



Consulenti per la Gestione Aziendale



Study on differentiated port infrastructure charges to promote environmentally friendly maritime transport activities and sustainable transportation

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EXECUTIVE SUMMARY

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1 Background

According to the United Nations Conference on Trade and Development (UNCTAD), around 80% of world trade in terms of volume is carried by sea¹, and this share is expected to grow considerably in the near future.

Maritime transport is a relatively climate-friendly mode of transport, but it also has adverse impacts on the environment, human health and climate. There is a range of options that port managing bodies can apply to influence the environmental performance of shipping. Amongst others, one is to offer incentives to the shipping industry in its effort to carry out more environmentally-friendly maritime operations, thus reducing or limiting the negative effects of maritime transport on the environment.

Among the multitude of possible measures to tackle adverse environmental impacts of maritime operations, 'environmental charging' has been receiving increasing attention in the last few years, having generated a considerable maritime transport economics literature, as well as a number of concrete, bottom-up initiatives voluntarily implemented by port managing bodies (e.g. the Environmental Ship Index, Clean Baltic Sea Shipping, Green Award, etc.).

Part of this attention originates from the reaction to the EU policy developments of the late '90s, and culminated with the publication of the Green Paper on Sea Ports and Maritime Infrastructure². 15 years later, after a series of legislative advancements and increasing acknowledgment by ports of the role of environmental charging, the 2013 Commission's communication on ports policy (COM(2013) 295) identified the need to raise the environmental profile of European ports as a priority of the EU Transport Policy in the coming years, inter alia by *considering whether to reward operators who anticipate or exceed the application of mandatory environmental standards and promote the use of door-to-door low carbon and energy efficient logistics chains*.

More recently, the Regulation of the European Parliament and of the Council establishing a framework on market access to port services and financial transparency of ports (Regulation (EU) 2017/352) has stated that "The Commission, in cooperation with Member States, should elaborate guidance on common classification criteria for vessels for the purpose of voluntary environmental charging, taking into account internationally agreed standards" (Recital 51), and that "[...] port infrastructure charges may vary in accordance with the port's economic strategy and the port's spatial planning policy, related inter alia to certain categories of users, or in order to promote a more efficient use of the port infrastructure, short sea shipping or a high environmental performance, energy efficiency or carbon efficiency of transport operations (Art. 13.4).

The legal framework in which environmental charging may work is not limited to the EU. Efforts to reduce the environmental footprint of human activity are being carried out worldwide at the international level. In December 2015, in the framework of the 2015 United Nations Climate Change Conference (COP 21 or CMP 11), 195 countries agreed on the Paris Agreement to reduce emissions as part of the method for reducing greenhouse gas³. The members agreed to reduce their carbon output "as soon as possible" and to do their best to keep global warming "to well below 2 degrees C". The agreement entered into force on 4 November 2016, but it does not cover air and maritime transport.

More specifically to maritime transport, the International Maritime Organisation (IMO) has assumed responsibility for pollution issues and subsequently has, over many years, adopted a wide range of measures to prevent and control pollution caused by ships and to mitigate the effects of any damage that may occur as a result of maritime operations and accidents. Initially the IMO focussed on prevention of marine pollution by oil, resulting in the adoption of the first ever comprehensive antipollution convention, the International Convention for the Prevention of Pollution from Ships (MARPOL) in 1973. This has changed over the last few decades to include a much wider range of measures to prevent marine pollution,

¹ UNCTAD, *Review of Maritime Transport*, 2013.

² COM(97)678 final, Green Paper on Sea Ports and Maritime Infrastructure, 10.12.1997

³ http://unfccc.int/paris_agreement/items/9485.php

and the original MARPOL Convention was amended many times to also include requirements addressing pollution from chemicals, other harmful substances, garbage, sewage and, under an Annex VI adopted in 1997, air pollution and emissions from ships. Latest developments have led to establishing Sulphur Emissions Control Areas (SECAs) and Nitrogen Oxide Emission Control Areas (NECAs) in several areas of the world, among which are the Baltic and the North Sea (SECA in 2005 and 2006 respectively, and NECA from 2021). Recently the IMO has also approved the entry-into-force of the global low sulphur in fuel cap as from 2020. Furthermore, in view of the Paris agreement, the Marine Environment Protection Committee (MEPC) of the IMO agreed that IMO should determine a possible fair share contribution for the international shipping sector, which if developed, should take into account the circumstances that are relevant to the international shipping sector, including the importance of international trade in supporting the sustainable development of national economies. In October 2016, the MEPC formally adopted a mandatory data collection system for fuel consumption of ships. The MEPC also agreed that an initial but comprehensive IMO strategy on reduction of GHG emissions from ships should be adopted in 2018.

The EU too has a role in this debate. In December 2016, the Environment Committee (ENVI) of the European Parliament adopted a report on the revision of the EU Emissions Trading System (ETS)⁴, which puts pressure on the IMO to have a system comparable to ETS operating for global shipping as from 2021. If that is not the case, then shipping should be included in the European ETS as from 2023. Part of the revenues generated from ETS would be channelled through a Maritime Climate Fund to improve energy efficiency and invest in innovative technologies for ports and short sea shipping.

While a system of environmental infrastructure charges may well be a promising method for improving the environmental and social performance of transportation systems, this does not guarantee *per se* that such a solution could be implemented successfully across the whole European sector. From the viewpoint of a port managing body, if inappropriately implemented, environmental charging, could be tantamount to raising prices⁵, which in turn may lead to reduced business volumes and negative financial impacts, especially if the implementation of the schemes is on a voluntary basis, i.e. if competing ports are allowed to act as free riders and decide not to implement environmental charging schemes at all. At the same time, however, environmental charging schemes may also serve as potential attractors to generate profits, enhance image and increase the position of a port in the market.

