Sustainable Shipping and Ports: Levers of Change

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Abstract

Sustainable shipping and ports refers to the broad set of challenges, nature of governance rules and regulations, patterns of management and corporate behaviors and aims, engagement of stakeholders, and forms of industrial activity that should come to define a marine transport industry that is shaped by the broader societal goals of sustainable development. This paper aims to provide a brief overview of the marine transport industry, its role and relevance in sustainable development and the kinds of changes that are needed for shipping and ports to be sustainable. The focus is mostly on the environmental dimension of sustainable development. Shipping as a sector, and for reasons that have to do with the special nature of its international governance that partly falls outside the confines of national jurisdictions, shipping may have been a late comer to some of the most pressing sustainability challenges of our time. After presenting some recent economic trends of the sector and their potential implications for sustainability the chapter will present some environmental pressures that are related to shipping and will focus on two particular sustainability challenges confronted by maritime transport: the need to drastically reduce sulfur emissions and the even more demanding challenge to mitigate CO_2 emissions. However Ports and Shipping are intrinsically linked – as such efforts to reduce maritime emissions need to extend beyond seagoing ships alone. IMO's MARPOL Annex VI (2010) regulations on air pollution and energy efficiency are aimed at ships but it is clear that in order for port emissions to be reduced, emissions from all port-related emission sources need to be addressed.

Before concluding, the penultimate section will briefly present some sustainability initiatives already under way.

Key words: Sustainable shipping and ports, maritime transport, CO2 emissions mitigation, EU ETS.

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1.1 Introduction

Two landmark agreements adopted in 2015 are the 2030 Agenda for Sustainable Development under the framework of the United Nations Sustainable Development Summit and the Paris Agreement on climate change under the auspices of the United Nations Framework on Climate Change (UNFCCC). None of the 17 sustainable development goals (SDGs) is dedicated to the thematic area of transport. In elaborating the goals the international community recognized that by integrating and mainstreaming transport considerations into a range of SDGs its cross-sectoral nature would be a critical enabler of most of them (Benamara, Hoffmann, & Youssef, 2019).[4]

Maritime transport is an economic sector in its own right. With 80% of international merchandise trade by volume and over two thirds by value in 2017 (UNCTAD, 2018), it is central to the sustainability agenda. Maritime transport links almost all countries relevant supply chains, supports international production processes, carries international trade and provides access to the global markets. In addition, many sectors and industries are intimately linked to marine transport: marine equipment manufacturing, marine auxiliary services (e.g., insurance, banking, brokering), fisheries, tourism, ship building and demolition, offshore energy (Benamara, Hoffmann, & Youssef, 2019).

Maritime transport can be seen as environmentally friendly relative to other modes of transportation when measured in tonne-miles (weight per distance travelled). In conjunction with its strategic economic and social function of supporting international trade it can be viewed as an important sustainable development enabler (Benamara, Hoffmann, & Youssef, 2019). Unsustainable transport pattens, however, are linked to numerous social costs in the form of air and marine pollution, GHG emissions, resource depletion and biodiversity loss among others.

Ports and Shipping are intrinsically linked – as such efforts to reduce maritime emissions need to extend beyond seagoing ships alone. IMO's MARPOL Annex VI (2010) regulations on air pollution and energy efficiency are aimed at ships; however, it is clear that in order for port emissions to be reduced, emissions from all port-related emission sources need to be addressed. Environmental challenges relating to ports are twofold, namely the effects of maritime transport on the environment (e.g. pollution, CO2 emissions) and conversely the environmental impact on maritime transport (e.g. Climatic Variability and Change, (CV&C)) (Asariotis, Benamara & Mohos-Naray, 2017).

In this regard, it is important to address the global challenges effectively, in the light of the Paris Agreement and the 2030 UN Sustainable Development Agenda. Reducing the sources of GH emissions and of marine pollution emanating from the port industry as well is of growing importance and source of anxiety for port authorities, policy makers, port users and the local communities (Acciaro, Ghiara & Cusano, 2014).

Sustainability in maritime transport involves, inter alia, the ability to provide transportation infrastructure and services that also further the multiple dimensions of sustainable development. For instance: safety, accessibility, social inclusivity, reliability, fuel-efficiency, affordability, environment-friendly, low carbon and climate resilient. Figure 1 provides an overview of the intersection between the three pillars of sustainable development as they relate to the marine transport sector.

