follows a 3.8% decrease in trade in 2020[5] provoked by the Covid-19 pandemic, and before that, two consecutive years of a slow-down in the growth of transported volumes: 2.7% in 2018, then 0.5% in 2019. These figures are below the average rate recorded from 1970 to 2017 (+3%/year).

The global traffic of container ships, which is a key indicator of the state of international trade, followed a similar trend: -1.2% activity in 2020, after a drop in growth from 6.7% in 2017 to 2% in 2019.[6] Container traffic in Asia, which concentrates 54% of global maritime trade, only went down slightly in 2020 (-0.4%), and not at all in Africa (0%), with a much bigger decline in Europe (-4.2%), North America (-1.9%) and Latin America and the Caribbean (-1.8%).[7] This decreased activity did not therefore outweigh the long-term growth in maritime traffic for developing countries, which now receive 69.5% of shipped goods in the world. Another indication of the sector's healthy economic state is the rate of shipbuilding capacity in shipyards, which dropped by 14% from 2015 to 2020, then shot up again by 13% from 2020 to 2021, although without returning to 2019 levels.[8]

The general drop in activity in 2020 had a variable impact on shipping companies depending on the activity sector. Oil tankers were initially hit hard by the drop in fuel demand and

a Other sources provide different figures, but with similar orders of magnitude in proportion to other transport sub-sectors. The IPCC, in its report "Climate Change 2022: Mitigation of Climate Change", published in April 2022, announced a figure of 0.8 $GtCO_2e$ emitted by the sector in 2019; the fourth IMO report published in 2020 estimates that the sector's emissions reached 1.076 $GtCO_2e$ in 2018.

the reduced production organized by OPEC, but then returned to profitability following Russia's invasion of Ukraine.[9]

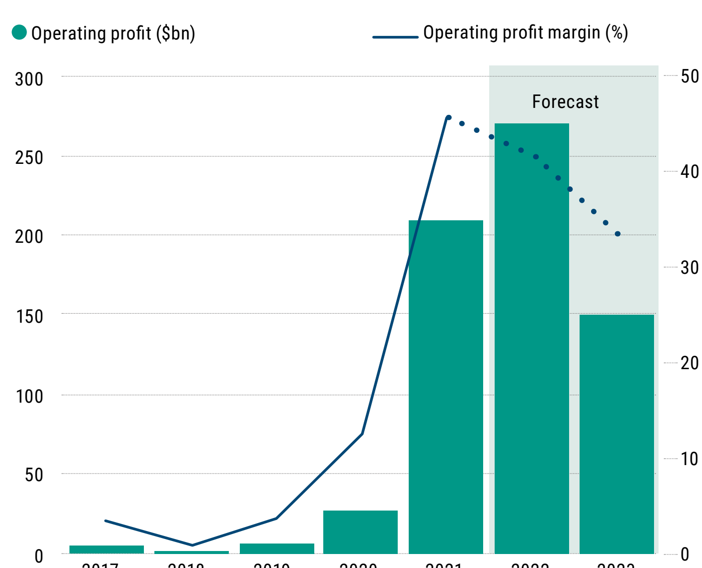
But the biggest winners of the crisis are undeniably container ship operators (Maersk, CMA-CGM, MSC, COSCO, etc.). This is because the tariffs fixed by shipowners for transporting goods, known as "freight rates", are inversely proportional to demand: the greater the transport capacities, the lower the tariffs. For several years, this situation limited transporters' financial margins. Yet the generally disorganized distribution of container ships available between the main commercial zones, coupled with the high demand for manufactured goods during and after lockdowns, sent freight rates soaring. In February 2022, one-year contracts, which make up three-quarters of the annual revenues of shipping operators, were being negotiated at between $7,000 and $8,000 for a forty-foot-equivalent-unit container between China and the West Coast of the USA, compared to an already record average cost of $5,500 in 2021.[10] As a result, the industry made record-breaking earnings before interest and taxes (EBIT) of $210 billion in 2021, compared to only $7 billion in 2019 and $26 billion in 2020. Even more spectacular results are expected for 2022, with Drewry, a consultancy firm specializing in maritime, predicting profits of $270 billion for the industry.[11]

This advantageous situation for the sector's finances could therefore make it easier for shipping companies to make investments to reach the long-term emissions and pollution reduction objectives set by the IMO. Yet when actors in the sector start deploying strategies to implement them, these commitments sometimes reveal contradictions.

