TREND MARITIME

In the Midst of a Perfect Trade Storm, Shipping Companies' Climate Ambitions Remain a Dot on the Horizon

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Following heavy disruption due to the pandemic, maritime freight transport needs to keep up with the frantic recovery of international trade. This erratic economic situation highlights the difficulties faced by the sector in responding to interational agreements on reducing pollution and emissions.

DATA OVERVIEW

The global recovery in consumer demand throws maritime freight off course

Greenhouse gas (GHG) emissions from the maritime sector increased by 9.6% from 2012 to 2018, according to the fourth study by the International Maritime Organization on greenhouse gases[1]. Following a 3.7% rise between 2016 and 2017, emissions from the sector dropped slightly by 0.75% from 2017 to 2018. In 2018, total emissions from the sector (including international transport, domestic transport and fishing) amounted to slightly over 1,076 $GtCO_2e$, which is 2.86% of energy-related global emissions. 98% of these GHG emissions were carbon dioxide (CO_2). However, the study reports that from 2012 to 2018, emissions of methane (CH_4) rose sharply (+150%), while the global warming potential (GWP) of this gas is 86 times greater than that of CO_2 over 20 years. Three classes of ship alone are responsible for 55% of CO_2 emissions from the maritime sector: container ships (23%), bulk carriers (19%), and oil tankers (13 %)[2].

Globally, the maritime sector is regulated by the International Maritime Organization (IMO), a specialized United Nations agency that currently counts almost 140 member countries. Like international aviation, international maritime transport does not fall within the scope of the Paris Agreement. However, in April 2018, over one hundred states meeting at the IMO in London adopted a strategy to reduce emissions by at least 50% by 2050 compared to 2008. More precisely, the agreement establishes emissions reduction, for all international transport activities, by at least 40% by 2030 and up to 70% by 2050[3].

For years, shipping companies been claiming to have made great progress in saving energy and decreasing carbon intensity by applying various measures with an exponential impact, like reducing the cruising speed of ships[a]. Indeed, the average carbon intensity of the entire sector, whether related to ships or journeys, is currently 21~30% lower than it was in 2008, according to the IMO's Energy Efficiency Operational Indicator (EEOI). The sector also claims to be the most efficient transit method in terms of greenhouse gas emissions by volume of goods per kilometre (**fig. 1**): shipping covers about 80% of the volume and 70% of the value of international trade, but only emits 21% of the total emissions from freight. Nevertheless, most of this progress in efficiency was made prior to 2012, and the carbon intensity of activities has not decreased by more than 1% or 2% since 2015.

Due to the impact of the Covid-19 pandemic in 2020, the volume of commercial sea trade dropped by an estimated 4.1% in 2020, according to the UNCTAD Review of Maritime Transport published in November 2020[4]. This was the first decrease since

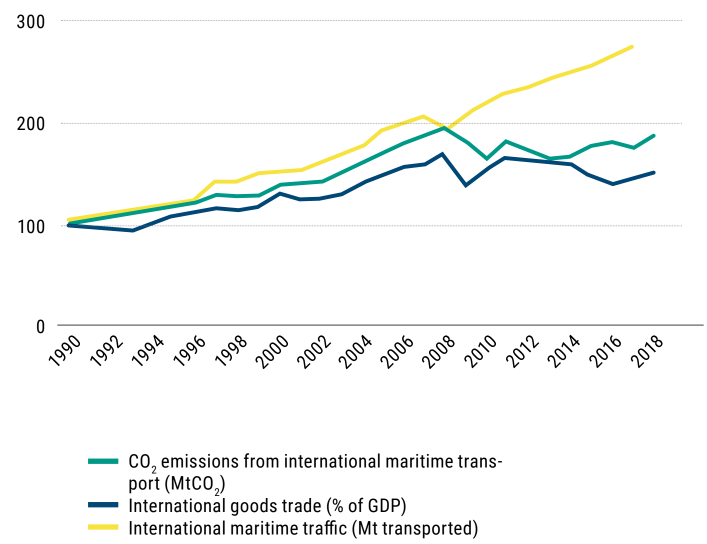
a There is in fact a cubic relationship between the reduction of a ship's speed and its fuel consumption: reducing speed by 10% brings down the required engine power by 27%. Therefore, covering an equal distance more slowly requires 19% less energy (Faber et al., 2017). Reducing speed is therefore a way for companies to decrease their emissions and save on fuel consumption. The Sector-based Report 2020 pointed out that numerous companies in the shipping sector support the proposal to make this measure compulsory, as presented to the IMO by the NGO Transport & Environment.

the financial crisis of 2008, mainly as a result of the interruption of supply chains triggered by successive lockdowns. However, figures were already pointing to a flagging shipping sector in 2019, when the growth in volumes transported slowed for the second year in a row, from 2.7% in 2018 to 0.5% in 2019. These figures are well below the average recorded from 1970 to 2017 (+3% a year). Global traffic of container ships, a key indicator of international trade performance, followed a similar decline, with growth slipping from 6.7% in 2017 to 2% in 2019[4, 5].