4. This chapter draws heavily on Benamara, Hoffmann, and Youssef (2019) and UNCTAD (2018)

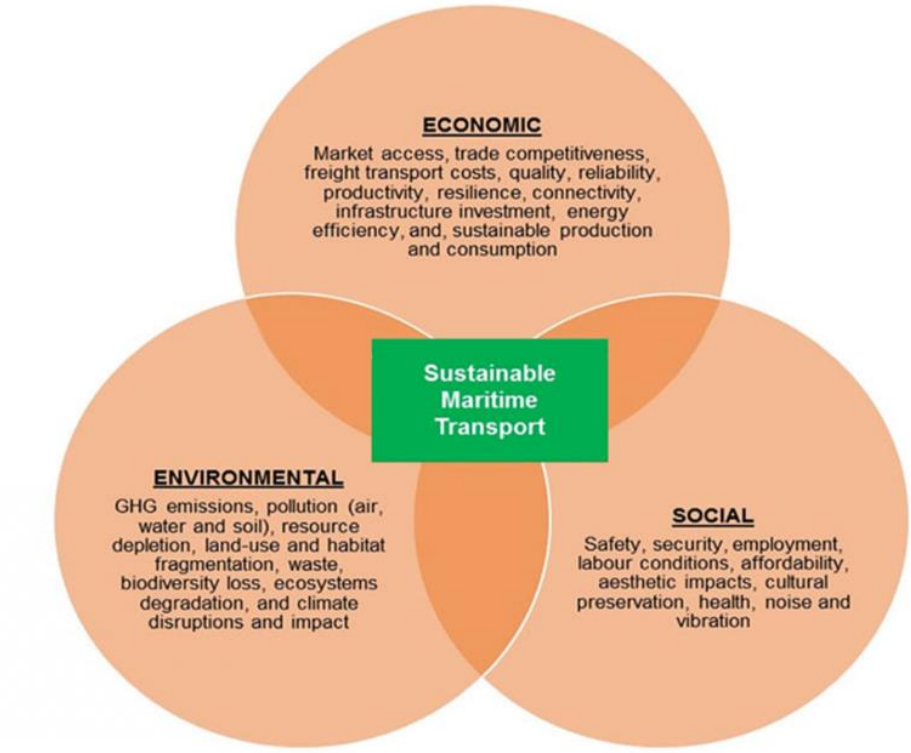


Figure 1 - Source: UNCTAD (2015)

1.2 Recent economic trends for maritime transport

Demand for maritime transport increases in tandem with gross domestic product and industrial production. OECD (2017b) projects the tripling of total freight transport demand over the 2015-2050 driven mostly by economic growth with maritime transport accounting for 75% (up from 71% in 2015). The projected increase in total freight transport is expected to translate into 120% increase in CO_2 emissions (OECD, 2017b).

Climate change impacts in the form of rising water level, floods, storms, precipitation and extreme weather events are likely to have significant effects on transport networks and seaports (Asariotis, Benamara, & Mohos-Naray, 2017). Enhancing climate resilience of the maritime transport system will also be critical for sustainability.

1.3 Environmental pressures from shipping

A number of environmental pressures are associated with the marine transport industry. Various types of wastes are generated by ships such as oily wastes, drainage from bilges, sewage and garbage and cargo residues. Harmful aquatic organisms and pathogens can be transferred between marine ecosystems through ships' ballast waters and sediments. About half of global crude oil production is carried by sea making oil spills a major pollution risk. Two new challenges for sustainable shipping are the reduction of sulfur dioxide and greenhouse gas emissions. The new IMO regulations on sulfur dioxides aims to drastically lower the sulfur cap for air emission from ships. This paper will focus on the challenge of mitigating greenhouse gases.

1.4 New challenges to sustainable shipping

1.4.1 CO_2 emissions

All transport accounted for 24% of the world CO_2 emissions from fuel combustion in 2015. Total shipping emissions reached approximately 938 million tons CO_2 emissions in 2012 with international shipping representing 85% for this total accounts for 2.2% of global total CO_2 emissions (OECD, 2017a). Depending on economic growth and global energy demand international carbon emission could increase by 50-250% by 2050 (IMO, 2014).

International shipping emissions were notably absent from the Paris Agreement. CO_2 emissions from international shipping have grown more slowly than international trade. This decoupling reflects increases in shipping efficiency (with slow steaming, increased size of ships and other operational measures playing a key role rather than technological innovations). There is presently no global mechanism to control CO_2 emissions beyond the efficiency standards for new-build ships (Traut et al., 2018). The Kyoto Protocol mandated its parties to work through the IMO for emission reductions from international shipping. For international aviation emissions it mandated the International Civil Aviation Organization (ICAO) (UNFCCC, 1997). Parts of the shipping industry have argued that shipping should have a more limited role in emission reductions because of its 'vital role' in serving developing economies (drawing on the notion of Common but Differentiated Responsibilities and Respective Capabilities) and because shipping has fewer opportunities to decarbonize relative to other sectors (ICS, 2016).

IMO adopted a mandatory data collection system for fuel consumption of ship in 2016 and in April 2018 the IMO Marine Environment Protection Committee (MEPC) adopted an initial strategy on GHG emissions reductions from ships (IMO, 2018). This strategy entails the first global climate framework for shipping and includes quantitative GHG reduction targets through 2050 as well as a list of candidate policy measures to help achieve these targets. A key target is to reduce CO_2 emissions per transport work as an average across international shipping by at least 50% by 2050 compared to 2008 while simultaneously pursuing efforts to at total phase out. Market-based measures (MBMs) are considered as potential measures. More generally the international community under the auspices of IMO/UNFCCC has seen a number of proposals in the form of incentivizing shipping companies to reduce carbon through operational changes or adoption of more carbon-efficient vessels, the introduction of a carbon tax on shipping, or emission trading mechanisms.

In the short-term CO_2 intensity of shipping can be reduced by a number of measures like changes to speed, ship size and utilization, retrofit technologies and other efficiency measures. Slow steaming, a practice of deliberately lowering he speed of a ship to reduce fuels costs is one suggested response to the sulfur cap. It proved very effective when the shipping industry was hit hard buy the oil rally of 2002-2008. Slow steaming even in a lower oil-price environment can help mop up excess capacity when the shipping markets are oversupplied.