Incidentally, the above-mentioned argument is not limited to the port industry, but is equally valid for all transport modes where a form of differentiated infrastructure charging is applied. Ports are complex entities comprised of different stakeholders, engaged in diverse activities, who need to work together to maximise efficiencies for the entire supply chain. Ports involve facilities for several modes of transport: water, rail, road, or even air. They manage and maintain assets, facilities, utility networks, and utility consumption. They coordinate and optimise transport infrastructure and minimise traffic congestion and environmental impacts. They coordinate leases and tenants and monitor performance.

However, the fact that the EU port sector is so diverse, and also happens to be characterised by fierce competition among players may suggest that a more coordinated approach to environmental charging could ensure a level-playing field, maximise the environmental and image benefits, and reduce 'free-riding behaviour'.

⁴ ENVI(2016)1215_1. Documents available at

[http://www.emeeeting.europarl.europa.eu/committees/agenda/201612/ENVI/ENVI\(2016\)1215_1/sitt-3968209](http://www.emeeeting.europarl.europa.eu/committees/agenda/201612/ENVI/ENVI(2016)1215_1/sitt-3968209)

⁵ Bergqvist R, Egels-Zandén N, *Green port dues – The case of hinterland transport*, in "Research in Transportation Business & Management", 2012 (5), pp. 85-91. The authors argue that the introduction of port dues "initially will not produce direct and immediate benefit compensation for the corresponding cost increase related to the fee per load unit, since the transport system is not able to respond quickly to the changes in fee levels. The lag is usually a consequence of transaction cost and system lock-ins, such as contract periods, dedicated transport services, system designs, supplier integration, etc." Hence, ports may benefit from a long-term strategy, which, "if carefully designed and managed, can provide a powerful tool for port management to manage overall efficiency, especially hinterland transport efficiency and the environmental impact of hinterland transport". [...] "To increase the feasibility of differentiated port dues, a regulatory framework of a larger area as opposed to a single port authority would minimise distortion of competition and large inter-port shift of volumes".

2 Objectives and methodology

The EU Commission's Directorate-General for Mobility and Transport (DG MOVE) has decided to conduct a study to assess the various options that are currently applied to differentiate port infrastructure charges according to environmental or sustainability criteria.

The specific objectives of the Study are to:

- (a) Update information and data of EU and worldwide existing practices' inventories;
- (b) Examine the benefits and costs, including the economic aspect and environmental potential, of certain schemes, and identify good practices;
- (c) Develop guidelines and practical options for the voluntary application of environmental charging principles in European ports.

The study was developed in three phases:

1. The first phase aimed to establish the potential qualitative and quantitative costs and benefits for reducing shipping emissions and waste, and to provide an overview of the state of play of environmental charging in the EU. A survey was carried out in all TEN-T core ports to map any possible environmental charging scheme in the EU. The first part of the survey was a desk-based research through which the research team collected publicly available information. In the second part of the survey, ports were asked to validate the information collected. Notable examples of environmental charging outside the EU were also looked at.
2. The second phase was designed to quantify the costs and benefits of one or more environmental charging schemes for both port authorities and shipping companies. Through direct interviews with port authorities, 15 case studies were developed with the aim to collect precise insights as to the functioning of environmental charging. However, it soon emerged that, due to a variety of reasons (including technical, financial, organisational and legislative), port authorities do not currently measure the effect of a charging scheme on the environment, and in many instances, they do not monitor the implementation of the scheme from the economic point of view either. To cope with lack of data, an environmental and an economic assessment were also carried out, based on what-if scenarios.
3. Recommendations and guidelines: the results of the first two phases were presented to stakeholders during two conferences. An array of qualitative and quantitative information was also obtained through direct interviews with stakeholders. The resulting discussion made it possible to draft recommendations that will support port authorities with an interest in environmental charging to shape their schemes so as to address their needs.

The study acknowledges that the EU port sector is neither standardised nor homogeneous in terms of ownership, organisation, competitive framework or management; ports vary in size, function and geographical location. Although basic scaling factors used for price differentiation may be similar to some extent, the governance of a port has a significant impact on the charges levied because of the different degrees of supervision and regulation involved.

3 Inventory of environmental charging in EU ports

- 30 ports applying an environmental charging scheme⁶ were detected: 11 in the Hamburg-Le Havre port range, 7 in the Baltic Sea, 1 in the North Sea, 6 in the Mediterranean Sea, and 5 in the South-Atlantic Ocean.
- Port size plays a somewhat lesser role in the uptake than one may expect, as large, small and medium-sized ports implement schemes with similar characteristics. Small- and medium-sized ports tend to dedicate fewer resources to the set-up and follow-up of the schemes, given their reduced overall financial base.

⁶ A map of ports that differentiate charges based on environmental criteria is provided as an Annex to this report.

- The vast majority of schemes are rebates on port dues, which range from 0,5% to 20%⁷, for vessels that take part in environmental indexes or certification programmes (Environmental Ship Index, Green Award, Clean Shipping Index, Blue Angel). These initiatives assign scores to ships that comply with certain environmental standards.
- Spain stands out as the only Member State whose differentiated charging policy is established at central level, although implemented by ports individually.
- The typologies of schemes identified do not vary to a great extent, even though their implementation is far from being harmonised in terms of nomenclature, parameters, rebates, etc.
- Most environmental charging schemes equally apply to all ships, as long as they are eligible for a rebate. Nonetheless, some rebates specifically target certain ship categories (e.g. LNG-fuelled vessels). Ports may decide to favour a particular ship or cargo type, thus ‘discriminating’ against the categories that do not fall under the scheme.
- In at least 7 instances, rebates connected to waste management were identified.
- Short-sea shipping is often priced lower than deep-sea shipping. Generally speaking, port authorities did not connect this incentive with environmental objectives. For instance, some ports suggested that short-sea shipping is priced lower when it is a core traffic segment and vessels call at port frequently. Despite rebates not being strictly ‘environmental’, incentives to short-sea shipping may be considered as a way to shift traffic from road to sea, thus contributing to increasing transport efficiency.