FIGURE 1

EARNING BEFORE INTERESTS AND TAXES FROM THE INDUSTRY BETWEEN 2017 AND 2023 (FORECASTS)

Source: Financial Times, 08/09/2022, based on Drewry Maritime Research



BOX 1 • **KEYS TO UNDERSTANDING**

MARITIME TRANSPORT: A SECTOR THAT ORGANIZES ITS OWN CARBON-REDUCTION ACTION

Since the Kyoto Protocol in 1997, the question of reducing emissions generated by international maritime transport has been handled by the International Maritime Organization (IMO). This organization has historically specialized in shipping security issues and today has nearly 140 member countries. Spurred by the agenda of the Paris Agreement in 2016, the IMO has defined a two-step global strategy, with an initial strategy for 2018 and a revised strategy for 2023. In April 2018, over one hundred States gathered at the IMO headquarters in London, where they adopted an initial strategy to reduce emissions by transport unit (in gCO_2/tkm) by at least 50% in 2050 compared to 2008. More precisely, the agreement establishes the reduction of emissions for all international transport activities by at least 40% by 2030, and up to 70% by 2050 compared to 2008.[12] In spring 2023, a revised strategy is due for publication, following an appeal by several state and non-state actors at COP26 to scale up the sector's ambition to reach "zero emissions by 2050"; these actors included the main G7 countries (Declaration on Zero Emission Shipping by 2050) and over 200 companies and organizations from the sector through the global maritime forum (Call to Action for Shipping Decarbonization).
For years, maritime shipping has claimed to have made major advances in energy efficiency and carbon intensity thanks to a range of measures with exponential impacts, such as reducing the cruising speed of ships[b]. Indeed, the average carbon intensity of the entire sector, whether in terms of vessels or journeys, is 21-30% lower today than in 2008, according to the IMO's energy efficiency operational indicator (EEOI). As a result, the sector has maintained relatively stable emissions compared to 2010 levels, despite rising international demand. Nevertheless, most of these efficiency gains were made before 2012, and the carbon intensity of activities has not gone down more than 1 to 2% a year since 2015, which is insufficient to reduce absolute emissions compared to their 2008 level. Today, commitments and investments to decarbonize the sector are concentrated on developing zero-emission fuels; however, they depend on the capacity to produce enough zero-emission energy to meet needs, and on the speed of rolling out "green corridors" equipped with charging stations. More than 20 countries have partnered with private actors to develop at least six corridors by 2025 (Clydebank Declaration). Lastly, notably none of these strategies considers the reorganization of logistics chains towards shorter, more regional chains, as a lever to develop and to reduce the sector's emissions, despite the fact that this option could help alleviate pressure on the demand for zero-emission energy and facilitate the penetration of alternative forms of motorization.

b There is a cubic relation between the reduction of a ship's speed and fuel consumption: reducing the speed by 10% decreases the engine power required by 27%. Therefore, for an equal distance covered more slowly, the energy necessary for the journey diminishes by 19% (Faber et al., 2017). Slowing the speed therefore allows companies to lower their emissions and save on fuel consumption.