Energy efficiency is also an important means of reducing air pollution. One study that considered 22 potential ship efficiency measures found that a reduction of 33% of CO_2 emissions could be achieved by 2020 (ICCT, 2011). Another study found that energy-saving could reduce CO_2 emissions by 50% by 2030 (Alvik, Eide, Endresen, Hoffmann, & Longva, 2010). Energy efficiency has been promoted in the maritime transport sector through regulatory measures in force since 2013.

Virtually full decarbonization will be needed in the longer term that will mean fleet-wide deployment of near-zero carbon ships. This is a great challenge given the very short time frame (Traut et al., 2018). Bouman, Lindstad, Rialland, and Strømman (2017) review around 150 studies to provide a comprehensive overview of CO_2 emissions reduction potentials and measures published in the literature and find that emissions can be reduced by more than 75% based on current technologies (and through a combination of the proposed measures) by 2050.

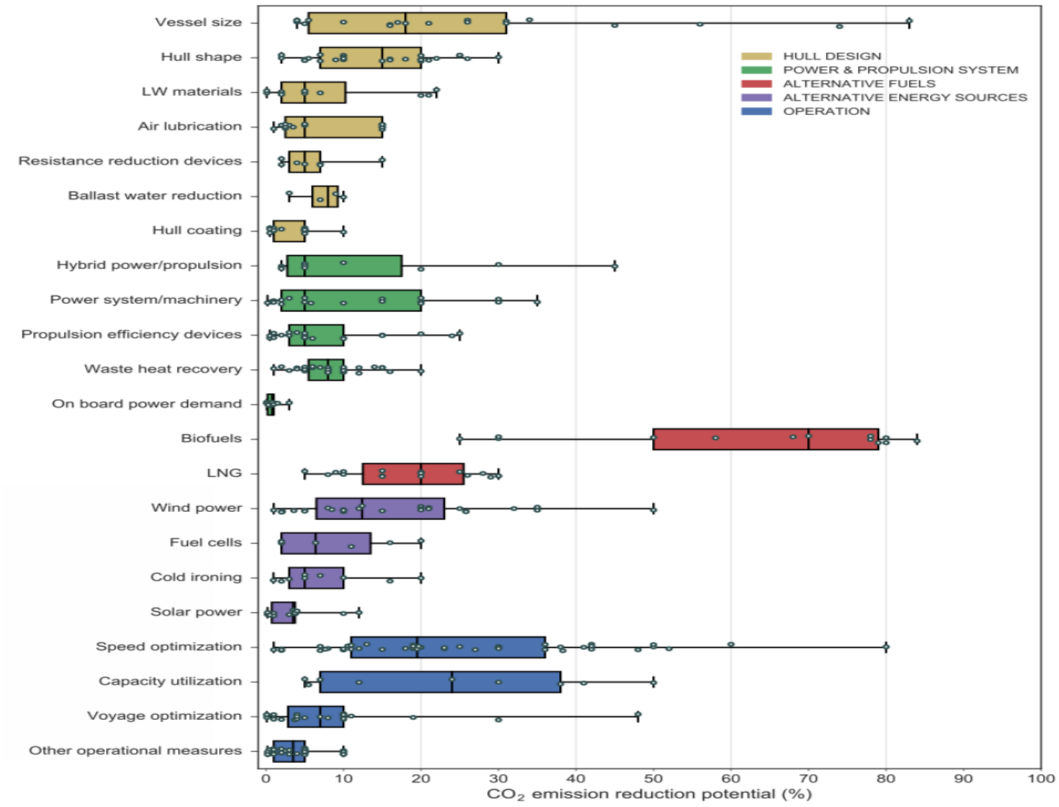


Figure 3 - CO2 emission reduction potential from individual measures, classified in 5 main categories of measures. Source: Bouman et al. (2017)