FIGURE 1

DECOUPLING OF EMISSIONS GROWTH AND INTERNATIONAL MARITIME TRANSPORT TRAFFIC

Source : Compiled by the author using IEA, UNCTAD and World Bank data



At the same time, the commercial vessel fleet had grown by 4.1% in 2019, primarily boosted by increased numbers of LNG carriers (+6.5%) and oil tankers (+5.8%)[4]. The sector therefore kicked off 2020 with an excess capacity for freight transport. This situation was highly detrimental to what is known as "freight rates", i.e., tariffs established by shipowners for the transport of goods: the greater the transport capacity, the lower the rates. For several years this situation had been reducing shipping companies' financial margins.

Covid-19 completely changed the situation. During spring 2020, oil tankers were called on to supplement storage capacities overflowing with excess oil supplies following reduced demand due to lockdown. This led to a spectacular increase in their freight rates, which then plummeted when the OPEC agreed to reduce its production.

Liquified Natural Gas (LNG), which at one point during the pandemic was the worst-performing energy product, went on to make up for its initial price drop with a moderate growth of 0.4% over the entire year, thanks to a pick-up in Asian demand (71% of global demand for LNG), in particular from China (+11.2%)[6]. Because it is liquified, LNG can be transported by sea, which is much more flexible than transportation through gas pipelines. The fleet of LNG carriers has therefore continued to grow (+7% in 2020) and now counts 572 ships around the world[7].

The recovery of international trade has had the biggest impact on freight transport by container ship. Demand for consumer goods and the reestablishment of production chains following the first lockdown measures led to a sudden increase in demand for maritime freight, to the point that it led to a shortage of containers in the first half of 2021, and probably longer. In fact, the problem was not so much the lack of containers as it was their unequal distribution on trade routes. Complications began when the anticipated recovery of Chinese production led to the delivery of manufactured goods (electronic, medical, etc.) ordered online during and after lockdowns in North America and Europe. Yet health restrictions imposed by China's main trade partners were still blocking their own production chains. Naturally, it was unthinkable for freight carriers to send empty containers back to China. As a result, ports in places like Los Angeles/Long Beach[8] and Auckland[9] found themselves piled up with empty containers, while ships were waiting offshore to be unloaded. In total, on 13 August 2021, 352 ships with a cumulated capacity of over 2.3 million tons in twenty-foot equivalent units (TEU)[b], were blocked at the entrance to a port somewhere in the world[10]. This global situation has also generated significant delivery delays that were occasionally exacerbated by crises like the six-day blockage of the Suez Canal[11], or the closure of ports in Yantian, Shenzhen[12], and Ningbo-Zhoushan[13] in response to new epidemic waves.

Large retailers were discontented with this general chaos, being obliged to deal with delayed deliveries and accumulate inventories, which was coupled with an increased demand for manufactured goods and online competition since the economic recovery. For example, the home furnishings specialist Home Depot, the multinational retailer Walmart, and the Swedish furniture store Ikea have had to take the exceptional measure of renting, and sometimes buying their own containers and chartering private ships in order to accelerate logistics[14].

The consequence of this situation is that container "freight rates" shot up by 258% from July 2020 to July 2021, according to the Freightos Baltic Index. For transit between eastern Chinese ports (Shanghai) and northern Europe (Rotterdam), the freight rate went up by as much as 666% over the same period: chartering a 40-foot container in July cost over $13,000[15], a record (**fig. 2**).