THE OBSERVATORY'S LENS

LNG increasingly popular for long-distance transport

To reduce sulphur emissions, scrubbers are overtaking VLSFO

Since 2018, the IMO has been calling on shipping companies to reduce their GHG emissions by at least 50% by 2050 compared to 2008. And since January 2020, the IMO 2020 regulation has reduced the limit of sulphur content in heavy fuel oil (HFO) used in ships from 3.5% m/m (mass by mass) to 0.5% m/m for all ships outside Emissions Control Areas (ECAs). To succeed in meeting this double requirement for decarbonization and depollution, the IMO plans four other types of mid-term measures: the development of low-carbon (or even "zero-carbon") fuels, operational measures for the energy efficiency of ships, technical cooperation and capacity-building activities, and feedback mechanisms to share good practices.[13]

To reduce sulphur emissions, two options are possible: replacing HFO with a fuel that has a lower sulphur content but is much more expensive or requires technical adaptations, such as VLSFO (Very Low Sulphur Fuel Oil), MGO (Marine Gas oil) or LNG **(SEE BELOW)**; or equipping ships with systems that clean sulphur particles from exhaust gases, i.e., "scrubbers", and continuing to use HFO. Following a trend that began in 2020, scrubbers have overtaken VLSFO as the preferred market option; the price spread between VLSFO and HFO reached record levels in 2022, thus favouring the option of maintaining traditional fuels and fitting smokestack scrubbers.[14] In late 2020, over 4,000 ships around the world were equipped with these systems, which is double the number at the start of the year, according to BIMCO, a network of maritime sector actors that represents 60% of the global freight fleet.[15]

However, the most popular version on the market, which is cheap and easy to install, is the "open-loop" scrubber, which directly discharges wash water from the smokestack into the sea. This discharge, which is loaded with polycyclic aromatic hydrocarbons, nitrates, nitrites and heavy metals, makes the ocean water more acidic and threatens marine life. Eighty percent of this wash water is discharged into exclusive economic zones (200 nautical miles), within which states have the exclusive right to exploit resources, according to an ICCT study.[16] A recent Swedish study estimates that open-loop scrubbers are responsible for 9% of certain pollutants in the Baltic Sea.[17] To date, about forty States and port authorities in the world have prohibited or restricted discharges of wash water from scrubbers.[18]

The track record is not much better for VLSFO, with a recent study presented to the IMO revealing that VLSFO combustion produces from 10% to 85% more black carbon emissions than HFO combustion.[19] Black carbon not only has significant negative impacts on human health, it is also a greenhouse gas (GHG) with a short lifespan but a strong radiative forcing effect. Resulting from the incomplete combustion of fuel, its global warming potential (GWP) is between 460 and 1,500 times higher than that of CO_2 during the four to twelve years it stays in the atmosphere.[20]

LNG is the choice fuel for long-distance transport

In terms of decarbonization, investments and research and innovation mostly focus on developing alternative means of motorization to the high-carbon fuels used by the majority of ships. At the moment, according to figures from the insurance and risk management company DNV,[21] 99.8% of ships operating in the world and 78.9% of those on order run on conventional fuels. Among the alternative options, LNG largely dominates order books for long-distance vessels (90% of tonnage on order and 98% of tonnage in operation), while the other options (batteries, hybrid, methanol, liquified petroleum gas) are aimed at short-distance vessels.

Currently, 923 LNG-fuelled vessels are in operation in the world, and 534 are on order, according to DNV figures.[22] This increase is substantial compared to the figures reported in the 2021 edition of the Global Synthesis Report on Climate Action by Sector.[c] LNG is not just an alternative to conventional heavy fuels to help the sector reach its decarbonization targets, it is also one of the fastest-growing products in international trade, and therefore one of the main drivers of the growth of international maritime transport. In 2021, imports of LNG, which had not gone down despite the pandemic, increased 4.5% compared to 2020, while LNG transport capacities increased by 9%.[23] In 2022, the market is likely to profit from the increased demand for LNG as an alternative to Russian gas.