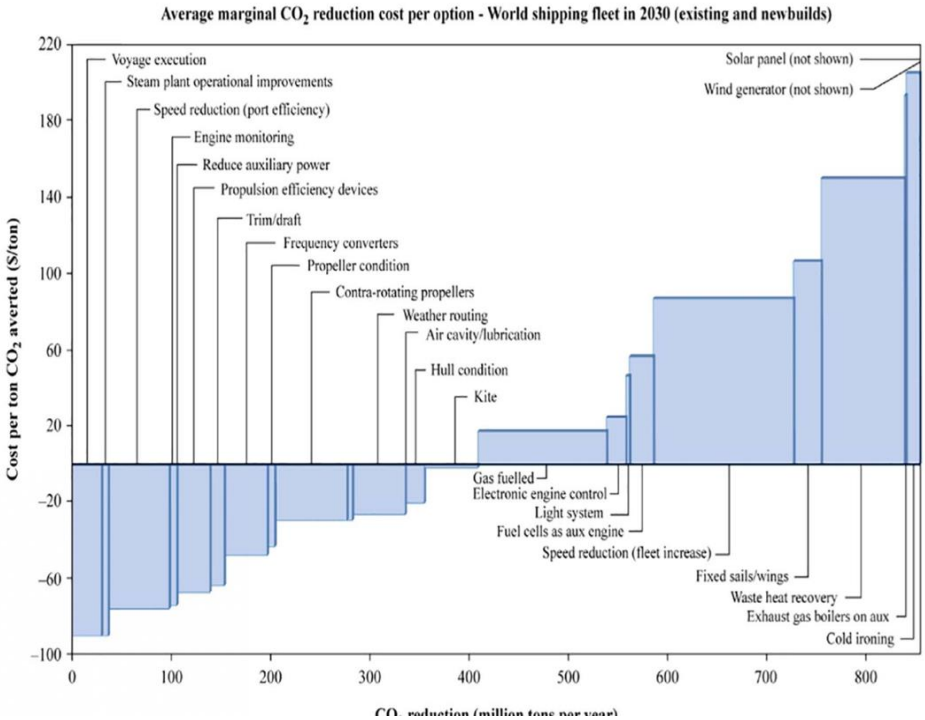


Figure 4 - Average marginal CO 2 reduction cost per option. Figure adapted from the study by Eide, Longva, Hoffmann, Endresen, and Dalsøren, B. (2011). Source: Wan, el Makhloufi, Chen, and Tang (2018)

Psaraftis and Zachariadis (2019) highlight some issue in the discussion about the use of alternative fuels for marine use for GHG reductions. Many of what are called “clean burning” fuels may be correctly labelled as such when focusing on SOx, NOx and particulate matter but not when the GHG footprint is considered. When considering the life cycle GHG footprint of nearly all proposed alternative fuels, they are worse than conventional liquid fuels (marine gas oil (MGO), marine diesel oil (MDO), or desulfurizer fuel oil). For instance, when taking into account its life cycle methane slip LNG’s global warming effect is much worse than conventional liquid fuels and possibly even worse than coal.

1.4.2 Market-based mechanisms for GHG mitigation

Several market-based mechanism proposals have been submitted to the Maritime Environment Protection Committee (MEPC). Importantly, in February 2017 the EU parliament voted to include shipping into the EU-ETS as of 2023 if there is an absence of action from the IMO by 2021. This caused concern among industry stakeholders that such a regional MBM would create distortions and may not lead to reduced CO_2 emissions, though the intent is to catalyze global action (Balcombe et al., 2019).

Broadly speaking market-based approaches can be divided into three categories: environmental price control approach, environmental quantity control approach, and subsidies. The environmental price approach can involve emissions charges or charges on fuels. The latter means that some opportunities for decoupling are lost, e.g., carbon capture, but may be easier to enforce. Kosmas and Acciaro (2017) consider bunker levy schemes for GHG emission reductions in the form of a unit-tax per ton of fuel and an ad-valorem tax. While recognizing that MBM’s do not seem to be up for discussion in the foreseeable future Psaraftis (2019) sees the idea of a significant bunker levy at a global level worth pursuing. He points to how higher fuel prices in Europe and Japan have had a significant impact on

the fuel-efficiency of their cars relative to the USA. Importantly a levy (or any charge resulting from tax or permits) should not be confined to marine transport as this could lead to a modal shift to land-based modes that are generally greater emitters of GHG.

The emission quantity control approach includes credit programs that provide operators with credits to if they undertake or support activities that reduce emissions. Benchmarking trading programs sets an average emissions level that should not be exceeded and usually allow for offsetting as opposed to elimination of emissions. A cap-and-trade program sets a total aggregated cap on emissions and allocates emission allowances that can then be traded by emitters.

Subsidies can be used to provide direct financial support for mitigation. Under the Freight Technology Incentives Program subsidies are provided by Transport Canada to encourage the employment of energy efficient technologies (Nikolakaki, 2013).

The global application of market-based measures is essential to avoid carbon leakage and competitive distortions especially given the relative ease with which ships are able to change their legal jurisdiction and register flags of convenience with more lenient carbon regulation. A maritime ETS or a carbon tax, or some hybrid system of emission trading with a price floor and/or ceiling could provide cost-efficient emission reductions allowing for the fullest range of responses by ship owners. An additional advantage of a tax or auction of permits is that the funds raised could be used to support technological innovation, cover administrative costs and be used to re-distribute funds towards developing countries and climate change funds. A key challenge for such a system is the costs of administering, monitoring and enforcing these measures. Given the myriad of options available for mitigation in the shipping industry market-based mechanisms have the advantage of not attempting to pick the technological or operational fix. On the other hand, a short-term option like LNG may require a combination of subsidies and port dues to effectively accelerate the large capital infrastructural costs involved.

1.5 Sustainability initiatives in maritime transport

Beyond regulatory measured and IMO strategies there have been a number of Government led initiatives for sustainability in transport more generally and maritime transport in particular that have emerged. There are also numerous industry-led voluntary actions and initiatives. Maersk, for instance, has developed an “eco voyage” maritime software tool which can help cut fuel costs and make a voyage plan resulting in minimum fuel consumption. CMA CGM decided to equip its future giant containerships with engines using LNG meant to bring about large reductions in pollution emissions. Examples of voluntary self-regulation in maritime transport include the Clean Cargo Working Group that provides tools to help understand and manage sustainability impacts, the Sustainability Shipping Initiative that brings leading companies to promote a sustainable future, and Eco-Ships that involves investing and ordering a new generation of vessels that are eco-friendly and at the same time fuel efficient.