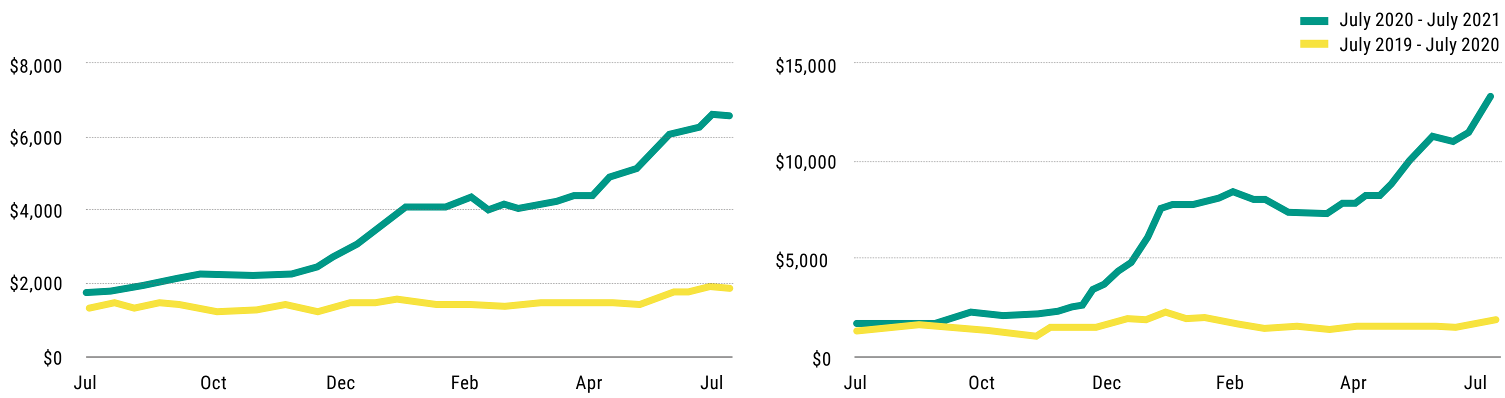
This situation therefore works to the advantage of major container shipping companies, which have been making record profits since the second half of 2020. In the first quarter of 2021, the earnings before interest and taxes (EBIT) generated per TEU reached a new high, in sharp contrast with the chronic

b A twenty-foot equivalent unit (TEU) is a unit of measurement that calculates the volume of merchandise transported based on the volume of a twenty-foot container. Forty-foot equivalent units are also used sometimes.

FIGURE 2

COMPARISON OF THE ANNUAL EVOLUTION OF THE INTERNATIONAL FREIGHT RATE AND THE FREIGHT RATE ON THE TRADE ROUTE FROM EAST CHINA TO NORTH EUROPE BETWEEN JULY 2019-JULY 2020 AND JULY 2020-JULY 2021

Source: Freightos Baltic Index, 2021



difficulties encountered by some companies like the Chinese shippers HMM and Cosco over the past decade and the Israeli ZIM (**fig. 3**). Less forthcoming about its financial results, which it does not publish, the Italian company MSC also appears to be in good shape since it is close to overtaking Maersk as the biggest container shipping group in the world in terms of capacity[16]. In all areas of maritime freight, orders for new vessels from shipyards increased by 119.7% during the first five months of 2021 compared to the same period in 2020. Orders for container ships in particular multiplied by twelve[17].

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 shippers start deploying strategies to implement them, these commitments sometimes reveal contradictions.

THE OBSERVATORY'S LENS

Faced with atmospheric pollution and climate change, maritime freight navigates between the devil and the deep blue sea

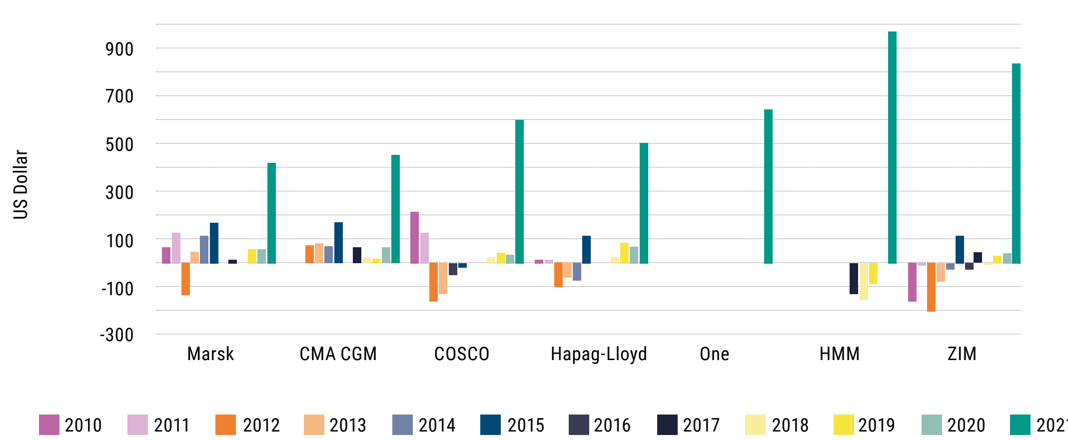
Scrubbers, a popular but double-edged technique to remove pollution