Nevertheless, while LNG effectively emits 25% less CO_2 than traditional ship fuel, and contains practically no sulphur, it is still a gas, and its combustion contributes to the increased CH_4 emissions observed by the IMO in recent years.[24] These emissions are generated by low-pressure injection dual fuel (LPDF) engines, the most common technology for operating LNG vessels, which release significant levels of CH_4, in particular from ships carrying light loads.[25] According to a life cycle assessment carried out by ICCT, the use of LNG with this technology produces 70% to 82% more GHG emissions than the other gas-based fuel option: marine gas oil (MGO). An investigation by Transport & Environment using infrared cameras reported methane leaks on ships moored in the port of Rotterdam;[26] these leaks could represent from 0.2% to 3% of the combustion process, according to the IMO.[27] In 100 years' time, provided a more efficient technology is adopted, gains in emissions thanks to LNG could reach 15% compared to MGO; in 20 years, closer to the urgent deadline for climate action, the use of LNG would generate 4% more emissions.[28]

c These figures are cited by secondary sources. In the 2021 edition of the Global Synthesis Report on Climate Action by Sector, the figures quoted date from April 2021 and report 563 ships running on LNG, either in operation or on order. See Observatory of Non-State Climate Action (2021). Global Synthesis Report on Climate Action by Sector. Climate Chance

FIGURE 2

HYDROGEN DEMAND IN INDUSTRY, 2020

Source: International Energy Agency, 2022

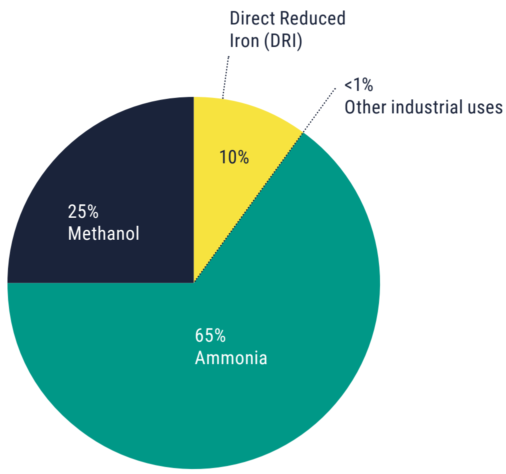
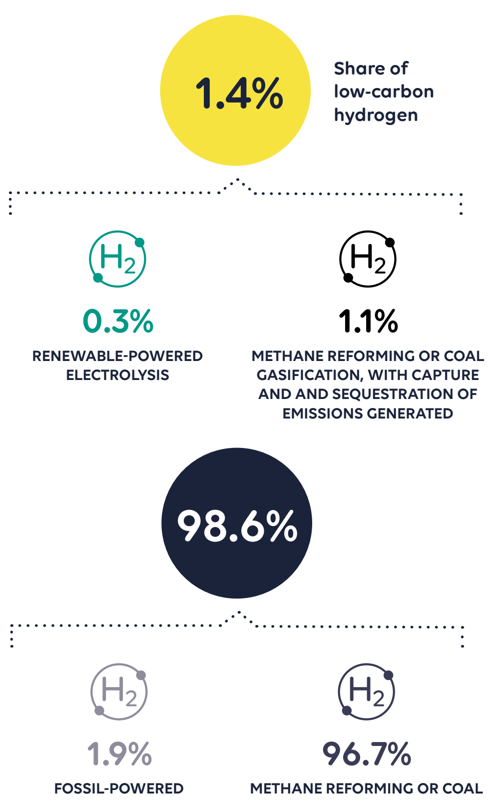


FIGURE 3

SHARE OF DIFFERENT HYDROGEN PRODUCTION METHODS

Source: Climate Chance, based on Global CCS Institute, 2021



Ammonia and methanol: two fledgling bets on the future

In an analysis of 24 transition scenarios for the maritime sector, DNV excluded electric propulsion from the shipping decarbonization options. Hydrogen was also ruled out for long-distance transportation, due to the technical difficulties of storage **(SEE BOX 2)**: hydrogen derivatives like ammonia and methanol are more viable for long distances, while hydrogen could be employed for shorter distances if mixed with other fuels.[29] Ammonia (NH_3) is one of the main outputs of hydrogen, known for its application as a fertilizer in the farming sector: in 2020, according to the IEA, ammonia production[d] already concerned 65% of the demand for hydrogen **(FIG. 2)**, of which 70% was used to produce fertilizer. According to the International Chamber of Shipping, because the energy density of ammonia is lower than that of oil, converting the entire international maritime fleet would mean tripling ammonia production to reach 440 million tonnes, which would require no less than 750 GW of renewable electricity.[30] Yet today, only 0.3% of the hydrogen produced in the world comes from renewable energy **(FIG. 3)**. In February 2022, the Greek shipowner Avin International launched *Kriti Future*, a "Suezmax" tanker presented as the first ship in the world ready to run on ammonia; to date, the vessel still operates on conventional fuel, but is equipped with the technology required for its conversion.[31]