Beyond government and industry led initiatives, shipping firms are responding to the rapidly evolving regulatory challenges as well as the institutional pressures from civil society and investors. The Environmental, social and governance (ESG) rating industry is putting pressure on international and domestic companies to improve their sustainability profile. ESG reports, ratings and indices are increasingly relied upon by institutional investors, asset managers and financial institutions and other stakeholders to assess and measure company sustainability performance. In response to the greater demand of stakeholders for greater transparency in sustainability matters, shipping companies may undertake sustainability reporting on their own and in conjunction with third party certification agencies. For a company to achieve good sustainability ratings or to gain certification for (dimensions of)

sustainability ultimately it needs to adjust or fundamentally alter its strategic vision and management approach. Many shipping firms are placing importance on environmental protection when performing shipping activities such as mega carriers (e.g., Hapag-Lloyd, APL, K Line, Maersk, NKY, and OOCL) and giant shippers (e.g., IKEA, Mattel, Nike, Home Depot, and HP) that are members of the Clean Cargo Working Group looking to integrate sustainability business principles into transport management.

2.1. Ports role in reducing the global carbon footprint

Environmental sustainability in the port sector relates to environmental performance and management. Seaport environmental management progressed over the last decades from a 'point focused' seafront-based exercise to an integrated seaport area management concept. The concept of ports as facilitators refers to the contribution that ports can make in assisting the whole port community (including partners in the logistic chain) to deliver compliance with legislation, prevention of pollution, reduction and mitigation of environmental impacts, sustainable development and evidence of satisfactory performance. Environmental reporting is also becoming increasingly important for ports in the face of growing environmental concerns and stakeholder pressure from market players, public bodies and social interest groups. This resulted in the development of the port practice to include the sustainability performance, as part of the annual corporate social responsibility and financial report.

In view of the differences among ports and the changing nature of the environmental challenges that ports face, the establishment of an environmental management system is considered of utmost importance. A systematic approach to environmental management system enables the continuous identification of an individual port’s priorities while it introduces a functional organisational structure that sets respective targets, implements measures, monitors impact, evaluates, reviews and takes corrective actions when and where necessary. In this way, ports can achieve and demonstrate continuous environmental improvement towards sustainability. A set of indicators, both qualitative as well as quantitative, visualizing the environmental sustainability perspective has been identified under several scientific studies (Puig, Wooldridge & Darbra, 2014). Indicators which formulate the port's environmental sustainability constitute inter alia, waste management and handling, ballast water and water conservation and quality, air quality and reduction of emissions, noise control, energy efficiency and transition to cleaner energy.

Evaluating air pollution impacts of ports requires consideration of numerous sources, including marine vessels, trucks, locomotives, and off-road equipment used for moving cargo. By going digital, connectivity and automation may reduce environmental footprints of the port industry along with intelligent transport systems, which have a significant potential to reduce CO2 emissions. Approaches to mitigation encompass a range of possibilities from currently available, low-cost approaches, to more significant investments for cleaner air, such as restrictions on truck idling and the use of low-sulfur diesel fuel; the latter includes shore-side power for docked ships, and alternative fuels (Bailey & Solomon, 2004). A variety of further measures are suggested towards the reduction of port emissions such as: introducing differentiated port dues, providing onshore power supply/ 'cold ironing', switching to low-sulphur fuels at berth and establishing speed limits in ports. In addition, the improvement of the exchange of information between ports and ships so that ships are able to sail at optimal speed (virtual arrival) is of great importance. Another potential measure is giving preferential treatment to harbour crafts with engines that meet stringent emissions standards while on the other hand, strengthening port State control inspection regimes for visiting ships, relating to compliance with MARPOL, Annex VI. Finally, the designation of additional emission-control areas leading to stricter environmental emission standards enforced at certain ports (ships going through them should use fuel with a sulphur content

lower than 0.10 per cent (below the 0.5 per cent limit applicable on 1 January 2020), could make a significant difference (UNCTAD, 2019).

According to the analysis report published by the International Transport Forum (ITF) in 2018, ports play a significant role in reducing the global carbon footprint of maritime shipping and consequently portside measures can significantly add to the environmental performance of shipping and the decarbonisation of maritime transport. Currently 28 of the 100 world's largest ports (in terms of total cargo volume handled) offer incentives for environmentally friendly ships. However, green incentives typically apply to the 5% of the ships calling at a port with an incentive scheme. Only five ports use CO2 emissions as a substantial criterion for incentives.

Furthermore, the existing port-based measures establish that market interventions are needed to reward clean performance. The fact that financial incentives have been chosen implies that there is support for flexible measures to drive behavioural change. However, more emphasis is needed on monitoring, reporting and verification of the impacts of these measures. More could also be done to enshrine the 'polluter pays' principle. Higher rates of differentiation between vessels based on their environmental performance could drive more and faster change. It is possible within the policies to differentiate fees according to type of vessel, enabling the economic activities that can afford to pay, to undertake more of the responsibility for acting.

A project on the Environmental Impacts of International Shipping and the role of ports, that took place under the aegis of OECD, showed that while it is difficult to identify 'best practices' for all the environmental impacts that port activities generate, the introduction of shore-side electricity supply ('cold ironing') is identified as a specific measure that would have the advantage of reducing several negative impacts simultaneously, such as SO2, NOx and particulates emissions, noise and, possibly, CO2 emissions.