The IMO 2020 limit on emissions of sulfur oxides (SO_x) came into force on 1 January 2020. These particles are emitted by the combustion of HFO (heavy fuel oil), the fuel most commonly used by ships. Sulfur dioxide (SO_2) is well known for its harmful effect on human respiratory health and its role in the formation of acid rain. The IMO 2020 regulation reduces the maximum sulfur content permitted in fuel oil used on ships from 3.5% m/m (mass by mass) to 0.5% m/m. This new standard applies to all ships outside emissions control areas

FIGURE 3

EBIT PER TEU IN THE FIRST QUARTER OF 2021 FOR THE MAIN SEA CARRIERS

Source : Sea Intelligence, 2021



(ECAs): when they exist, ECAs can set even higher standards (0.1% m/m), such as in the Baltic Sea, the North Sea and the Caribbean maritime zone of the United States[18]. Voted in 2016 by the IMO's Marine Environment Protection Committee (MEPC), this new standard is an amendment to the International Convention for the Prevention of Pollution from Ships (MARPOL), adopted in 1973.

To meet these constraints, shipowners have several options: they can either replace HFO with a fuel that has a lower sulfur content but is much more expensive or requires technical adaptations, like VLSFO (Very-Low Sulfur Fuel Oil), MGO (Marine Gas Oil) or LNG (see below); or they can equip their ships with exhaust gas cleaning systems, known as "scrubbers", and continue to use HFO. The collapse of oil prices in the first half of 2020 — which greatly reduced the price spread between HFO and VLSFO, the main IMO-compliant alternative fuel — had cast doubt on scrubbers for a while, but they did capture the interest of shipping companies. In late 2020, over 4,000 ships around the world were equipped with a scrubber, which is twice as many as at the start of the year, according to BIMCO, a network of maritime actors that represent 60% of the global freight fleet[19]. Now stabilized at over $100/tonne, the spread between HFO and VLSFO is likely to continue to encourage sales of traditional fuel and so the installation of scrubbers in 2021[20]. Currently, demand for scrubbers is mainly boosted by numerous orders for new container ships from shipyards, explains Wärtsilä, a Finnish scrubber manufacturer[21].

Although it offers a solution to reduce atmospheric pollution, this technology does however raise other pollution issues. The most popular version on the market, which is cheap and easy to install, is the "open-loop" scrubber, which directly discharges cleaning water from the smokestack into the sea. This discharge is loaded with polycyclic aromatic hydrocarbons, nitrates, nitrites and heavy metals, contributing to the acidification of the sea and presenting a danger to marine life. Eighty percent of this cleaning water is discharged within the perimeters of Exclusive Economic Zones (200 nautical miles), within which sovereign states have the exclusive right to exploit resources[22]. For this reason, to date, over 32 states and port authorities have prohibited open-loop scrubbers, while others subject their use to certain conditions[23]. The Turkish Chamber of Shipping is one of the most recent bodies to have banned open-loop scrubbers[24].

The track record is not much better for VLSFO, with a recent study presented to the IMO revealing that it contains aromatic compounds that increase black carbon emissions by 10% to 85% compared to HFO[25]. Black carbon, which is dangerous for health, is a greenhouse gas with a short lifespan and a powerful radiative forcing effect. Resulting from the incomplete combustion of fuel, its global warming potential (GWP) is between 460 to 1,500 times greater than that of CO_2 during the four to twelve years that it remains in the atmosphere[26]. The main options open to shipping companies to remove pollution from their activities are therefore a double-edged sword in view of atmospheric pollution, as well as in contradiction with the climate targets established by the IMO.

Decarbonization options struggle to scale up

Since 2018, the IMO has been calling on shipping companies to reduce their GHG emissions by at least 50% by 2050 compared to 2008. Unlike air transport with Corsia (**see Aviation trend**), an emissions trading scheme is not yet in place in the maritime sector. But the subject reached the negotiation table this year, especially following pressure from the European Commission, whose Fit for 55 legislative package suggests including maritime transport in its carbon trading market[27]. The Marshall Islands, one of the three biggest ship registries in the world, joined forces with the Salomon islands to make a proposal to the Marine Environment Protection Committee (MEPC) at its meeting of June 2021 (**see Keys to Understanding**). The idea is to charge shipping companies $100 for each tonne of CO_2 equivalent their vessels emit starting from 2025[28]. Coupled with low-carbon technologies, a $100 charge would reduce emissions from the sector by 13% in 2030, estimates the fourth study by the IMO on GHG emissions[1].