The use of methanol as a fuel remains extremely marginal, but is entering into the strategies of the big shipping companies to diversify their energy sources. Methanol is an alcohol naturally produced by the metabolism of anaerobic organisms; while scarce in its natural state, it is produced synthetically using various chemical reaction processes mainly based on the use of gas (65%) and coal (35%). As a result, almost all of the 98 million tonnes of methanol produced annually come from fossil energies. Only 0.2 million tonnes of "renewable" methanol are produced each year, mostly biomethanol from biomass. But other forms of "e-methanol", obtained from blue or green hydrogen, open up perspectives for developing a low-carbon alternative – largely depending on the market capacity to develop a sufficient supply of low-carbon hydrogen to satisfy all of its potential uses.

Methanol, which has a high octane rating, can be used as a fuel in internal combustion engines. Today, 31% of methanol is used to produce biodiesel, and 14% employed directly as a fuel.[32] Although it is widely used in urban transportation in some countries (like China), methanol is still rarely employed in maritime transport: only 11 ships are currently in circulation, and 35 are on order.[33]

Actors have nevertheless become more interested in this option over recent years. AP. Moller – Maersk, which has committed to only order ships able to operate on low-carbon fuels, for example, placed an order for six vessels running on methanol in October 2022, with delivery expected in 2025.[34] With the aim of ensuring supplies of around 730,000 tonnes/year of methanol starting from late 2025, the Danish shipowner has

d 1 tonne of ammonia requires 180 kg of hydrogen formed a series of strategic partnerships with industrial companies (including Orsted, Proman and European Energy) in order to develop bio- and e-methanol production.[35] CMA-CGM also ordered six ships operating on methanol in June 2022.[36]

BOX 2 • **KEYS TO UNDERSTANDING**

AMMONIA SEEN AS "ANOTHER" FORM OF HYDROGEN FOR THE ENERGY TRANSITION

Ammonia takes the form of a gas at room temperature and can be stored in liquid form once compressed (at -33 °C, against -253 °C for hydrogen). It is also cheaper than hydrogen to store in the long term ($0.5/kg-$H_2$ against $15/kg-$H_2$ for hydrogen), one to two times cheaper to transport by pipeline, and up to three times less expensive by boat. Therefore, more and more actors are thinking about using ammonia, in a similar way to hydrogen, as an alternative fuel for transportation or to supply gas or coal plants for example. The benefit of ammonia is that its combustion only generates water and nitrogen, and emits no carbonated molecules or soot particles. Japan in particular is banking on this molecule to reduce the carbon intensity of its maritime industry, transport hydrogen, and store energy. In November 2020, the Japanese Ministry of Economy, Trade and Industry (METI) announced the formation of a council to work on developing ammonia as an energy product. By 2030, Japan intends to import 3 million tonnes of "clean" ammonia, and to this end, is accelerating its international cooperation efforts (especially with the Middle East, Australia and New Zealand).