2.2. Environmental Ship Index (ESI) and Port Emissions Toolkits

The International Association of Ports and Harbours has set up a World Ports Sustainability Program (WPSP) guided by the 17 UN SDGs in order to enhance and coordinate future sustainability efforts of ports worldwide and foster international cooperation with partners in the supply chain.

One of the projects within WPSP is the Environmental Ship Index (ESI) which identifies seagoing ships that perform better in reducing air emissions than required by the current emission standards of the International Maritime Organization. The ESI evaluates the amount of nitrogen oxide (NOx) and sulphur oxide (SOx) that is emitted from a ship via a reporting scheme and is intended to be used by ports to reward ships but can also be used by shippers and ship owners as their own promotional instrument.

Toolkits to tackle ship and port emissions have been developed under the GEF-UNDP-IMO Global Maritime Energy Efficiency Partnerships (GloMEEP) project in collaboration with its partners, the Institute of Marine Engineering, Science and Technology (IMarEST) and the International Association of Ports and Harbors (IAPH). By virtue of utilizing these guides, national strategies can be developed which address emissions from the maritime sector as a whole – protecting public health and the environment while contributing to the fight against climate change.

2.3. EU policies on Sustainable Ports

The EU has already in place an extensive and comprehensive regulatory environmental framework with which the European Ports' Environmental Policies must be aligned, while new stricter environmental protection measures are on the way with the introduction of the European Green Deal (European Commission, 2019). The Green Deal seeks a 90% reduction in the transport emissions by 2050, while it boosts the supply of sustainable alternative transport fuels - biofuels and hydrogen – which will be promoted in aviation, shipping and road transport. In addition, the European Green Deal purports to extend emissions trading to the maritime sector as well. Most importantly, the circular economy, including new waste and recycling laws is erected as ' utmost priority' of the European Green Deal in the EU's effort to achieve net-zero carbon emissions by 2050.

The European Sea Ports Organisation (ESPO) welcomed Europe's objective set out in the European Green Deal to become the world's first net zero emission area by 2050 and to reduce emissions by 50% towards 55% compared with 1990 levels by 2030. To this effect, ESPO recognizes the importance of LNG as a transition fuel - LNG has been one of the compliant fuels for shipping to meet the 0.1% Sulphur cap in SECA areas (since 2015) and the overall 0.5% sulphur cap (effective as of 1 January 2020) - and considers Onshore Power Supply (OPS) as an important pillar of the future energy landscape.

2.4. EcoPorts Environmental Report

EcoPorts constitutes the main environmental initiative of the European port sector fully integrated into the European Sea Ports Organisation (ESPO) whose founding principle is to create a level playing field on environment through cooperation and sharing of knowledge between ports. In particular, the ESPO Green Guide specifically addresses five major environmental issues, namely; air quality, energy and climate, noise, waste management and water quality, accompanied by a best practice database which promotes existing port projects. EcoPorts provides two well-established tools to its members: the Self Diagnosis Method (SDM) and the Port Environmental Review System (PERS, certificate assessed by Lloyds register). The SDM is a well-established and widely adopted, time and cost efficient methodology for identifying environmental risk and establishing priorities for action and compliance while SDM Comparison compares the port's SDM score with the European average. Accordingly, the SDM Review aims at receiving expert's advice and personalized recommendations.

The following ESPO (2019) Environmental Report provides the latest trends of European sea ports concerning environmental issues. A set of environmental indicators were selected from the SDM to assess the environmental performance of EU ports. *Table 1* presents the results of a set of selected environmental management indicators that are included in the EcoPorts' Self Diagnosis Method (SDM) providing information about the management efforts that influence the environmental performance of a port and it includes the percentage of positive responses to these indicators for the year 2019 as well as for 2013, 2016, 2017 and 2018 in order to analyse the variations over time.

Over the last years, the existence of an inventory of relevant environmental legislation has been the indicator with the higher percentage of positive responses demonstrating the awareness of ports about the requirement to comply with legislation. The indicator on the existence of an Environmental Policy (95%) follows in the second position, evincing ports' environmental commitment.

The definition of objectives and targets as well as the existence of an inventory of Significant Environmental Aspects (SEA) are elements that are present in most of the ports (around 90%). Consequently, ports are not only willing to implement an Environmental Management System but also commit to comply with the standards in order to be certified.

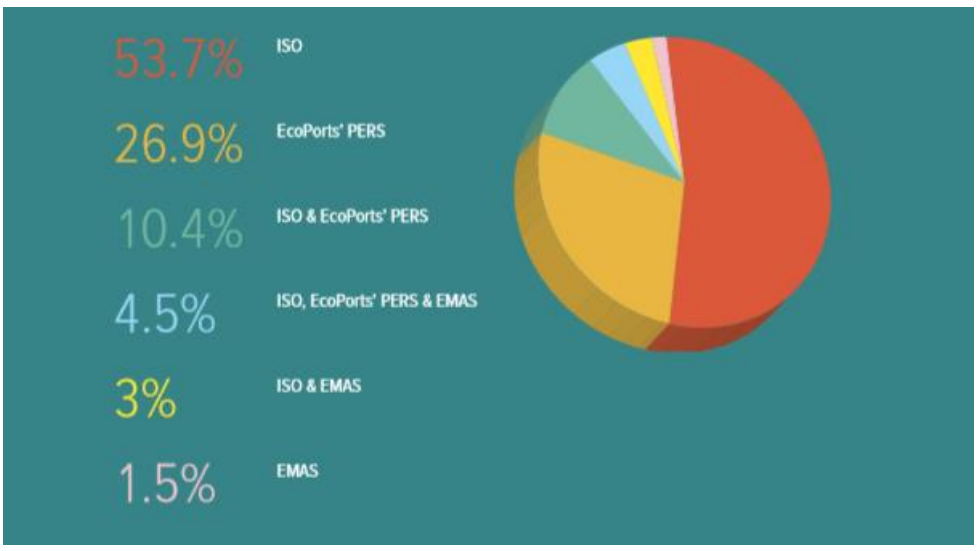
Table 1 – Percentage of positive responses to environmental management indicators