4 Assessment

4.1 Case studies

- Almost all ports mentioned their environmental strategy as part of the motivation for implementing environmental charging.
- Both diversified and specialised ports apply similar schemes, in the latter case somewhat more oriented towards the core markets of the port. However, the initial decision to adopt a certain type of scheme is mostly made without the specialisation of the port in mind.
- It is easier for ports to rely on an existing index or certification that measures how much ‘greener’ a ship is, rather than developing new metrics from scratch.
- With the notable exception of Sweden, which started rewarding green vessels in 1991, environmental charging has been implemented regularly in Europe only since 2011. Being a recent practice, its implementation in some cases is fraught with uncertainties.
- In almost all ports, the decision-making process sits at least with the environmental department of the port authority. In large ports, however, the commercial department is often reported to be the main decision-maker.
- Almost all case study ports allocate a variable budget for the payment of rebates, where adjustments can be made during the year. The budget is generally the result of a learn-by-doing process, i.e. based on the number of calls and rebates of the previous year.
- Most ports did not disclose exact figures, as budget allocation is considered confidential data. As to the ports that shared their data, budget allocation varies from 0,5% to 2,2% of the revenue from port dues and is redistributed to rebates.
- Most ports interviewed do not specifically monitor the environmental and economic impact of the scheme applied.

⁷ Albeit rarely, some schemes offer rebates on port dues up to 50%.

- In the short run, the schemes do not seem to alter ship owners' behaviour. However, port authorities reported that the incentive may be effective when it comes to the development of new ships and the choice of fuel. As a result, the real impact of the scheme should be considered in the long run.
- On average, the full-time equivalent (FTE) necessary to manage the scheme varies from 0,5 to 3 a year. It can be argued that managing a scheme is not particularly burdensome. Most schemes are based on third-party initiatives and / or certifications because these reduce ports' workload considerably.
- The principle of 'malus' has not been identified in the schemes surveyed. However, if the principle of revenue-neutrality is to be respected, then an implicit transfer of value from more polluting to less polluting ships must take place in any case, through recalibrations in the tariff structure.

Table 1 - Pros and cons of indexes and certification systems used in environmental charging⁸

Index/Certification	Managing body	Pros	Cons	Uptake prospects	Fees
Environmental Ship Index (ESI)	International Association of Ports and Harbours (in the framework of the World Ports Climate Initiative)	<ul style="list-style-type: none"> - Extremely 'easy-to-use'. A score from 0 (perfect compliance with current standards) to 100 (no emissions whatsoever) is assigned to each of its constituents (NO_x, SO_x, CO₂, plus a bonus for Onshore Power Supply - OPS). - High uptake worldwide, most likely because it was developed in the framework of the IAPH. 	Only focused on air quality and CO ₂ .	The ESI is by far the most used initiative in environmental charging in the EU, with an increasing number of ports and ship owners adopting it. This is a competitive advantage which suggests that the uptake may further increase in the future, because both ports and ship owners are more likely to choose an index if it recognised worldwide.	Ship owners pay no fees for participation. Incentive providers are expected to contribute in the costs for any changes, additions, renewals, improvements, of the website. No fees are due for audits and inspections, because the ESI relies on self-declaration and does not require any data to be verified or certified by external auditors; the data are randomly checked for inconsistencies and obvious mistakes
Green Award (GA)	The Green Award Foundation, a neutral, independent foundation, established 1994 on the initiative of the Rotterdam Municipal Port Management and the Dutch Ministry of Transport. Since 1 January 2000 Green Award has been completely independent.	<ul style="list-style-type: none"> - It is quite comprehensive, as its requirements address aspects related to safety, quality, environment and technical areas related to the ship and the ship's manager office. There are over 50 subjects and examples of requirements related to environment are 'exhaust emissions, water ballast, anti-fouling, ship breaking, navigation in 'sensitive areas', waste management). - High uptake worldwide. - It is recognised by users as delivering 'extra quality'. 	<ul style="list-style-type: none"> - More complicated criteria and inspections (it is a certification and 'has to be' more complicated than the ESI and the Clean Shipping Index - CSI). - Only for oil tankers, chemical tankers, dry bulk carriers from 20.000 DWT up, and for LNG and container carriers and inland navigation vessels). 	Green Award is the second most popular initiative used for environmental charging in the EU. It is also well established worldwide, which suggests that its uptake may increase further in the future. In addition, there is no competition with the ESI, in that GA is not limited to emissions, but covers a broader range of environmental aspects as well as safety aspects to ultimately protect the environment. GA and ESI actually cooperate as GA performs ESI data check on GA-certified ships and also gives extra points when a ship has higher ESI scores.	Ports do not pay any fee (fees are paid by ship owners / managers to cover: <ul style="list-style-type: none"> - Shipping office audit fee (every three years) - Application fee per ship (costs vary depending on ship type and tonnage from ca. € 4.000 to ca. € 8.000). - Annual fee per ship (costs vary depending on ship type and tonnage from ca. € 2.500 to ca. € 5.000) - Additional costs for every office audit and survey (mainly travel and subsistence expenses for auditors)

⁸ This table has been compiled based on publicly available information from the following websites:
<http://www.environmentalshipindex.org/Public/Home>
<http://www.greenaward.org/>
<https://www.cleanshippingindex.com/>
<https://www.blauer-engel.de/en>