Electrification targets short-distance transportation and ships moored at the quay

Only very few large ships running on electricity or hydrogen have entered into service or even into the test phase. DNV currently lists 396 vessels in operation running on electric batteries or hybrid systems. The *Yara Birkeland*, announced in 2017 as the first autonomous container ship propelled by an electric battery, was named this year in Norway and has started a two-year test phase to attain certification.[37] To support its strategy of carbon neutrality by 2050, the port of Antwerp ordered a hydrogen-powered tugboat in 2019. Called *Hydrotug*, it is not due to enter into service for several years.[38] The Swedish company Stena Line, which already operates hybrid ferries (diesel-electric), announced in September that it would be launching a 100% electric ferry, the *Stena Elektra*, for journeys between Gothenburg and Frederikshavn (Denmark) – but not until 2030.[39] In addition to the obstacles related to the supply of strategic metals indispensable for manufacturing batteries, the negative environmental externalities of extraction, and the pressure on demand for electricity **(SEE "ROAD TRANSPORT" TREND)**, the electrification of ships requires creating a political, economic and infrastructural ecosystem shared by the ports of different countries. In fact, guaranteed access to charging stations and their compatibility with the different vessels are indispensable for the roll-out of electric ships. In the absence of an international agreement, port authorities and cities have set up bilateral and multilateral initiatives that aim to coordinate their efforts to reduce the carbon intensity of maritime transport.

BOX 3 • **EXPERIENCE FEEDBACK**

GREEN SHIPPING CORRIDORS

Green shipping corridors involve developing low-carbon commercial shipping routes between major ports, by promoting the deployment of low-emitting vessels, the installation of shore power facilities, and an incentivizing legal environment. One year after the Clydebank Declaration, a report by the Global Maritime Forum provides the very first overview of these fledgling initiatives: 21 green shipping corridor initiatives have been listed, twelve of them short distance and seven in the high seas. Nineteen of them are run by non-state actors: ports (9), industries (4), and public-private partnerships (9), and the remainder by states (3). At the moment, the targets fixed by these projects run from 2027 to 2030. For example, in January 2022, the ports of Los Angeles and Shanghai, joined by the port of Long Beach in June, in partnership with the global city network C40Cities, A.P.Moller–Maersk, CMA-CGM and other industrial and research actors, announced the kick-off of a project to create the first transpacific green shipping corridor between China and the United States;[40] the implementation plan of the corridor is expected in late 2022. At COP27 in Sharm el Sheikh, the Norwegian prime minister Jonas Gahr Støre and the US special presidential envoy for climate, John Kerry, officially launched the Green Shipping Challenge, an initiative aimed to encourage all actors in the maritime transport value chain to make concrete commitments to decarbonize the sector. About forty announcements were made during the conference to promote innovation for ships, the expansion of low-carbon fuels, and policies encouraging the adoption of new-generation vessels.[41]

Shoreside electricity for ships also reduces pollution in the ports. The activities associated with the highest-emitting port in Europe, Rotterdam, for example total almost 14 MtCO_2e, which is as much as the Weisweiler coal-fired plant in Germany, the fifth most emitting industrial site in Europe according to an assessment by the NGO Transport & Environment.[42] Of these emissions, 640,000 tCO_2e are produced by activities at the port site, i.e., loading, unloading and fuelling. The Alternative Fuels Infrastructure Regulation (AFIR) proposed by the European Commission as part of the Fit for 55 plan and voted by the European Parliament in October 2022 anticipates establishing minimum targets for shoreside electricity supply in sea ports.[43] The ports of Southampton (United Kingdom),[44] Sydney (Australia)[45] and the French Haropa Port complex (Le Havre, Rouen, Paris)[46] have for example launched works to install power supply facilities for ships at the quayside. Maersk has announced a plan to set up offshore charging stations to supply ships with electricity through underwater pipelines to avoid the combustion of fossil fuels when ships moor close to ports. The Danish group is planning to install ten buoys in 100 ports by 2028, to reduce emissions by 5 MtCO/year as well as air and sound pollution.[47]