(source: ESPO (2019))

	Indicators	2013	2016	2017	2018	2019	CHANGE 2013–2019
A	Existence of a Certified Environmental Management System –EMS (ISO, EMAS, PERS)	54	70	70	73	71	+17%
B	Existence of an Environmental Policy	90	92	97	96	95	+5%
C	Environmental Policy makes reference to ESPO's guideline documents	38	34	35	36	38	–
D	Existence of an inventory of relevant environmental legislation	90	90	93	97	96	+6%
E	Existence of an inventory of Significant Environmental Aspects (SEA)	84	89	93	93	89	+5%
F	Definition of objectives and targets for environmental improvement	84	89	93	93	90	+6%
G	Existence of an environmental training programme for port employees	66	55	68	58	53	-13%
H	Existence of an environmental monitoring programme	79	82	89	89	82	+3%
I	Environmental responsibilities of key personnel are documented	71	85	86	86	85	+14%
J	Publicly available environmental report	62	66	68	68	65	+3%

Table 2 below demonstrates the number of ports that are certified with an internationally recognized environmental standard (Environmental Management System-EMS). Out of the 71% of ports with a certified EMS, more than half have opted for ISO 14001 (53.7%) and almost one third of them for EcoPorts' PERS (26.9% - Table 15), making ISO and PERS the most popular standards in the port sector. Additionally, there are ports certified with more than one standard, manifesting the willingness of the sector to contribute to greening the supply chain.

Table 2 - Breakdown of the EMS Certificates (source: ESPO (2019))



2.5. Green Services to Shipping

The EcoPorts SDM was updated in 2016 to enable the monitoring of the status and evolution of the green services that ports may choose to provide to their stakeholders. The results are benchmarked and presented in the following *Table 3* covering the period from 2016 until 2019. As shown, more than half of the ports use OPS at their berths. In absolute figures, the ports offering OPS have increased from 32 (2016) to 50 ports (2019). These results offer encouraging perspectives for the particular measure. However, the price differential between electricity and marine fuel and increased investment costs are the most significant barriers for the uptake of OPS. A recent evaluation paper of the European Commission on the Energy Taxation Directive (ETD) identified the problematic situation on OPS and recognised that 'the ETD does not provide for EU-wide preferential tax treatment of shore-side electricity and as a result, shore-side electricity is disadvantaged compared to onboard generation'.

Taking into consideration these challenges, the Energy Taxation Directive should be reviewed to provide a permanent EU-wide tax exemption for OPS in order to be on equal terms with electricity generated on-board of the vessel which enjoys a tax exemption.It is to be noted that investments in shore-side electricity remain high-risk investments since there is no guarantee or requirements whatsoever for the use of the available installations once provided. Co-funding of these investments by the users could contribute to sharing this risk.

Table 3: Onshore power supply (OPS) (source: ESPO (2019))