Index/Certification	Managing body	Pros	Cons	Uptake prospects	Fees
Clean Shipping Index (CSI)	The Clean Shipping Index is the core around which the organization is gathered. The users of the index are members of the non-profit association Clean Shipping Network which is composed both by cargo owning companies, from a variety of branches, and forwarders	A user-friendly score (similarly to the ESI) is assigned for CO ₂ , SO _x and PM, NO _x , water and waste, and chemicals.	<ul style="list-style-type: none"> - Not very popular among EU ports, and so 'less attractive', because ship owners cannot benefit from multiple rebates. - Details on uptake by port are not available online. 	The CSI is relatively less popular as an initiative used for environmental charging, and its scope partly overlaps with the ESI (although the CSI also includes waste on board and sewage and ballast water). This makes it relatively less attractive when compared with the ESI; ports may be induced to prefer the ESI, because more ships can be eligible for a rebate.	A membership fee of € 2.700 per year is required. There is no reference online as to the cost of audits and inspections.
Blue Angel	<p>Blue Angel is managed by 4 entities:</p> <ul style="list-style-type: none"> - The Environmental Label Jury is an independent body composed of representatives from associations, unions, industry, trade, crafts, local authorities, science, media, churches and landers. - The Germany Ministry for the Environment Nature Conservation and Nuclear Safety is the owner of the label. - The Federal Environment Agency acts as office of the Environmental Label Jury and develops the technical criteria - RAL gGmbH is the label-awarding agency. 	<ul style="list-style-type: none"> - Flexible criteria: 10 binding requirements plus 20 optional requirements - Management instruments as well as social conditions, operation and technology are covered - Emission of black and grey sewage waters, bilge waters, disposal of wastes on land are included in the Blue Angel awarding system 	<ul style="list-style-type: none"> - Blue Angel is not as popular as the other initiatives surveyed, with only one EU port granting rebates to Blue Angel-certified. - Oil tankers and product carriers, chemical tankers, gas carriers, ships coming under the High Speed Craft Code, fishing vessels, recreational ships and navy ships are not included. 	With just one EU port recognising it as a valid certification to be eligible for a rebate, the uptake prospects of Blue Angel in environmental charging are considerably low.	<p>There is a one-off fee of 250 EUR (plus the statutory level of VAT) for processing the application for the use of the Blue Angel ecolabel.</p> <p>A yearly fee based on a graduated scale is also to be paid. The size of the fee is determined by the total yearly sales of all of the products or services awarded with the environmental label in accordance with the corresponding Basic Award Criteria. The yearly fees range from a minimum of 270 EUR to a maximum of 6.000 EUR.</p>

4.2 Environmental assessment

- A simulation specifically carried out for the Study has revealed that a discount of only 20% on port dues in all EU ports for vessels certified with an ESI score of 30 points may lead up to a 4,34% reduction of current NO_x, SO_x and PM emissions in the EU, if only 14% of the EU fleet were eligible for the discount⁹. In terms of emission performance, an ESI score of 30 points is assumed to imply that a ship emits 30% NO_x, SO_x and PM less of what required by the current relevant emission standards of the International Maritime Organisation for these pollutants (the mechanism to assign the score is revised each time new standards enter into force)¹⁰.
- When it comes to climate change, there is potential for environmental charging to become a market-based measure to reduce GHG emissions. If a EU-level scheme were to be established, whereby ship owners who decide to be 50% more efficient than the standards already set until 2025 at IMO level¹¹ were given a 20% rebate on port dues, it would be possible to reduce CO₂ emissions from voyages from/to EU ports by 3,97% in 2030 alone, assuming that 30% of the fleet is eligible. The reduction is likely to increase in the years following 2030, and is likely to increase after 2030 reflecting the upward trend in the demand for maritime transport. Furthermore, through the data collected in the framework of the MRV Regulation, the rebates may be linked to the level of efficiency of each ship. In contrast from schemes addressing air quality and / or waste, in the case of CO₂, the actual effect would be appreciable if a critical mass of ports implementing the scheme is created at EU level.
- The models developed in the study show that, if external environmental costs are factored in, the benefits from reduced emissions for the people living in the port environs may outweigh the costs incurred by the port because of the revenue foregone from reduced port dues.
- The environmental monitoring systems currently in place are not measuring the impact of port charging schemes. Several port authorities believe that it may be extremely difficult to tease out the effect of a scheme in improving air quality. There are several factors that impinge on air quality in a port area, and it may be costly and technically challenging to set up a system that can gauge with extreme precision the effect of the initiatives set in place by a port authority. At the same time, examples from several ports and projects show that it is possible to use modelling techniques to estimate emission sources in a port area at a sufficient level of detail, also taking into account meteorological confounding factors. The availability of time series may make it possible to estimate the impact of introducing an environmental charging scheme, with a reasonable degree of reliability.
- In its Final report, the Clean North Sea Shipping project (March, 2014) recommended that harbours estimate emissions from ships in port, including manoeuvring, as this would help improve reliability and comparability between harbours, and test the effectiveness of different incentive schemes.

⁹ 14% of the EU fleet eligible for a rebate is an assumption based on data provided by the Port of Rotterdam. In 2014, 21% of the vessels calling at Rotterdam had an ESI score, but only 7% had an ESI score ≥ 31 . The port of Rotterdam grants a 10% on port dues to ships with an ESI score ≥ 31 ; it has been assumed that demand for port services is elastic to dues variations. Furthermore, the ESI was introduced in 2011, and its uptake has been increasing steadily since then; 14% of the fleet with a score ≥ 31 is considered a realistic assumption for the years to come.