KEYS TO UNDERSTANDING

MEPC 76: NEW TECHNICAL AND OPERATIONAL AMENDMENTS TO THE MARPOL CONVENTION TO REDUCE SHIPS' CARBON INTENSITY

During online meetings running from 10 to 17 June 2021, the 76th session of the IMO's Marine Environment Protection Committee (MEPC 76) ratified new technical and operational measures to guide the sector's efforts to reduce its carbon intensity. Voted in the form of amendments to the MARPOL convention, the decisions modify Annex VI of Chapter 4 of the convention, which includes instructions on the energy efficiency of ships. These new measures will come into force from 2023. An Energy Efficiency Existing Ship Index (EEXI) will apply to vessels of 400 Gt and over, to certify their energy efficiency in comparison with a reference value. Ships will therefore have to respect a particular level of EEXI, based on a reduction factor expressed as a percentage of the Energy Efficiency Design Index (EEDI), which already exists and applies to all new ships. The operational Carbon Intensity Indicator (CII) will apply to all ships of 5,000 Gt or over, which are already obliged to collect data on their fuel consumption. The CII will determine the annual reduction factor required to ensure continuous improvement of the boat's operational carbon intensity. Each ship's CII will be accompanied by a performance rating, and the IMO will leave it to the discretion of port authorities to create incentives to reach the highest ratings. Announced in autumn 2020, and supported by a coalition of EU Member States alongside Japan, China, South Korea and Norway, these new measures have not convinced NGOs. According to the International Council on Clean Transportation (ICCT), although limiting ships' engine power is theoretically the easiest way to respect the EEXI, in practice this power limitation will have little impact because ships already operate well below their maximum speed.

Source: IMO, 2021. ICCT, 2020

In the absence of more effective market instruments, the IMO is planning four other types of medium-term measures: the development of low-carbon (or even "zero-carbon") fuel, operational measures for the energy efficiency of ships, technical cooperation and capacity-building activities, and feedback mechanisms to share good practices[3].

Very few ships are powered by electricity at present, and those that are operate on low-volume and short-distance projects, like in the Norwegian fjords[29]. The *Yara Birkeland*, awaited since 2020 as the first battery-powered autonomous container ship, is still not in operation[30]. However, hydrogen-powered electric propulsion is an object of high expectations in the sector. Engine manufacturers like the Finnish company Wärtsilä and the German firm Man Energy Solutions are hedging their bets on the potentially massive use of decarbonized ammonia, a combination of nitrogen and hydrogen (NH_3)[31]. Japan, in particular, intends to develop its large-scale production by 2030. The shipping company NYK Line, the ship builder Japan Marine United Corporation (JMU), and the company ClassNK have signed a research and development (R&D) agreement to commercialize a ship running entirely on ammonia[32]. However, as pointed out by the International Chamber of Shipping, the energy density of ammonia is lower than that of oil, so much so that converting the entire international fleet would mean tripling production to reach 440 million tons, which would require no less than 750 GW of renewable electricity[33]. The processes currently used to produce hydrogen and ammonia mostly involve carbon and are much less competitive than VLSFO (**see Hydrogen trend**). A consortium of 26 companies and associations, led by the DNV GL consultancy company, has published a roadmap reflecting on regulation and safety issues concerning the use of hydrogen in ships[34].

At the moment, LNG is the preferred choice of shipping companies to navigate in ECAs and respect the IMO's new sulfur emission standard and low-carbon strategy. A total of 563 ships running on LNG are currently in operation or have been ordered, and another 199 are ready, according to DNV GL[35]. In early 2021, the number-two worldwide container shipper, CMA-CGM, launched the *Jacques Saadé*, the biggest container ship functioning on LNG in the world. With a capacity of 23,000 TEU, the *Jacques Saadé* corresponds to CMA-CGM's anticipation of the creation of an ECA in the Mediterranean Sea. It is the first vessel in a fleet of eight LNG-powered container ships planned by the French company[36].