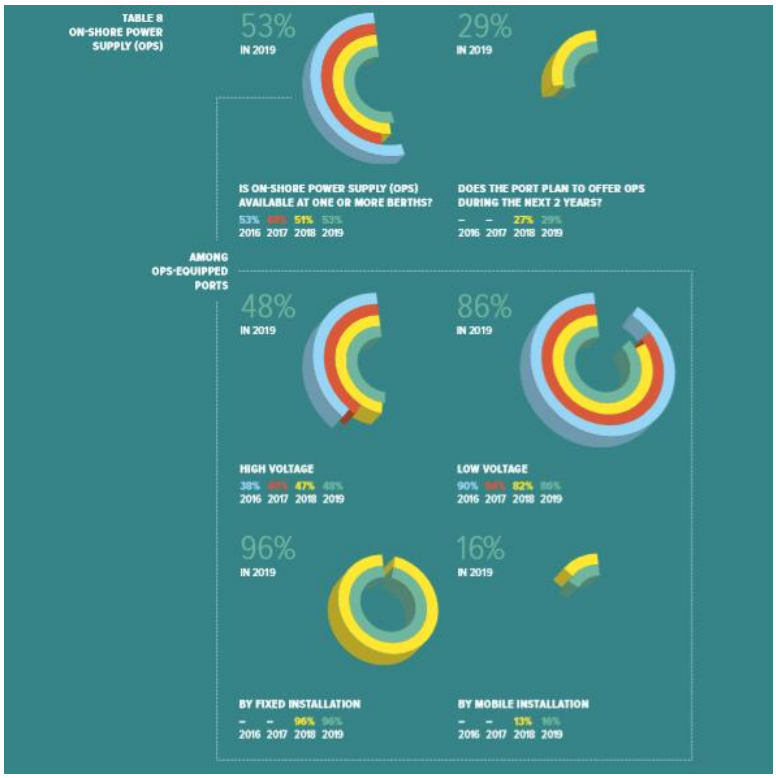
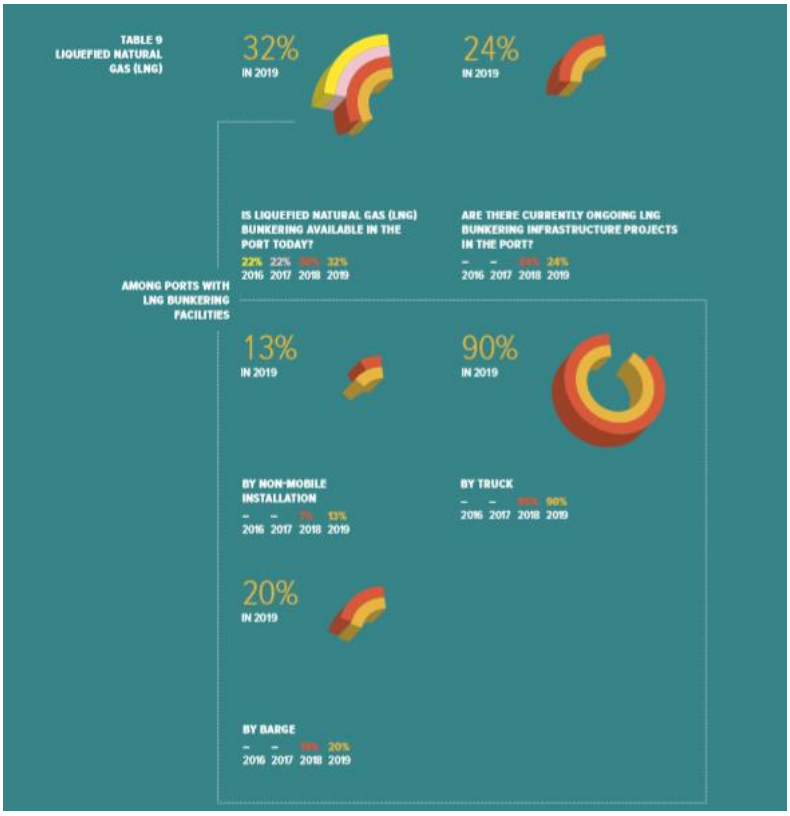


Table 4 hereunder shows that the availability of LNG bunkering in the port sector continues to increase. This is a positive sign for the implementation of the Alternative Fuels Infrastructure Directive with regard to the provision by TEN-T core network ports of LNG bunkering facilities by 2025. Currently, one third of the ports offer this service to ships.

Table 4 - Liquefied Natural Gas (LNG) (source: ESPO (2019))



Conclusions

Maritime transport has a critical role in addressing the sustainability challenges of our times. It plays a key role in international trade, providing market access and linking communities. “Safe, secure, energy-efficient, affordable, reliable, low-carbon, environmentally friendly, climate-resilient and rule-based maritime transport systems contribute to achieving an economically efficient, socially equitable and environmentally sound development” (Benamara, Hoffmann, & Youssef, 2019). The new regulatory challenge posed by the sulfur cap in 2020 has generated substantial uncertainty in the shipping industry. While the shipping industry is focusing on the sulfur cap the greatest challenge it has likely ever faced is the need to find the effective means of decarbonizing in line with global commitments. The speed of the required transition along with the relative difficulty of technological options vis-a-vis other sectors of the economy make this a particularly demanding endeavor.

A number of government-led initiatives indicate a growing awareness of the shipping challenge while initiatives at the level of industry and companies suggests a new reckoning of corporate responsibility. The International Maritime Organization will have a critical role to play in determining the right approach for decarbonization policy. Market based mechanisms could potentially play an important role though they are still far from the center of the debate. They can incentivize the low carbon transition, spurring innovation across CO_2 emissions options and providing needed funding both for innovation and supporting developing economies address the heightened burdens of the transition. They are likely however to be one of many measures, regulations and initiatives needed for the task. Scaling up financial resources and investments will also be an important enabler. This is a

role that can be undertaken by regional and national development banks, e.g., the European Investment Bank (EIB) and ING signed an agreement to support the European shipping market with 300 million worth of green investment. Green bonds are another potential instrument for large infrastructural investments.

Enhancing the sustainability of the maritime transport will require a multi-sector approach involving governments, transport industry, financial institutions, academia and civil society. Besides the ambitious goals of the European Green Deal and the European Climate Law of achieving climate neutrality by 2050 in alignment with the Agenda 2030 and IMO regulation, there is a lack of depth in the individual targets that need to be met by all Climate components. Shipping industry, as well as other sectors, needs to be specifically mentioned and targeted in the short-medium-long term in these agendas, otherwise the overarching goal of reducing GHG by 2050 will not be achieved. Furthermore, financial mechanisms that will be essential for climate neutrality achievement, need to be explicitly stated, while maritime transport emissions should be included in the EU ETS. Finally, ‘Greening the port' means more than greening the transport side; it mainly signifies support for large investments in the provision of clean energy, connectivity of energy infrastructure networks and green grids, as well as support for innovative technological projects in and between ports. In addition, ports can also attract new investments in clean energy and technology and become centres of excellence and innovation, instead of being just energy 'takers'.

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