¹⁰ The ESI score is composed of a set of sub points for each of the three (PM is included in SO_x) emission groups. ESI NO_x and SO_x scores may vary from 0, when a ship's emissions are perfectly compliant with existing international legislation, to 100 when a ship virtually produces no emissions of these pollutants at all.

¹¹ The standards referred to here are those included in MARPOL Annex VI, whereby it is required that most new ships be 10% more efficient beginning 2015, 20% more efficient by 2020, and 30% more efficient by 2025. The proposed environmental charging scheme would reward ships that decide to be more efficient than current standards by 50%; it thus builds on top of an already foreseen set of reduction. A further 50% is considered to be a realistic achievement, based on available data on EEDI uptake (MEPC 70/INF.14, 19 August 2016).

4.3 Economic assessment

- Should all ports in the EU (plus Norway and Turkey) apply an environmental charging scheme, an average 30% rebate on port dues for 'green ships' could result in financial incentives for the shipping sector up to 1,4 billion euro over a 5-year period¹². These projections are based on the hypothesis that 30% of calls in EU ports are eligible for a discount.
- Under certain circumstances, economic incentives from environmental charging may shorten the payback period of investments in green technologies by one or more years.
- Certain indexes or measures taken by the ship can entitle to multiple rebates in different ports. Whether these rebates can be cumulated or not is important, as several small rebates can lead to sizable financial incentives.
- In line with the case studies findings, the economic assessment also suggests that, although in the short run environmental charging may not necessarily alter ship owners' behaviour, the incentive may be effective when it comes to the development of new ships and the choice of fuel (e.g. LNG or OPS). As a result, the real impact of the scheme should be considered in a long-term perspective.
- Environmental charging may also carry positive implications in terms of image (which could ultimately yield economic benefits) for both ports and ship owners, and could also be seen as one of the steps to reduce the overall environmental footprint of the industry.
- When implementing a scheme, ship owners suggested that if they got more involved by ports in the decision-making process, this might contribute to making the incentive more attractive to them.

5 Recommendations

#1 - Port authorities and national authorities

Consider environmental charging as part of a broader policy to support the uptake of alternative fuels for waterborne transport

Directive 2014/94/EU on the deployment of alternative fuels infrastructure sets clear goals and establishes a common framework of measures for the deployment of alternative fuels infrastructure in the EU, in order to minimise dependence on oil and to mitigate the environmental impact of transport. As far as ports are concerned, the deployment of facilities for OPS and LNG is of special significance and requires considerable investments from both port authorities and ship owners. While rebates from environmental charging alone cannot be a decisive factor to persuade ship owners to adopt these technologies, this Study finds out that under certain conditions they can reduce the payback period of the investment. In view of implementing the Directive at national level, besides focusing on deploying the necessary infrastructure, MSs and port authorities could use environmental charging as one of the possible tools to foster the uptake of alternative fuels, and make sure that the infrastructure is actually used by ships.

¹² When trying to estimate the economic impact of an environmental charging scheme, it is paramount to consider a realistic 'elasticity' value. By 'elasticity' it is meant the responsiveness of the quantity demanded of port services to a change in their price. When demand is elastic to port charges, a 10% reduction/discount will result in 10% more port calls, or likewise a 10% increase will result in 10% fewer port calls. Demand elasticity to port services is difficult to estimate for the whole sector, as it may vary considerably across geographical areas and ship types. While it is considered to be rather high in the container sector, especially in areas served by many ports, it may also be relatively low in other sectors.

#2 - EU

Consider environmental charging as a market-based measure for reducing greenhouse gas emissions from shipping

Through the EEDI, the IMO intends to increase ship efficiency and reduce GHG emissions until 2025, and it may make sense to propose a system of rebates that incentivises ship owners to adopt the increasingly stringent standards even before their entry into force (early compliance). The EEDI applies to new builds, but the scheme proposed may also reward existing ships by measuring their environmental performance through the EEOI. To be effective, this scheme would require a concerted effort by ports, as ship owners could cumulate rebates in every port of call, and because CO₂ reduction scale effect becomes appreciable only if a remarkable number of ports adopt the same scheme.

Furthermore, the effective application of the MRV Regulation, entered into force in 2015, will create an EU-wide legal framework for the monitoring, reporting and verification of CO₂ emissions from maritime transport. The impact of the MRV Regulation should also be analysed against the wider international framework, further to the formal adoption by the MEPC of a mandatory data collection system for fuel consumption of ships. The MEPC also agreed that an initial but comprehensive IMO strategy on reduction of GHG emissions from ships should be adopted in 2018.

If linked to an environmental charging scheme, this framework will make available data on:

- a) how much and to what extent a vessel is 'going beyond' international standards in the framework of the EEDI;
- b) how much CO₂ is emitted (and how much is saved) on a certain journey;

Through a) and b), it will be possible to determine the level of rebate corresponding to the percentage of increased efficiency (or of CO₂ emitted). The potential of this scheme could be enormous, as it would add up to ambitious reduction standards already set at EU and international level. The EU could be the subject to start this process, which however requires close coordination with the ports.

#3 - EU, Port authorities and / or national authorities, depending on the governance model

Assess the feasibility of defining common criteria for environmental charging across the EU.

One of the recurring topics analysed during the study is whether also a more consistent application of environmental charging should be fostered at EU/national level. The 2013 EC Communication on ports policy 'Ports: an engine for growth' (COM(2013) 295) states that "Although existing schemes introduced on a voluntary basis by a number of ports to raise their environmental image should continue to be supported, a more consistent application of such environmental variation of port infrastructure charges at a European or regional level would help to increase their effectiveness". Furthermore, the Regulation of the European Parliament and of the Council establishing a framework on market access to port services and financial transparency of ports (Regulation (EU) 2017/352) states that "The Commission, in cooperation with Member States, should elaborate guidance on common classification criteria for vessels for the purpose of voluntary environmental charging, taking into account internationally agreed standards" (Recital 51), and that "[...] port infrastructure charges may vary in accordance with the port's economic strategy and the port's spatial planning policy, related inter alia to certain categories of users, or in order to promote a more efficient use of the port infrastructure, short sea shipping or a high environmental performance, energy efficiency or carbon efficiency of transport operations (Art. 13.4).