Nevertheless, although LNG emits 25% less CO_2 than traditional ship fuels and contains almost no sulfur, the combustion of this gas is the reason for the increase in CH_4 emissions observed by the IMO in recent years[1]. These emissions are generated by the use of LPDF (low-pressure injection dual fuel) engines, the most widespread technology employed in LNG-powered ships, which gives off considerable methane fumes, in particular on ships carrying light loads[37]. According to a life cycle analysis by ICCT, the use of LNG with this technology generates 70% to 82% more GHG emissions than the alternative gas-based fuel, marine gas oil (MGO). In 100 years, provided a more effective technology is adopted, LNG could enable emissions savings of up to 15% compared to MGO; in 20 years, as climate action reaches a critical point, using LNG would generate 4% more emissions[38].

In a maritime transport market concentrated around three large alliances dating from 2017 (THE Alliance, Ocean Alliance and 2M Alliance represent 80% of global activities in volume), but whose financial results have fluctuated in recent years, the leading companies have embarked on a strategy involving the vertical integration of all logistics processes, based on their digital transition and the requirements of the low-carbon transition[39]. Cosco Shipping Lines, for example, has opened its first electronic platform in Spain to facilitate online reservations of transport space for its goods[40]. In Germany, A.P. Møller–Mærsk began converting its entire rail transport network this year to connect the port of Bremerhaven to the economic centres of Nuremburg, Munich, Stuttgart and Mannheim, thanks to a partnership with ERS/boxXpress.de, which operates electric trains running on hydropower. The initiative, known as CapO2, is supported by the recently created Maersk Mc-Kinney Møller Center for Zero Carbon Shipping, and is waging on (hydrogen) fuel-cell locomotives to save up to 9,000 tCO_2/year, according to the company[41]. MSC is also launching a new multimodal service to create a rail connection between Turkish ports and the city of Ludwigshafen in Germany, passing through Trieste in Italy. The aim is to reduce delivery times of manufactured goods, although the energy that will be used to carry them has not been stipulated[42].

Lastly, like in many industries this year, the buzzword used to describe shipping companies' climate strategies is "carbon neutrality". Aware that all areas of the industry will need to contribute to reach GHG emissions reduction targets, a group of US and Canadian companies created the Blue Sky Maritime Coalition. This strategic alliance, which features a wide range of actors including the oil group Shell, the Chamber of Shipping of America, the industrial tool manufacturer Caterpillar, and the port authorities of Vancouver and Houston Bay, wants to facilitate collaboration between regional and international players in the industry to encourage the adoption of good commercial and technical practices aiming to follow a "net zero" trajectory[43].

Numerous port authorities have joined the list of ports committed to becoming "carbon neutral", like Esbjerg (Denmark), the biggest port in the North Sea, in cooperation with the company Atos[44]; Yokohama (Japan), which has become an LNG fuelling station[45]; and the port of Gothenburg (Sweden), which invites roll-on/roll-off ships at berth to refuel from an electric station (shore power facility) rather than keep their motors running. Gothenburg intends to extend this facility to tankers in 2022, which would be the first of its kind in the world and would potentially reduce emissions by 2,100 tCO_2/year per boat[46]. The relative efficiency of this type of facility depends, as always, on the share of renewable energy in the mix that produces the electricity, and obviously on the type of usage it targets. Thus, according to the Environment Protection Agency (EPA), the installation of a shore power facility in 2023 in a new terminal at the port of Miami should result in a 35% reduction in emissions. Yet the initiative, the result of an agreement between the port and six cruise lines, may only be a drop in the ocean compared to the emissions from these vessels capable of transporting up to 5,000 passengers[47]. The same goes for their impact on atmospheric pollution: the 47 luxury cruise liners owned by a single company, the Carnival Corporation and PLC group, emit ten times more sulfur dioxide than the 270 million passenger vehicles circulating in Europe, according to an estimation by Transport & Environment in 2019[48].

KEY TAKEAWAYS

The intense recovery of international consumption of manufactured goods during and after lockdown measures have sent supply chains into the economic doldrums. Yet container ship companies have successfully ridden the storm, making record financial profits thanks to inflated freight rates, following a passage of several difficult years — an economic situation that they are using to extend their load capacities and integrate value chains rather than to reduce the environmental impacts of their operations.

Forced by the International Maritime Organization to find new solutions to reduce their sulfur and greenhouse gas emissions, shipping companies are proving slow to engage any real changes. Worse still, the most common solutions for reducing pollution (smokestack scrubbers) and for decarbonization (LNG fuel) are often contradictory and generate externalities that work against one target or another. To date, the IMO has shown little inclination to impose any of the more ambitious proposals put forward by some of its members, such as obliging ships to reduce their speed, regulating black carbon emissions, or setting up a carbon trading market.

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