BOX 4 • **EXPERIENCE FEEDBACK**

INNOVATIVE USE OF WIND POWER FOR BIG SHIPS

As part of the Fit for 55 plan, the European Commission has proposed the FuelEU Maritime directive, with the aim of driving the sector towards low-carbon fuel. In its position on the text adopted in October 2022, the European Parliament suggested a more ambitious reduction of the intensity of GHG emissions: 2% starting from 2025, 20% in 2035, and 80% in 2050. To achieve this, the Parliament rapporteur defends a "technologically neutral" approach, which gives shipowners the possibility of using methanol, hydrogen, advanced biofuels and… wind propulsion. In moving away from an approach centred on fuels and extending the scope of the text to "energies", the Parliament satisfies the demands of industrial and political actors that advocate the development of widescale wind-assisted propulsion, like the International Windship Association. In France, several projects are based on wind-assisted propulsion to transport goods. On a small scale, the Grain de Sail company makes transatlantic crossings using a 23-metre sailboat with a 350-tonne loading capacity to import chocolate and coffee from North America to Europe, which it then processes in Brittany in its own factories. This approach leads to a 97% reduction in the journey's carbon footprint.[48] A second ship is due to be launched in 2023. The French region of Brittany, with over 150 companies in the sector, announced that it was launching a new maritime transport activity by sailboat in November 2021.[49] The cooperative Windcoop will begin building a first ship with a load capacity of 1,400 tonnes in 2023 and inaugurate its activities in 2025 between France and Madagascar.[50] The TOWT (TransOceanic Wind Transport) project, backed by the European Union and French public donors, is pursuing similar objectives to increase transport of organic goods by sailboat from the port of Le Havre.[51]

Reorganizing logistics chains: the elephant in the room

Demand for transport of goods in tonne-kilometres is set to triple by 2050 if no action is taken.[52] This demand is the result of an intensification of international trade (tonnes), coupled with a logistics chain organization that involves very long distances (km). The latest IPCC report in fact explains that emissions from goods transportation grew faster over recent years than the total emissions from transportation of people, mostly due to a sharp increase in distances and trade. The report also highlights the need to integrate more mitigation options, and in particular to consider organizational and systemic changes, in addition to technological changes, if we want to reach carbon neutrality half way through the century.[53] Whereas technological avenues for deep decarbonization of long-distance ships and the production of low-carbon fuels are still far from mature, the reorganization of international value chains helps to reduce distances and the associated energy consumption, therefore decreasing the need for alternative zero-emission fuels and facilitating the penetration of alternative forms of motorization at regional level. This reorganization involves the transition from a production-consumption system towards more circularity, proximity and resilience to simplify and shorten value chains.[54] A recent study by UNCTAD for example characterized four main development trends in logistics chains (reshoring, diversification, regionalization and replication); three of them tend towards shorter, sometimes less fragmented chains.[55] Other reports observe a regionalization of trade and the shortening of current logistics chains, in particular in Asia.[56] At present, numerous non-coordinated public actions already underway are transforming international production and logistics chains, such as the development of new economic and industrial policies (e.g., reinforcement of regional and bilateral commerce, change in commercial and geopolitical alliances, reinforcement of national production strategies) or the development of new environmental policies (e.g. carbon emissions trading, carbon taxation at borders, zero-deforestation product regulations). Nevertheless, none of the strategies to reduce maritime transport emissions (not even the official IMO strategy) considers a real change in logistics chains.

KEY TAKEAWAYS

While the sector struggles to reduce its emissions in absolute value, the IMO is planning to revise the emissions reduction strategy for the shipping sector in 2023 by setting an even more ambitious target. Over recent years, international maritime transport actors have already made initial short-term technological choices: scrubbers to reduce sulphur emissions, LNG to reduce long-distance transport emissions, and electrification for short distances. However, these options will not be sufficient in the long term to considerably reduce the sector's emissions. The course is set, but alternative routes are emerging to reduce the climate impact of the sector. First, the reorganization of logistics chains around regional hubs can reduce the distance of international exchanges and the associated energy consumption. Second, still rather exceptional local initiatives are attempting to organize value chains based on transporting goods by sailboat. Alternative fuels based on hydrogen, such as methanol and ammonia, although still marginal on the market, are the object of increasingly large investments and feature in shipowners' decarbonization strategies. But the very low current production of low-carbon hydrogen (green and blue) and competition with other usages (decarbonization of industry, for example) raise the question of whether these alternative fuels are really capable of shifting the sector in the next few years.

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