By way of an example, an EU-level register could list under which conditions green ships should be entitled a rebate in EU ports. Similarly, it may be useful to define a list of green initiatives that could give entitlement to rebates. A good solution could be to refrain from dictating rigid requirements, but rather to list possible options that entitle to rebates and ranges for discounts. The Spanish experience can be a useful benchmark, in that ship owners and port authorities can negotiate an agreement that entitles to rebates, provided that the agreement fulfils certain conditions defined at the central level by a State agency.

The economic and the environmental assessments carried out in the framework of this Study show that the advantages of improved coordination may be appreciable, their order of magnitude increasing along with

the number of ports that join the common initiative. Defining common criteria for environmental charging would make it possible to:

- (i) Create a “level playing” field for ports;
- (ii) Simplify the rules for ship owners to be eligible for rebates;
- (iii) Pile up what are now perceived as small rebates to sizable incentives when cumulated;
- (iv) Reduce NO_x, SO_x, PM and CO₂ emissions to a greater extent.

In the current scenario, where only limited coordination has been achieved spontaneously through bottom-up initiatives, environmental charging is likely to remain a fairly weak incentive to alter ship owners’ behaviour, characterised by uncertainty and implicit costs against only moderate benefits.

#4 - Port authorities and / or national authorities, depending on the governance model

When environmental charging schemes are designed, they should (i) be simple to understand and to implement, (ii) clearly state the goals to be achieved, and (iii) be monitored throughout their implementation.

(i) Any successful incentive system needs to be easily understandable by stakeholders, so as to reduce implementation costs. Most ports in the EU prefer to link their schemes to popular environmental initiatives (ESI, Green Award, CSI, Blue Angel, etc.). This practice keeps schemes relatively easy to understand, while reducing the administrative burden for port authorities and ship owners, who can delegate verification of requirements to third-party certification bodies.

(ii) Not setting clear environmental goals undermines the effectiveness of environmental charging - by concealing what may be achieved through it – and makes it almost impossible to adjust a scheme based on its performance. While one should keep realistic expectations as to what can be achieved through differentiated charging, it is fundamental to at least estimate the desired effects. The overall environmental benefit should be assessed before defining individual goals. Reduction of air pollution should for instance not lead to an increase of discharges to the water, or of greenhouse gas emissions. Furthermore, because ports and cities are complex and integrated systems, any pollution reduction target should be set jointly with the local and regional authorities that are responsible for significant environmental aspects in the port environs.

(iii) There are multiple sources of pollution in ports and port cities; moreover, pollution levels are strongly influenced by weather conditions. These two considerations suggest that it may be difficult to monitor and establish the effect that a charging scheme has on the environment. Nonetheless, having comparable time series of air quality data across ports would make it possible to apply statistical methods and attempt to tease out the effect of a scheme, by controlling for confounding factors and comparing results between similar ports.

#5 - Port authorities and / or national authorities, depending on the governance model

Make sure to involve all the relevant actors in the decision-making process.

It should be ensured that all interested parties are involved in the decision-making process. Some ship owners lamented that they are not consulted by port authorities in the decision-making process. Port authorities should seek to identify alliances with all stakeholders that have a liability or responsibility towards green shipping/differentiated charging schemes in order to share knowledge, experience and some of the costs. Such collaboration is at the heart of the EcoPort concept where ports share experience and avoid ‘re-inventing the wheel’.

The actors to involve in the decision-making process should at least include the port authority, shippers, forwarders, shipping companies, and terminal operators. Furthermore, the municipality and / or other administrative units should also be involved in the consultation process, as the people living in a port city are ultimately the main beneficiaries of improved air quality.

When it comes to environmental matters, including port infrastructure charging, a comprehensive consultation process with port users and other relevant stakeholders is also envisaged in Art. 15 of the ‘Regulation of the European Parliament and of the Council establishing a framework on market access to port services and financial transparency of ports’ (Regulation (EU) 2017/352).

#6 - Port authorities and national authorities

The total costs for financing a differentiated charging scheme should be balanced with the environmental benefits yielded by it.

If the implementation of an environmental charging scheme contributes to reducing emissions in the port area, it follows that that scheme has improved the quality of life of the people living nearby. With precise data on the emissions saved as a result of the scheme, that improvement can also be quantified in economic terms. This is to say that, if the environmental benefits outweigh the costs of financing a scheme, then the scheme itself should not be seen as a loss of revenue. On the contrary, considering that any improvement of air quality will inevitably benefit citizens, any potential loss of revenue for port authorities could be balanced with a compensation from local authorities – proportioned with the environmental benefits obtained – based on the consideration that, if a measure implemented by the port benefits the whole community, then its costs should be shared accordingly.

#7 - EU and / or Port authorities

Establish a forum and a neutral platform to collect and exchange learning insights on environmental charging between ports.

Many port managing bodies are still in the learning phase, with several of interesting insights generated at the level of port managing body. A neutral platform could be set up at EU level or in the framework of the IAPH to collect learning insights, making sure to preserve confidentiality and competitive aspects.

A sector-wide collaboration based on the principle of ‘ports freely exchanging knowledge and experience’ would also provide a data base from which the actual environmental benefits of green charging could be assessed at both local and strategic scales.

#8 - EU and / or port authorities

Develop a pilot project for the collection of information on actual emission production on board ships

Feedback from port sector stakeholders suggests that it may be difficult to monitor and quantify the environmental benefits of environmental charging schemes because of the difficulties of distinguishing the impact of specific emissions or related to differentiated charging schemes from all the aspects impinging on environmental quality in its entirety.

While it is possible to develop modelling techniques to estimate the overall impact of a specific charging scheme on certain significant environmental aspects, one of the main challenges is that high resolution modelling requires highly detailed data on emissions from the sources to be considered. The study analyses several studies and projects that aim to calculate detailed ship emissions even for single ships and their spatial distribution within the port area at different times. Because it is costly to set up a system to collect emissions data at single ship level, and because there is no framework for the collection of such data, these exercises remain isolated initiatives.

For this reason, more data on actual production of emissions on board ships should be collected and made available, so as to allow improve verification of emission production models. A pilot project could be conducted by a sample of ports and ship owners together with other relevant parties like NGOs or the European Maritime Safety Agency (EMSA).

If successful, the model could be replicated on a wider scale. The data on actual emissions collected in the framework of this exercise could be used to make a comparison with ships’ environmental performance as certified by existing indexes and / or certification programmes. Amongst other things, the benchmarking exercise could contribute to fine-tuning indexes and certification programmes.

#9 - EU

Further detail the concept of ‘green ship’ in the revision of the Port Reception Facilities Directive

The formulation of Article 8(2)c¹³ of the PRF Directive is very generic, and may create problems to Member States when it comes to establishing specific criteria. This might explain why only few ports seem to be implementing differentiated schemes that address waste. It is thus recommended that at least basic requirements are laid down in the new directive so as to reduce the vagueness. The Directive could attempt at defining the criteria to establish an EU-level register of those considered reliable for the purposes of the PRF directive.

#10 - EU and / or port authorities

Further analysis should be carried out to complete the mapping of incentives to reducing emissions and waste for ports

Ships are not the sole source of emissions and waste in ports, nor are they necessarily the major polluters¹⁴. It is advisable to map if there exist other economic incentives to reducing emissions in and around ports.

#11 - Port authorities and national authorities

When negotiating concessions or service contracts, consider introducing contractual provisions by which service providers must offer differentiated charging options to users.

As noted with recommendation #10 'ships are not the sole source of emissions and waste in ports, nor are they necessarily the major polluters.' While recommendation #10 deals with mapping existing incentives for terminal operators, it is recommended that, in conjunction with this exercise, port and / or national authorities also consider introducing specific contractual provisions and clauses in the concessions to service providers and terminal operators, by virtue of which they must reward users (for example, but not only, ships) that voluntarily decide to go beyond the environmental standards required by the law.

At the current level of knowledge, and without first completing the proposed mapping exercise, it may be difficult to outline potential incentives, especially because there is a multitude of services provided in ports, and each of them may need specific mechanisms.

#12 - Port authorities and / or national authorities, depending on the governance model

Make sure that existing certification schemes include mechanisms for inspections and/or audits.

The relative lack of standardised inspections and audits currently somewhat harms the perceived strength of the (successful) ESI system, through the lens of some stakeholders (as opposed to e.g. Green Award). Government support might need to be envisaged to support successful and widely adopted schemes to gain further credibility.

6 Conclusions

All transport activities generate benefits and costs to society. Users are normally charged a price for the latter, but there are also external costs imposed on society and not fully borne by users, such as pollution, noise, congestion, accidents and spills, etc. The policy intervention aimed at making side effects part of the decision-making process of transport users is called 'internalisation of external costs'; through the use of market-based instruments, it may lead to a more efficient use of infrastructure, reduce negative side effects of transport activities and improve fairness between transport users¹⁵.

¹³ Fees may be reduced if the ship's environmental management, design, equipment and operation are such that the master of the ship can demonstrate that it produces reduced quantities of ship-generated waste.

¹⁴ Nonetheless, it should be noted that at least according to a study by Merk, between 70% and 100% of in-port emissions may be attributed to shipping, 1/5 to trucks and locomotives and roughly 15% comes from equipment. Merk O., Shipping Emissions in Ports, International Transport Forum, Discussion Paper 2014-20. Retrieved from: <http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201420.pdf>

¹⁵ Ricardo-AEA, Update of the Handbook on External Costs of Transport, Report for the European Commission: DG MOVE, 2014.

Fair and efficient transport pricing is advocated in a number of policy documents issued by the European Commission, notably the 2011 White Paper on Transport and the Handbook on external costs of transport (2008 and 2014¹⁶). In 2008, the Commission also adopted a communication on a strategy to internalise the external costs for all modes of transport that was adopted in July 2008. Environmental charging is a step in the direction towards this policy. Even though it is a relatively new practice in Europe, an increasing number of ports are implementing schemes that “reward” clean ships by charging them lower fees for port use.

The study has found 30 ports in the TEN-T core network that are applying one or more environmental charging schemes. The vast majority of schemes revolve around a common set of core principles, and are based on widely acknowledged environmental initiatives and indexes that assign ‘user-friendly’ scores to ships complying with certain environmental standards. This makes it easier for port authorities to structure differentiated charging schemes, - because they can rely on well-established criteria certified by a third party - and more convenient for ship owners to become eligible for rebates based on well-known certifications with clear and common qualifying criteria.

It has been argued that the ‘transaction costs’¹⁷ of differentiated port dues may be significant, in that ships must demonstrate that they qualify for a rebate and port authorities have to handle a more complex pricing structure¹⁸. In actuality, the port and shipping professionals interviewed for this study seem to believe that relying on third-party certifications and / or indexes is a win-win approach. Ports actually incur lower transaction costs than they normally would if they were to set up bespoke metrics to measure ‘how much green’ a green ship is; from the viewpoint of ship owners, a quick look at the websites of the most popular indexes and certifications reveals that the transaction costs are negligible.

As of today, environmental charging is implemented on a voluntary basis in the EU. The question as to whether the sector should continue to “self-regulate environmental charging”, or a more consistent application of it should be fostered at EU level is of special significance for the success of the practice. The study demonstrates that, should a more consistent approach be pursued, ship owners might benefit from common standards by cumulating the incentives from environmental charging across each port of call, thus spreading the costs of qualification (i.e. investment in clean technology) over a larger number of ports. This is consistent with the EC Communication ‘Ports: an engine for growth’, when it states that “Although existing schemes introduced on a voluntary basis [...] should continue to be supported, a more consistent application of such environmental variation of port infrastructure charges at a European or regional level would help to increase their effectiveness”.

Furthermore, despite being relatively widespread, the belief that the incentives are too weak to alter ship owners’ behaviour seems to rest on anecdotal evidence, as very few port authorities are actually monitoring the effects of the scheme they implement. Therefore, the study took on developing a set of scenarios to verify whether and to what extent rebates from environmental charging could actually be an effective economic incentive, and it emerged that, should all ports in the EU (plus Norway and Turkey) apply an environmental charging scheme based on common characteristics, an average 30% rebate on port dues for ‘green ships’ could result in incentives for the shipping sector of 1,4 billion euro over 5 years (provided that at least 30% of the EU fleet meets the eligibility criteria).

Environmental charging can also make investments in greener technologies (e.g. OPS or LNG) more profitable, as, under certain circumstances, incentives may shorten the payback period of an investment by one or more years. For this reason, it is believed that the practice may contribute to accelerating the deployment of alternative fuels such as LNG or OPS.

However, environmental charging should also be analysed under the environmental point of view. Most ports do not actually monitor the impact of their schemes on air quality and/or waste, because they believe

¹⁶ Idem.

¹⁷ Transaction costs can be defined as the costs of participating in a market.

¹⁸ De Langen P., The Analyst: sense of green port dues, published on Port Economics on 7 October 2016. Available at: <http://www.porteconomics.eu/2016/10/07/4010/>

it is extremely difficult to tease out the effect of a charging scheme in improving a complex variable such as, for instance, air quality. In the absence of actual data, a simulation was specifically carried out as part of this Study. It emerged that a discount of only 20% on port dues in all EU ports for vessels certified with an ESI score of 30 points may lead up to a 4,34% reduction of current NO_x, SO_x and PM emissions in the EU, if only 14% of the EU fleet were eligible for the discount. Furthermore, there is potential for environmental charging to become a market-based measure to reduce GHG emissions, if a concerted effort is made at EU level. An EU-level scheme may be established, rewarding ship owners who decide to go beyond current standards for CO₂ reduction. If a 20% rebate is given to vessels that are 50% more efficient than the standards already set until 2025 at IMO level, the scheme would make it possible to reduce CO₂ emissions from voyages from /to EU ports by 3,97% in 2030 alone¹⁹, assuming that 30% of the fleet is eligible. This reduction would build on top of an already existing set of reductions decided at IMO level, and is likely to increase after 2030 reflecting the upward trend in the demand for maritime transport. Furthermore, with the effective application of the MRV Regulation, the scheme could be fine-tuned in such a way as to link the rebates to the level of efficiency of each ship, and to know with a sufficient degree of precision how much CO₂ is emitted (and how much is saved) on each journey.

Even more importantly, the study links environmental and economic considerations under the same framework. Pollution has both social and economic costs such as, for instance lost working days, high healthcare costs, damages to ecosystems, crops and buildings – which should be a concern for society as a whole, not simply for port authorities. The models developed in the study show that, when these costs are factored in, savings from reduced emissions may outweigh the costs connected with the (possible) revenue foregone after reducing port dues.

Because, the benefits from reduced pollution can be enjoyed by a wider community than port authorities alone, the argument proves that there is scope for collaboration between port authorities, municipalities and the shipping sector to monitor to mutual benefit. This would ease the concerns of port authorities who see the cost of set-up, staffing and operating such schemes as expensive, provide scope for the ‘polluter pays’ principle, and generally encourage a systems approach to this trans-boundary, multi-parameter complex of science and technology-based challenges. In addition, there is potentially even stronger scope for a more coordinated approach to environmental charging across the EU, as the application of common standards would inevitably maximise environmental and economic benefits, while reducing the workload and administrative burden connected to the implementation and management of the schemes.

Finally, the focus of this study is on ‘port infrastructure charges’, thus not covering either port service charges, or the contractual conditions between port authorities and port service providers which could regulate port service charges. Besides ship owners, there are other players that carry out potentially polluting activities in the port area. While, it is true that, just like ship owners, these other players too are often completely or partially subject to further legislation or permitting (e.g. EURO standards for road transport, Energy Performance of Buildings, Ecodesign, etc.), they still remain sources of pollution. It is thus recommended that port and / or national authorities also consider introducing service charges or other financial incentives that reward port service providers based on their environmental performance.

¹⁹ The reference scenario upon which the calculations are based has been developed by TNO. It includes the analysis of: the transportation volume, the economic growth rate (4.25% global and 1.55% for Europe annually) and the development of ship specifications (growth of average ship size and implementation of EEDI and LNG as a fuel). The abatement scenarios were based on Marginal CO₂ Abatement Costs Curves for ten individual vessel categories. For more details, please see ‘GHG emission reduction potential of EU-related maritime transport and on its impacts’, TNO, 2014.

Annex - Map of EU ports that differentiate charges based on environmental criteria

